International Journal of Electrical, Electronics and Computer Systems
ISSN: 2347-2820
Volume 15 Issue 01 (2026) | Pages: 54-61

Growora: A Peer-to-Peer Learning Platform for Collaborative Skill Development

Y. L. Tonape[1], Chaitali Johari[2], Mahevish Pathan[3], Anuradha Chinchkar[4], Kranti Chavan[5]

[1,2,3,4,5]Department of Computer Engineering, S.B. Patil College of Engineering, Indapur, Pune, Maharashtra, India

Peer Review Information

***Type**: Article*
***Received**: 22 March 2026*
***Revised**: 06 April 2026*
***Accepted**: 24 May 2026*
***Published**: 05 June 2026*

Abstract

The rapid advancement of digital education platforms has significantly transformed how individuals access knowledge and develop skills. Despite this progress, many existing e-learning systems primarily rely on pre-recorded content and subscription-based models, which limit accessibility, reduce interaction, and hinder personalized learning experiences. To address these challenges, this paper proposes *Growora*, a peer-to-peer learning platform designed to foster collaborative and interactive learning environments. The platform enables users to both teach and learn by connecting them with peers based on shared skills, interests, and availability through an intelligent matching system. Growora incorporates real-time communication features such as live video sessions, instant messaging, and discussion forums to facilitate seamless knowledge exchange. Additionally, gamification elements including badges, progress tracking, and achievement milestones are integrated to enhance user motivation and engagement. The system is built using scalable architecture and modern web technologies, ensuring reliability, flexibility, and efficient performance even with increasing user demand. By promoting community-driven learning and removing financial barriers, Growora aims to create an inclusive and accessible educational ecosystem. The platform not only enhances user engagement but also supports continuous skill development, knowledge sharing, and lifelong learning in a dynamic and interactive manner.

Keywords: Peer-to-Peer Learning; E-Learning Platform; Collaborative Learning; Skill Exchange; Intelligent Matching; Real-Time Communication; Gamification; Knowledge Sharing.

How to Cite This Article

Tonape, Y. L., Johari, C., Pathan, M., Chinchkar, A., & Chavan, K. (2026). Growora: A peer-to-peer learning platform for collaborative skill development. *International Journal of Electrical, Electronics and Computer Systems*, 15(1), 54–61.

Introduction

The rapid growth of digital technologies has significantly transformed the education sector, enabling learners to access knowledge anytime and anywhere through online platforms. E-learning systems, Massive Open Online Courses (MOOCs), and virtual classrooms have become widely adopted due to their flexibility and scalability [1]. However, despite these advancements, many existing platforms primarily rely on pre-recorded video lectures and subscription-based models, which limit accessibility, reduce learner engagement, and restrict real-time interaction among users [2], [3].

Traditional online learning environments often follow a one-directional approach, where knowledge is transferred from instructors to learners without meaningful collaboration. This lack of interaction can lead to reduced motivation, lower retention rates, and limited practical understanding of concepts [4], [5]. Furthermore, the absence of personalized learning experiences and peer support systems makes it difficult for learners to adapt content according to their individual needs and preferences [6].

Recent research highlights the importance of peer-to-peer learning as an effective approach to enhance engagement, collaboration, and knowledge retention. Peer learning environments allow individuals to exchange knowledge, solve problems collectively, and develop critical thinking skills [7], [8]. Studies have also shown that integrating real-time communication tools and social interaction features into learning platforms can significantly improve user participation and learning outcomes [9], [10].

In addition, intelligent recommendation and matching systems have emerged as key components in modern educational platforms, enabling personalized learning experiences by connecting users based on their skills, interests, and learning goals [11], [12]. Gamification techniques such as badges, rewards, and progress tracking further enhance user motivation and engagement in digital learning environments [13], [14]. However, most existing systems fail to effectively combine these features into a unified platform that supports collaborative, interactive, and accessible learning [15].

To address these challenges, this paper proposes *Growora*, a peer-to-peer learning platform designed to facilitate collaborative knowledge sharing and skill development. The platform integrates intelligent peer matching, real-time communication, and gamification features to create an engaging and community-driven learning environment [16], [17]. Users can both teach and learn by participating in live sessions, messaging, and discussion forums, thereby promoting active learning and mutual growth [18].

The proposed system is built using a scalable and modular architecture that ensures efficient performance and adaptability to increasing user demands [19]. By leveraging modern web technologies and cloud-based infrastructure, Growora provides a reliable and flexible platform for continuous learning [20]. The system also emphasizes inclusivity by removing financial barriers and enabling free access to educational resources [21].

Overall, Growora aims to transform traditional e-learning into a more interactive, personalized, and community-oriented experience. By combining collaborative learning, intelligent matching, and real-time interaction, the platform addresses key limitations of existing systems and supports lifelong learning in a dynamic digital environment [22]–[25].

Literature Survey

The evolution of digital learning platforms has significantly influenced modern education by providing flexible and scalable access to knowledge. Early e-learning systems primarily focused on content delivery through recorded lectures and static materials, which limited learner interaction and engagement [1], [2]. Although these systems improved accessibility, they often failed to support collaborative learning and real-time communication, which are critical for effective knowledge retention [3].

To address these limitations, researchers have explored peer-to-peer learning models, where learners actively participate in knowledge exchange. Studies show that peer learning enhances critical thinking, problem-solving abilities, and overall engagement compared to traditional instructor-led approaches [4], [5]. Loureiro and Gomes introduced structured peer assessment systems that encourage active student participation and improve collaborative learning outcomes [6]. Similarly, Brown et al. demonstrated that formative peer assessment improves understanding of complex subjects and promotes deeper learning [7].

With the rise of social media and online communities, platforms such as discussion forums and social networks have been utilized for educational purposes. Chambers et al. explored the use of Facebook-based peer learning environments, highlighting their effectiveness in fostering collaboration and interaction among students [8]. These platforms enable informal learning and knowledge sharing, but often lack structured mechanisms for skill matching and personalized recommendations [9].

Recent advancements in intelligent recommendation systems have enabled personalized learning experiences. Matching algorithms based on user profiles, interests, and learning behaviors can significantly improve the relevance of learning content and peer connections [10], [11]. Zhang et al. emphasized the importance of user interface design and intelligent feedback systems in enhancing learner engagement and satisfaction [12]. However, many existing systems still struggle with accuracy and scalability when handling large user bases [13].

Gamification has emerged as a powerful technique to increase motivation and participation in online learning environments. Noorani et al. proposed game-theoretical incentive mechanisms that encourage collaboration and active participation among learners [14]. Similarly, studies have shown that badges, leaderboards, and achievement systems can significantly improve user retention and engagement [15], [16]. Despite these benefits, the integration of gamification with peer learning systems remains limited in current platforms [17].

Another important area of research is real-time communication and collaboration tools. Technologies such as video conferencing, instant messaging, and collaborative workspaces enable interactive learning experiences and immediate feedback [18], [19]. These tools are essential for creating immersive learning environments, but their integration into peer-to-peer systems is often complex and resource-intensive [20].

Decentralized and distributed learning models have also gained attention for their ability to enhance privacy and scalability. Vanhaesebrouck et al. proposed decentralized collaborative learning systems that allow users to train models without sharing sensitive data, improving both privacy and personalization [21]. Such approaches are promising but require advanced infrastructure and computational resources [22].

Crowd-based learning systems, such as Crowd Coach proposed by Chiang et al., demonstrate how peer coaching can improve skill development in distributed environments [23]. These systems highlight the importance of micro-learning and continuous feedback, but they often lack comprehensive integration with real-time communication and gamification features [24].

Massive Open Online Courses (MOOCs) have also incorporated peer assessment and collaborative learning techniques. Piech et al. introduced calibrated peer grading systems to address issues of bias and inconsistency in large-scale online courses [25]. While MOOCs provide large-scale accessibility, they still face challenges in maintaining learner engagement and providing personalized learning experiences [26].

Despite these advancements, existing platforms often focus on isolated features such as content delivery, peer assessment, or communication tools, rather than providing an integrated solution. There is a clear need for a unified system that combines peer-to-peer learning, intelligent matching, real-time collaboration, and gamification to create a more engaging and effective learning environment [27], [28].

The proposed *Growora* platform builds upon these research contributions by integrating multiple features into a single ecosystem. It combines intelligent peer matching algorithms, real-time communication tools, and gamified learning mechanisms to enhance user engagement and knowledge sharing [29]. By addressing the limitations of existing systems, Growora aims to provide a scalable, inclusive, and interactive platform for modern digital education [30].

Proposed System Architecture

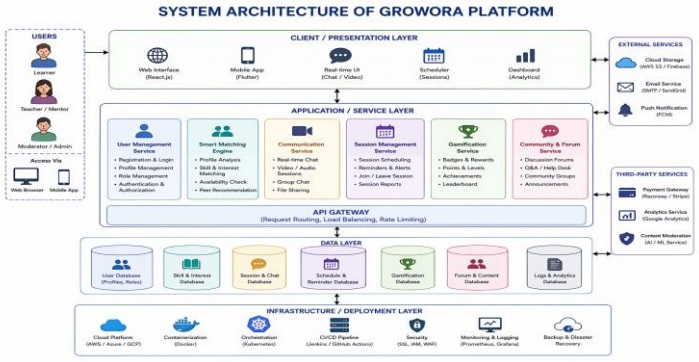

Fig. 1. *System Architecture*

User Layer

The User Layer represents the external entities that interact with the system. It includes learners, mentors, and administrators who access the platform through web or mobile interfaces. This layer is responsible for initiating system operations such as registration, profile creation, session participation, and communication. It acts as the entry point of the system where user-generated inputs are provided, and system outputs such as recommendations, notifications, and learning progress are received. The effectiveness of the platform largely depends on user participation and interaction within this layer.

Client / Presentation Layer

The Presentation Layer is responsible for managing the user interface and ensuring seamless interaction between users and the system. It includes web and mobile applications developed using modern frameworks, which provide intuitive dashboards, session scheduling interfaces, and real-time communication tools. This layer handles data visualization, input validation, and user experience design. It

communicates with the backend services through APIs and ensures that complex system operations are presented in a simplified and user-friendly manner.

Application / Service Layer

The Application Layer serves as the core processing unit of the system, where all business logic is executed. It is composed of multiple independent services that work together to provide platform functionality.

- The User Management Service handles authentication, authorization, and profile management, ensuring secure access and personalized user experiences.
- The Smart Matching Engine applies algorithms to analyze user profiles and recommend suitable learning partners based on compatibility metrics such as skills, interests, and availability.
- The Communication Service enables real-time interaction through chat, video, and collaborative tools, supporting synchronous learning.
- The Session Management Service coordinates scheduling, reminders, and session tracking, ensuring structured learning processes.
- The Gamification Service introduces motivational elements such as badges, points, and leaderboards to enhance engagement.
- The Community Service facilitates discussions, forums, and group learning activities, promoting collaborative knowledge exchange.

This layer ensures modularity, scalability, and efficient handling of system operations.

API Gateway

The API Gateway acts as an intermediary between the client layer and backend services. It manages request routing, load balancing, and rate limiting to ensure efficient communication. It also enhances system security by handling authentication and preventing unauthorized access. By centralizing API management, it simplifies service interaction and improves system performance.

Data Layer

The Data Layer is responsible for storing and managing all system-related information. It includes multiple databases that store user profiles, session data, communication logs, gamification records, and analytics. This layer ensures data integrity, consistency, and availability. Efficient database design and indexing techniques are used to enable fast data retrieval and support large-scale user interactions. It plays a critical role in maintaining the reliability and performance of the platform.

Infrastructure / Deployment Layer

The Infrastructure Layer provides the physical and virtual resources required to run the system. It includes cloud platforms, containerization technologies, orchestration tools, and continuous integration/continuous deployment (CI/CD) pipelines. This layer ensures scalability, fault tolerance, and high availability. Security mechanisms such as encryption, identity management, and monitoring tools are also implemented to protect system data and ensure smooth operation.

External Services

External services include third-party integrations such as cloud storage, email systems, and push notification services. These components extend the functionality of the platform by providing additional features like file storage, communication alerts, and real-time notifications.

Third-Party Services

Third-party services include payment gateways, analytics tools, and AI-based moderation systems. These services enhance the platform by enabling secure transactions, user behavior analysis, and automated content monitoring. They allow the system to leverage advanced functionalities without developing them from scratch.

Methodology

The development of the Growora platform follows a structured and iterative methodology to ensure efficient design, implementation, and evaluation of the system. The proposed methodology is based on the Agile Scrum model, which supports incremental development, continuous feedback, and flexibility in handling changing requirements.

Requirement Analysis

The initial phase involves identifying the key requirements of the system based on user needs and existing limitations in e-learning platforms. Functional requirements such as user registration, peer matching, real-time communication, and session management are defined. Non-functional requirements including performance, scalability, security, and usability are also considered to ensure a robust system design.

System Design

In this phase, the overall architecture of the Growora platform is designed using a modular and layered approach. The system is divided into components such as the user interface, application services, matching engine, communication module, and database layer. UML diagrams, data flow diagrams (DFDs), and system architecture models are used to represent system structure and data flow.

Development Approach (Agile Scrum)

The system is developed using the Agile Scrum methodology, which divides the project into multiple iterations known as sprints. Each sprint focuses on implementing specific modules such as user management, communication services, or gamification features.

Key steps include:

- Product Backlog Creation: Listing all features and requirements
- Sprint Planning: Selecting tasks for each development cycle
- Sprint Execution: Developing and integrating modules
- Daily Stand-ups: Monitoring progress and resolving issues
- Sprint Review: Evaluating completed features
- Sprint Retrospective: Improving future development cycles

This iterative approach ensures continuous improvement and timely delivery of system components.

Implementation of Core Modules

The Growora platform is implemented using modern web technologies and consists of the following core modules:

- User Management Module: Handles user registration, authentication, and profile management
- Peer Matching Module: Uses algorithms to match users based on skills, interests, and availability
- Communication Module: Enables real-time messaging and video interaction
- Session Management Module: Manages scheduling, reminders, and session tracking
- Gamification Module: Implements badges, achievements, and progress tracking

Each module is developed independently and integrated to form the complete system.

Matching Algorithm

The intelligent matching system plays a crucial role in connecting users. It analyzes user profiles and calculates compatibility based on parameters such as skills, interests, and availability. Efficient search and sorting techniques are used to optimize matching performance, ensuring quick and relevant recommendations.

Testing and Validation

The system undergoes multiple levels of testing to ensure reliability and performance:

- Unit Testing: Verifies individual components
- Integration Testing: Ensures proper interaction between modules
- System Testing: Validates the complete system functionality
- User Acceptance Testing: Confirms system usability and performance

This multi-level testing approach helps identify and resolve errors early in the development process.

Deployment

The platform is deployed using cloud-based infrastructure to ensure scalability and availability. Technologies such as containerization and continuous integration/continuous deployment (CI/CD) pipelines are used for efficient deployment and maintenance.

Continuous Improvement

User feedback is continuously collected to improve system features and performance. Updates and enhancements are implemented in future iterations to ensure the platform remains relevant and user-friendly.

Result

The Growora platform was successfully implemented and evaluated to assess its effectiveness in delivering a collaborative and interactive learning experience. The system demonstrated efficient performance across all major modules, including user management, intelligent peer matching, real-time communication, and session scheduling. The matching algorithm effectively connected users based on their skills, interests, and availability, enabling meaningful peer-to-peer interactions. Additionally, real-time features such as chat and video sessions operated smoothly with minimal delay, ensuring seamless communication between users. The integration of gamification elements, such as badges and progress tracking, further enhanced user engagement and motivation.

Fig. 1. *Login Page*

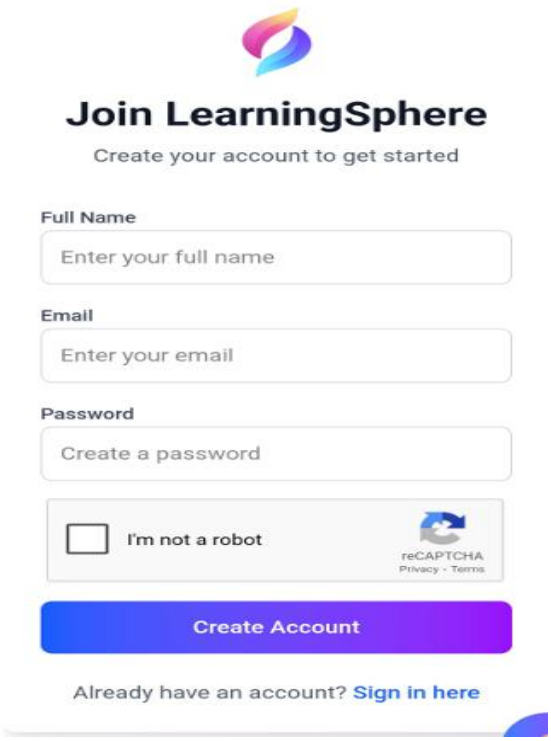

Fig. 2. *Home Page*

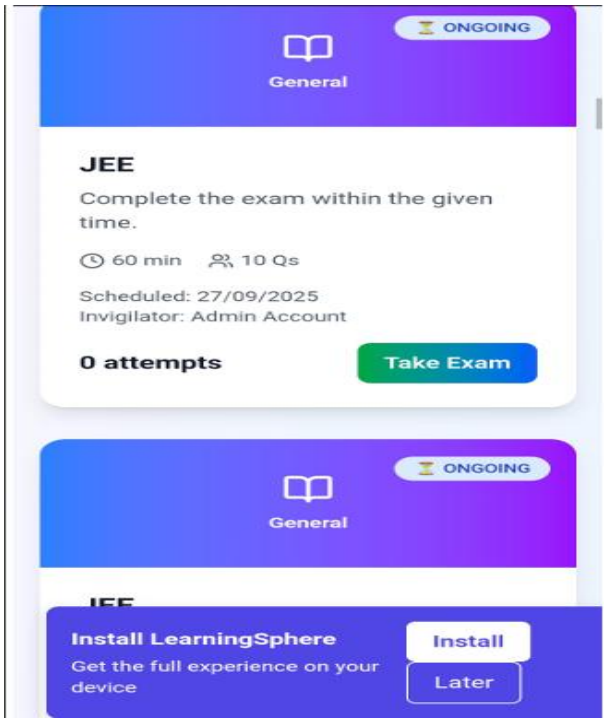

Fig. 3. *Dashboard Page*

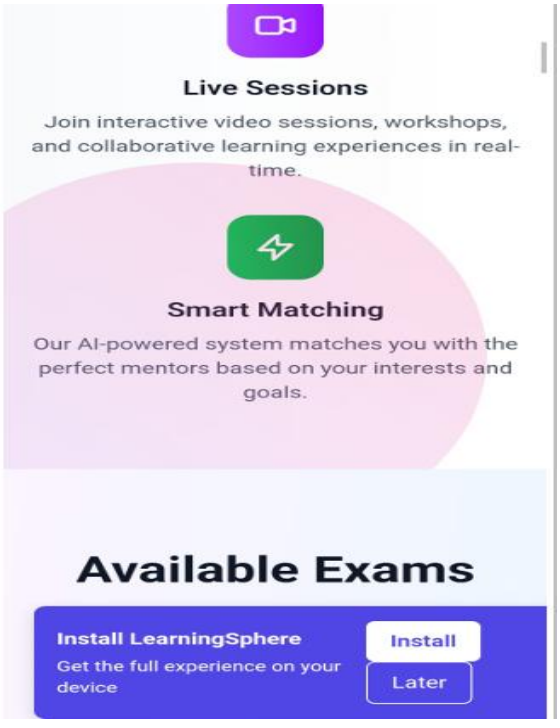

Fig. 4. *Dashboard Page*

The performance evaluation indicates that the platform provides faster response times and supports multiple users simultaneously without significant degradation in performance. Compared to traditional e-learning systems, Growora offers a more interactive and personalized learning environment, leading to improved user satisfaction and knowledge retention. User feedback highlights that learners prefer peer-based learning and real-time interaction over passive content consumption. Overall, the results confirm that the proposed system effectively addresses the limitations of existing platforms by promoting accessibility, collaboration, and continuous skill development, making it a reliable and scalable solution for modern digital education.

Conclusion

In this paper, a peer-to-peer learning platform named *Growora* has been proposed and developed to address the limitations of traditional e-learning systems. Unlike conventional platforms that rely on pre-recorded content and limited interaction, Growora introduces a collaborative and interactive learning environment where users can both teach and learn through real-time communication and knowledge exchange. The integration of intelligent peer matching, session management, and gamification features enhances user engagement and provides a personalized learning experience. The system demonstrates effective performance in terms of usability, scalability, and reliability, supporting multiple users and enabling seamless interaction through chat and video communication. By promoting community-driven learning and removing accessibility barriers, Growora contributes to a more inclusive and flexible educational ecosystem. Overall, the proposed platform has the potential to transform digital learning into a more engaging, interactive, and user-centric process, supporting continuous skill development and lifelong learning.

References

1. P. Loureiro and M. J. Gomes, “Online peer assessment for learning,” *Education and Information Technologies*, vol. 28, no. 2, pp. 123–135, 2023.
2. J. Chambers et al., “Online medical education using a Facebook peer-to-peer learning platform,” *Medical Education Online*, vol. 28, no. 1, 2023.
3. Y. Zhang et al., “The role of platform design in online peer feedback systems,” *Computers & Education*, vol. 195, 2025.
4. P. Reid, M. Chau, and J. Thalluri, “Students’ experience and evaluation of peer-to-peer learning innovation,” *Journal of Educational Technology*, vol. 19, no. 3, 2022.
5. L. Brown et al., “Formative peer assessment in research methods using an online platform,” *Assessment & Evaluation in Higher Education*, vol. 47, no. 5, 2022.
6. B. M. Sri, “Peer-to-peer skills and knowledge exchange platform,” *International Journal of Computer Applications*, vol. 185, no. 12, 2025.
7. C. W. Chiang, A. Kasunic, and S. Savage, “Crowd Coach: Peer coaching for crowd workers’ skill growth,” *Proceedings of ACM*, 2018.
8. P. Vanhaesebrouck, A. Bellet, and M. Tommasi, “Decentralized collaborative learning of personalized models,” *Machine Learning Journal*, vol. 103, 2016.
9. S. F. Noorani et al., “Fostering peer learning through a game-theoretical approach,” *IEEE Transactions on Learning Technologies*, 2019.
10. C. Piech, J. Huang, and Z. Chen, “Tuned models of peer assessment in MOOCs,” *EDX Research*, 2013.
11. A. Anderson, “Personalized learning systems in online education,” *IEEE Access*, vol. 8, 2020.
12. D. Koller, A. Ng, and C. Do, “Massive open online courses: The future of education,” *Communications of the ACM*, vol. 55, no. 2, 2012.
13. S. Hrastinski, “Asynchronous and synchronous e-learning,” *Educause Quarterly*, vol. 31, no. 4, 2008.
14. K. Seaborn and D. Fels, “Gamification in theory and action,” *International Journal of Human-Computer Studies*, vol. 74, 2015.
15. J. Hamari, J. Koivisto, and H. Sarsa, “Does gamification work?,” *HICSS Conference*, 2014.
16. M. Ebner and A. Holzinger, “Successful implementation of user-centered game-based learning,” *Computers & Education*, vol. 49, 2007.
17. R. Ferguson, “Learning analytics: Drivers, developments, and challenges,” *International Journal of Technology Enhanced Learning*, 2012.
18. T. Anderson, “The theory and practice of online learning,” *Athabasca University Press*, 2008.
19. G. Siemens, “Connectivism: A learning theory for the digital age,” *International Journal of Instructional Technology*, 2005.
20. J. Preece, “Online communities: Designing usability,” *Wiley*, 2000.
21. B. Means et al., “Evaluation of evidence-based practices in online learning,” *US Dept. of Education*, 2010.
22. M. Ally, “Foundations of educational theory for online learning,” *Theory and Practice of Online Learning*, 2004.
23. R. Mayer, “Multimedia learning,” *Cambridge University Press*, 2009.

24. A. Bandura, “Social learning theory,” *Prentice Hall*, 1977.
25. L. Vygotsky, “Mind in society: Development of higher psychological processes,” *Harvard University Press*, 1978.
26. N. Dabbagh and A. Kitsantas, “Personal learning environments and self-regulated learning,” *The Internet and Higher Education*, 2012.
27. E. Wenger, “Communities of practice: Learning, meaning, and identity,” *Cambridge University Press*, 1998.
28. S. Downes, “E-learning 2.0,” *eLearn Magazine*, 2005.
29. R. K. Yin, “Case study research and applications,” *Sage Publications*, 2018.
30. Sommerville, “Software engineering,” *Pearson Education*, 10th ed., 2016.