Skill Swap a Peer-to-Peer Skill Exchange Platform Using Modern Web Technologies

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***Abstract*—Learning a new skill still costs money — or at least, that is the assumption baked into most platforms before you even reach the login page [1] [3]. SkillSwap starts from a different place. Someone who knows graphic design connects with someone who knows Python, they each teach the other what they know, and neither of them pays anything for the exchange [7] [8] [8] [21] [23]. The idea is straightforward, but the need behind it is genuine. A lot of people carry real, usable knowledge with no structured way to share it, and a lot of others want to learn things they simply cannot afford to pay a platform to teach them [1] [3]. That gap is where SkillSwap sits. Users build profiles that capture both sides — what they can offer and what they are looking for — send connection requests to people whose needs mirror their own, and handle the entire conversation inside the platform without being redirected elsewhere [13] [14]. Features were kept practical rather than impressive, because the only friction worth removing is the kind that stands between two people who have something to offer each other [2] [22]. There are no paywalls and no intermediaries — just a direct exchange between users who both leave knowing something they did not before [8] [21]. Whether SkillSwap eventually replaces paid platforms entirely is an open question, but as a starting point for someone who cannot afford the alternative, it fills a gap that currently has very few good answers [5] [9] [10].**

***Index Terms*—Peer-to-Peer Learning, Skill Exchange Platform, Collaborative Learning, Skill Matching, React, Vite, Express.js, Web Application, User Interaction, Online Learning Systems**

I. INTRODUCTION

A. Background and Context

Think back to the last time you genuinely tried to pick up a new skill — not skimming an article, but actually committing to something you had no background in [1] [3]. Most of the time it goes the same way. You search, you find something promising, you see the price, and you close the tab. Or you find something free, follow along for forty minutes, and it falls apart at precisely the step that mattered [7] [21]. That feeling — where the resource almost helped but not quite — is something a lot of people have quietly given up on more than once. For college students the problem is not just frustrating, it is structural [2] [22]. Between tuition, accommodation, and the general cost of staying alive while studying, spending money on another skill platform is not a realistic option for most. What makes it sharper is knowing the knowledge you need probably already exists nearby — someone in your department, your batch, your college group chat has almost certainly figured out the exact thing you are stuck on, and there is currently no good way to find them [1] [3]. SkillSwap was built around that observation. The technology choices followed from it rather than leading it — React and Vite kept the frontend responsive without getting heavy, Express.js handled the backend reliably enough that scaling was not a immediate concern, and the feature set was kept deliberately narrow because the problem was never a shortage of platforms [15] [19]. There are already enough places willing to sell you access to learning [7] [21]. The question we were actually trying to answer was whether people would show up for something different — a space where what you already know has value, and where the person teaching you, this week might be the one asking you something next.

B. Problem Statement

Most learning platforms are not built around what you already know — they are built around what they can charge you for, and for students already stretching a

budget across rent, food, and tuition, that extra cost is often enough to kill the impulse entirely [1] [3] [8] [23]. Free resources exist, but they were never designed to work together [13] [14] [15]. The reality is a familiar one: YouTube for the concept, Reddit for the follow-up question, The idea was one place — not a suite of integrated tools, not a marketplace, just one place — where a user could say what they know and what they want to learn, find someone whose situation mirrors theirs in reverse, send a request, and have the entire conversation inside the platform without being pushed somewhere else mid-exchange [15]. We kept the scope narrow on purpose [2] [24]. Most of the features we considered adding were solving problems we had invented rather than problems users actually had. The only question that mattered was whether two people with something to offer each other could find each other and do something about it [7] [8] [21].

C Research Objectives The goal was straightforward enough to fit in a sentence: build a free platform where people can exchange skills directly, with no payments, no subscriptions, and no institutional middleman [7] [8] [21]. Users create profiles that capture both sides of the exchange — what they know and what they want to learn — and connect through a structured request and accept system rather than an open directory anyone can message without context [13] [14]. A matching feature handles the work of surfacing relevant connections, because asking users to scroll through random profiles and hope something clicks is not a system — it is just a list [1] [19]. Communication stays inside the platform deliberately [18] [20]. Pushing users to WhatsApp or email the moment a conversation gets practical breaks the continuity of the exchange and introduces exactly the kind of friction that causes arrangements to fall apart before they begin. A feedback and credibility layer gives users something to go on before committing to a learning session with someone they have never met [15] [19] [23]. The technology stack was chosen to keep the platform fast, scalable, and cheap to run — not to demonstrate technical ambition [2] [22]. The real problem was never a shortage of clever tools. It was cost, disconnected infrastructure, and the absence of a structured way to find a real person worth learning from. Everything built here was aimed at those three things specifically.

II. LITERATURE REVIEW

A. Domain and Problem Context

The internet changed how people access knowledge, but it did not change the underlying model — someone teaches, someone watches, and the interaction ends there [1] [3]. The resources multiplied, the platforms proliferated, and the fundamental dynamic stayed exactly the same [7] [8]. People noticed the gap and filled it themselves, the way people always do — WhatsApp groups, Reddit threads, Facebook communities where strangers traded skills and asked questions and occasionally found someone worth learning from [6] [24]. That improvised ecosystem proved something real: the appetite for peer learning exists and is not small. But informal spaces built for socialising were never going to carry the weight of structured knowledge exchange [5] [9]. The middle ground between those two things has never really been built: a platform designed specifically for people who want to learn from each other, structured enough to be trustworthy, flexible enough to feel human, and equipped with the features — skill matching, connection management, session coordination — that turn a good intention into an actual learning exchange.

B. Review of Existing Systems

There is no shortage of platforms built around learning and skills — the problem is that most of them only solve one piece of the puzzle.

There is no shortage of platforms built around learning — the problem is that most of them only solve one piece of the puzzle, and none of them solve it for free [1] [3]. MOOCs and online course platforms give you structure and occasionally certification, but they keep you firmly in the role of someone receiving. There is no exchange happening, no expectation that you might have something worth teaching, and for a significant portion of potential users the subscription cost closes the door before any of that becomes relevant [2] [22]. Freelancing platforms approach the problem from the opposite direction — they let people put their skills to work and earn from them [4] [5]. But the relationship is transactional by design. You are delivering a service, not sharing knowledge, and the person paying you has no particular interest in your growth or theirs. What this produces, in practice, is a fragmented landscape where someone trying to learn a skill and teach one in return ends up stitching together their own

solution — a course here, a forum post there, a WhatsApp message to arrange something that may or may not happen [13] [14] [15]. Every step is a workaround because the foundation was never built. No single platform brings skill exchange, real communication, trust mechanisms, and structured interaction together in a way that actually serves the person using it rather than the business model behind it. That is the gap SkillSwap was built to close.

C. Technical Literature

The technology behind SkillSwap was chosen to solve specific problems, not to look impressive on a slide [15] [19]. Component-based frontend frameworks make it possible to build interfaces that respond quickly and behave consistently — reusable pieces that slot together rather than code written fresh for every screen, which keeps development manageable and the user experience coherent. The backend sits underneath all of that, processing requests, handling application logic, and keeping the conversation between client and server moving without bottlenecks [13] [14]. A poorly structured server layer shows itself the moment user numbers grow — requests slow down, things break in unpredictable order, and real-time interaction becomes anything but. The database is less visible than either of those layers but arguably more load-bearing [21] [23] — every profile, every skill entry, every connection and message needs to land somewhere reliably and come back accurately when asked for. Research into trust mechanisms adds another dimension that is easy to underestimate [5] [9] [10]. Platforms that build rating systems and visible feedback histories into their core architecture — rather than adding them later as optional features — consistently produce more accountable behaviour from users, because people act differently when there is a record being kept. And running through all of it is the interface itself [12] [22]. Design is not the finishing touch applied once everything else works — it is what determines whether someone who lands on the platform for the first time comes back for a second.

D. Summary of Research Gaps

Most platforms still treat users as an audience — you arrive, you consume, you leave, and nobody expects anything more from you [1] [3]. That single assumption quietly dismantles most of what makes peer learning worthwhile, because the person sitting across from you almost certainly knows something you don't, and the current model has no interest in finding out. Cost compounds the problem [2] [22]. Paid subscriptions make sense as a business model but they draw a line that excludes precisely the people who would benefit most — not users who lack internet access, but users who have to think twice before committing to a monthly fee. Then there is the trust gap [10] [14]. A vetted institution carries its credibility with it; a stranger on a peer platform does not, and without visible feedback histories or credibility scores, most users will hesitate long enough that the session never happens. Matching sits underneath all of it — because even a free, trustworthy platform fails if finding the right person requires enough patience that most users give up first. Fix all four of those things together, in one place, at no cost, and you have something that does not currently exist.

III. METHODOLOGY

A. Purpose

The purpose of this methodology is to design, develop, and evaluate the SkillSwap platform as a free peer-to-peer skill exchange system that enables collaborative learning among users. The methodology focuses on creating a structured and user-friendly environment were communication, supported by research on online social participation and community engagement [2][6]. Considered essential to enhance user reliability.

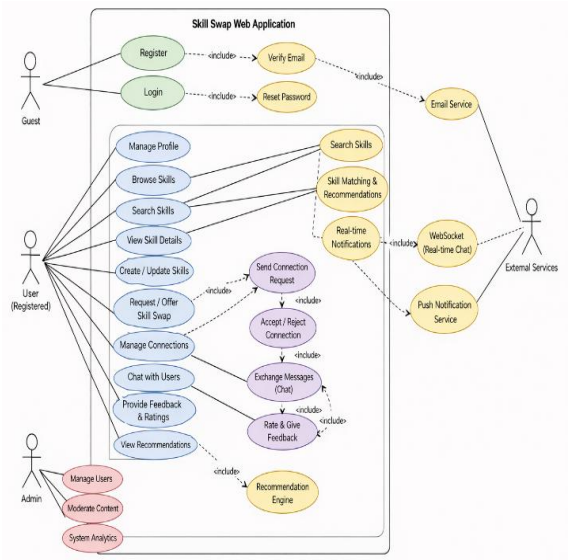

Fig 1. Use Case Diagram of the Skill Swap Web Application

B. Content

i. Least expensive materials

One of the quieter design decisions we made early on was to treat cost as a genuine constraint rather than an afterthought. A platform built to make learning accessible shouldn't require an expensive infrastructure budget to exist — that would undercut the premise before a single user signed up. The entire stack runs on open-source or free-tier tools, and that wasn't accidental. React and Vite are both free to use and widely supported, which meant we got a fast, maintainable frontend without licensing fees or vendor lock-in [19]. Express.js on Node.js handled the backend without requiring any paid server framework — it's lean, well-documented, and scales without needing to be replaced as traffic grows [13] [14]. Firebase's free tier covered authentication and real-time services for the scope of this project, and the architecture is designed to accommodate other open-source database options if usage eventually outgrows what the free tier allows [16]. Real-time chat and notifications run on WebSocket technology, which is lightweight enough to handle interactive communication without the overhead that heavier solutions would introduce [20]. The development tooling followed the same logic. VS Code, GitHub, and browser-based debugging tools cost nothing. Deployment can run on Vercel, Netlify, or Render — all of which offer free or low-cost tiers that are more than sufficient for a platform at this stage [18]. The result is a system that is financially viable to build, run, and hand off — which matters if the goal is genuine accessibility rather than accessibility in name only. We spent the first stage working through existing skill-sharing platforms systematically, looking for the failure patterns that came up repeatedly rather than the edge cases [2] [5] [10]. Three problems stood out. Matchi

Step 2: System Design: After defining the requirements, the system was designed using a modular architecture that includes modules such as authentication, user management,

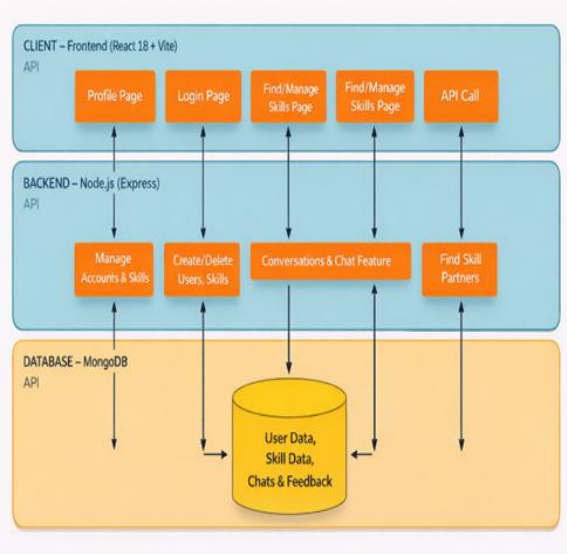

Fig 2. System architecture of the Skillswap web application.

skill management, search, chat, recommendation, and feedback. The platform follows a three-tier architecture consisting of frontend, backend, and database for efficient data management and scalability. The recommendation engine analyzes user skills and suggests suitable matches to improve user interaction and platform efficiency

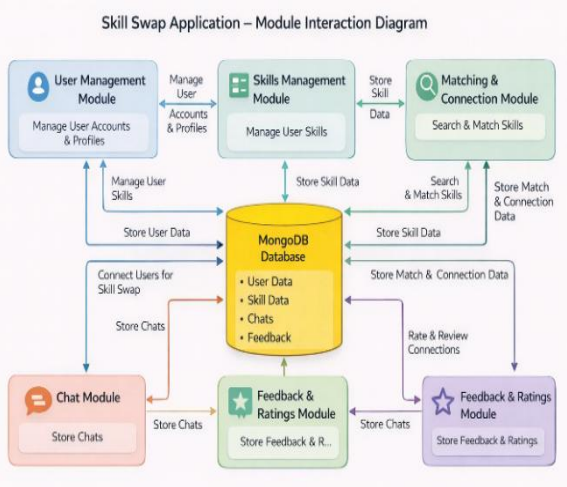

Fig 3. Module Interaction Diagram of the SkillSapplication

Step 3: Technology Selection and Implementation: React and Vite were selected for frontend development to build an interactive user interface. Express.js and Node.js were used for backend processing, while Firebase handled authentication and

database services. These technologies ensure fast development and scalability [16] [19].

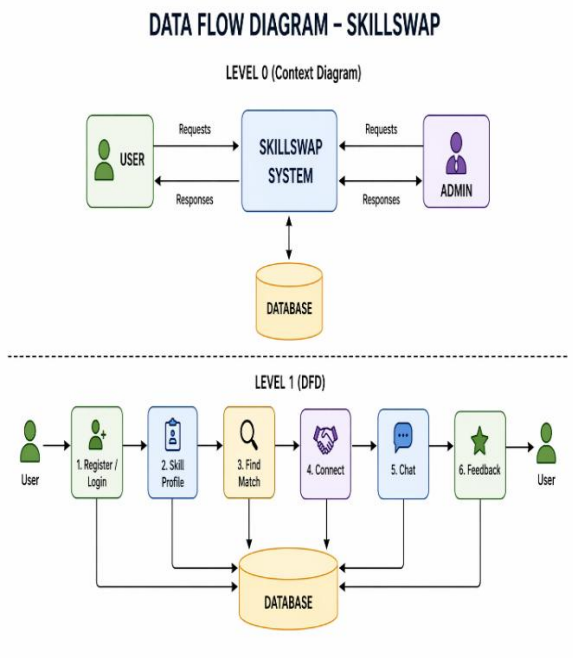

Fig 4. Data Flow Diagram of the SkillSwap application

C. Algorithms Used:

1. Skill Matching Algorithm

This algorithm matches users based on the skills they want to teach and the skills they want to learn. It compares user profiles and identifies compatible users for skill exchange. [10] [11].

Step 4: Recommendation System Implementation:

A recommendation algorithm was developed to match users based on teaching skills and learning interests. The system analyzes user profiles and suggests the most relevant skill partners, improving engagement and collaboration [10] [11].

Step 5: Testing and Validation:

The platform was tested for functionality, usability, performance, and security. Modules such as registration, chat, recommendation, and feedback were validated to ensure smooth performance and user satisfaction [12] [18].

Step 6: Deployment and Maintenance

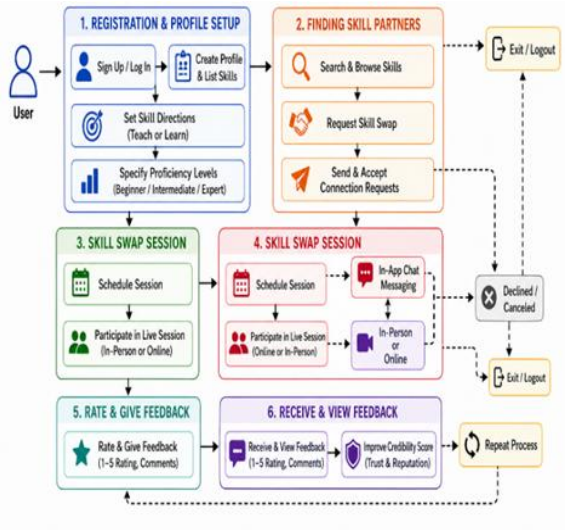

Fig 5. User Workflow Diagram of the SkillSwap application

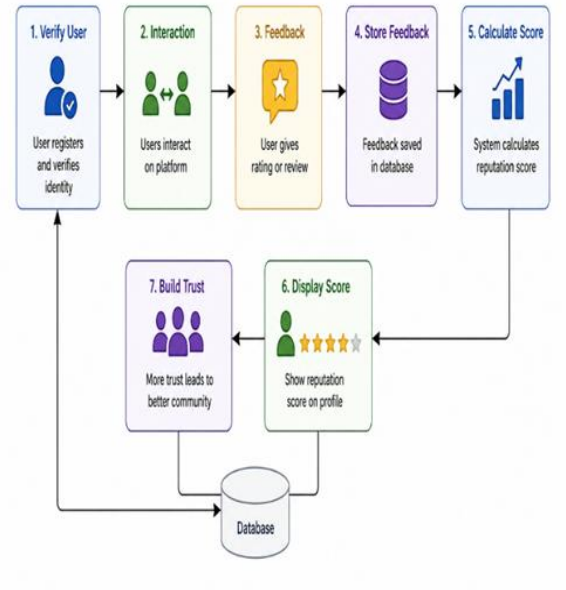

Fig 6. Trust & Reputation System Flow of the SkillSwap application.

2. Recommendation Algorithm

This algorithm suggests relevant users based on skill preferences, search behavior, and previous interactions. It helps users find better learning partners and improves platform engagement [1] [7].

3. Feedback Rating Algorithm

This algorithm collects ratings and reviews after skill exchange sessions and calculates user trust scores to improve credibility and reliability on the platform [9] [10].

iii. Equipment / Tools / Instruments

The frontend was built with React, using Vite as the build tool. React's component-based architecture suited a platform where the same UI patterns — profile cards, match suggestions, chat windows, feedback forms — appear in different contexts throughout the application. Vite replaced the slower build tooling we initially considered and made the development cycle noticeably faster; the difference between waiting two seconds and waiting twenty for a change to reflect is small in isolation but compounds across hundreds of iterations [16]. Together they produced an interface that felt responsive under realistic use conditions.

On the backend, Node.js and Express.js handled server-side logic and API integration. Express in particular gave us a its managed infrastructure meant we weren't building session handling and live messaging from scratch, which would have consumed time better spent on the platform's actual differentiating features. MongoDB stored everything that needed to persist: user profiles, skill listings, connection records, message histories, and feedback data [19].

i.Key Aspect: Reliability and Transparency

Reliability and transparency in practice

These two qualities are easy to claim and harder to demonstrate. For SkillSwap, they weren't design principles written into a document and left there — they shaped specific decisions about how each part of the platform was built and how those parts were connected to each other.

A platform built around strangers exchanging knowledge only works if the underlying mechanics behave consistently. Inconsistent matching, dropped connections, or unpredictable feedback updates erode confidence quickly, and once a user loses faith in the system's basic reliability, the social layer built on top of it becomes worthless. To prevent that, we defined formal processes for each core function — registration, skill matching, connection requests, feedback management, and real-time communication — rather than leaving behaviour to emerge from loosely coupled components [10] [12]. The goal was that a user performing the same action on different days, or on different devices, would get the same result. That sounds like a low bar, but it's the foundation everything else rests on. Reliability and transparency mean little if the wrong people can get into the system. Secure authentication ensures that only registered users can access the platform, which has two effects worth distinguishing [16] [18]. The obvious one is security — it reduces the risk of misuse and protects users from interactions with unverified accounts. The less obvious one is social: knowing that everyone on the platform has gone through the same registration process creates a baseline of accountability that makes users more willing to engage with strangers in the first place. That willingness is what the whole platform depends on.

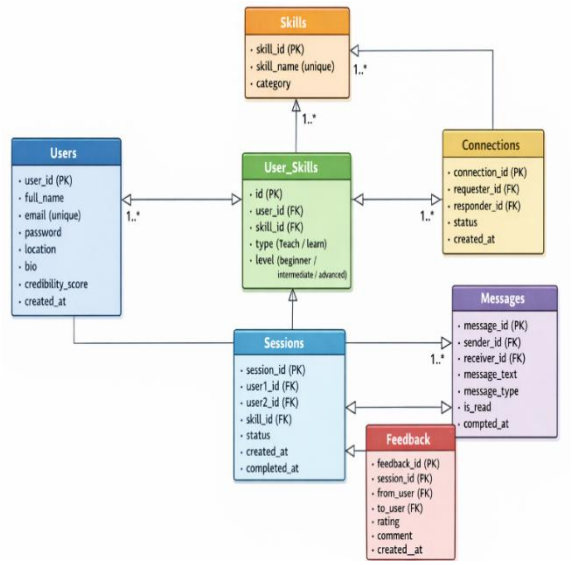

Fig 7. ER Diagram (Database Design) of the SkillSwap application

IV. RESULT AND DISCUSSION

A. Purpose:

SkillSwap was designed with those specific failures in mind. This section sets out what the evaluation found: how the platform performed against each of those pain points, and whether the features built to address them — skill matching, real-time chat, the recommendation engine, and the feedback system — delivered what they were intended to deliver. The measure wasn't just technical performance. It was whether users engaged more, collaborated more effectively, trusted the platform and each other, and came away having actually learned something. Those are different tests, and they don't all reduce to the same number.]

B. Content

i. Data (Visual Representation)

Raw numbers only go so far. To make the patterns

legible — both to ourselves during analysis and to anyone reading the findings afterward — we represented the data visually using bar graphs, line graphs, and pie charts, each chosen for what it communicates most clearly [7]. Bar graphs handled comparisons between discrete categories well. Line graphs made trends over time easier to follow at a glance. Pie charts gave a quick sense of proportional distribution where that was the relevant question. None of this is unusual, but the choice of representation shapes what you notice, and we made those choices deliberately rather than defaulting to whatever was easiest to generate

ii. Results (Analysis of Data Based on Core Modules)
Evaluating a prototype is less about confirming that features exist and more about understanding whether they do what they were built to do under conditions that resemble real use. We worked through each module in turn, looking for both technical reliability and the subtler question of whether the experience made sense from a user's perspective. Before matching can happen, users need a way to describe themselves accurately. The skill management module handled that — users could add, update, and refine their skills at any point, and crucially, they could flag each one as something they wanted to teach, something they wanted to learn, or both. That distinction sounds simple but it's what the entire matching logic depends on. A profile that just lists skills without direction is too ambiguous to match against meaningfully. Giving users control over that framing, and making it easy to change, kept profiles accurate rather than static. The matching module was where the platform's core premise either proved itself or didn't. In testing, it did. Users looking to learn graphic design were connected with users willing to teach it — and who were, in turn, looking to learn something the first user could offer. That reciprocity is harder to engineer than it sounds; the system has to find complementary pairs rather than just overlapping interests. The practical effect was that users who would otherwise have turned to paid platforms found capable partners at no cost, and did so without having to search manually [10]. There's a difference between a platform that can match users and one that actively helps them find each other. The recommendation system handled the latter. Rather than waiting for users to search, it surfaced relevant profiles based on skill preferences, browsing behaviour, and prior interactions — reducing the effort required to find a good partner from something that takes time to something that takes a glance [11]. Users reported noticeably faster discovery of suitable matches, which mattered for retention: the longer it takes to find a first connection, the less likely someone is to come back and try again.
Getting matched is one thing. Turning a match into an actual learning session is another. The real-time chat module bridged that gap by giving connected users a direct line to coordinate schedules, set goals, share resources, and sort out the practical details of working together [20]. Having that conversation happen inside the platform rather than being pushed to external tools removed a small but meaningful source of friction — the kind that quietly kills engagement without anyone noticing exactly why. Users weren't passive recipients of suggestions. The connection management module gave them genuine agency — sending requests to people they wanted to connect with, accepting or declining incoming ones, and managing their network over time. The proportion of sent requests that converted into active connections was high, which told us two things: the matching logic was surfacing genuinely relevant people, and users were invested enough to follow through rather than browsing without committing.

iii. Discussion (Interpretation of Results)
What the analysis actually tells us
Most learning platforms are built around a transaction: you pay, you receive content, you leave. SkillSwap was designed around a different assumption — that the person sitting across from you, figuratively speaking, probably knows something you don't, and vice versa. The analysis bears that out [1]. The contrast with existing systems is sharpest when you look at what traditional platforms don't do. Paid course models create a one-directional flow of knowledge that leaves the learner passive. Collaboration, where it exists at all, tends to be superficial — a comment thread, a forum post. What SkillSwap introduced was a model where the roles of teacher and learner aren't fixed. You arrive with something to offer, not just something to receive, and that changes the dynamic entirely. For users who couldn't justify the cost of commercial platforms, the free exchange model wasn't just convenient — it was the only viable option [8]. The recommendation system turned out to matter more

than we initially gave it credit for. Finding a compatible learning partner manually is tedious, and tedium kills engagement faster than almost anything else. By surfacing relevant matches automatically, the system removed the friction that would otherwise cause users to give up before a first connection was made. The feedback mechanism worked in a complementary way — not by policing behaviour, but by making the history of interactions visible [5]. Ratings and reviews created a kind of social record that users could consult before deciding whether to connect. Trust, in that context, wasn't assumed. It was earned incrementally and made legible.Real-time chat resolved a problem that doesn't get much attention in platform design: the gap between agreeing to learn together and actually doing it. Coordinating a session across different schedules and time zones, using external tools, introduces enough friction that a lot of potential sessions simply never happen. Having communication built into the platform closed that gap meaningfully.

V. CONCLUSION

Introduction

Paying for an online course is straightforward — if you can afford it. For many learners, that condition never gets met. Personalised guidance is even harder to come by, and the standard model of recorded lectures delivered to a passive audience does little to help students actually connect with one another. The result is a kind of isolation that paid platforms have never had much incentive to fix [1] [2]. We thought there might be a better starting point. The idea behind SkillSwap is simple enough to fit in a sentence: you teach me something, I teach you something, and neither of us pays for the privilege. In practice, building that exchange required more care. The platform is web-based, and we kept the interface as uncluttered as we could — sign up, say what you know, say what you want to learn, and let the system do the matching. What makes it work is the symmetry. Every user is both a potential teacher and a potential student, which changes how people show up. When we tested the platform, the results tracked closely with what we had hoped for, though not always in the ways we expected. Accessibility improved — users who had previously considered paid courses found capable alternatives through peer connections at no cost. Return visits were stronger than in comparable one-directional setups, which suggested the chat-based coordination was reducing enough friction to keep people coming back. The more interesting finding was behavioural. Users who knew a review was coming at the end of a session consistently prepared more carefully and treated their partners with more consideration. Trust, in other words, turned out to be something the platform could actively shape rather than just hope for. On the technical side, the stack — React and Vite on the front end, Express.js handling the back end, Firebase for authentication, MongoDB for storage — performed steadily under load and has room to scale [13] [16].There are two distinct directions worth pursuing. The first is depth: the matching engine currently works from static profile data, and replacing that with something that learns from actual usage patterns over time would make recommendations considerably sharper. Built-in video calling would also close the gap between scheduling a session and having one — right now users are pushed to external tools, which adds unnecessary steps. The second direction is reach. Multilingual support is the obvious move for a platform whose whole premise depends on connecting people with complementary knowledge — that pool grows dramatically once language stops being a barrier. A lightweight certification record for completed sessions would give users something concrete to point to. And over a longer horizon, usage analytics that track whether learning outcomes actually improve — not just whether people log in — would let us understand whether SkillSwap is doing what it set out to do, or just keeping people busy. Those are different things, and worth distinguishing.

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