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DIVISION OF ELECTRONICS AND COMPUTERS
INTERACTIVE TECHNOLOGIES LABORATORY

APPLYING GAMIFICATION AND ACCOUNTABILITY TECHNIQUES TO SUPPORT STUDENTS IN MANAGING ACADEMIC OBLIGATIONS

D I P L O M A T H E S I S

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University of Patras, Department of Electrical and Computer Engineering.

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ABSTRACT

APPLYING GAMIFICATION AND ACCOUNTABILITY TECHNIQUES TO SUPPORT STUDENTS IN MANAGING ACADEMIC OBLIGATIONS

STUDENT NAME, SURNAME:
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This diploma thesis explores the design and development of a mobile application aimed at supporting university students in managing their academic obligations through gamification and accountability techniques. Modern students, face increasing challenges in maintaining focus, organization, and motivation within the demanding environment of higher education. While numerous digital tools exist for task management, few address the motivational and social aspects that significantly influence student engagement and consistency. This work responds to that gap by proposing a human–centered solution that merges productivity, playfulness, and social accountability into a unified platform.

The project follows a User-Centered Design (UCD) methodology, emphasizing continuous user involvement and iterative refinement. Preliminary user research, conducted through semi-structured interviews with university students, revealed recurring difficulties such as procrastination, lack of self-discipline, and low motivation. The findings also highlighted students' desire for tools that encourage collaboration, recognition, and visible progress. These insights informed the definition of user personas, functional and non-functional requirements, and ultimately guided the design of the application's features.

The application incorporates gamified elements, such as experience points (XP), badges, streaks and a leaderboard, to transform academic tasks into engaging challenges, fostering motivation and a sense of accomplishment. Simultaneously, accountability features, including study buddies, shared obligations and peer visibility during focus sessions, aim to strengthen users' sense of responsibility and community.

The system was implemented using React Native with Expo for the cross-platform mobile interface and Appwrite for backend functionality, providing a secure and scalable environment.

Evaluation was conducted through both self-assessment and user testing, including the think aloud protocol, field evaluation, focus groups and questionnaires. Results demonstrated that users perceived the application as intuitive, supportive, and motivating, particularly appreciating the combination of playful design and social interaction. Participants reported that the application helped them stay more consistent and aware of their academic progress.

In conclusion, this thesis presents a functional and empirically validated prototype that applies gamification and accountability principles to enhance students' academic management and motivation. Beyond its immediate technological contribution, the project highlights how

Human–Computer Interaction (HCI) principles can be leveraged to address real psychological and behavioral challenges in education.

Future work may expand the application's adaptability and technicalities, as well as add personalization. Lastly, further integration with obligations out of everyday life could be evaluated, further strengthening its role as a meaningful digital companion for students navigating life.

ΕΚΤΕΤΑΜΕΝΗ ΕΛΛΗΝΙΚΗ ΠΕΡΙΛΗΨΗ

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ΧΡΗΣΤΟΣ ΣΙΝΤΟΡΗΣ

Η παρούσα διπλωματική εργασία έχει ως κύριο στόχο την ανάπτυξη ενός κινητού εργαλείου που υποστηρίζει φοιτητές στη διαχείριση των ακαδημαϊκών τους υποχρεώσεων, ενισχύοντας ταυτόχρονα τη δέσμευση και το κίνητρο μέσα από τεχνικές παιχνιδοποίησης (gamification) και κοινωνικής λογοδοσίας (accountability).

Η επιλογή του θέματος εδράζεται στην αναγνώριση ευρέως προβλήματος: πολλοί φοιτητές παλεύουν με την προθεσμία/αυτο-οργάνωση και την τάση προς αναβλητικότητα - προβλήματα που στη βιβλιογραφία συνδέονται με παράγοντες όπως έλλειψη κινήτρου, απόσπαση προσοχής και αδύναμη αυτο-ρύθμισης. Η μελέτη επιχειρεί να γεφυρώσει την οργάνωση εργασιών με ψυχολογικούς / κοινωνικούς μηχανισμούς κινητοποίησης.

Το έργο στοχεύει σε δύο αλληλένδετους άξονες:

- Την ενσωμάτωση μηχανισμών παιχνιδοποίησης (π.χ. XP, badges, streaks, leaderboards) ώστε οι καθημερινές ακαδημαϊκές υποχρεώσεις να αποκτήσουν στοιχείο «προκλήσεων» και επιβραβεύσεων.
- Την εφαρμογή μηχανισμών κοινωνικής λογοδοσίας - όπως study buddies, ορατότητα χρόνου μελέτης και κοινές εργασίες - που αξιοποιούν την αλληλεπίδραση με συφοιτητές για να αυξήσουν την ευθύνη και την επιμονή. Η βασική επιδίωξη είναι να δημιουργηθεί ένα περιβάλλον που υποστηρίζει τη διαμόρφωση υγιών και σταθερών μαθησιακών συνηθειών.

Η ανάπτυξη ακολούθησε ανθρωποκεντρική προσέγγιση (User-Centered Design — UCD) και ένα SDLC με το Star-Model πλαίσιο: έρευνα - σχεδιασμός - πρωτότυπο - υλοποίηση - αξιολόγηση. Πραγματοποιήθηκαν βιβλιογραφικές ανασκοπήσεις, ανάλυση state-of-the-art, και προκαταρκτική ποιοτική έρευνα χρηστών με ημι-δομημένες συνεντεύξεις. Οι μετέπειτα φάση Σχεδίασης περιλάμβανε δημιουργία personas, use cases, functional & non-functional requirements, wireframe και brand. Από αυτή προέκυψε το Figma prototype, με συνεχείς αξιολογήσεις και διορθώσεις βάσει σχολίων χρηστών. Στη συνέχεια ακολούθησε η υλοποίηση και η εργασία έκλεισε με μια ακόμα φάση αξιολόγησης.

Η προκαταρκτική έρευνα (ημι-δομημένες συνεντεύξεις με αντιπροσωπευτικούς φοιτητές) αποκάλυψε κοινά μοτίβα: προβλήματα συγκέντρωσης, κόπωσης, ανάγκης για κοινωνική υποστήριξη, και προτίμησης για παιχνιδοποιημένες αλληλεπιδράσεις. Από τα δεδομένα σχηματίστηκαν τρεις κύριες personas: Ariadne (The Disciplined), Akali (The Procrastinator) και Glaucus (The Passionate), οι οποίες οδήγησαν στον καθορισμό σεναρίων χρήσης και στις

απαιτήσεις του συστήματος. Τα ευρήματα τροφοδότησαν άμεσα το PACT analysis και τις προτεραιότητες σχεδιασμού.

Οι σχεδιαστικές επιλογές υποστηρίχτηκαν από wireframes, navigation maps και Figma prototype και προσαρμόστηκαν μετά από usability feedback.

Η πρώτη αξιολόγηση πραγματοποιήθηκε μετά την ολοκλήρωση του διαδραστικού πρωτοτύπου στο Figma, πριν από την τελική υλοποίηση της εφαρμογής. Συμμετείχαν έξι (6) άτομα: πέντε εκπρόσωποι της ομάδας-στόχου (φοιτητές) και μία ειδική αξιολογήτρια με εμπειρία σε διεπαφές χρήστη.

Η μέθοδος που χρησιμοποιήθηκε ήταν το Think-Aloud Protocol, όπου οι συμμετέχοντες καλούνταν να εκτελέσουν βασικές λειτουργίες μέσα στο πρωτότυπο και να εκφράζουν φωναχτά τις σκέψεις και δυσκολίες τους. Τα κύρια ευρήματα αυτής της φάσης ήταν:

- Θετική αποδοχή της συνολικής πλοήγησης και λογικής των οθονών, με επισημάνσεις για μικρές βελτιώσεις στη διάταξη και ορατότητα κάποιων κουμπιών (“See more Experience Points Insights”, “Add Task”).
- Η αισθητική και η ταυτότητα του brand κρίθηκαν ελκυστικές και συμβατές με το κοινό των φοιτητών.
- Οι χρήστες θεώρησαν τις λειτουργίες Leaderboard και Badges ενδιαφέρουσες και παρακινητικές, ωστόσο προτάθηκε να δοθεί μεγαλύτερη έμφαση στην προβολή προόδου (π.χ. στατιστικά ή χρονική απεικόνιση).

Με βάση τα παραπάνω σχόλια έγιναν διορθώσεις στο design πριν την υλοποίηση: απλοποίηση της σελίδας προφίλ, ενίσχυση της ιεραρχίας πληροφοριών και άλλες μικρές αλλά σημαντικές αλλαγές για καλύτερη εμπειρία χρηστών.

Η εφαρμογή σχεδιάστηκε ως mobile app με έμφαση στην απλότητα και το παιχνίδι· κύρια χαρακτηριστικά που υλοποιήθηκαν είναι:

- Experience Points (XP): χρήστες αντιστοιχίζουν πόντους στις εργασίες και συγκεντρώνουν XP κατά την ολοκλήρωση.
- Leaderboard: εβδομαδιακοί πίνακες κατάταξης που ενισχύουν τη φιλική ανταγωνιστικότητα.
- Streaks: καθημερινές «αλυσίδες» ολοκληρώσεων για προώθηση συνέπειας.
- StudyBuddy / Social features: δυνατότητα σύνδεσης με άλλους χρήστες, κοινές εργασίες και ορατότητα «ποιος εστιάζει τώρα».
- Focus Timer: μετρητής «χρόνου μελέτης» (προσομοίωση pomodoro συνεδριών) που εμφανίζει σε άλλους χρήστες ότι κάποιος «είναι σε focus».
- Badges: διακριτικά επιβράβευσης (κατηγορίες: Committed, Leader, Social, Newbie) με επιλογή αγαπημένων.

Η εφαρμογή αναπτύχθηκε με React Native + Expo (cross-platform frontend) και Appwrite ως backend-as-a-service (DB, Authentication, Functions). Η αρχιτεκτονική ακολουθεί ένα στρωματικό μοτίβο: Frontend → Contexts → Services → DatabaseService (Appwrite SDK).

Η υλοποίηση έκανε ουσιαστική κάλυψη CRUD της βάσης δεδομένων της εφαρμογής. Επιπλέον έγινε χρήση των Appwrite Functions (serverless) που υλοποιούν αυτοματισμούς

όπως την καθημερινή επαναφορά των streaks και την ενεργοποίηση εβδομαδιαίων ειδοποιήσεων leaderboard. Οι functions αναπτύχθηκαν και προβάλλονται μέσω του GitHub. Τέλος, το deployment έγινε με Expo EAS για preview builds, ενώ το backend αξιοποιεί την cloud φιλοξενία του Appwrite.

Ακολούθησε αξιολόγηση που πραγματοποιήθηκε μετά την ολοκλήρωση της ανάπτυξης του λειτουργικού πρωτοτύπου. Σε αυτή συμμετείχαν 8 άτομα τα οποία άνηκουν στην ομάδα-στόχο και έλαβε μέρος μέσα στην εξεταστική περίοδου του Σεπτεμβρίου. Η αξιολόγηση περιλάμβανε πολλαπλές μεθόδους:

- Think-aloud,
- Field study σε πραγματικές συνθήκες χρήσης,
- Focus groups,
- Ερωτηματολόγιο.

Τα ευρήματα αυτής της φάσης συνοψίζονται ως εξής:

- Οι χρήστες χαρακτήρισαν την εφαρμογή διαισθητική και ευχάριστη, επιβεβαιώνοντας τη χρηστικότητα του περιβάλλοντος.
- Οι λειτουργίες Focus Timer και Leaderboard ξεχώρισαν ως οι πιο παρακινητικές και αποτελεσματικές στη διατήρηση συνέπειας.
- Από το ερωτηματολόγιο, 87,5% των συμμετεχόντων δήλωσαν ότι θα σύστηναν την εφαρμογή, ενώ 62,5% παρατήρησαν αύξηση στην προσωπική τους παραγωγικότητα κατά τη χρήση της.
- Οι παρατηρήσεις επικεντρώθηκαν κυρίως σε τεχνικές βελτιώσεις: ανάγκη για αξιόπιστες ειδοποιήσεις/reminders, μικρές διορθώσεις στον timer και προσθήκη περισσότερων επιλογών προσωποποίησης.

Η συνολική εικόνα της δεύτερης αξιολόγησης επιβεβαίωσε ότι ο συνδυασμός gamification και accountability συνέβαλε ουσιαστικά στην ενίσχυση της δέσμευσης και του κινήτρου των φοιτητών, ενώ ταυτόχρονα ανέδειξε συγκεκριμένα τεχνικά πεδία για μελλοντική βελτίωση.

Η εργασία παρήγαγε ένα λειτουργικό πρωτότυπο που επιβεβαίωσε την εφικτότητα της ιδέας: οι συνδυαστικές μηχανικές παιχνιδοποίησης και κοινωνικής λογοδοσίας μπορούν να βελτιώσουν την αυτοαντίληψη παραγωγικότητας και να ενισχύσουν τη δέσμευση των φοιτητών. Τα πιο επιτυχή στοιχεία ήταν ο Focus Timer, οι XP/Leaderboard μηχανισμοί και τα badges, ενώ ελλείψεις σε τεχνική ωριμότητα (ειδικά ειδοποιήσεις, σταθερότητα timer, προσωπικοποίηση) έδειξαν σαφείς κατευθύνσεις βελτίωσης.

Τα κύρια πεδία επεκτάσεων που προτείνονται στο έγγραφο είναι:

- Τεχνικές βελτιώσεις: επιδιόρθωση σφαλμάτων timer, εισαγωγή νέων λειτουργιών timer (countdown, packet modes), υλοποίηση push notifications & reminders.
- Εμπλουτισμένη παιχνιδοποίηση: επίπεδα, milestones, «all-time» leaderboard για μακροπρόθεσμη δέσμευση.
- Κοινωνικά & accountability features: study-buddy requests, nudges/ reactions, σχολιασμός σε κοινές εργασίες, προσαρμοζόμενοι πίνακες κατάταξης (φίλοι, μάθημα, εβδομάδα).

- Προσωποποίηση & προσβασιμότητα: dark mode, avatars, themes, συστηματικός έλεγχος προσβασιμότητας (labels, contrast, screen-reader).
- Εκτεταμένη αξιολόγηση: μακροχρόνιες δοκιμές μέσω ακαδημαϊκών κύκλων (όχι μόνο περιόδους εξετάσεων) για να μετρηθεί διάρκεια δέσμευσης και διαφοροποιήσεις χρήσης.
- Επέκταση πεδίου: εφαρμογή της δομής σε μη-ακαδημαϊκούς στόχους (fitness, προσωπικά projects) με προσοχή στην απλότητα.

Η διπλωματική εργασία παρουσιάζει τόσο ένα τεχνικό προϊόν όσο και εμπειρικά δεδομένα που υποστηρίζουν τη χρήση gamification και accountability στην ψηφιακή υποστήριξη φοιτητικής μελέτης. Το πρωτότυπο απέδειξε την υπόθεση εργασίας αλλά ταυτόχρονα ανέδειξε τεχνικά και σχεδιαστικά πεδία που χρειάζονται συστηματική βελτίωση προκειμένου να μεταβεί η εφαρμογή από πρώτη υλοποίηση σε ένα ώριμο, ευρέως χρησιμοποιήσιμο εργαλείο.

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1. Introduction

In order to ground this work, the following chapter begins by examining the underlying motivations for developing this thesis. This is followed by an overview of the context, situating the application within existing academic and technological trends, and highlighting how it addresses specific gaps in current task management tools. Finally, the chapter concludes by outlining the objectives, clarifying the intended contributions of the thesis and the design principles guiding its development.

1.1 Motivation

This paragraph focuses on the motivation, both general and personal, of writing this thesis. It will first consider the broader societal and generational context in which today's students navigate their studies, before moving on to the personal perspective that inspired the present topic. Together, these subsections highlight both the external pressures shaping student life and the lived experiences that informed the project's conception.

1.1.1 General

Society today is evolving at a rapid pace. Information has become central to everyday life, to the point that these years are often described as the "Age of Information". As technology advances, individuals are expected to adapt quickly in order to keep up with constant changes. At the center of this environment are students and especially university students, who, as members of the younger generation and future contributors to the job market, face increasing pressure to meet these expectations. This pressure can at times result in what may be described as a "freezing effect," where students disengage from their academic obligations and instead prioritize other aspects of life, such as family, friendships, or personal hobbies.

In this context, there is a clear need for tools that can encourage students to remain engaged with their academic responsibilities. Such tools should not only help them organize their obligations in a manageable way but also reduce the sense of being overwhelmed. Members of Generation Z, who constitute the majority of today's student population, value fun, freedom, and autonomy in their choices. Consequently, adding elements of gamification into academic task management promises a helpful approach to elevate their motivation higher. At the same time, this generation places significant value on community and peer relationships so fostering accountability and shared accomplishment is another essential factor to consider as something they cherish and could be useful to them.

Since students are highly familiar with smartphones and rely on them as indispensable tools in their daily lives, it is logical to enable them using these devices for also managing academic obligations. Students already use this technology to organize their schedule, assess information, manage their finances, maintain and communicate with their social network and much more. It is important to have in mind this dependence, to understand this generation's

use of a smartphone, not exactly as a supporting device, but as an extension of everything that they are familiar with.

Thus, the conclusion is made that developing a mobile application and enabling students to have access to it everywhere could be a helpful tool for them. A mobile application specifically designed for students, that is focused not only on task management but also on enhancing motivation and commitment, could provide meaningful support in helping them respond more effectively to the diverse academic responsibilities they face every day. Ultimately, this kind of intervention has the potential to contribute not only to improved academic performance but also to greater well-being and satisfaction among students as they navigate the demands of higher education in the fast-paced “Age of Information”.

1.1.2 Personal

The motivation for choosing this topic for my Diploma Thesis arises both from my own experiences as a university student and from observing the experiences of those around me who went through similar practices during their student years.

When I first enrolled at university, I came across a problem I didn’t expect to have. Studying in university is very different from the structured learning environment of school. In school, assignments are mandatory, clearly listed, and scheduled from one day to the next. In contrast, university as a higher education institution emphasizes independent learning, with much of the required knowledge expected to be self-explored and often not formally assessed until the final examinations. At the same time, adapting to a new schedule with daily obligations quickly became overwhelming, and I observed how both my peers and I had to get used to the struggle of managing the new demands placed upon us.

Nowadays, creating a schedule is something I do regularly and out of necessity, as I have learned how important it is for managing academic obligations. In the beginning, however, I had little knowledge of how to organize my time and, I did not realise its importance. Learning to plan was one step; committing to those plans proved to be a different challenge altogether, and one that has consistently presented difficulties for me over the years.

Over time, I noticed that my peers and I each developed different methods for coping with academic demands. Despite our varied approaches, three common themes stood out: a strong desire to maintain social connections while still succeeding academically, a recurring difficulty in focusing on the tasks we needed to complete and how to organise said tasks.

The initial idea of this application emerged during my membership in a student NGO where tasks had to be completed but with the acknowledgment that we didn’t having prior knowledge of how to plan and organize them effectively. I remember more experienced members introducing us to time management methods, project timelines, the importance of realistic deadlines and how to build a schedule as well as various productivity tools that will later be mentioned. These lessons highlighted the importance of planning, documenting tasks, and breaking down work into manageable components as key factors in successfully completing projects.

Another formative influence was the strong sense of community within the organization. We worked on our projects together and even when we did different things we stayed side by side. We held each other accountable for the completion of our tasks, we got inspired by seeing each other work and celebrated our achievements collectively. Gamification was another prominent feature in our activities: levels, badges, rewards and acknowledgement were regularly used, and I saw firsthand how these elements motivated members to remain committed and productive. Later, as a more experienced member of the NGO, I came to fully appreciate how gamification features could significantly enhance motivation and efficiency within a group.

Today, after several years of study and commitment to completing my degree, these lessons seem obvious. I can see not only how I have grown but also how my peers have matured in their ability to plan, schedule, and manage academic responsibilities. Still, sometimes I see recurring struggles to sustain motivation for something that feels so distant and abstract. How they need a push from a friend to get working instead of chatting.

With this application, I'm hoping to provide a supportive solution that enables students to build on their studying habits, grow accountable and get motivated to work. I hope to offer students a platform that keeps them engaged and responsible and gives them the opportunity to face their academic obligation with more consistency.

1.2 Context

This mobile application is designed with the potential to support university students in their daily academic lives. Across different countries and institutions, students face similar challenges: balancing lectures, assignments, projects, exams, and personal commitments while also maintaining their social connections and well-being. Smartphones, already an essential part of students' everyday routines, provide an ideal platform for delivering such support. By integrating task management with motivational and community-driven features, the application can accompany students wherever they are, ensuring accessibility and relevance in real time.

The context in which this application is introduced is defined by the increasing complexity of academic life in higher education. Traditional task management tools often focus solely on productivity, neglecting the psychological and social aspects of motivation that are particularly important for Generation Z students. Young adults today are more responsive towards interactive, personalized, and gamified digital products, as demonstrated by the rapid growth of social media platforms and lifestyle applications. They seek autonomy, but also thrive when their progress is recognized and when they feel part of a larger community.

What differentiates this project from other productivity or task management tools is its incorporation of social features and gamification principles. The aim of the platform is to introduce a playful dimension to academic work, transforming obligations into engaging challenges rather than mandatory tasks. At the same time, it provides social features that promote accountability and healthy competition, allowing students not only to manage their own responsibilities but also to share motivation and encouragement with peers.

In summary, the app is positioned within the intersection of education, technology, and motivation. It acknowledges the real struggles students face in managing their obligations and offers a solution tailored to their digital habits and social preferences. By blending productivity with gamification and peer support, it aspires to provide a meaningful and sustainable way for students to remain committed to their studies, while still valuing the freedom and community that characterize their generation.

1.3 Objectives

The main objective of this thesis is to **support** users in **managing their academic tasks** and to **incentivise them** to complete those tasks on time by applying **gamification** and **accountability** techniques. The application aims not only to provide a structured way of organizing obligations but also to actively encourage timely completion of those tasks. This will be achieved through two main elements. Firstly, the integration of gamification techniques, which aim to transform routine academic responsibilities into engaging challenges. Secondly, accountability mechanisms, which aim to draw upon the motivational power of community and peer support.

Beyond simple task management, the goal is to create an environment where students can build healthier study habits, strengthen their commitment to academic work, and experience a sense of progress and achievement along the way. By combining practical organization tools with motivational features tailored to the needs and preferences of Generation Z, the project aspires to demonstrate how Human–Computer Interaction principles can be applied to address real challenges in student life. Ultimately, the thesis seeks to contribute both a working prototype of the application and a reflection on how gamification and accountability can be leveraged as design strategies to enhance motivation and academic performance in higher education contexts.

1.4 Thesis Overview

Before moving to the next chapter, an overview of the thesis will be presented. This is in order to guide any reader in understanding the steps of the process.

- **Chapter 1 - Introduction:**

Presents the motivation for the project, both in a general and personal sense, situates the work within its broader context and outlines the main objectives of the thesis.

- **Chapter 2 - Background:**

Reviews the existing literature on students' challenges and current solutions, surveys the state of the art in comparable tools and introduces user-centered design principles that inform this work.

- **Chapter 3 - Design:**

Describes the design process, including user research, personas, functional and non-functional requirements and the creation of mock-ups that shaped the application's structure and features.

- **Chapter 4 - Prototype:**

Presents the developed prototype, outlining its screens, key features, and the evaluation process that guided refinements toward a final version.

- **Chapter 5 - Implementation:**

Explains the technical realization of the application, detailing system architecture, chosen technologies, data models and deployment.

- **Chapter 6 – Evaluation:**

Reports on both self-evaluation and user-based evaluation, including findings from interviews, focus groups, monitoring and questionnaires.

- **Chapter 7 – Results:**

Summarizes the conclusions of the thesis, discusses future directions for improvement and expansion, and reflects on the overall contributions of the project.

Together, these chapters provide a structured path from motivation and theoretical grounding to design, implementation, and evaluation, ensuring that the project is understood both in its academic context and in its practical application. The next chapter, *Background*, lays the foundation by reviewing existing research and related work in the field.

2. Background

In order to frame the development of the proposed application, this chapter explores three key areas. First, a review of existing literature highlights the main problems faced by students in managing their academic obligations, as well as approaches that have been studied to mitigate them. Second, an analysis of existing tools and applications provides an overview of the current state of the art and identifies gaps that remain unaddressed. Finally, the design approach adopted in this work is presented through the principles of User-Centered Design, ensuring that the proposed solution is aligned with the needs and experiences of its intended users.

2.1 Bibliography

To begin, Paragraph 2.1 provides a bibliographic overview of the challenges that students face when dealing with academic tasks and the strategies that have been suggested to overcome them. This part is structured into three subsections: the main problems identified in the literature, the most relevant solutions proposed and the conclusions that can be drawn from these findings in order to inform the present work.

2.1.1 Main Problems

To further base the problems of studying in university student demographic of this era, research was made accordingly. It was found out that undergraduate university students often struggle to complete their academic tasks on time, a challenge that has been strongly associated with procrastination (He, 2017). Based on several studies, it has been identified that procrastination is a widespread behavioral issue in higher education. It is often linked to factors such as lack of motivation, stress, and fear of failure, combined with poor time and task management skills (He, 2017).

Steel (Steel, 2007) provides a more comprehensive view by identifying additional key contributors to procrastination, including distractibility, impulsiveness, task aversiveness, disorganization, and a lack of self-discipline. He also highlights the student's perspective on duty and its connection to self-control, suggesting that procrastination is deeply tied to failures in self-regulation.

The research ties to the initial statement that students struggle in fulfilling their academic obligations and it encourages further investigation on the common approaches of solving this issue.

2.1.2 Solutions

Having outlined the core difficulties students encounter, the next step is to examine solutions that have been proposed to address these challenges. The literature highlights three main approaches that are particularly relevant for supporting academic performance:

- **Goal-setting**, which strengthens self-regulation and provides clearer direction
- **Gamification**, which fosters sustained engagement and motivation
- **Accountability**, which leverages peer or community support to encourage task completion.

Each of these approaches is explored in more detail in the following subsections.

Goal-Setting

Research indicates that external interventions can help students strengthen their self-regulation skills and improve motivation, which in turn increases their academic success (Kitsantas et al., 2008). Before moving further in the solutions it is important to define the aspects that need improvement from the students and how to tackle them.

Firstly, self-regulation in learning is defined as the ability of students to manage their thoughts, behaviors, and emotions in order to achieve academic goals (Schunk & Zimmerman, 2012). An external intervention to boost the self-regulation of students is goal-setting. Goal-setting theory suggests that distinguishing between mastery goals (focused on learning) and performance goals (focused on achievement) provides students with clearer direction in their academic paths (Linnenbrink & Pintrich, 2002). As mentioned in Chapter 1: Introduction, it is further established that writing down the goals, tasks and overall items that need to be completed, encourages productivity.

In an attempt to support these processes, a number of digital tools such as Google Tasks[1], Google Calendar[2], and School Planner by Andrea Da Cin[3] have been developed to help students break their academic obligations down into manageable tasks. All of them are platform that encompass planning and scheduling features and will be explored further when the current state-of-art is analysed.

Gamification

While these tools are useful for planning and scheduling, it was observed that they often lack mechanisms that actively engage students in following through with their tasks. As a result, research has shown that although many mobile applications have been introduced and

[1] https://tasks.google.com/
[2] https://calendar.google.com/
[3] https://play.google.com/store/apps/details?id=daldev.android.gradehelper&hl=en

evaluated for academic support, they sometimes fail to maintain user engagement over time, ultimately leading to the abandonment of the tool (Okuboyejo, Aremo, & Sowunmi, 2019).

Because of that statement, it was worth exploring which techniques maintain the interest of its target group and especially methods that captivate university students.

It was found out, studies that integrate gamification techniques into educational applications report improved student engagement, retention, and academic performance (Pechenkina et al., 2017)(O'Donovan, Gain, & Marais, 2013). This indicates that fostering student engagement is not just desirable but crucial for supporting self-regulation and ensuring the completion of academic tasks.

Gamification, broadly defined as the use of game design elements in non-gaming contexts, has become an established strategy for improving user experience and engagement (Deterding et al., 2011). For example, Duolingo[4], a widely used language-learning platform, demonstrates how gamified features such as streaks and badges can significantly increase user commitment to continuous learning (Huynh, Zuo, & Iida, 2018). These findings highlight the potential value of integrating gamification into task management systems for students.

Accountability

Beyond gamification, other techniques can also be employed to sustain motivation. Peer-to-peer accountability is one such approach, where individuals of equal status hold each other accountable for progress toward their goals. This involves openly sharing objectives, tracking milestones, and offering mutual encouragement.

Studies have found that students who disclosed their goals to others were more productive and more likely to achieve them (Klein et al., 2019 ; Matthews, 2007). One study (Klein et al., 2019) used the mechanism of evaluation apprehension: the concern about being judged by the audience. It explored how participants feel when someone will evaluate them (positively or negatively), especially someone of higher status. It was found out that there was a tendency of them committing more strongly in their goals when they were made public. In the second study (Matthews, 2007), more than 200 participants were divided into 5 groups according to how they would treat their goals:

- Group 1: No written goals (just thinking of goals)
- Group 2: Written goals
- Group 3 : Written goals and Action commitments
- Group 4: Written goals and Action commitments and Sharing them with a supportive friend
- Group 5: Written goals and Action commitments and Sharing them with a supportive friend and Sending a weekly progress report to said friend.

The study demonstrated a graded effect, with Group 5 achieving significantly more than all other groups, while even intermediate steps such as writing down goals and sharing them with a supportive partner resulted in higher levels of achievement compared to groups

[4] https://www.duolingo.com/

without written or shared commitments. These are both findings that can be incorporated into the outline of the application being constructed.

Additionally, institutions such as Harvard University actively promote Accountability Groups as a strategy for maintaining academic productivity. These groups provide structure, social commitment, and focus, helping participants to progress on assignments, projects, and readings that might otherwise feel overwhelming or isolating (Harvard Academic Resource Center, 2023).

These findings further show the overlap with the statement of Chapter 1, as they highlight the importance of community being present to encourage progress in a student's obligations.

2.1.3 Conclusions

Finally, Fogg's Behavioral Model (Fogg, 2009) provides a theoretical lens for understanding these dynamics. According to the model, a target behavior occurs when three elements converge: sufficient motivation, adequate ability, and an effective trigger. Translating this into the academic context, a student may possess the ability to study but still fail to do so if motivation is lacking or if no trigger prompts them to begin. Triggers can take many forms, such as external reminders, peer encouragement, or digital notifications.

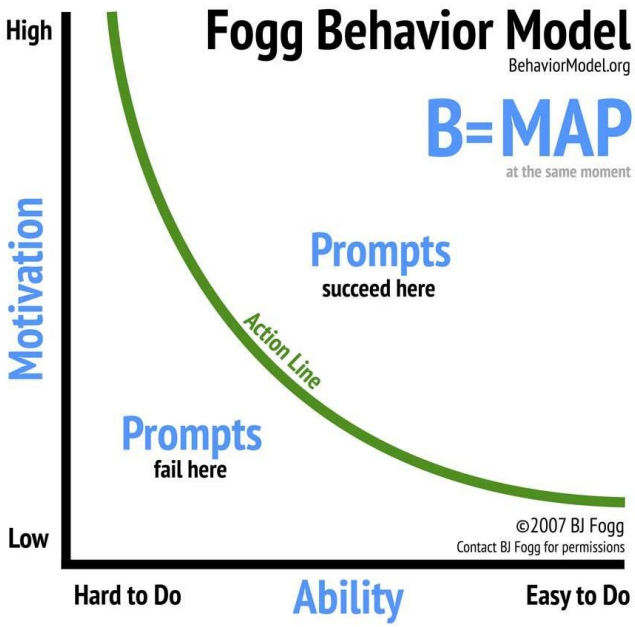


Figure 1: Fogg Behaviour Model, chart explanation[5]

Building upon these insights, the aim of this thesis is to design a mobile application that provides both motivation and triggers, supporting students in managing their academic tasks and incentivizing timely completion. A simple task-management tool is not sufficient to

[5] https://web.archive.org/web/20250909172715/https://www.behaviormodel.org/

accomplish this. By combining gamification with accountability techniques, the application seeks to address the key challenges identified in the literature: low engagement, weak self-regulation, and the persistent tendency to procrastinate seen in today's students.

2.2 State of the art

This section serves for analysing existing mobile and web applications that have a similar purpose statement to the application being developed in this thesis. By reviewing and comparing established tools, it is possible to identify common functionalities, innovative features, and gaps that may be addressed in the proposed solution. The analysis begins with a comparative summary table of selected applications, highlighting their platforms and noteworthy features, followed by a more detailed discussion of each application and a concluding synthesis of elements that could inform the design of the present work.

2.2.1 Summary

The following table summarizes the main applications considered, outlining their platforms and key features that make them relevant to this study.

Application Name	**Platform**	**Interesting Features**
Google Calendar	Web, iOS, Android	Event scheduling Task Management Reminders Calendar sharing
School Planner by Andrea Da Cin	Android, iOS	Task management Calendar Grade tracking Customizable timetables Notifications
Notion[6]	Web, iOS, Android, Windows, macOS	Task Management Database customization, Collaboration tools, Templates for tasks and notes.
Duolingo	Web, iOS, Android	Gamification (Stories, Ranks, Experience Points, Streak) Social Features (Goal Setting, Experience Points, Friends)

[6] https://www.notion.com/

Clickup[7]	Web, iOS, Android, Windows, macOS	Task management Task collaboration
TickTick[8]	Web, iOS, Android, Windows, macOS	Calendar view Pomodoro timer Customizable reminders Task collaboration Habit tracker
FLIP - Focus Timer for Study by RinaSoft[9]	ioS, Android	Task Management Focus Timer Statistics Social Features (Friends, Dashboard, Ranking, Group studying) Notifications
Finch: Self-Care Pet[10]	ioS, Android	Task Gamification, Rewarding System

Table 1: State of the art summary

2.2.2 Details

To gain a deeper understanding of how these features are implemented in practice, the following section provides a more detailed description of each application and its most relevant functionalities.

Google Calendar offers a daily, 3-days, weekly or monthly view of the calendar where users have the option to add their tasks and events and additionally invite other users to attend or collaborate with them. An option it includes, is the creation of specific "calendars" color-coded to reflect different aspects such as work, entertainment etc.

TickTick is a task management platform encompassing multiple aspects of every-day life. Tasks can be set and organised in labels, projects, customised lists and a built-in calendar. The labels are set to reflect different aspects of life such as work, socialising, errands etc. The app offers multiple views of visualising the tasks depending on the needs and preferences of the user; Weekly calendar, Kanban, Eisenhower Matrix, Timeline and Sticky Notes. It additionally includes a habit-tracker, a pomodoro timer as well as collaboration tools for teams.

Clickup and **Notion** are both great examples of task management and collaboration. Both platforms include tables for setting tasks, deadlines, progress and people who are responsible for them. To better organise and divide the tasks they can be given tags as well as be put into

[7] https://clickup.com/
[8] https://ticktick.com/
[9] https://play.google.com/store/apps/details?id=kr.co.rinasoft.yktime&hl=en
[10] https://finchcare.com/

bigger projects. They also include a built-in calendar and a customisable collaborative workspace, as both are marketed as online-work tools.

School Planner by Andrea Da Cin is an app targeted for students of all ages to facilitate their academic tasks. It includes setting tasks to organise one's homework, exams and classes with the option to specify the date, time, progress and subject. It also has a built-in customisable calendar including milestones and tasks' time-allocation and a user-friendly widget to include on the home screen and see one's tasks at a glance.

FLIP - Focus Timer for Study APK by RinaSoft is a time and habit management study and work app with collaborative tools. Its focus tool includes a "flip-timer" which functions with motion tools as it activates when the user's phone is flipped and stops tracking as soon as the user moves their phone. It also covers social features such as friends, ranks, statistics and group studying as well as customisable notifications and schedule tracking.

Duolingo is a language-learning platform that uses both gamification and accountability tools to keep user engagement. The app uses frequent reminders, crystals that give you experience points and a daily streak to motivate its users. It also ranks users in different leagues depending on their crystal-count per week and encourages them to climb higher by comparing them to other users. It also includes collaborative tools; making friends, getting crystals together for extra points and a friends leaderboard to compete in.

Finch: Self-Care Pet is an app focusing on gamification of every-day tasks, chores and mood-tracking. It includes customisable task and goal-setting where all tasks can be set depending on the user's perspective on their difficulty. It includes ready-made-tasks as suggestions but also lets the user create their one task and set their difficulty and time and date. As the users complete their task they are given encouraging messages and points to enable Finch, their pet, to go on engaging adventures and win in-game clothing and accessories.

2.2.3 Conclusions

In conclusion, a lot of applications have been created with an aim to declutter and schedule tasks and some of them have taken steps in including gamification and accountability elements.

When it comes to task management and goal setting, among the most effective features are built-in calendars, which allow users to plan events and assign deadlines to their planned tasks. Many applications also include customizable labels or categories, enabling users to divide their work according to subjects, projects, or areas of life, which enhances clarity and efficiency.

Additionally, several applications incorporate gamification elements to sustain user engagement. Popular strategies include experience points, rewards, daily streak and leaderboards, which encourage users to compare their progress with that of others. These elements not only make the process of completing tasks more enjoyable but also provide extrinsic motivation that can complement intrinsic commitment.

Finally, accountability plays a crucial role in driving task completion. Many applications foster this by integrating social features such as adding friends, completing tasks collaboratively, or participating in shared leaderboards. These tools highlight each user's study time or achievements, creating a sense of shared responsibility and healthy competition that strengthens commitment to personal goals.

2.3 User Centered Design

Human-Centred Design (HCD) as defined by ISO Standards is a systematic approach to problem-solving that emphasizes the involvement of human perspectives throughout all stages of the design process.

According to ISO 9241-210 (2019), human-centered design follows these principles:

- "Design is based upon an explicit understanding of users, tasks, and environments.
- Users are involved throughout design and development.
- Design is driven and refined by user-centered evaluation.
- The process is iterative.
- Design addresses the whole user experience.
- The design team includes multi-disciplinary skills and perspectives."

(International Organization for Standardization, 2019).

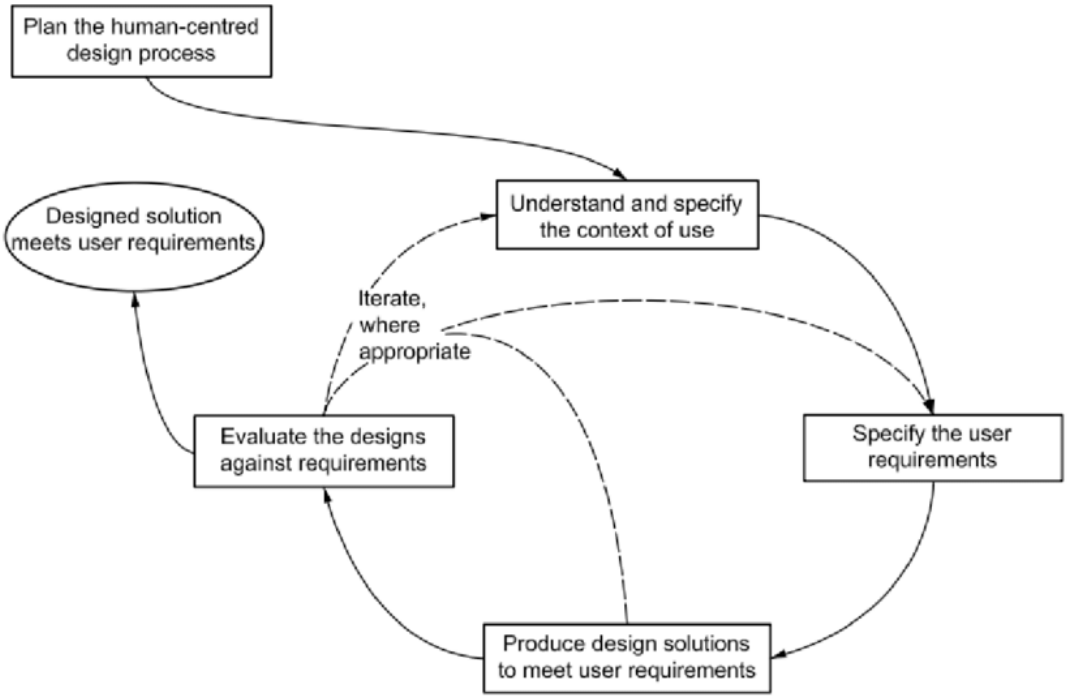


Figure 2: the Human-Centered Design (HCD) Process[11]

When it comes to HCD in a Human-Computer Interaction (HCI) context, the term UCD, User-Centered Design is more suitable and will be followed in this thesis.

UCD is a design approach introduced by Donald Norman in 1986 [18] that emphasizes on the experience of end-users throughout the designing process. It focuses on the end-users' feedback in order to make adjustments in each step before delivering the final product.

On this basis, this thesis has been planned in making an application with a User-Centered Design that will include feedback and adjustments throughout the whole process. Namely feedback will be gathered and implemented on the following moments:

- Before functional and non-functional Requirements formulation.
- After the Prototype creation.
- After the complete Implementation.

Various strategies of UCD will be implemented throughout the multiple evaluation stages that will be explored further when it is time.

2.4 Models of Software Development

The development of software systems is usually structured around specific models that guide the process from conception to completion. These models are built upon the fundamental

[11] https://www.researchgate.net/figure/The-HCD-process-ISO-9241-210_fig1_352536448

stages of the Software Development Life Cycle (SDLC), namely analysis, design, implementation, evaluation, and maintenance. Depending on the type of project, its scope, and the needs of the end-users, a different model may be adopted to implement these stages in the most effective manner.

One of the most widely used approaches is the Software Development Life Cycle (SDLC) itself, which provides a structured, step-by-step methodology for system development. It begins with analysing requirements and understanding user needs, followed by designing the architecture and user interface. The next stage is the implementation of the system through coding, which is then followed by systematic testing and evaluation with representative users. Finally, once the system is deployed, it enters the maintenance stage, where updates, bug fixes, and improvements are performed to ensure long-term usability and quality. (Nayan B. Ruparelia. 2010)

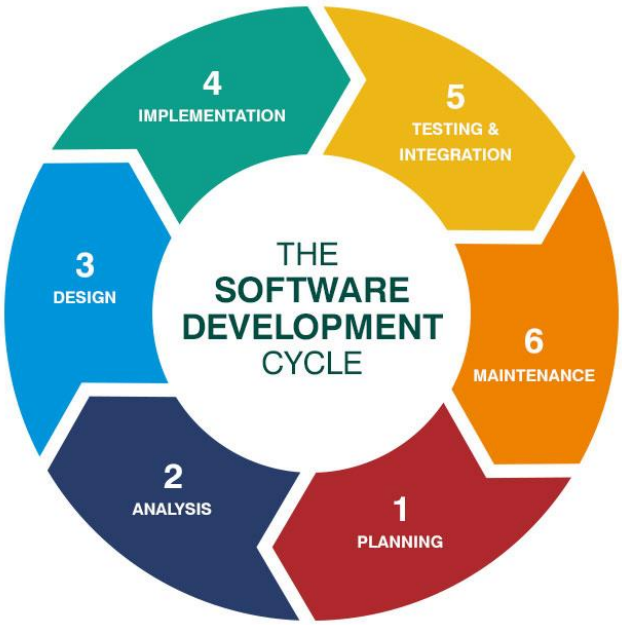


Figure 3: Software Development Life Cycle[12]

Another important approach, particularly relevant in the context of Human-Computer Interaction (HCI), is the Hix–Hartson Star Model. Unlike traditional linear models, the Star Model places human users at the center of the development process. Evaluation with end-users is not restricted to a final stage but takes place iteratively after every activity. This non-linear approach allows developers to return to previous stages whenever necessary and adjust the design or functionality based on user feedback. As a result, the system is continuously refined to meet the actual needs and expectations of its users. (H.R.Hartson; D.Hix, 1989)

[12] https://datarob.com/essentials-software-development-life-cycle/

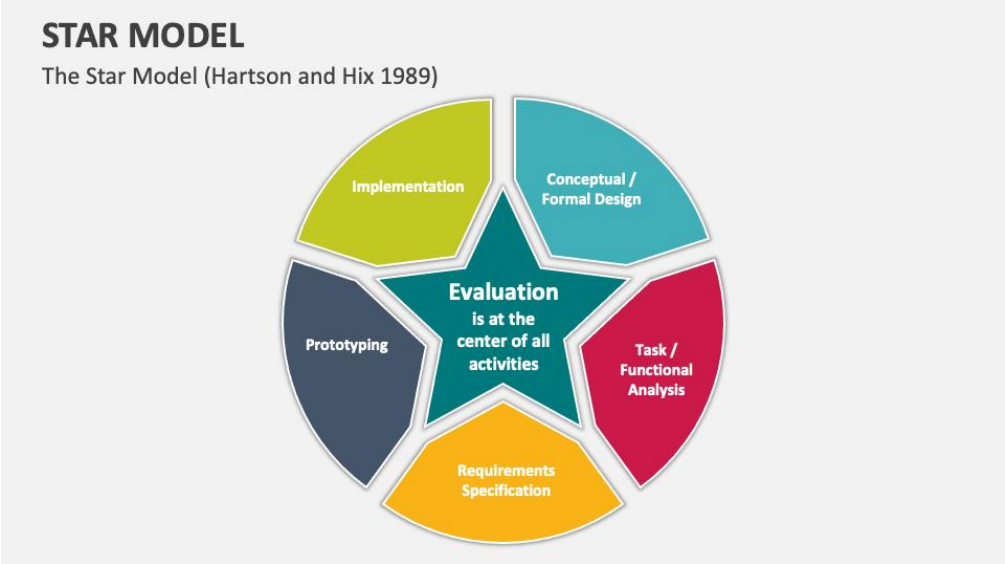


Figure 4: Star Model[13]

In this thesis, both the structured process of the SDLC and the human-centered flexibility of the Star Model are highly relevant. They provide complementary perspectives: the SDLC ensures methodological discipline across stages, while the Star Model reinforces the iterative and user-centered nature of the design.

2.5 Methodology

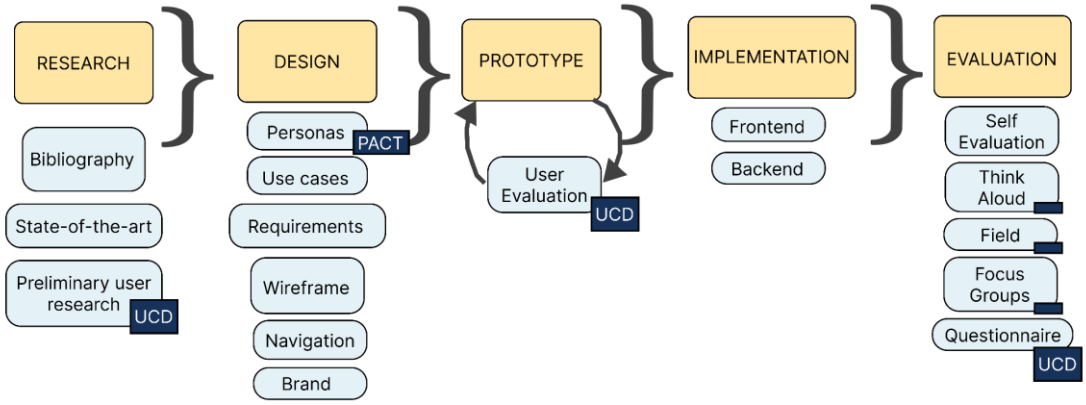


Figure 5: Methodology of the Thesis

The methodology adopted in this thesis can be structured into five main phases: **Research, Design, Prototyping, Implementation, and Evaluation**.

The **research phase** involved a review of the bibliography, a state-of-the-art analysis, and preliminary user research, ensuring that the process was grounded in user-centered design (UCD) principles. The bibliography study focused on concepts such as gamification,

[13] https://www.collidu.com/presentation-star-model

accountability, motivation and goal-setting. The state-of-the-art analysis examined existing applications operating in at least one of these areas, providing insights into current practices and design trends. Preliminary user research was conducted in the form of semi-structured interviews, which helped to identify user needs and inform subsequent stages.

The **design phase** concentrated on defining personas, which are part of the PACT framework, use cases, and system requirements, before moving on to the development of wireframes, navigation structures, and branding guidelines.

The **prototyping phase** integrated the outputs of the previous steps into an initial system prototype. This prototype was then evaluated through user testing, employing think-aloud protocols and structured feedback sessions. These evaluations provided feedback for refinement and improvement, once again guided by UCD principles.

The **implementation phase** encompassed both frontend and backend development. The system was implemented using Expo, a React Native framework, for the mobile interface, and Appwrite as the backend service and database, ensuring a robust and scalable technical foundation.

Finally, the **evaluation phase** employed a range of methods to assess the system's effectiveness and usability. These included self-evaluation of the implementation against the defined requirements, as well as user-focused techniques such as think-aloud protocols, field study, focus groups, and questionnaires. Collectively, these methods reinforced the user-centered orientation of the methodology.

This structured and iterative approach ensured that user needs remained central throughout the development lifecycle, from the initial research to the final evaluation.

3. Design

Following the theoretical foundations presented in the previous chapter, this chapter focuses on the design process of the proposed system. Design is a critical stage in Human–Computer Interaction (HCI) and user-centered development, as it translates user needs and requirements into concrete representations of the system. The aim is to ensure that the final application is not only functional, but also intuitive, accessible, and aligned with the users' expectations.

The chapter begins with the PACT framework, which provides a structured way of analysing People, Activities, Contexts, and Technologies. It then presents the preliminary user research, including its definition, process, and the thematic analysis of findings. Based on this research, the chapter identifies the target users through personas and use cases, which guide the design decisions. The next step is the requirements analysis, where both functional and non-functional requirements are established. Finally, the chapter introduces the mock-ups of the system, including wireframes, navigation structures and brand-related design choices such as the colour palette, fonts and logomark.

By following this sequence, the chapter provides a comprehensive view of the design process, from understanding users and contexts, to defining requirements, and ultimately shaping the visual and interactive aspects of the application.

3.1 PACT

Within the broader philosophy of User-Centered Design (UCD), the PACT framework serves as a practical method for structuring the design process. UCD emphasizes designing interactive systems around users' needs and experiences, and PACT contributes to this approach by ensuring that all relevant human, contextual, and technological factors are systematically considered before development begins.

The PACT framework (People, Activities, Contexts, and Technologies) was first proposed by Benyon (Benyon, 2013) (Benyon et al., 2005) and refers to an approach to designing interactive systems. It emphasizes human-centered design, considering users' needs, activities, and environments alongside technological capabilities. In other words, before the creative process begins, the following 4 areas need to be analysed and pre-decided:

- **People**: The people (users) who will utilise the product. Alternatively, who the product will concern. Some factors that differentiate one user from another could be their age, culture, habits, preferences and limitations.

- **Activities**: What activities and functions will the users be able to do with the product. The tasks that the product will have available will be many and different. Some will be used often and some rarely and they will all have varying duration and complexity. Some activities are individual while there's also the possibility to make an activity collaborative.

- **Contexts**: The context and environment in which the product will be used. It depends on where the human - computer interaction happens in physical, social and organisational context. It includes factors such as distractions, lighting, internet access and other external factors that affect the product's usability.

- **Technologies**: The hardware and software of the product. It also refers to the human-computer interaction style, for example the screen, input methods (touch, voice, keyboard) and the feedback/reply mechanisms from the computer.

In this particular application the PACT framework is the following:

People

The primary users whom this application concerns are university students aiming to boost their productivity and maintain accountability in their academic obligations. The application aims for users who grow committed in getting their motivation boosted. Of the users, most will be young adults as by a large percentage this is the age in which people enrol in university. These people are familiar with technology and we can assume they use it every day in their lives.

Activities

The application allows users to create, manage and collaborate on task and event obligations. It provides organisation of these obligations via their dates and deadlines using a calendar. It also features a built-in timer element to support focused study sessions that also showcases productivity to other users called buddies. Buddies allow users to collaborate, share progress and stay accountable in their obligations. The application also focuses on gamification elements such as Experience Points, Badges and Daily Streak.

Contexts

The application is only limited in its need of internet access. It will be accessed mostly on mobile devices. Some areas from where the app could be used include but are not limited to: university spaces, libraries, cafes and from home. It can be used both individually and in a social setting so it is worth highlighting the need for interactivity and constant refreshing so that new data is available to everyone.

Technologies

To ensure easy access to all users and all devices no matter their operating system, the application is supported by a cross-platform solution that supports both Android and iOS. Additionally scalable elements are utilised, ensuring its responsiveness in all screen sizes. The backend provider is chosen to ensure secure authentication and data storage. Lastly the interaction is primarily touch-based with also the keyboard input being used.

Overall, applying the PACT framework to this project clarifies the essential design considerations and ensures that the application remains focused on its users' goals. By addressing the characteristics of students, the types of activities they perform, the contexts in which they study, and the technologies they rely on, the framework guides the development process toward a human-centered solution that supports productivity, accountability, and engagement.

3.2 Preliminary User Research

For the purpose of gathering qualitative data from relevant people that fit the target group of the application, conducting Semi-Structured Interviews was selected as a suitable method.

3.2.1 Definition

Semi-structured interview is a qualitative research method that allows flexibility to both the interviewer and the interviewed party (Horton J., 2004). The interviewer has prepared for its purpose a series of questions, mostly open-ended, for the person being interviewed. While asking, the interviewee is free to express their thoughts and feelings on the matter and stray from the initial question to their liking. Follow-up, unscripted, questions may also be asked by the interviewer to further encourage conversation that might bring more outcomes (Karatsareas P., 2022).

It has been concluded that semi-structured interviews are a good methodology for the researcher to explore a lot of answers and get interesting and diverse outcomes. They can be used both at the start of a research to outline information and background and kick-off the design process, as well as, later to gather feedback and implement improvement points.

3.2.2 Process

Before conducting the interviews, the interviewers were selected. There was special care taken to ensure all subjects were university students and all of a different demographic. The main criteria in which they were selected were to have different academic habits, commitment and availability and to be in various stages of their degree.

The people that were selected in the end were six (6) and mirrored the criteria to a satisfactory level.

Before the interviews were conducted, all participants were informed about the purpose of the study and the intended use of their data. Consent was explicitly obtained for participation and for the storage and analysis of anonymized responses, in line with GDPR principles. Participants were also assured that their contributions would remain confidential and that they had the right to withdraw at any stage.

Following that, the semi-structured interview questions were drafted with the following goals in mind:

- Understand the studying behaviour and routines of students.
- Identify barriers and motivational drivers that influence the academic productivity of students.
- Explore different organisational and accountability strategies that different students use and how it affects them.
- Investigate how aware students are of gamification in academic settings and how they perceive its use.

- Collect feedback on different productivity tools and applications that students have used.
- Gather suggestions for features that students would find valuable in a new application.

To address these goals, the following questions were asked during the interviews:

1. Do you study? If yes, what for?
2. On a scale from 1–10 how content are you with your academic productivity right now?
3. Would you like to study more?
4. What keeps you from studying?
5. What motivates you to study?
6. How do you motivate yourself to study?
7. Do you plan your tasks? If yes, how?
8. How do you keep yourself accountable?
9. Do you use negative or positive reinforcement? Is it effective?
10. Have you ever worked with an accountability partner/group?
11. Have you ever used peer pressure to perform better?
12. Are you familiar with gamification? How would you integrate it in an academic-task environment?
13. Have you ever used an application to boost academic productivity? What did you like/dislike?
14. What other things have helped your academic productivity?
15. What kind of features would you like to see in an app targeted to boost your academic productivity?

The answers from all participants were written down and carefully reviewed. Each of the responses was then grouped into themes such as motivation, barriers, strategies etc, to make a sketch about students' productivity behaviours.

From the answers' analysis, three (3) personas were then created to represent the different types of students.

3.2.3 Thematic Analysis

The semi-structured interviews revealed a diverse set of perspectives on academic productivity, self-regulation, and motivational strategies. While the participants varied in their fields of study, stages of completion, and personal circumstances, common themes emerged across six main dimensions: goals, challenges, strategies of self-regulation, reinforcement mechanisms, attitudes toward collaboration and peer-pressure, and preferences for supportive tools and features. A thematic analysis was made and the patterns are explained below.

Thematic analysis is a qualitative research method used to identify, analyse, and interpret patterns or "themes" within a set of data (Braun & Clarke, 2006). It provides a structured yet flexible approach to coding responses, allowing the researcher to organize diverse perspectives into meaningful categories that reveal shared experiences, recurring challenges, and underlying motivations.

Goals and Motivations

Across participants, a strong emphasis was placed on completion of studies as the primary driver of academic effort. Many described their main goal as finishing their thesis or degree ("I want to be done with my studies", "I want to be done and get my degree"). For some, this was tied to economic independence and career development, while for others it was about avoiding the anxiety of being left behind as peers graduate ("I have to finish uni especially since my friends will finish and move away").

Secondary motivations included the desire for personal growth and character development, though these often appeared less central as time in the degree progressed. Several participants admitted that earlier in their studies they wanted to learn and develop themselves, but this shifted toward merely "getting it over with" as years passed.

Motivational aids mentioned included rewards (food, outings, small treats), study music and videos. A few participants also noted that clear understanding of the material or mapping the structure of chapters itself was motivating, suggesting that clarity and structure in academic content contribute to persistence.

Challenges and Barriers

The most frequently reported challenge was a lack of attention span. Nearly all participants mentioned struggling to maintain focus for extended periods. This was accompanied by tiredness, lack of the inclination of starting a study-session, boredom and a sense of futility ("I feel that I waste my time when studying, because the results won't be imminent").

External distractions were also highlighted: friends, relationships, and social obligations competed with academic commitments. Some students noted that they feared missing out on their social life and sometimes postponed academic obligations in order to see their friends.

Another critical challenge was self-discipline. Some admitted openly to lacking it ("I don't have self-discipline and I can't hold myself accountable easily"), while others relied heavily on deadlines (e.g. exams, labs) to trigger last-minute productivity.

Finally, planning difficulties appeared: while most tried to create schedules or allocate tasks across days, many reported that these plans were either too idealistic or quickly fell apart if disrupted even once. Some students added that the chaotic or unclear nature of academic instructions made things even more difficult.

Self-Regulation and Accountability

Self-regulation strategies varied widely. Some participants expressed a relatively high sense of discipline ("If I don't do it, I feel bad"), while others admitted that they depended on external accountability through peers or deadlines.

Task planning typically took the form of breaking down large goals into smaller units (e.g., chapters, daily milestones). Yet adherence to these plans was inconsistent. A recurrent theme

was the “all-or-nothing” effect: skipping a planned day often led to collapsing the entire system.

Accountability was managed through different internal mechanisms:

- Self-parenting (“do this now or you won’t go to the concert”),
- Short-term deadlines as artificial motivators,
- Or simply relying on guilt when tasks were left unfinished.

For several participants, accountability worked best in collective environments, where the presence of others provided a social framework for staying on track. However, more about the social environment will be explored in a later category.

Reinforcement Strategies

Participants discussed both positive and negative reinforcement. Positive reinforcement included treats (cookies, ordering food, watching a film), breaks, or outings after achieving milestones. Negative reinforcement was expressed as restrictions (not standing up before completing a task, denying oneself sleep until completion).

While positive reinforcement was generally described as more pleasant and sustainable, negative reinforcement was often perceived as more effective for inducing pressure. However, its use was limited by the individual’s tolerance and discipline levels: those who lacked self-control found negative reinforcement unsustainable, whereas others admitted it helped them push through difficult periods.

Collaboration, Peer Pressure, and Social Influence

Collaboration played a complex role. Some participants thrived in group study sessions, where milestones were set collectively, and mutual accountability ensured progress. Others, however, found that peers could become sources of distraction (“with others I get carried away”).

Peer pressure functioned both positively and negatively. For some, seeing peers succeed or study diligently spurred competitiveness and additional effort. For others, it had the opposite effect: rather than motivating, it led to feelings of inadequacy without increased productivity.

A common thread was the importance of the environment. Neutral or public spaces (cafés, libraries) often created an atmosphere conducive to focus. Yet, this atmosphere could fall apart when peers didn’t share a common studying mindset as socializing overtook productivity.

Desired Features and Supportive Tools

When participants were asked about gamification and digital support, their answers revealed interest in structured, playful systems that reward progress without being overly simplistic or repetitive. Key suggestions included:

- Progress tracking (percentages, statistics, mapping chapters)
- Streaks and badges for continuous effort
- Customizable rewards rather than fixed ones

- Playful notifications that vary in tone
- Study streaks shared with peers (e.g., “X is studying Y”)
- Mini-games or virtual companions (e.g., bookworm, animal-friend avatars)
- Calendars and reminders tied to main academic events

A recurring demand was for honesty and adaptability as systems should reflect real progress (not just logged hours) and offer diverse options to sustain attention over multiple days

Personality and Attitudes

Finally, personality traits emerged indirectly through their approaches. Some key characteristics the participants displayed are:

- Discipline-driven personalities, relying on guilt, structure, and strict routines.
- Socially-dependent personalities, requiring peers for accountability and motivation.
- Playful and reward-oriented personalities, drawn to gamified tools, fun notifications and collectible systems.
- Frustrated and tired with academia, personalities shaped by long-term exposure to stress and the diminishing intrinsic value of studies.

These personality inclinations informed the ways each participant approached productivity, reinforcement, and tool adoption. Some displayed characteristics from more than one personality. More about those inclinations will be explored further in the next chapter.

3.2.4 Conclusions

The preliminary user research provided a rich understanding of students’ studying behaviours, challenges, and motivational strategies. Through the semi-structured interviews, diverse yet recurring patterns emerged, highlighting the central role of external pressures, accountability systems, and reinforcement mechanisms in shaping productivity. While motivations often shifted from intrinsic curiosity to extrinsic completion goals over time, barriers such as poor self-discipline, distractions, and lack of structure consistently appeared across participants. Thematic grouping of responses revealed three distinct personas, each reflecting unique combinations of motivation, self-regulation, and social influence. Overall, the findings serve as a valuable foundation for the design of the application, ensuring that future features and gamification strategies are grounded in the lived experiences and expressed needs of real students.

3.3 Users

Building on the thematic analysis of the interviews, the next step is building representative user profiles based on the findings. By spotting the recurring patterns, the analysis is translated into personas that capture the essence of distinct user types. In addition to personas, this chapter also presents user stories that illustrate how these profiles might interact with the system in practice.

3.3.1 Personas

Personas are fictional, yet realistic representations of the people who are part of the target group and capture their goals, motivations and difficulties in a specific and relatable way. They are widely used in Human-Centered Design as a tool to make sure that decisions are based on real users and their preferences and not assumptions. They make sure that the system will be fitting for the users who are going to be utilising it. (Pruitt & Adlin, 2010)

From the interviews stemmed 3 different Personas that are explained below. The graphic tool that was used to describe the Personas is Canva[14].

1. **The Disciplined - Ariadne**

<table>
<tr><td rowspan="2"></td><td>GOALS</td><td>CHALLENGES</td></tr>
<tr><td>• Complete her thesis on time
• Maintain study-life balance</td><td>• Communicating her needs appropriately when working in a team
• Identifying her achievements and hard-work</td></tr>
<tr><td>ARIADNE</td><td>LIKES</td><td>DISLIKES</td></tr>
<tr><td rowspan="2">Archetype: The Disciplined

Age: 23
Pronouns: she/her
Faculty: Electrical Engineering
Year: 6th

Has Studying for: Thesis

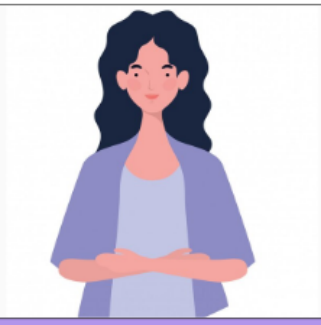
Thorough and disciplined. Ariadne makes a studying timeline and follows it. She would like a tool that offers her flexibility in her planning in order to make her schedule exactly as she envisions it.</td><td>• Structure
• Realism
• Rewards</td><td>• Distractions
• Lack of flexibility
• Feeling stuck</td></tr>
<tr><td>PERSONALITY</td><td>PRODUCTS THEY ENJOY</td></tr>
<tr><td></td><td>• Strict with herself
• Driven
• Fun-loving

Quote: “Do it now, have fun later”</td><td>• Statistics
• Visual Progress Tracking
• Reward system</td></tr>
</table>

Figure 6: Ariadne, the first Persona

2. **The Procrastinator - Akali**

[14] https://www.canva.com/

<table>
<tr><td rowspan="2"></td><td>GOALS</td><td>CHALLENGES</td></tr>
<tr><td>• Pass as many subjects as possible
• Organise her timeline better
• Focus more</td><td>• Procrastination
• Getting started on time and not last minute
• Paralysis by analysis; not knowing where to start</td></tr>
<tr><td>AKALI</td><td>LIKES</td><td>DISLIKES</td></tr>
<tr><td rowspan="2">Archetype: The Procrastinator

Age: 21
Pronouns: she/they
Faculty: Mechanical Engineering
Year: 4th

Has Studying for: Projects, Laboratories and Exams

Akali struggles with getting started studying. She has fallen behind from getting her diploma and has a lot of subjects to pass in her upcoming journey. She needs a tool to help her organise and commit to her academic work.</td><td>• Reminders
• Being part of a community
• Study groups
• Positive reinforcement</td><td>• Negativity
• Unclear or chaotic course outlines / syllabus</td></tr>
<tr><td>PERSONALITY</td><td>PRODUCTS THEY ENJOY</td></tr>
<tr><td></td><td>• Communicative
• Anxious
• Pessimistic

Quote: “I will do it later!”</td><td>• Focus Timer
• Study Groups
• Accountability-partnership
• Rewards
• Nudges</td></tr>
</table>

Figure 7: Akali, the second Persona

3. The Passionate -Glaucus



Figure 8: Glaucus, the third Persona

3.3.2 Use Cases

Scenario 1:
Ariadne is producing a lot of work but doesn't acknowledge her own effort and is hard on herself. She notices that she is in the first place of the Leaderboard, the data showing clearly that she has gathered the most points during the week. She feels accomplished.

Scenario 2:
Ariadne completes a task and sees that she gained a new Badge because of it. She is excited and browses the Badges she has already gotten reminiscing about her journey.

Scenario 3:
Akali writes down all the things she has to do and sorts them by their Experience Points (XP) and Due Date. She manages to prioritise her work and go through it without feeling paralysed. She knows what to do first.

Scenario 4:

Akali is sitting at her desk, lounging instead of studying. She browses on her phone and notices that a friend is "Focusing on Maths". She feels motivated to follow suit and also focus on her upcoming Math exam. She uses the Timer so that she puts her phone aside.

Scenario 5:
Glaucus completes one of his tasks and sees his Experience Points (XP) increase, overtaking another user on the Leaderboard. He feels gratification and gets motivated to add more tasks in his list to follow through on the one he just completed and climb the Leaderboard even more.

Scenario 6:
Glaucus wants to study with his friend on their common project so they plan a "Study Session" event on the App. They meet up and structure their timeline, divide responsibilities and agree on their next meeting. Later he notices his friend "Focusing on Project" so he gets a burst of energy to work on it too.

3.4 Requirements

The next step is to list the functional and nonfunctional requirements of the end product as a conclusion on the results of the research done from the background section (bibliography and state of the art) as well as the preliminary user research and the personas that were derived from it.

The main pillars of operations that the functional requirements of the application are broken down on are the following:

1. The user has their personal account
2. The user can list their task and event obligations.
3. The user can search for and connect(/befriend) with other users.
4. The user can collaborate with other users in common tasks and events.
5. The user can get in-app gamified rewards for completing their obligations
6. The user can count their focused studying time
7. The user can see their obligations in calendar view
8. The user can track their obligation completion statistics.
9. The user receives notifications and reminders.
10. The user can personalise their in-app environment.

Similarly the non-functional requirements are made with the following priorities in mind:

1. Help the user avoid mistakes
2. Accessible to people
3. Get continuous user feedback
4. Responsiveness
5. Platform Compatibility
6. Engagement
7. Usability

Following that, the pillars are analysed in the categories relating to functional and the non-functional requirements that the application will be able to perform. The format of the table will be the following:

Requirement Category		
Number	Function Sentence	Priority

Table 2: Format of the function presentation of the application.

The Requirement Priorities are the following:
P0 - Fundamental Requirement, Minimum Viable Product (MVP).
P1 - High Priority, Must Have.
P2 - Medium Priority, Nice to Have.
P3 - Low Priority, Optional Enhancement.

The following table contains the **functional requirements** of the application.

1. User Registration & Authentication		
1.1	The app allows users to sign up (email, password, nickname)	P0
1.2	The app allows users to log in using their credentials. (username, password)	P0
1.3	The app provides an option for password recovery in case a user forgets it.	P2
2. User Profile		
2.1	The app allows users to view their profile information. (picture, username, nickname, points, streak, badges)	P0
2.2	The app allows users to edit their profile information.	P2
3. Task Management		
3.1	The app allows users to create tasks.	P0
3.2	The app allows users to view, edit and delete tasks.	P0
3.3	The app allows users to mark tasks as in progress and completed.	P0
3.4	The app allows users to create categories for tasks. (+provide predefined categories)	P1
3.5	The app allows users to categorize tasks.	P0
3.6	The app allows users to filter tasks by their characteristics (deadline, priority, category, duration, points).	P1

3.7	The app has the option to display Tasks in calendar view.	P1
4. Gamification		
4.1	The app invites users to assign points (1-5) to their (individual or collaborative) tasks	P0
4.2	The app adds the assigned points to the user when the task is complete.	P0
4.3	The app provides a congratulatory animation when the task is complete	P2
4.4	The app keeps track of the sum of points that the users gather.	P2
4.5	The app has a streak feature that keeps increasing by one, as long as the user completes at least one task per day. If the user neglects completing any task in a given day, the streak resets to zero.	P0
4.6	The app assigns badges to users depending on their app use.	P0
5. Social Features		
5.1	The app allows users to find other users via their unique username and send connection requests. (study-buddy requests)	P0
5.2	The app allows users to view, accept and decline connection requests.	P0
5.3	The app allows users to view another user's profile.	P1
6. Collaboration		
6.1	The app allows users to invite other users in completing collaborative tasks.	P0
6.2	The app allows users to view, accept and decline collaborative task requests.	P0
6.3	The app allows users to ping/nudge other users to complete their common task.	P3
7. Focus Timer		
7.1	The app allows the user to time their studying with a focus timer.	P1
7.2	The app provides motivational messages to the user while they are in focus mode	P3
7.3	The app displays the users who have an active focus timer as "Focused" in the dashboard.	P2
8. Events		
8.1	The app allows the scheduling of Events	P0

8.2	The Event facilitator can be a user (e.g. Student in a Study Group) or an outside facilitator (e.g. Professor in a Lecture)	P3
8.3	The app allows the invitation of study-buddies in the Events	P1
8.4	The app has the option to display Events in calendar view.	P1
9. Notifications and Reminders		
9.1	The app allows users to set custom Reminders for each Task and Event	P1
9.2	The app sends push notifications for reminders	P1
9.3	The app sends in-app notifications for invitations, requests, a study-buddy studying etc.	P2
9.3	The app allows for users to customise which notifications they receive.	P2
10. Statistics and Visual Progress Tracking		
10.1	The user can see statistical information of tasks completed	P2
11. Personalisation		
11.1	The app supports dark mode.	P2
11.2	The app allows users to choose their own theme (colour, adjust font size and weight)	P3

Table 3: Functional Requirements

The following table contains the **non-functional requirements** of the application.

12. Accessibility / Support / Feedback		
12.1	The app has an option to ask for support/help	P2
12.2	The app has a feedback feature	P3
12.3	The colours used are Colorblind Friendly	P3
12.4	The app uses Semantic / Accessibility Labels to elements to make it compatible with screen-reader applications	P1
13. Responsiveness / Platform Compatibility		
13.1	The app has responsive design	P1
13.2	The app is compatible with both iOS and Android devices	P0

14. Help Users Avoid Mistakes		
14.1	The app uses clear, large tap targets.	P1
14.2	The app gives confirmation messages before permanently deleting.	P1
14.3	The app provides an onboarding tutorial to new users	P3

Table 4: Non-functional Requirements

3.5 Mock-ups

The mockup process was carried out in several stages, progressing from initial structural planning to a fully interactive prototype. It began with the development of wireframes, which established the foundational layout of the application. The navigation flow was then defined to ensure usability and logical movement between screens. Following this, attention was given to the visual design, including the selection of a color palette and fonts, as well as the creation of the logo and application name to establish the identity of the brand. The process concluded with the construction of a Figma prototype, integrating all design elements into an interactive representation of the final product.

3.5.1 Wireframe

The first stage of the application's design process involved the development of wireframes that would later evolve into the application's interface. The main goal of this step was to determine the hierarchy of information inside the application and its overall usability.

The wireframe was done with paper-based sketches as they allowed for quicker adaptations and more creativity. Additionally, it ensured that there wasn't focus on details, such as feature-symmetry, that digital tools can replicate more clearly. The wireframe established all features that the app would entail in a low-fidelity format that would later be developed further.

The wireframes were scanned and some examples are displayed below:

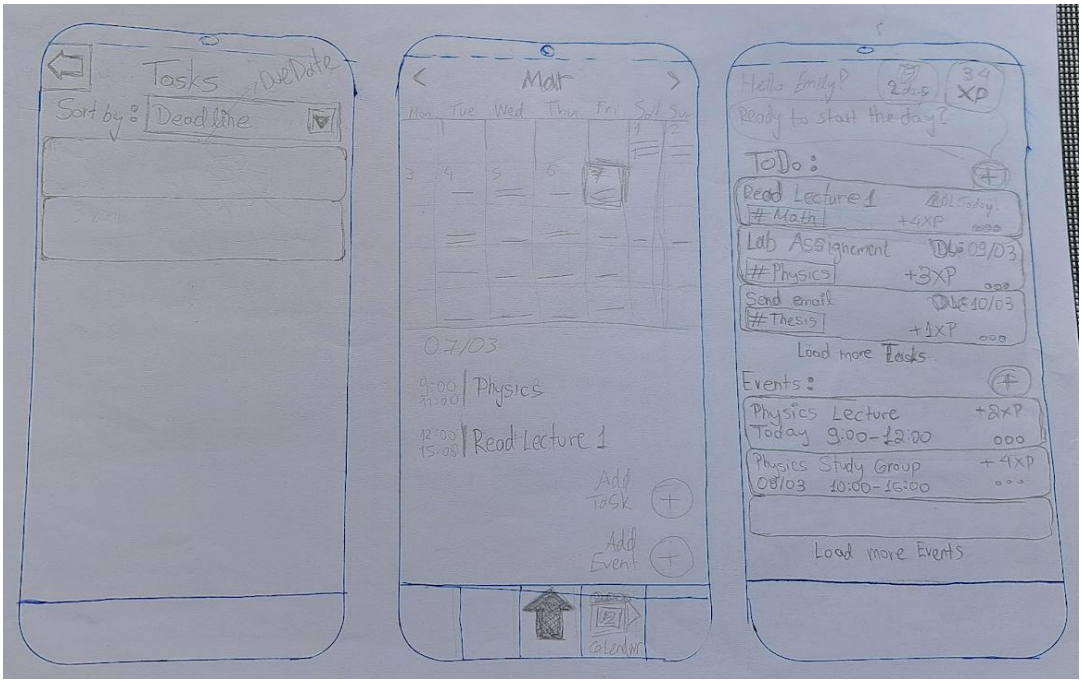


Figure 9: From left to right, "All Tasks", "Calendar" and "Dashboard" Screens with rough sketches.

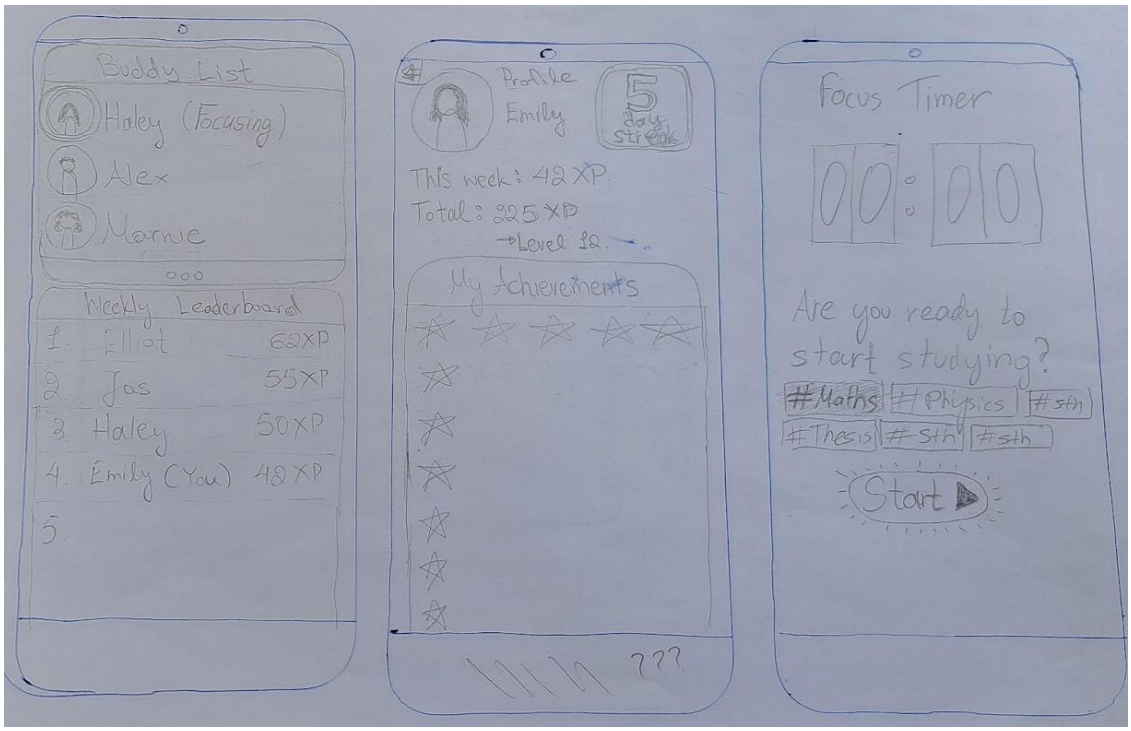


Figure 10: From left to right, "Buddies", "Profile" and "Timer" Screens with rough sketches.

3.5.2 Navigation

As the sketches became more refined, the need to determine the navigation flow between them appeared.

A sitemap was created taking into account all the major functions that the application would support according to the requirements. All features were grouped into pages/screens and then put into a hierarchy so that they could all be accessed intuitively and without unnecessary steps.

Priority was given in balancing the depth and breadth of the navigational structure to not overwhelm the users but also provide them with easy access to all tools.

The final version of the sitemap is displayed below:

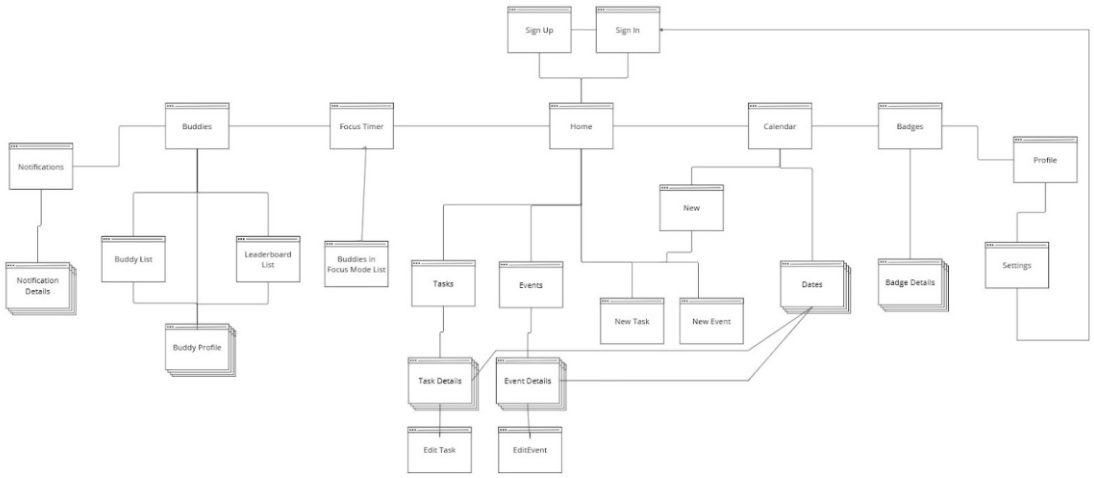


Figure 11: Complete navigational map of the App.

The user is first directed to “Sign In”, if their account is already logged, they are automatically redirected to “Home”, alternatively called “Dashboard”. From there a Bottom Navigation Bar is used for the five (5) main Screens / Functions of the Application. From each of them stem more related screens and utilities.

The screens and their sub-screens are the following:

- “Buddies” Screen that also includes redirecting to:
  - “Buddy List”
  - “Leaderboard”
  - “Buddy Profile” with parameters for information depending on the user it redirects to.

- “Timer” Screen with a redirect to:
  - “Buddies in Focus Mode List”

- “Dashboard” Screen which redirects to:
  - “New Task”
  - “New Event”
  - “All Tasks”
  - “All Events”

    - "All Tasks" and "All Events" produce or include *Task Items* and *Event Item*s which in turn give access to
        - "Task Details" (or "Task Modal)
        - "Event Details" (or "Event Modal")
    - The "Details" modals provide the user with more specific options depending on each task or event they have chose so they can also access the screens:
        - "Edit Task"
        - "Edit Event"

- "Calendar" Screen, that displays *Date Items* according to user-selection which in turn gives access to "Task Details" and "Event Details" and provides accesses in the same way that is mentioned above.

- "Badges" Screen that also displays "Badge Details" according to user-selection.

Moreover, to give access to additional crucial elements, two (2) Top Navigation Menu options were added. The functions related to them were separated from the Screens in the Bottom Navigation Bar as they aren't tied as much to the main goals of the application but nevertheless serve utilities that are universal and expected in most Mobile Applications.

- "Notifications" Screen that can also provide details for individual Notification Items.
- "Profile" Screen which redirects to:
    - "Settings" Screen which in turn gives the option of redirecting back to the "Sign In" and "Sign Up" screens.

It is worth noting that the sitemap displayed above corresponds to the final version of the setting as it was also evaluated in depth during the Users' Evaluation of the App's Design.

3.5.3 Brand

To establish a clear and consistent visual identity for the application, next came the development of the brand. The process began with the selection of the name, chosen to reflect the purpose and character of the project while remaining memorable and user-friendly. Building on this foundation, a color palette was defined to convey the desired mood and tone, ensuring harmony and readability across all interfaces. To complement this, a set of fonts was selected, balancing clarity with personality and supporting both headings and body text effectively. Finally, a logo was designed, serving as the central visual mark of the brand and integrating the chosen stylistic elements into a cohesive identity.

Name

For the application the name "Study Buddy" was chosen for its meaning and memorability due to its rhyme. The name encompasses two concepts; Firstly, the app's main utility which is studying with friends but also its second use as a study-planner and guidance through productive study-time. It also encapsulates one of its main features which is titled "study buddy" and gives the opportunity of assigning another user to a common task. In further reference to the app's name, links with other users (which are commonly called "Friends" in widespread applications) are called "Buddies".

Colour Palette

The colour palette of the application was selected to achieve a balance between usability, readability, and emotional factors, while also ensuring a cohesive, solid and attractive interface.

The background utilizes Light Gray (Whitesmoke - #F5F5F5), a gentle and neutral hue that is commonly used in apps. It helps in clarity and minimizes visual fatigue during extended usage. A second background colour was selected as Light Blue (Seagull -#78B7D0 at 5–15% opacity) which contributes in adding depth and variation without cluttering the interface.

For the text: Black (#000000), Blue (Gulf Blue - #3B3F5E), and Dark Blue (Midnight Blue - #16325B) were chosen to provide a strong contrast against the light background, therefore enhancing legibility while offering diversity in how elements are represented. Light Gray (Whitesmoke) is also employed for text in darker areas, ensuring accessibility and visual balance.

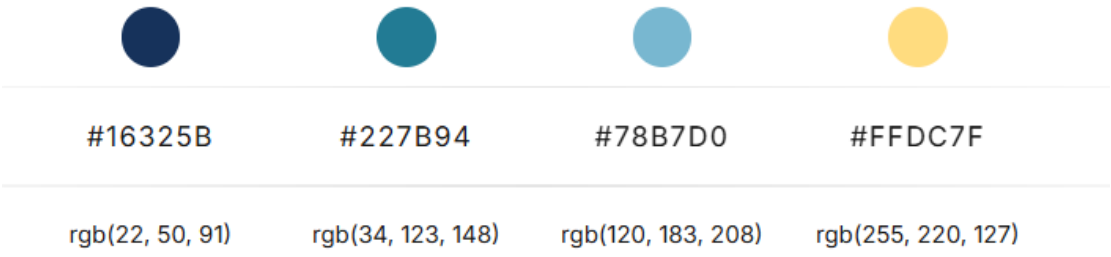


Figure 12: The defining accents of the color palette of the application

The primary accent colour, Teal (Java - #227B94), was selected for its connections to clarity, trust, and focus, which aligns with the application's purpose as a tool for productivity and collaboration.

The secondary accents: Pastel Yellow (Salomie - #FFDC7F) and Light Blue (Seagull - #78B7D0) provide warmth and vibrancy into the design. Yellow conveys positivity and motivation, whereas Blue promotes calmness and consistency. Together, these accents emphasize interactive components and direct user attention without detracting from the overall minimalist design.

After deciding that the main colours of the application will be blue and yellow, the final hues combination was selected with the colour palette tool of the website Color Hunt[15].

Fonts

The application's typography was chosen with priority given to readability, establishing hierarchy, and maintaining aesthetic coherence.

[15] https://colorhunt.co/palette/16325b227b9478b7d0ffdc7f

For headings, the modern, rounded sans-serif typeface Nunito[16] was selected, as it merges clarity with a sense of calm and approachability. Its well-balanced proportions enhance legibility, and the gently rounded shapes impart a friendly and inviting tone, which aligns with the app's focus on fostering supportive and motivational study environments.

For the body text, Inter[17] was chosen for its design as it is optimized for on-screen reading. As a widely utilized web font, Inter ensures easy legibility even at smaller sizes, with clear spacing and strong character differentiation, making longer text passages familiar and easy to read on mobile devices.

In buttons and user interface elements, Nunito is chosen again to give consistency with the headings, therefore reinforcing a unified visual identity. Additionally, Laila[18], a serif typeface characterized by its elegant curves, is integrated in some of the elements to provide emphasis and stylistic variation, giving specific elements a distinct quality without compromising overall harmony.

Logomark

The logomark design encapsulates the core values of the application which is learning and collaboration. The visual of stacked books acts as the main symbol that represents studying and its number, two, stands for its collaborative purpose. The selected colours, Salomie yellow and Seagull blue, are directly taken from the application's colour scheme, guaranteeing visual uniformity. Yellow symbolizes positivity and motivation and blue gives the sense of calm, trust, and concentration.

Two (2) versions were made to accommodate the application's needs. The primary version integrates the book graphic with the STUDY BUDDY wordmark, utilizing a bold serif typeface that communicates reliability and professionalism while remaining friendly. This version is mostly used in environments such as the landing page or login screens, where the complete identity can be effectively conveyed. The secondary version, which showcases only the book symbol or the books with text positioned below, is designed for compact or minimal contexts such as splash screens.



Figure 13: Primary version of logomark (iteration 1)

[16] https://fonts.google.com/specimen/Nunito
[17] https://fonts.google.com/specimen/Inter
[18] https://fonts.google.com/specimen/Laila



Figure 14: Primary version of logomark (iteration 2)



Figure 15: Secondary version of logomark

3.5.4 Conclusion

The mock-up phase established the structural, navigational, and visual foundations of the application, ensuring that the design aligned with both usability principles and the intended brand identity. Beginning with wireframes and evolving through navigation mapping and brand development, the process resulted in a cohesive and user-centered design framework.

The completion of the interactive Figma mock-ups provided a clear and tangible representation of the envisioned product, serving not only as a validation of design choices but also as a preparatory step for further testing. This stage successfully set the groundwork for the development of the prototype, where the proposed features and interactions would be brought to life and subsequently evaluated with users.

4. Prototype

The next stage involved the development of the Prototype. For its purpose Figma[19] was used as a well-fitting tool for the Design Stage's needs.

For this chapter, the prototype and its features will be presented and elaborated upon. Following that, the evaluation from users will be described and the findings will be analysed. Lastly, the conclusions from the evaluation will be implemented to finalise the prototype of the application before moving to the actual implementation with code.

4.1 Screens

Following the visual identity of the brand and the requirements of the application, all screens were made with all the details that the final product would have. To show an example of how the brand and both functional and non-functional requirements were taken into account in the design, the "Focus Timer" screen will be thoroughly analysed.

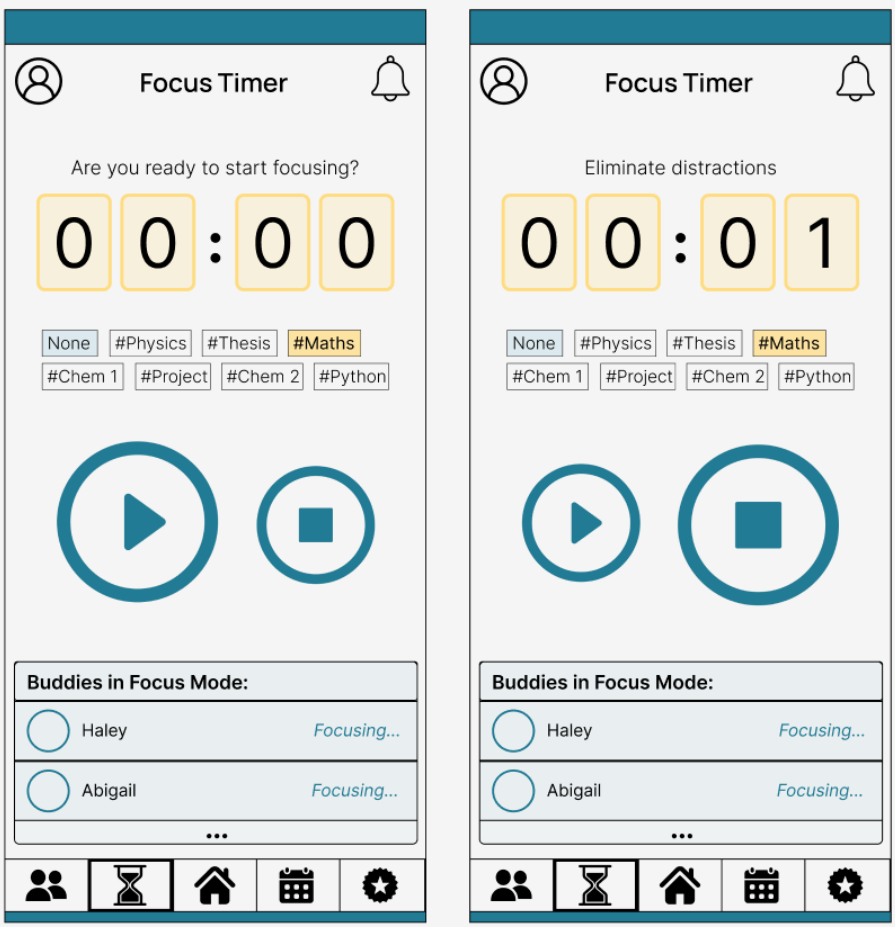


Figure 16: "Focus Timer" screen design on Figma

[19] https://www.figma.com/proto/bISNMbQlXQS4UTSb0zyVcY/StudyBuddy?node-id=162-2&starting-point-node-id=162%3A2&t=gc70sYEvttQaPuyI-1

Beginning with elements that are universal across all main screens, there are frames both at the top and the bottom of the application, anchors to ensure easy navigation for the user.

At the top, a consistent header bar in the primary dark blue houses two universally recognizable icons: a user profile symbol on the left and a notification bell on the right, enabling quick access to account management and alerts without disrupting the screen's central purpose. Beneath the header lies the title, in this case "Focus Timer", which is displayed in bold, anchoring the user's attention and establishing the context of the screen.

At the bottom, a persistent navigation bar with dark blue icons on a light background provides access to different functions of the application, with symbols for buddies, timer, home, calendar, and badges arranged in a clear sequence.

Moving on to the specific elements of this screen. There are two versions of the screen shown in the image: On the left the user has not pressed "play" yet and is not focusing on their studies. The right side shows the screen after the user interacts with the "play" button when they enter "Focusing mode".

On the left, the image presents the initial state of the focus timer in a clean and structured layout with few elements to emphasize concentration. A short prompt "Are you ready to start focusing?" sits directly below, offering a motivational nudge that sets the tone for engagement. The central element of this screen is the digital timer, which is styled in large, rounded digits framed with a subtle yellow secondary highlight, creating a visual hierarchy and reinforcing the focus on time. Directly underneath, a series of selectable tags, styled in neutral and light tones with the secondary accents of yellow and light blue, allows the user to categorize the current focus session by topic (e.g., #Physics, #Thesis, #Maths). The selected tag is distinguished by the yellow background that changes when the selection ensues. At the heart of the interaction are two oversized circular buttons: a play button in the primary dark blue, commanding attention as the main call-to-action, and a smaller stop button adjacent to it, also in matching style. This duality balances functionality with simplicity. Below, a section titled "Buddies in Focus Mode" displays a compact card-style list of peers who are currently active, reinforcing the social and collaborative dimension of the app.

On the right, the design reflects the active state of the timer once initiated, when the user presses the start button. It offers subtle but meaningful shifts in both visual cues and textual guidance. The timer digits begin to count upward, motivating the user to leave their device on the side and start focusing on their academic obligations. The supportive prompt text transitions from motivational to directive "Eliminate distractions" providing guidance in line with the application's purpose. The play button is still present but de-emphasized, while the stop button gains prominence as the immediate action available during an ongoing session. The "Buddies in Focus Mode" section continues to display other users, underlining the sense of shared commitment.

Together, these two views of the same screen illustrate a careful balance between motivational and functional design. The transition between the two states, before and during the session, demonstrates how minimal but deliberate design adjustments can convey progress and purpose while preserving an uninterrupted flow for the user.

When it comes to the functional requirement the screen addresses the requirement No.7:

7. Focus Timer		
7.1	The app allows the user to time their studying with a focus timer.	
7.2	The app provides motivational messages to the user while they are in focus mode	
7.3	The app displays the users who have an active focus timer as “Focused” in the dashboard.	

Table 5: Revision of Requirement 7, Focus Timer

Which are all realised successfully in the Prototype.

From the perspective of non-functional requirements, the screen design supports error prevention: when a user attempts to press play without selecting a category, the system prompts them to first choose a tag, ensuring that sessions are always contextualized and reducing mistakes. Accessibility is promoted through the use of a strong, high-contrast colour palette, with the use of dark text and buttons in the light background. Continuous feedback is embedded throughout the interaction: the timer digits provide real-time confirmation that the session is active, the motivational messages adapt to the user’s progress, and the peer section updates dynamically to show active buddies, all of which affirm that user actions have immediate, visible effects. Engagement and fun are cultivated through the social element of studying alongside peers and the encouraging, almost gamified tone of the prompts, making the experience feel less solitary. Finally, usability is evident in the structured layout and consistent navigation bar at the bottom, which ensures that users can easily move between different parts of the app without confusion.

In sum, this screen is a direct example of how the functional and non-functional requirements are met throughout the application’s design. In this case, the timer is not only a practical tool for measuring focused study time, but also an experience designated to motivate, prevent errors, provide feedback, and enhance engagement.

4.2 App Features

Based on the findings from the research, the distinct features that the product offers can be summarized as follows. The personas provided insights into user needs, motivations, and frustrations, while the interviews revealed expectations around study support, accountability, and gamified motivation. The state-of-the-art review highlighted gaps in existing solutions and inspired design decisions that could make the product both competitive and innovative.

Taken together, this preparatory work informed the feature set by showing that users are more likely to engage with a tool when it provides clear rewards, fosters consistency, and incorporates social elements. Thus, the features described below have been carefully designed to encourage gamification, create a sense of accountability, and ultimately sustain motivation throughout the study process.

4.2.1 Experience Points (XP)

One of the most common and effective mechanisms of gamification in digital learning tools is the use of points. They give abstract progress a tangible form and provide immediate feedback to the user. The XP system in this application is designed to capture this dynamic by translating study-related activities into measurable progress.

Users earn XP through tasks, events, and the focus timer. Specifically:

- **Tasks**: XP (ranging from 1–5) is awarded once the task is marked as completed.
- **Events**: XP is gained after the event's end date, when the user marks their attendance.
- **Focus Timer**: For every study session, XP is calculated based on the duration (e.g., 30 minutes = 1 XP). XP is awarded when the user stops the timer.

Accumulated XP is then displayed in the app's statistics, allowing users to track their progress and reflect on their activity over time.

4.2.2 Leaderboard

Competition is a powerful motivator, particularly when framed in a friendly and supportive way. The leaderboard provides this element by ranking users according to their XP accumulation. This allows progress to be compared on a weekly basis, creating both a sense of community and a drive to improve.

The leaderboard ranks users within a weekly cycle (Monday–Sunday). Each entry shows the user's name, rank, and score. This structure encourages continuous participation, as users aim to climb the rankings before the cycle resets, reinforcing weekly study habits.

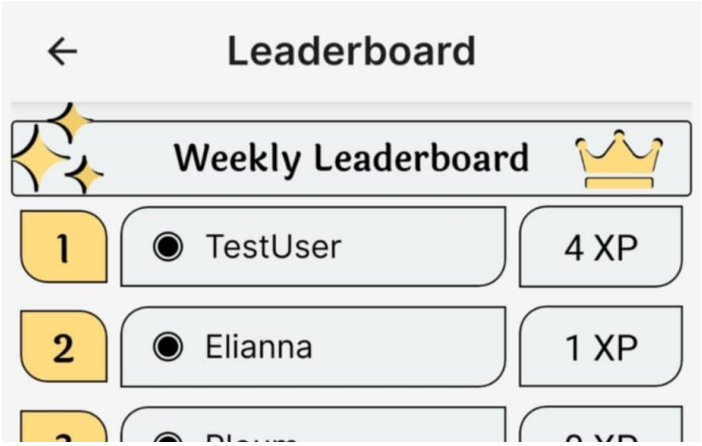


Figure 17: Section of the weekly leaderboard. In first place "TestUser" with 4 XP and in second place "Elianna" with 1 XP.

4.2.3 Streak

Habit formation suggests that consistency is more important than intensity when building long-term behaviours. The streak feature leverages this insight by rewarding daily engagement. By tying progress to consecutive activity rather than one-off efforts, the streak system creates a psychological incentive to avoid “breaking the chain.”

Each day with earned XP increases the streak count by +1, while missing a day resets the streak back to 0. This mechanism encourages users to make studying part of their daily routine. A flame icon is used to visually represent the streak, making progress both recognizable and rewarding.



Figure 18: Profile Screen of user. On the top right the square represents a “1 day Streak”

4.2.4 StudyBuddy

Accountability is often strengthened when goals are shared with peers. The Study Buddy feature responds to this by allowing users to plan and complete tasks or events together. This builds a sense of responsibility not only to oneself but also to a friend, increasing the likelihood of following through.

Through StudyBuddy, users can share tasks and events, plan collaboratively, and celebrate shared accomplishments. While the XP gained remains the same as completing tasks or events individually, the social aspect introduces accountability, support, and opportunities for social interaction within the study process.

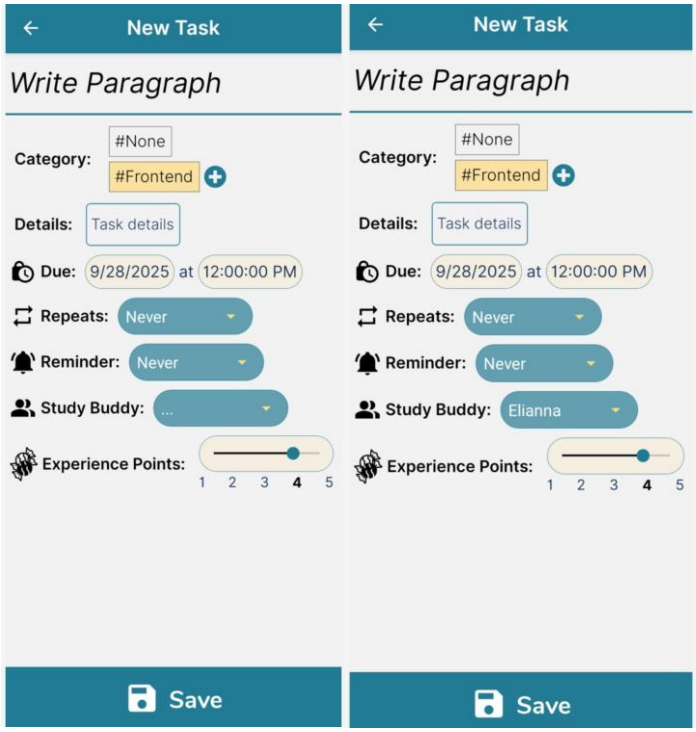


Figure 19: Making a new task called "Write Paragraph". On the left there is not a study buddy set yet. On the right screen the user has set a study buddy, another user called "Elianna".

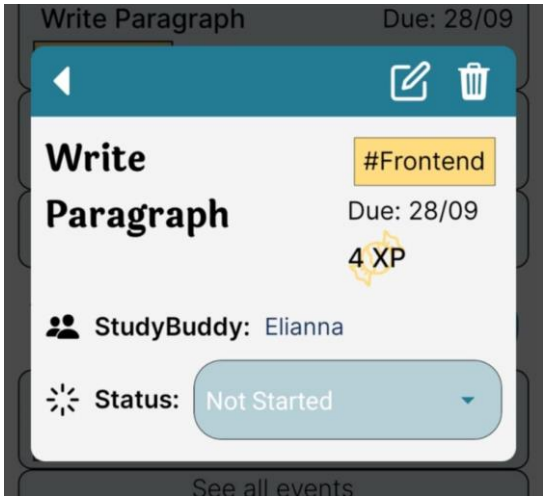


Figure 20: Modal of a task's details. The studybuddy set is "Elianna".

4.2.5 Focus Time

Concentration is often easier to maintain when one feels part of a broader effort. The Focus Time feature makes study sessions visible to others, creating both a motivational effect for peers and a sense of pride for the user. This visibility transforms what is usually a solitary activity into a shared experience.

During an active focus session, the icon next to the user's name changes colour, and a hashtag indicates the specific subject or task being studied. This not only makes the activity more engaging but also allows users to highlight their productivity while inspiring others to focus as well.

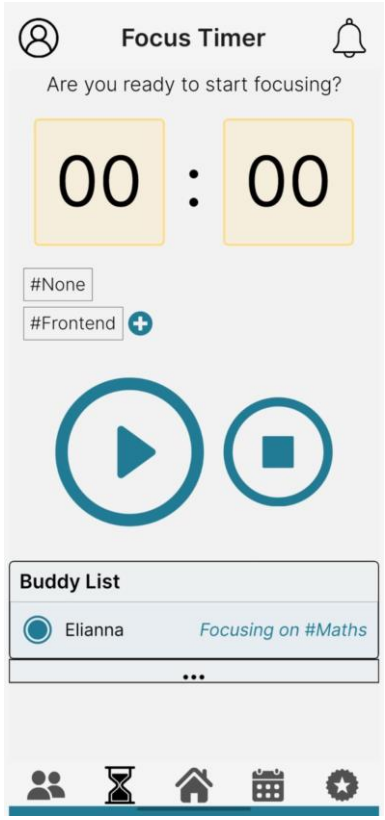


Figure 21: Focus Timer screen of user. On the bottom part another user "Elianna" is focusing on the subject "Maths".

4.2.6 Badges

Badges are a well-established gamification mechanism that transform progress into symbolic achievements. They provide milestones for users to aim toward and give recognition for both short-term efforts and long-term commitment. In this way, badges help sustain motivation over time while also encouraging exploration of the app's different features.

Badges remain hidden until earned, creating a sense of mystery and discovery. Each user can also select up to three badges to display as favourites, personalizing their profile with the achievements they value most.

Badges are divided into different types:

- **Committed**: Awarded for maintaining streaks and completing a number of tasks.
- **Leader**: Awarded for placing 1st, 2nd, or 3rd on the leaderboard.
- **Social**: Awarded for completing common tasks or attending events with others.
- **Newbie**: Awarded for early engagement, such as completing the first task or achieving a three-day streak.



Figure 22: Badges screen of a user. The rewarded badges are yellow and have visible titles. When tapping on a badge, the user can see its details such as the date it was earned and has the option to mark it as a favorite.

4.3 Evaluation

To follow Human-centered design means to evaluate after each step the progress that was done by asking feedback from people. To evaluate the prototype a total of 6 people were interviewed following the process described below:

- First the context of the application was described to the participants so that they were made aware of what to expect. Following that, the technology involved, in this case Figma, was briefed to make sure that they understood the functionality and limits of the testing environment.

- Then the Prototype was shared with them via a Figma link and they were asked to explore the environment while doing the Think Aloud Protocol.

- After they explored the testing environment, the participants were asked to give feedback on the product and offer their conclusions after the navigation.

- All notes from both the Think Aloud and the Feedback stages were written down in detail.

- The notes from the interviews were later centralised and evaluated and the conclusions were implemented to the prototype.

Each of the steps is elaborated upon below.

4.3.1 Interviews

The interviews took place both remotely and on-site, according to the availability of the people who would be participating. They were all conducted in a one-on-one fashion, with only the developer and one interviewee present each time.

Of the interviewees, 5 were relevant customers and 1 a field-expert. The 5 users were all part of the target group and had different demographics when it comes to age, studies and study habits. Specifically, according to their Personas

- 1 had the Disciplined archetype (Ariadne).

- 2 were close to the Procrastinator archetype (Akali).

- 2 were most like the Passionate archetype (Glaucus).

Additionally, of the five (5) relevant customer, three (3) had also taken part in the user research that is detailed in Chapter 3.2. This contributed in identifying how the requirements were tailored according to the people who were interviewed at the start but also, inserting fresh and different perspectives into the evaluation process.

As it was mentioned, the interviews followed the think aloud protocol. The Think Aloud Protocol is a method revolving around asking participants to express their feelings, ideas, and decision-making processes as they work with a prototype or product. By pointing out their cognitive processes, misconceptions, and usability problems that might not be apparent through simple observation, this method offers direct insight into how users understand, navigate, and react to interface elements in real time. (Jaspers, M. W., Steen, T., Van Den Bos, C., & Geenen, M.,2004)

4.3.2 Results

The aggregated conclusions of this evaluation stage are recapped below:

Navigation

All the users found the navigation of the application easy and intuitive. Exploring the 5 main pages, finding the profile, notification, the settings and logging out was straightforward to all interviewees. Some other comments that were made and are worth being highlighted are the following:

- It was helpful that the Tasks and the Events could be displayed both as a list and in a calendar.
- Some navigational problems were encountered in the change between the “All Tasks” and “All Events” pages. After some discussion it was concluded that the icons indicating the navigation between the 2 weren’t visible enough and were commonly missed.
- In all cases, no one tapped on the “See more Experience Points Insights” button that links from the Profile to the Statistics Page. Based on the reactions when interviewees were prompted to find the Statistics, it was decided that the Button’s Heading was unclear and needs to be changed.
- The way that the “Badges” page was accessible twice in 2 different ways caused some confusion as it wasn’t possible to navigate with a “Back” Button after tapping on it from the “Profile” page.

Usability

In general there were not a lot of constructive comments about usability of the application which showed that users were satisfied with its uses. All the feedback that was received on that topic is recapped in the following list:

- It was commented that it would be easier to change the Task’s status via a dropdown menu, where the starting default is “Not Started”. That would also ensure lower mistake risk as users would be able to instantly see their Task-status the moment they tap to see their Task’s details and specifically change it only when they tap on the dropdown.
- It was pointed out from the field expert, that the 3 dots vertically could indicate a possibility of dragging and rearranging the tasks on the screen so to ensure no mistakes are made, they will be changed to horizontal, in the same way that Events are displayed.

- As it was presented, it was derived that the hashtag option on the Focus Timer wasn't of any essence. It was suggested to display the chosen hashtag to other Buddies in a similar way that the "Focusing" label is being shown.

Interface

When it came to the aesthetic choices of the application's interface these are the comments that were repeated and highlighted the most:

- The cornered and round preference was appreciated.
- The interviewees were satisfied with the primary and secondary colours and pointed out that they matched the application's theme.
- To make the calendar page less cramped, it was suggested to display the "Add Button" and only after the user has chosen to tap it, further the display into the 2 options.
- A lot of discussion centered around the display of Badges and the fact that it was difficult to differentiate between them as even though they belonged to different categories they were all displayed in the same way. The need for differentiation was brought up more because of the grid display in the profile page where there was no indication of how one star was set apart from another.

Expert Insights

The expert insights were about functions that were forgotten during the design and smart remarks on the usability of the application. The main points are:

- The signup requires an email so that the user has the option to reset their password.
- The password needs the "hide/unhide" option.
- To make the Statistics page worth the redirection and extra loading time/interaction, it was suggested to show more than one chart at once and remove the dropdown menu or alternatively add the chart directly in the profile page.

4.3.3 Conclusion

The evaluation stage confirmed that the prototype offered a clear navigation flow, intuitive usability, and a consistent visual identity, while also highlighting specific areas in need of refinement. Feedback from both target users and the field expert provided practical insights, ranging from small interface adjustments to improvements in functionality and labelling. Importantly, the findings not only validated many of the initial design choices but also revealed opportunities to enhance clarity, efficiency, and overall user satisfaction.

These conclusions directly informed the adjustments made to the final prototype, ensuring that the next iteration of the application is more robust, user-centered, and aligned with the expectations of its intended audience.

4.4 Final Prototype

All the conclusions that were gathered from the think aloud protocol and the feedback were strategically implemented. The evaluation stage was then concluded with the changes being made to ensure an ideal version for the final Prototype.

Below some examples of the implementation of changes are analysed.

Profile and Statistics

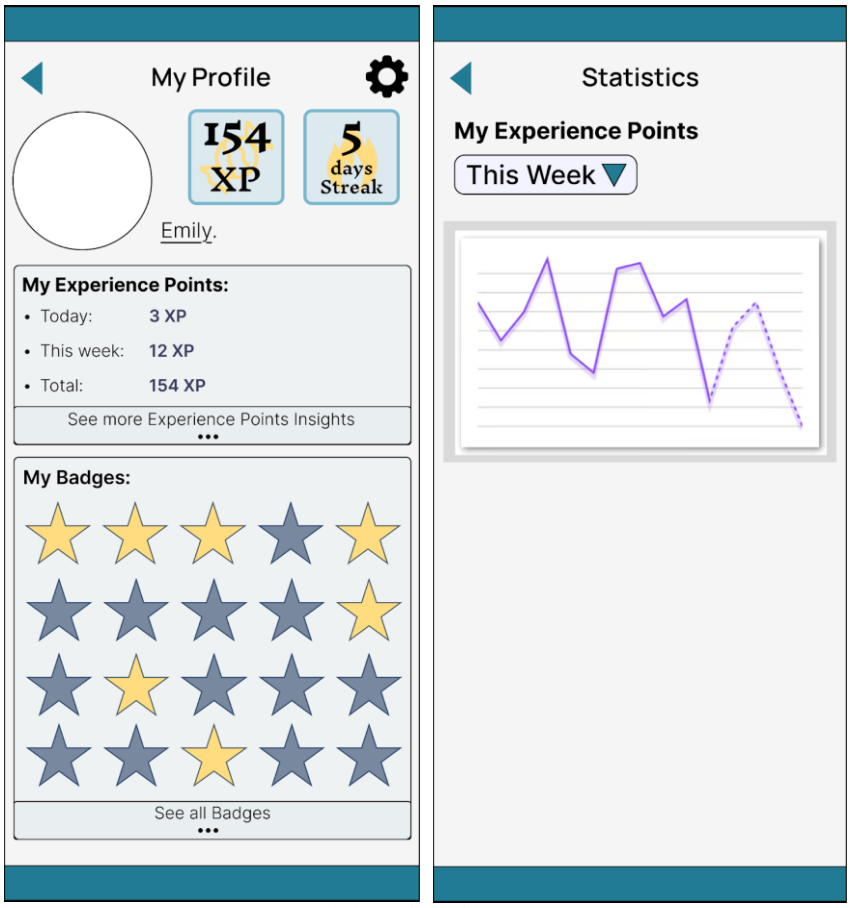


Figure 23: Initial plan of Profile and Statistics Page.

During the evaluation, the test-users didn't give attention to the "See more Experience Points Insights" and most didn't navigate to the Statistics Page unless prompted to. They also displayed difficulty in finding the Page. It was also mentioned that viewing "My Badges" both on the Profile and in the Badges Pages was excessive and ineffective.

To implement the feedback received from the evaluation stage, it was decided to compile the 2 Pages together by removing the "My Badges" feature from the Profile Page and instead display the Statistics right below "My Experience Points".

The final implementation can be seen below:



Figure 24: Final Profile and Statistics Display.

All Tasks

Another example of the changes that the evaluation prompted is analysed below:

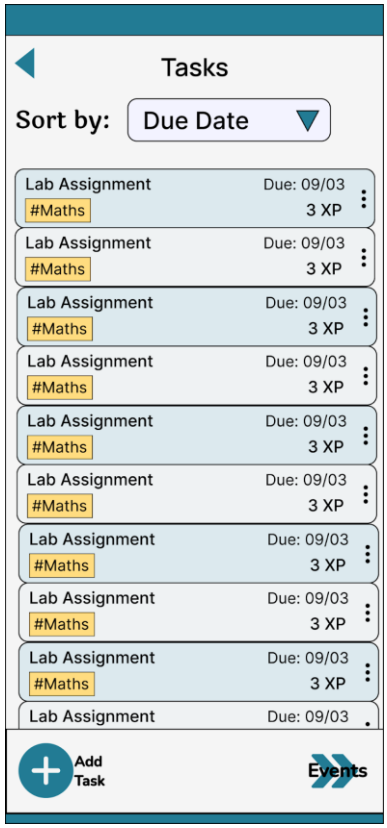


Figure 25: "All Tasks" Screen before the evaluation

During the evaluation, many participants puzzled over the color differences between the Tasks in the Think Aloud protocol. Even though it was initially added as a color differentiation to ensure a smooth User Interface and differentiation between the tasks, it didn't result in a good User Experience.

Additionally the "Events Arrow" icon that is visible on the bottom left of the screen was mostly unnoticed by the testers. When prompted to remark upon it, most of them admitted they hadn't noticed it at all and feedback was given to make it more prominent by changing the coloring.

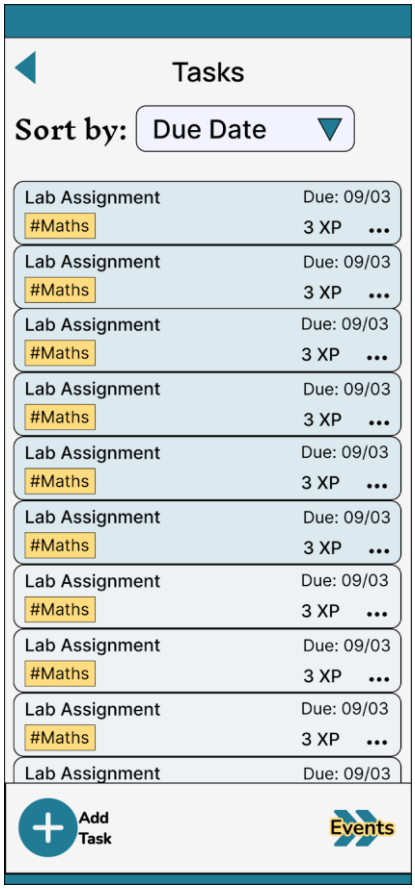


Figure 26: "All Tasks" Screen after the implementation of changes due to the evaluation.

To account for these remarks, it was decided to restructure the page. Tasks were colored depending on their status as "Done" or not and filtered accordingly so the ones that are pending would appear on top. Additionally, the icon was changed to a clearer version adding another color to increase its visibility.

5. Implementation

With the final Prototype being ready, the next step was moving to Implementation of the application. In this chapter, first the system architecture that was chosen for the project will be explained. Following that each part of the architecture will be elaborated upon. First, the database diagrams will be analysed, then the technologies that were chosen to build the application will be mentioned. After that, both frontend and backend will be featured.

5.1 System Architecture

The application follows the system architecture shown in the image below:

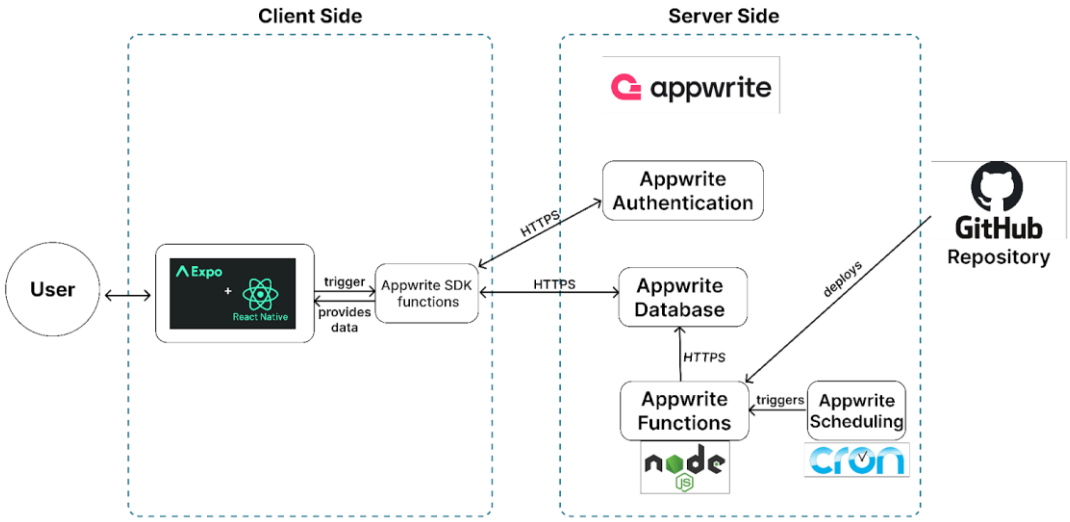


Figure 27: System Architecture of the application.

The user interacts with the frontend which in turn uses the Appwrite SDK functions library to send HTTP requests which in turn reach Appwrite.

Depending on their type, the requests interact with a different feature.

- If the request is about creating, reading, updating or deleting data, then the Appwrite Database is reached.
- If the request is concerning the users, then the Appwrite Authentication feature is reached, where functions such as user login and registration are performed.

Additionally, Appwrite Functions are triggered independently in fixed time intervals to perform methods that are not connected to users' interaction with the frontend. The said functions are deployed to Appwrite via Github where the scripts have been written and then set up.

5.2 Technologies

The implementation of the application required the integration of several technologies, each serving a specific role in the development process. The following subsections describe the technologies used, their purpose within the system, and, where relevant, the rationale for their selection.

5.2.1 Frontend

The frontend of the application was developed using React Native in combination with Expo, enabling cross-platform mobile development from a single codebase.

This approach was chosen because it allows a single development effort to target both iOS and Android devices, significantly reducing time and resources compared to native development. In addition, React Native and Expo are well sought after in the current job market, making them valuable technologies to learn. Since there was no prior experience with them, this project provided an opportunity to become acquainted with their ecosystem. Both frameworks are also free to use, with Expo offering straightforward deployment and distribution processes, which further supported their selection.

Initially, testing and debugging were performed with *Expo Go*, before transitioning to *Expo Development Mode* to support building standalone versions of the application. The application's user interface was constructed using JSX files, which allow the combination of JavaScript logic with declarative UI definitions.

A number of additional packages were integrated into the project to extend React Native's functionality and improve user experience.

React Native libraries:

- **react-native-modal** – Provides customizable modal components for React Native, offering more flexibility and animations compared to the default Modal.
- **react-native-picker/picker** – A cross-platform dropdown selection component that lets users choose from a list of items.
- **react-native-calendars** – A set of customizable calendar, agenda, and date-picker components commonly used for scheduling and event management.
- **react-native-community/datetimepicker** – A native date and time picker wrapper that ensures consistent behaviour across iOS and Android.
- **react-native-chart-kit** – A charting library for React Native that supports line, bar, pie, and progress charts for data visualization.
- **react-native-dropdown-picker** – Provides a customizable dropdown picker component with support for multi-select and search functionality.
- **react-native-community/slider** – A native slider component that allows users to select a value from a range by sliding a thumb control.
- **react-native-svg** – A library for rendering and manipulating SVG images in React Native, useful for custom graphics and icons.

JavaScript libraries:

- **moment** – A widely used JavaScript library for parsing, validating, manipulating, and formatting dates and times.
- **dayjs** – A lightweight alternative to Moment.js for handling dates and times with a similar API but smaller bundle size.

5.2.2 Backend

The backend was implemented using Appwrite, a self-hosted, open-source backend-as-a-service platform. For this project, the free tier version of Appwrite was employed. It provided integrated support for database management, user authentication, and serverless functions, all accessible via the official Appwrite SDK.

Appwrite was selected due to its simplicity, modern developer-friendly design, and its ability to consolidate multiple backend services (database, authentication, and cloud functions) within a single platform. Furthermore, it offers a generous free tier, which significantly reduces costs while still providing all necessary functionality. This balance between cost-effectiveness and technical capability made Appwrite an appropriate choice for the project.

Appwrite's built-in database was selected for storing all application data, as it integrates seamlessly with the platform's authentication and function services. The database stored entities such as users, tasks, events, badges, and notifications, while authentication ensured secure access and protected user data. The functions extended backend logic by handling badge logic, scheduling, and event-driven tasks, eliminating the need for a dedicated server.

The functions were developed in JavaScript and deployed directly from GitHub, which ensured maintainability and version control. Furthermore, cron scheduling was utilized within Appwrite functions to automate recurring tasks.

5.2.3 Other Tools

In addition to the main frontend and backend technologies, the development environment relied on supporting tools:

- **GitHub**[20] was used as a version control system and remote repository, enabling safe storage of code and streamlined deployment.

- **Visual Studio Code (VS Code)** served as the primary code editor, providing integrated debugging, extension support, and a suitable environment for working with both JavaScript and React Native.

[20] Github Repository: https://github.com/eliannapot/study--buddy

5.3 Data Model

A crucial element of the system's architecture is the database, which is responsible for storing and managing the data produced through user interaction with the application. To provide a comprehensive understanding of the relationships between data elements, an Entity-Relationship Diagram (ERD) has been designed, together with a relational database schema (DB design).

The ERD is a graphical model that demonstrates how entities -such as Users, Tasks or Events- interconnect through relationships in the system. In order to interpret the ERD, three core concepts must first be considered: entities, attributes, and relationships.

- **Entity.** An entity represents a distinct object or concept within the application for which data must be stored. In ERDs, entities are depicted as rectangles. Within the database, entities correspond to tables, which provide the foundation for storing and retrieving data.

- **Attribute.** Attributes are the defining properties of an entity, represented as ovals/circles in the ERD. Each attribute has both a name, describing its purpose, and a data type, specifying the kind of values it holds (e.g., *VARCHAR* for text, *BOOLEAN* for logical values). In relational terms, attributes translate into fields or columns within a table.

- **Relationship.** Relationships, illustrated as diamonds in the diagram, describe the associations between entities. Some relationships include additional attributes that provide further information about the nature of the connection, such as timestamps or status indicators.

Each entity is uniquely identified by a primary key (PK), which ensures that every record can be distinguished from others. Foreign keys (FKs) are used to establish connections between tables and don't have to be unique.

Another key concept is **Cardinality**, which defines how many instances of one entity may be associated with another:

- **One-to-One (1:1):** A single instance of an entity is connected to one and only one instance of another entity.

- **One-to-Many (1:N):** A single instance of an entity can be related to multiple instances of another entity, but the reverse is restricted to one.

- **Many-to-Many (M:N):** Instances of both entities can be linked to multiple instances of each other.

For the application the ERD and DB Design are the ones pictured below.

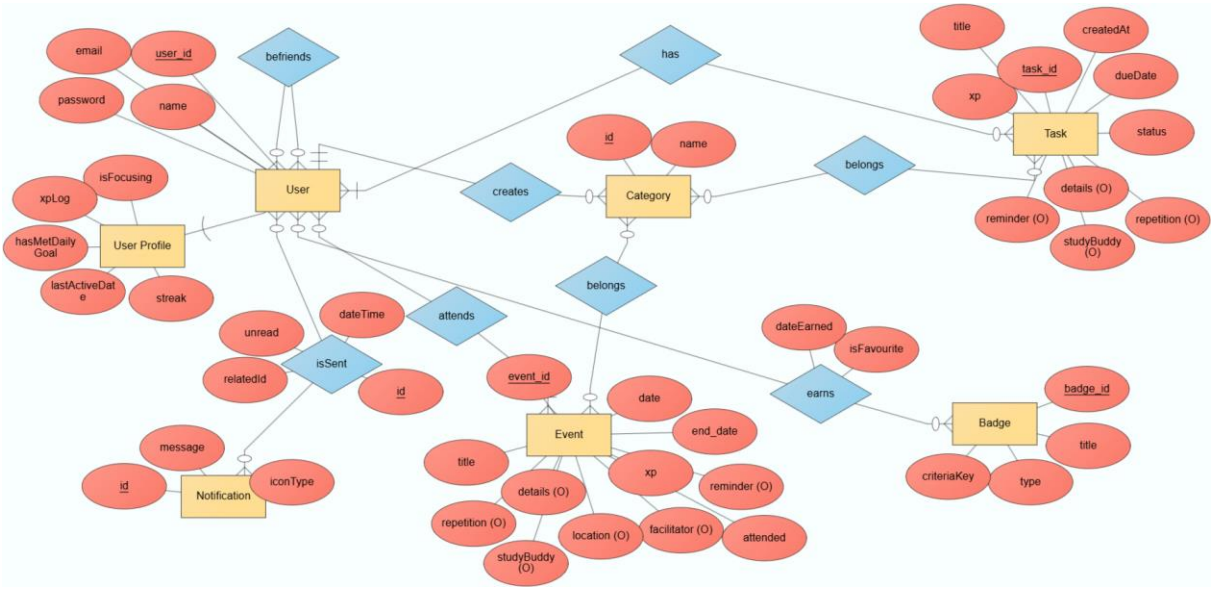


Figure 28: Entity Relationship Diagram (ERD) of the application.

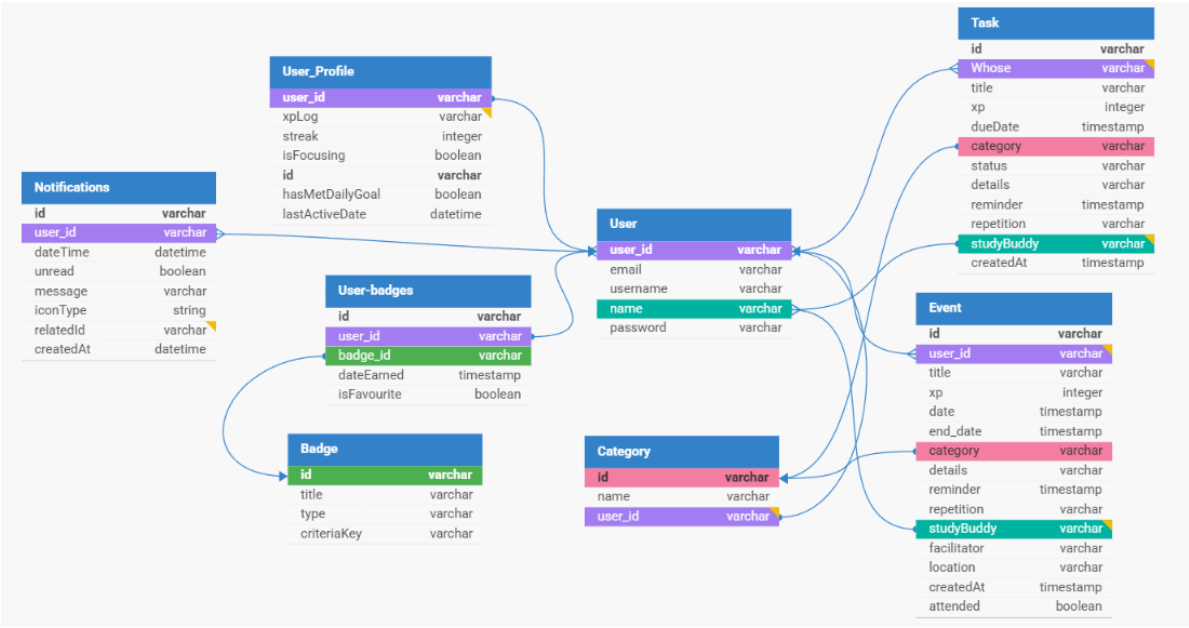


Figure 29: Database (DB) Design of the application.

5.3.1 Entities

According to the ERD the system incorporates seven core entities:

- **User.** The *User* entity is central to the database and stores essential details such as *user_id*, *name*, *email*, and *password*. This entity underpins the majority of relationships within the system, serving as the starting point for tasks, events, notifications, and badges.

- **User Profile.** The *User Profile* entity extends the information of the user, focusing on personal progress and customization. Attributes include *xpLog*, *streak*, *hasMetDailyGoal*, lastActiveDate and *isFocusing*. This creates a one-to-one relationship with the *User* table, ensuring that each user has at most one associated profile. Further explanation is needed for some of the attributes as follows:
    - ***xpLog*** is an attribute containing a table of unique varchars that are generated when the user completes an obligation that gives them Experience Points (XP). The varchars are generated with the format of "DATE-TIME-XP-OBLIGATION_ID" and the format gets broken down with various functions in order to calculate the user's statistics. An example of one line of the xpLog is the following: "2025-07-08T13:31:21.714Z-5-68147edf001fd7f4c594", which means that at 13:31 of Aug 7 2025 the user that has this xpLog gained 5 experience points because they marked the obligation with id:68147edf001fd7f4c594 as Done.
    - ***streak*** is an integer that gets calculated from the user's actions. It is increased by one if the *lastActiveDate* is different from "today"
    - ***lastActiveDate*** gets set to "today" if the user does any action from which they earn xp. It is important for calculating the *streak*, both in increasing and resetting it.
    - ***hasMetDailyGoal*** is a boolean that gets set to 1 if the user does any action from which they earn xp. It gets reset to 0 at the end of the day (midnight). It is important for preventing users that have been active from getting their streak reset.
    - ***isFocusing*** is a varchar that gets the value of the category title that a user is counting Focus Time on. When the focus time ends, the value gets set to NULL.

- **Category.** A *Category* provides organizational structure for grouping tasks and events. Each category contains an *id* and a *name*. Categories are created by users and are visible only to the user that created them. Each category may encompass multiple tasks or events as well as get chosen as a "focus time" topic.

- **Task.** The *Task* entity represents actionable items created by users. Attributes include *task_id*, *title*, *status*, *xp*, *dueDate*, and *createdAt*, alongside optional fields such as *details*, *reminder*, *repetition*, and *studyBuddy*. Each task belongs to a category and can be linked to other users through the *studyBuddy* attribute.

- **Event.** The *Event* entity records collaborative or individual activities. Each event has an *event_id*, *title*, *date*, *end_date*, *xp*, *attended* and optional details such as *location*, *facilitator*, *reminder*, *repetition*, and *studyBuddy*. Events can involve multiple users who attend them, supporting collaboration and engagement.

- **Badge.** The *Badge* entity reflects achievements earned by users. Each badge is defined by *badge_id*, *title*, *type*, and a *criteriaKey*.
    - ***criteriaKey*** defines the specific condition or rule required for a badge to be earned. It serves as a reference key that links system logic (e.g., completing a set number of tasks or attending events) with the badge-awarding mechanism. By externalizing these criteria into a single attribute, the system ensures flexibility and easier management of achievement conditions. An

example of a criteria key is “task_10” which means that if the user gets 10 tasks done, then they will earn that Badge, thus they will get an entry in the “User-Badges” table that will be elaborated late.

- **Notification.** Notification message template that can be sent to users. Attributes include *id*, *message*, *iconType*. Notifications can be related to events, tasks, badges and more.

5.3.2 Relationships

The ERD defines several relationships between entities, shown as diamonds in the diagram:

- **befriends.** A many-to-many relationship between users, enabling connections and social interaction. The users that have an accepted study buddy request between them can view and interact with each other.

- **creates.** Connects *User* with *Category*. One user may create multiple categories, but each category is owned by exactly one user (1:N).

- **has.** Connects *User* with *Task*. Each user is able to own zero to many tasks (0:N), but each task has to belong to at least one user in order to exist (1:N).

- **attends.** A many-to-many relationship between *User* and *Event*. Users can attend zero to multiple events, while each event can have one to many participants.

- **earns.** Links *User* with *Badge*. This many-to-many relationship includes attributes such as *dateEarned* and *isFavourite* to capture additional information about the achievement. In the database it is portrayed as a table titled “user-badges” that connects which User has won each Badge.

- **isSent.** Connects *Notification* with *User*. Each user may receive multiple notifications, but each notification is directed to one user (1:N). The relationship carries the attributes *id, unread*, *relatedId* and *dateTime*.
    - ***relatedId*** is an attribute linking the notification to another entity such as a task or event so that the user may tap on the notification and get redirected to the related screen.

- **isSent.** Connects *Notification* with *User*. A user may receive multiple notifications, but each notification is addressed to exactly one user (1:N).

- **belongs.** Used in both *Task-Category* and *Event-Category* contexts, ensuring that all items are assigned to an appropriate category.

5.3.3 Database Design

The ERD was translated into a relational schema to form the system's database design. Each entity corresponds to a table, with primary keys ensuring unique identification and foreign keys maintaining relational integrity. For example, the *Task* table references *Category* through a foreign key, while the *earns* relationship is realized as an associative table connecting *User* and *Badge*.

The schema was designed to reduce redundancy and ensure data consistency through normalization. Optional attributes, such as *reminder* and *studyBuddy*, provide flexibility without complicating the structure of the core entities. Furthermore, some many-to-many relationships are resolved using joined tables (e.g., *User–Badge* through *earns*), enabling scalable handling of user interactions.

Overall, this design supports efficient storage, fast data retrieval, and seamless integration with application features. The chosen schema provides both structure and flexibility, accommodating future extensions of the system while ensuring maintainability and performance.

5.4 Frontend

As mentioned previously, the frontend of the application was developed using React Native in combination with Expo. The structure followed common React Native conventions, with routes organized into screens, tabs, and authentication flows, each managed by their respective _layout files. In addition, the project made extensive use of reusable components, allowing for consistency across the interface and simplifying maintenance.

The development process was guided by the final Figma prototype, which served as the blueprint for the visual identity and interaction flow of the application. However, during implementation, certain modifications and additions became necessary due to the constraints and opportunities presented by React Native. These adjustments not only ensured technical feasibility but also enhanced the overall usability and efficiency of the system.

The decisions from straying from the initial plan are elaborated upon below.

5.4.1 Calendar Integration with react-native-calendars

Initially, the calendar component was designed in Figma as a series of simple square elements representing the days. While this design was visually clear, implementing it from scratch in React Native and making sure it was responsive in all screens would have been time-intensive and prone to errors. Instead, the project adopted the react-native-calendars library, which provided a robust set of pre-built components for calendar visualization and interaction.

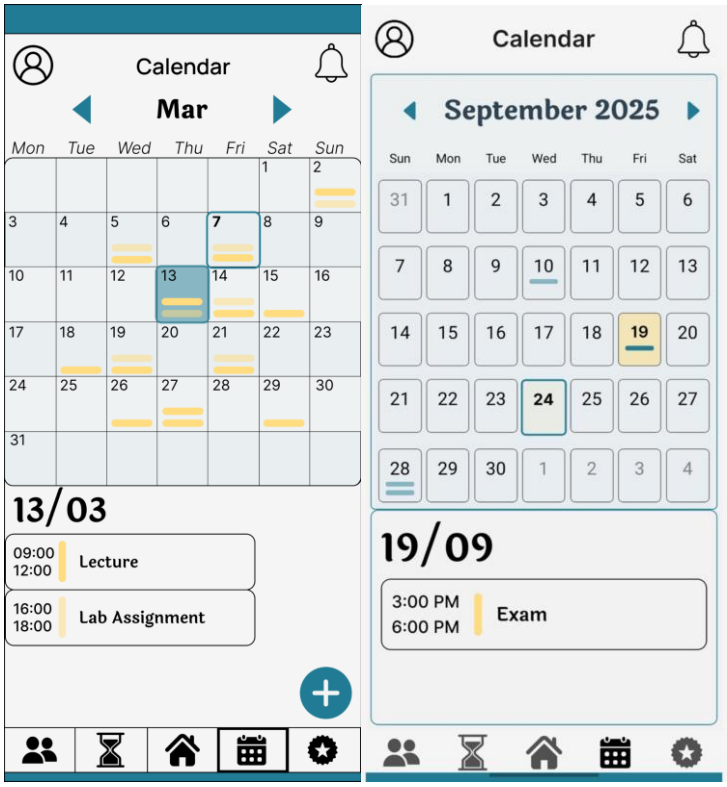


Figure 30: On the left, the calendar screen's look according to the Figma Prototype. On the right, the final interface of the page.

The overall page structure remains consistent with the original design; however, several notable adjustments were made during implementation. Specifically, the calendar was placed against a continuous light blue background to visually distinguish its functionality from other widgets within the application. The stripe indicators were adjusted to a dark blue hue to enhance accessibility for color-blind users. Furthermore, the date header beneath the calendar was enlarged and made horizontally scrollable, thereby allowing multiple happenings to be displayed simultaneously. The "+" button was removed, and the bottom navigation menu was simplified by eliminating border lines, yielding a cleaner and more streamlined appearance.

These adaptations offered several advantages. From a development perspective, reliance on a well-documented library substantially improved time efficiency. From a design standpoint, the standardized interface ensured visual and functional consistency with the remainder of the application. Moreover, the inclusion of built-in features, such as date marking, enriched the user experience beyond what was originally specified in the Figma prototype.

In retrospect, this shift highlights the importance of balancing fidelity to initial design prototypes with pragmatic implementation choices. By doing so, the project achieved both technical efficiency and enhanced usability, ultimately strengthening the overall quality of the application.

5.4.2 Statistics and Chart Visualization with react-native-chart-kit

Unlike the calendar, the statistics section was not fully specified in the original Figma prototype. The absence of a finalized design stemmed from uncertainties regarding the structure of the database and the types of metrics that would be available. Once these backend aspects were resolved, the decision was made to incorporate data visualization using the react-native-chart-kit library.



Figure 31: On the left, the profile screen's look according to the Figma Prototype. On the right, the final interface of the page.

The statistics section was designed to include a pop-up filter that allows users to toggle between *all-time*, *weekly*, and *monthly* statistics. Based on the selected range, the application calculates and displays the user's accumulated experience points (XP) in a graphical format, as exemplified in the image above. Blue was chosen as the primary accent color for this visualization, both to align with the application's overall color scheme and to reinforce the association between blue and data representation.

The selection of this library was motivated by several factors. First, in terms of design compatibility, the visual style of the charts integrated seamlessly into the existing interface and complemented the application's aesthetic. Second, with regard to its feature set, the library offered a broad selection of chart types and customization options, providing flexibility for future expansion and refinement.

Ultimately, the integration of data visualization significantly enhanced the clarity with which user progress is communicated. The charts not only fulfilled the immediate functional requirements but also established a foundation for future development, ensuring that this section of the application can evolve alongside the project's broader objectives.

5.5 Backend

The backend of the application was designed with the goals of simplicity, reliability, and scalability in mind. By leveraging Appwrite as a backend-as-a-service solution, the project benefited from ready-made authentication, database management, and serverless functions while still allowing for a modular and customizable architecture. This choice was particularly effective in the context of a student project, as it reduced the overhead of building infrastructure from scratch while keeping the focus on application logic and user experience. The following subsections outline the flow of data, the CRUD operations available for each entity, the authentication process, and the serverless functions that support recurring tasks.

5.5.1 Backend Architecture

The backend implementation was built around Appwrite as the primary backend-as-a-service (BaaS) provider, with the logic organized into a modular structure for clarity and scalability. The flow of data followed a layered approach:

1. **Frontend -> Context**: The frontend interacts with dedicated Context files, each created via createContext and wrapped within the central _layout file in the application's index. This ensured that global state and data were consistently accessible across the interface.

2. **Context -> Service**: Each Context was connected to a corresponding Service file, which defined the functions used by the UI to handle domain-specific logic (e.g., taskService, eventService).

3. **Service -> DatabaseService**: These services, in turn, interacted with a central databaseService file. This layer imported the Appwrite database instance and made use of Appwrite SDK functions to perform database operations.

4. **Appwrite.js and TempClient.js**: The appwrite.js file served as the central configuration for the Appwrite client. In addition, a tempClient.js was created to handle parallel sessions for specific authentication tasks, such as password verification, without interfering with the user's active session.

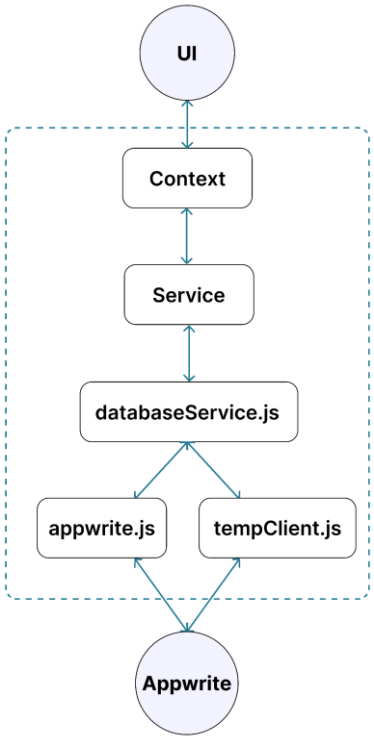


Figure 32: Backend Architecture.

This layered structure provided a clean separation of concerns and allowed the frontend to remain decoupled from the underlying database operations, improving maintainability and readability.

5.5.2 CRUD Operations

The application handled several key entities, each with its own set of operations:

- **User (implemented via appwrite's Authentication)**: Supported Create, Read, and Update (CRU) operations. Deletion was deliberately excluded to prevent accidental removal of test accounts during evaluation.
- **User Profile**: Similarly enabled CRU operations, with deletion disabled for the same reason.
- **Tasks**: Full CRUD functionality was implemented, as tasks represented a core feature of the system.
- **Events**: Supported full CRUD operations to allow users flexibility in managing event-based data.
- **Categories**: Provided CR operations. Update and delete were not prioritized within the project timeline.

- **Badges**: Implemented as Read-only. Since badges were pre-defined and static in the database, the only operation required was fetching them.

- **User Badges**: Supported CRU. Updates were limited to managing the isFavourite attribute, allowing users to highlight specific earned badges.

- **Notifications**: Provided CR operations. Only one notification type was implemented: weekly leaderboard updates. Notifications were created by server-side functions and retrieved by the respective users.

This model ensured that each data entity had a clear scope of operations, aligned with both the project's priorities and the intended user experience.

5.5.3 Authentication

Authentication was handled through Appwrite's built-in Authentication service, accessed via its Software Development Kit (SDK). An SDK is a collection of pre-built tools and functions that developers can integrate directly into their applications, allowing them to implement complex features—such as authentication—without building them entirely from scratch. By using Appwrite's SDK [21], the project benefited from a secure, standardized, and well-tested approach to handling sensitive user data.

The implemented endpoints were the following::

- **register**: Creates a new user account with credentials such as email and password. The data is transmitted securely and stored in encrypted form, ensuring that sensitive information is never exposed.

- **getUser**: Retrieves the details of the currently authenticated user. This allows the application to dynamically display user-specific information (e.g., username, email) while guaranteeing that only the logged-in user has access to their own data.

- **login**: Authenticates user credentials and establishes a session using secure tokens. This session mechanism ensures that users remain logged in without repeatedly entering their password, while still protecting against unauthorized access.

- **logout**: Terminates the active session by invalidating the associated token. This prevents further use of the application on that device, which is particularly important for shared or lost devices.

- **updateUser**: Required additional handling: password verification was performed using Appwrite's ***verifyPasswordWithoutAffectingSession***, necessitating the use of the ***tempClient*** setup. Following verification, updates to the individual attributes name, email, and password were executed using the Appwrite SDK. This approach

[21] https://appwrite.io/docs/sdks

allowed for both secure and flexible management of user credentials while preserving the active session.

Through the integration of these endpoints, authentication in the application was implemented with a strong emphasis on both **security** and **usability**, ensuring safe handling of user credentials while providing a seamless experience.

5.5.4 Functions

To extend backend functionality beyond direct database operations, two serverless Appwrite Functions were implemented:

1. **Reset Streak Function**: Executed every midnight to reset users' activity streaks.

2. **ResetLeaderboard Function:** Executed every Sunday at midnight to generate notifications informing users of their weekly leaderboard placement.

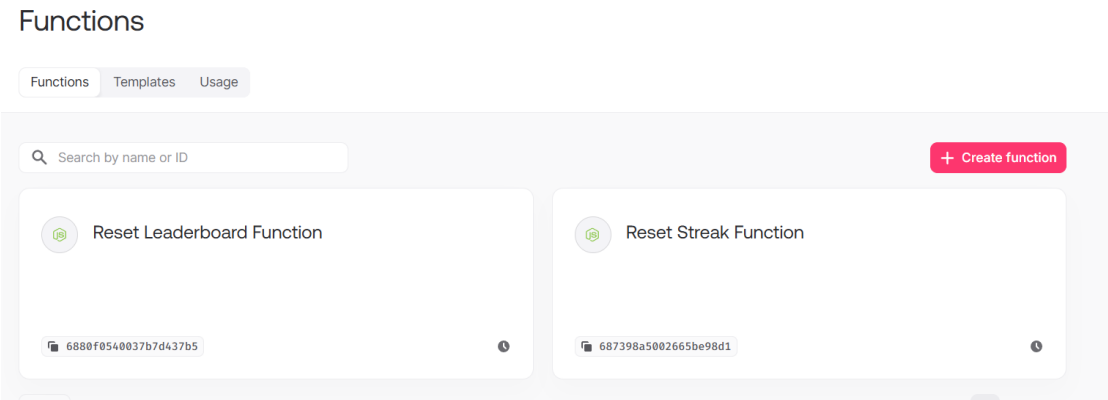


Figure 33: Functions setup in the environment of appwrite

Both functions were written in Node.js (version 18), one of the runtimes officially supported by Appwrite, and were deployed directly from the project's GitHub repository. This setup ensured proper version control and simplified deployment, as new commits could be synced to Appwrite through its integrated deployment system.

Their execution schedule was defined using cron expressions: the streak reset ran daily at 00:00, while the leaderboard notification ran every Monday at 00:00. This guaranteed that both features operated reliably without manual intervention.

Inside the functions, interaction with the backend was achieved via HTTP requests to the Appwrite API. This allowed the functions to perform the necessary CRUD operations on the database, such as updating streak fields or creating new notification documents. In this way, the functions acted as autonomous backend processes that extended the core database logic with time-based automation.

5.6 Deployment

The deployment process combined the use of Expo's **EAS (Expo Application Services)** and Appwrite's cloud infrastructure.

5.6.1 EAS

EAS is a cloud-based build and deployment service that simplifies the process of compiling and distributing React Native applications, removing the need for local Android or iOS build environments.

For this project, deployment to Android was performed via the command:

>> eas build --platform android --profile preview

This generated a preview build accessible through a temporary QR code. Although the QR code expired after a limited period, the resulting application package remained functional once installed on a device. This mechanism enabled efficient distribution to testers, who were able to install the app directly on their phones as a standard application package. Further discussion of the testing and feedback process is provided in the *Evaluation* chapter.

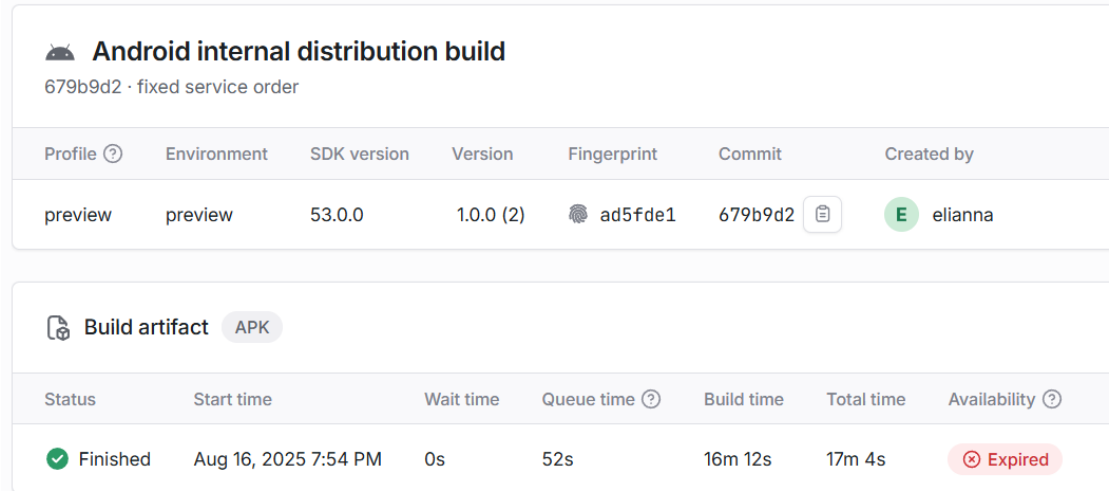


Figure 34: Build as shown in the expo website[22]

An alternative approach would have been to generate an Android App Bundle (AAB) for release on the Google Play Store. However, this option was not pursued during development, as it introduced additional steps such as app signing, Play Store configuration, and review processes. Moreover, publishing on the Play Store incurs financial costs (e.g., a developer account fee), whereas the EAS preview build could be created and distributed free of charge. Consequently, the preview build was chosen as the most pragmatic solution for development and testing purposes.

[22] https://expo.dev/

5.6.2 Appwrite

With respect to the backend, Appwrite did not require a traditional deployment process since it was already hosted on a cloud server. As long as the client application maintained an active internet connection, it could communicate with Appwrite's APIs seamlessly.

The only deployment-specific step for the backend involved the Appwrite Functions, which were deployed directly from the project's GitHub repository, as described in the implementation section. This allowed for continuous integration of function updates without manual configuration.

6. Evaluation

This chapter presents the evaluation of the developed application. The purpose of this evaluation is twofold: first, to conduct a self-evaluation of the system by examining the extent to which the functional requirements outlined in the design phase were implemented; and second, to assess the application through real-world, ecologically valid testing with users. Together, these approaches provide both an internal perspective—focused on the degree of alignment with initial specifications—and an external perspective, which reflects how the application performs in practical, authentic usage scenarios.

6.1 Self-Evaluation

The first stage of evaluation involves a systematic comparison between the application's implemented features and the original set of functional requirements. This self-assessment makes it possible to identify which requirements were fully met, which were only partially realized, and which remain unimplemented. In doing so, it provides a clear overview of the application's current state of completion and highlights areas for potential improvement in future iterations.

The requirements are analysed in categories and are presented below along with the priority that was given to them initially, in Chapter 3.4: Requirements and also the its completion level. The results are first going to appear centralised and after that clarifications will be made right after.

The format of the table will be the following:

Requirement Category			
Number	Function Sentence	Status	Priority

The Requirement Statuses are the following:

- **Completed** - The function is fully and properly completed.
- **Partially Completed** - The function is provided but not in its entirety.
- **Not Completed** - The function has not been completed.

1. User Registration & Authentication			
1.1	The app allows users to sign up (email, password, nickname)	**Completed**	P0

1.2	The app allows users to log in using their credentials. (username, password)	**Completed**	P0
1.3	The app provides an option for password recovery in case a user forgets it.	**Not Completed**	P2
2.	User Profile		
2.1	The app allows users to view their profile information.	**Completed**	P0
2.2	The app allows users to edit their profile information.	**Partially Completed**	P2
3.	Task Management		
3.1	The app allows users to create tasks.	**Completed**	P0
3.2	The app allows users to view, edit and delete tasks.	**Completed**	P0
3.3	The app allows users to mark tasks as in progress and completed.	**Completed**	P0
3.4	The app allows users to create categories for tasks. (+provide predefined categories)	**Completed**	P1
3.5	The app allows users to categorize tasks.	**Completed**	P0
3.6	The app allows users to filter tasks by their characteristics.	**Completed**	P1
3.7	The app has the option to display Tasks in calendar view.	**Completed**	P1
4.	Gamification (Engagement / Fun Factor)		
4.1	The app invites users to assign points (1-5) to their (individual or collaborative) tasks	**Completed**	P0
4.2	The app adds the assigned points to the user when the task is complete.	**Completed**	P0
4.3	The app provides a congratulatory animation when the task is complete	**Not Completed**	P2
4.4	The app keeps track of the sum of points that the users gather.	**Completed**	P2
4.5	The app has a streak feature that keeps increasing by one, as long as the user completes at least one task per day. If the user neglects completing any task in a given day, the streak resets to zero.	**Completed**	P0

4.6	The app assigns badges to users depending on their app use.	**Completed**	P0
5.	Social Features		
5.1	The app allows users to find other users via their unique username and send connection requests. (study-buddy requests)	**Not Completed**	P0
5.2	The app allows users to view, accept and decline connection requests.	**Not Completed**	P0
5.3	The app allows users to view another user's profile.	**Partially Completed**	P1
6.	Collaboration		
6.1	The app allows users to invite other users in completing collaborative tasks.	**Completed**	P0
6.2	The app allows users to view, accept and decline collaborative task requests.	**Not Completed**	P0
6.3	The app allows users to ping/nudge other users to complete their common task.	**Not Completed**	P3
7.	Focus Timer		
7.1	The app allows the user to time their studying with a focus timer.	**Completed**	P0
7.2	The app provides motivational messages to the user while they are in focus mode	**Partially Completed**	P3
7.3	The app displays the users who have an active focus timer as "Focused" in the dashboard.	**Completed**	P2
8.	Events		
8.1	The app allows the scheduling of Events	**Completed**	P0
8.2	The Event facilitator can be a user (e.g. Student in a Study Group) or an outside facilitator (e.g. Professor in a Lecture)	**Partially Completed**	P3
8.3	The app allows the invitation of study-buddies in the Events	**Completed**	P1
8.4	The app has the option to display Events in calendar view.	**Completed**	P1

9.	Notifications and Reminders		
9.1	The app allows users to set custom Reminders for each Task and Event	**Not Completed**	P1
9.2	The app sends push notifications for reminders	**Not Completed**	P1
9.3	The app sends in-app notifications for invitations, requests, badges, leaderboard etc	**Partially Completed**	P2
9.3	The app allows for users to customise which notifications they receive.	**Not Completed**	P2
10.	Statistics and Visual Progress Tracking		
10.1	The user can see statistical information of tasks completed	**Completed**	P2
11.	Personalisation		
11.1	The app supports dark mode.	**Partially Completed**	P2
11.2	The app allows users to choose their own theme (color, adjust font size and weight)	**Not Completed**	P3
12.	Accessibility / Support / Feedback		
12.1	The app has an option to ask for support/help	**Not Completed**	P2
12.2	The app has a feedback feature	**Not Completed**	P3
12.3	The colours used are Colorblind Friendly	**Partially Completed**	P3
12.4	The app uses Semantic / Accessibility Labels to elements to make it compatible with screen-reader applications	**Partially Completed**	P1
13.	Responsiveness / Platform Compatibility		
13.1	The app has responsive design	**Completed**	P1
13.2	The app is compatible with both iOS and Android devices	**Completed**	P0
14.	Help Users Avoid Mistakes		

14.1	Use of clear, large tap targets.	**Completed**	P1
14.2	Confirmation messages before permanently deleting.	**Completed**	P1
14.3	The app provides an onboarding tutorial to new users	**Not Completed**	P3

Table 6: Implementation of the requirements

Some elaborations on the table above will be provided, especially on the cases where a requirement with a relatively high priority was not fully completed.

Requirement 5: Social Features:

The social functionality was only partially implemented. In the original plan, users would be able to send and accept connection requests to build a network within the application. However, this feature was not developed. Instead, the decision was made to allow all users to view one another's profiles, scores, and leaderboard standings without the use of a separate connections table. This adjustment was motivated by the smaller scale of the evaluation phase, where only eight users were involved, and it was considered more appropriate to make interactions open and unrestricted. Additionally, the feature of viewing another user's profile was only partially realized. While basic profile details are visible, the display of a user's favourite badges -initially intended as part of the buddy profile view- was not implemented in this version.

Requirement 6: Collaboration

Collaboration features were also adapted from the original plan. Users are able to collaborate with all other users in the application; however, there is no process for sending or accepting collaboration requests. As a result, no notifications are triggered for collaboration acceptance. Instead, collaborative tasks or events simply appear on the shared screen without additional communication between participants.

Requirement 9: Notifications and Reminders

This requirement was not fully achieved. Push notifications were not realized in this version of the application, which also prevented the implementation of reminders. In-app notifications were partially developed, with functionality working reliably only for leaderboard updates. Other forms of in-app notifications remain incomplete.

Requirement 11: Personalisation

Personalisation features were not developed in this version of the application.

Requirement 12: Accessibility Functions

Accessibility support was only partially implemented. Some labels were provided, and contrasting colours were used to improve readability. However, these features were not

comprehensively tested for colour-blind friendliness, and full accessibility compliance was not achieved in this version.

6.2 User Based Evaluation

While the self-evaluation offered valuable reflections on the design process and highlighted areas of improvement from the researcher's perspective, it is not sufficient on its own to ensure the application's effectiveness. A product designed for students must also be assessed by its intended users, as their perceptions, behaviours, and feedback provide insights that cannot be captured through self-assessment alone. For this reason, a user-based evaluation was conducted, involving participants who represent the target audience, in order to validate the design choices and identify practical improvements grounded in real user experience.

6.2.1 Structure of the Evaluation

For the final stage of evaluation of the application, it was decided to pursue an Ecologically Valid Evaluation of three (3) stages during the course of 2 weeks, before and during the exam period of September.

The stages of the evaluation were the following:

1. Initial Evaluation
    i. Test Users selection
    ii. Think aloud protocol
    iii. Onboarding
2. Field Study
3. Final Evaluation
    i. Focus Groups
    ii. Questionnaire

Below there are elaborations on the approach of each stage of the evaluation.

Testers Selection

Firstly, eight (8) users were selected in accordance with the application's target group. The subjects were all active students in the University of Patras and studied in different faculties and years. The priorities of the subjects were the following:

- 6 studied for exams they would have to sit for.

- 2 studied for both their thesis project and exams.

The test users were selected to be of various gender, availability and academic motivation. The decision to work with eight participants is in line with usability testing guidelines, which suggest that 5–8 users are typically sufficient to find the majority of usability issues when testing. (Nielsen, 2000)

From the eight (8) people, two (2) had participated in both previous input-gathering phases and two (2) had participated in one of the two previous input-gathering stages (one in the first and the other in the second), so they were more familiar with the application's concept. The remaining four (4) did not have previous familiarity with the application.

The users were asked with which Persona (Chapter: 3.3.1 Personas) their study habits resonated more with. Their user profiles corresponded evenly to the personas, with three (3) people resonating with Akali, three (3) with Glaucus and two (2) with Ariadne.

Think aloud and Onboarding

For the next stage, a meeting was arranged with each subject individually. The subjects were given access to the application and downloaded it in their mobile devices and signed a GDPR form, stating their consent in their personal data being used for the purpose of evaluating the application. The meeting consisted of two parts;

Firstly, The users were asked to use the Think Aloud protocol while navigating the application for the first time, similar to how one might download an application from the app store and then use it. The Think Aloud protocol is a well-established method in usability studies, and has also been used during the Prototype Evaluation Stage of the application. It successfully allows researchers to capture users' cognitive processes while interacting with a system. (Ericsson & Simon, 1993)

The users after concluding the first stage were encouraged to ask questions they might have and were given an onboarding presentation with clarifications on the application and a briefing of the monitoring stage, the one they would follow for the next few days.

Field Study

This stage constituted a field evaluation conducted during the evaluation period, lasting approximately two (2) weeks. Every three to four days, the researcher privately contacted each test user with open-ended questions concerning their experience using the application: how often they used it, what difficulties they encountered, and their general impressions. This ongoing contact allowed the researcher to collect immediate feedback and ensure that participants remained engaged throughout the field evaluation.

Conducting the study in participants' natural environments increased the ecological validity of the findings, a critical concern in user experience and Human-Computer Interaction research (Bargas-Avila & Hornbæk, 2011).

In addition, this field evaluation employed experience sampling, a method in which participants report on their behaviors, thoughts, or feelings close in time to when they occur,

rather than relying solely on retrospective recall. Experience sampling has been widely used in HCI and behavioral research to capture contextually grounded, momentary user data, helping to reveal temporal dynamics and usage patterns that would otherwise be overlooked (Hektner, Schmidt, & Csikszentmihalyi, 2007). Collecting responses at periodic intervals during actual use allows for richer, more accurate insight into how users interact with a system over time, and how their experience evolves—an aspect particularly important in user-centered design.

Focus Groups

Following the monitoring, two (2) focus groups were organized in order to collect qualitative feedback on the usability, perceived usefulness, and overall experience of the application. Each Focus Group lasted approximately one (1) hour and included four (4) test users together with the developer acting as facilitator. The sessions were scheduled separately to accommodate the availability of the participants.

The Focus Groups aim was to get the impressions, specific experiences, and suggestions for improvement all together in a group environment.

The objective of this stage was to explore the participants' subjective impressions, capture instances of positive or negative experiences, and identify areas of potential improvement that could not be sufficiently revealed through quantitative questionnaires. Focus groups are particularly effective for such purposes, as they enable dynamic interaction between participants and provide richer qualitative data than one-on-one interviews alone (Morgan, 1997).The focus group was intentionally designed to precede the structured questionnaire, so as to avoid overlap and to allow participants to express their opinions in an open and unconstrained manner before being asked to provide specific ratings.

The structure of the discussion encouraged participants to:

- Share their first impressions.
- Reflect on their daily experience of using the application.
- Identify motivating or frustrating moments.
- Share their experience with the app's features.
- Propose improvements and imagine new features they would consider valuable for future versions of the application.

Questionnaire

After the conclusion of the focus group discussions, participants were asked to complete a structured questionnaire. The questionnaire was designed to provide quantitative data that would complement the qualitative insights of the Focus Groups. It included a combination of scale ratings and open-ended questions.

Participants were asked to:

- Evaluate their general academic productivity in comparison with their productivity while using the application
- Indicate the frequency of use of the application in relation to their academic obligations

- Assess the extent to which the application fulfilled specific goals such as gamification and accountability.
- Rate the core features of the application (Tasks, Timer, Badges, etc) along the dimensions of user interface clarity, usability, usefulness, and engagement and the frequency with which each feature was used in practice.
- Indicate whether they would recommend the application to peers.
- Suggest a single change they would prioritize for improvement.

The use of both focus groups and questionnaires in the evaluation was intentional in order to capture complementary forms of data. According to (Patton, 2015), qualitative and quantitative approaches in combination can provide a more comprehensive understanding of user experiences, a process often referred to as methodological triangulation. Focus groups are particularly effective for eliciting subjective impressions, shared experiences, and interactive discussion among participants (Krueger & Casey, 2015), while questionnaires allow for the systematic collection of quantifiable responses that can be compared across participants (Bryman, 2016).

By employing both methods, the evaluation aimed to balance the depth of qualitative insights (through the focus groups) with the broad scope and easy comparisons of quantitative data (through the questionnaire). This triangulation increases the validity of the findings, as the strengths of one method compensate for the limitations of the other (Denzin, 2012)[32].

Following that, the next section presents the main conclusions from the exercises that took place during the evaluation. It is organised into four parts: the think-aloud sessions conducted during onboarding, the monitoring phase which captured patterns of use over time, the focus group which provided deeper qualitative insights into user experiences, and the questionnaire which quantified participants' perceptions. Together, these components provide a comprehensive account of both the app's strengths and its areas for improvement.

6.2.2 Think aloud Findings

During the think-aloud exercise conducted at the start of onboarding, participants consistently reported that the application was easy to navigate. They described the interface as intuitive, allowing them to explore the available features without the need for detailed instructions. This sense of natural usability was reinforced by the fact that most participants were able to discover and test the core functionalities simply by interacting with the app, highlighting the effectiveness of a "learning by doing" approach.

The processes of creating and editing tasks and events were particularly well received. Users encountered no difficulties in entering information, managing their schedules, or modifying existing entries. The smoothness of this experience contributed to a sense of confidence in using the app from the very beginning, removing potential barriers to adoption.

Among the features tested, the focus timer attracted immediate recognition as a Pomodoro-style tool. Participants found it motivating during study sessions, particularly when they could see others also engaging in focus mode. This visibility added a subtle social dimension to what might otherwise be a solitary activity, reinforcing both accountability and motivation. The

buddy system similarly generated engagement by sparking curiosity about peers' activities. Its competitive element was repeatedly noted as a source of encouragement, with users expressing enjoyment in comparing their progress to that of others.

The gamification layer of the app was also received positively, with badges and rewards described as motivating and playful. Several participants mentioned the appeal of collecting badges, framing it as a "collect them all" experience that could sustain engagement over time. However, there were also signs of uncertainty around gamification mechanics, with XP accumulation, streaks, and badge unlocking not always fully clear to users during onboarding.

Finally, participants provided feedback regarding categories and design. While the aesthetic of the app was appreciated and described as visually pleasing, some users expressed a desire for greater personalisation, such as a dark mode or profile customisation options. At the same time, the process of creating and reusing categories was perceived as somewhat confusing, suggesting that this aspect of the interface could be streamlined to match the otherwise smooth onboarding experience.

6.2.3 Field Study Findings

The monitoring stage provided valuable insight into participants' actual patterns of interaction with the application, complementing the data collected through the questionnaire and focus group. Over this period, it became clear that the task function served as the central point of engagement. Most participants consistently relied on it to structure their study obligations, while the focus timer and leaderboard also received regular use, especially among those who valued motivation through accountability and competition. By contrast, the events feature was used less frequently, although some participants did experiment with it, indicating potential but more limited adoption at this stage.

In terms of motivational dynamics, both the XP system and the leaderboard emerged as particularly powerful. Participants described the gratification of gaining XP as validating, while the leaderboard reinforced a sense of playful competition. Comments such as *"gotta climb that leaderboard"* or *"I'm 2nd"* reflect the enthusiasm that the ranking system generated. Interestingly, even when participants did not fully commit to their planned tasks, they still reported that the app prompted them to think about studying more actively, demonstrating that its impact extended beyond direct usage to shaping study-related attitudes.

The focus timer was also central in this stage, though experiences were mixed. Many valued it as a motivating study tool, especially when combined with the visibility of peers who were also focusing. However, several issues limited its effectiveness. Users reported that the timer stopped when answering a call, that they sometimes forgot to press stop, and that they would have preferred countdown "packets" rather than continuous counting up. Suggestions included pause and break functionality, as well as more flexible behaviour overall, pointing to the timer as both one of the most appreciated and most in-need-of-refinement features.

Participants also engaged in self-reflection during the monitoring stage. For some, assigning their own XP was a gratifying and validating act, strengthening their sense of ownership over their progress. Others acknowledged that they did not always follow through with their

planned tasks, but nevertheless found that the app acted as a reminder of their academic responsibilities. In this way, even imperfect use still created a form of accountability.

Finally, the monitoring notes highlighted barriers and limitations that shaped engagement. On days when participants did not study, they naturally interacted little or not at all with the app. In addition, one participant explained that they avoided creating tasks entirely, fearing they would not complete them - an observation that illustrates the fine balance between support and perceived pressure in productivity tools. These reflections suggest that while the app effectively motivated and structured study for many of the testers, its long-term adoption may depend on lowering psychological barriers and ensuring that its tools remain supportive rather than burdensome.

6.2.4 Focus Group Findings

The Focus Group brought up a lot of insights into the users thoughts and feelings in using the application. The minutes were centralised and are summarized in categories as follows.

Daily Use and General Experience

The participants' accounts of their daily use of the application revealed both consistent patterns and individual variations. For many, the application played a supplementary role in their study routine, providing structure and a sense of order. The Tasks and Calendar functions in particular helped users organise their work in a centralised way, often replacing or complementing paper-based planning methods. As one participant put it, *"Usually I make my plans for exams on paper, but this time I put everything on the calendar, which was very pretty and satisfying to see centralised."* This sense of having one place to gather academic obligations was highlighted as a practical strength.

At the same time, not all participants were accustomed to using applications for studying, and this occasionally limited engagement. Several admitted they simply forgot to open the app, especially when no notifications reminded them to do so. *"I kind of forgot to open it because I don't usually combine apps with studying,"* explained one user, echoing a broader concern that without reminders the app could easily slip out of their routine. Others noted that when they saw their studying slowing down, they opened the app to ground themselves and get focused.

Despite these limitations, the general impression remained positive. Participants described the interface as easy to use and the experience as engaging. The learning curve was minimal, and several users reported feeling comfortable exploring features such as tasks, calendar, and leaderboard within the first few days. Over the course of ten days, the app became integrated into some students' study flow, while others engaged with it more sporadically. Importantly, even those who used it less often acknowledged that when they did engage, it helped them approach studying with a greater sense of structure.

Motivation, Accountability, and Gamification

The motivational aspects of the app were among the most frequently praised features. The Experience Points (XP) system stood out as the primary driver of engagement, creating both internal and social incentives to study. One participant described their experience as, *"I sat down to study and said let's gather some XP. When I completed a task I was very happy to mark it as done. It was very gratifying."* This sentiment was echoed repeatedly, with several participants emphasising that gaining points validated their effort and made academic work feel more rewarding.

The leaderboard played a complementary role by fostering a sense of competition. For some, seeing familiar names ranked above them encouraged additional study sessions: *"When I saw a familiar name on the leaderboard I felt engaged to surpass them."* Others highlighted the motivational boost of witnessing peers actively focusing at the same time. One participant explained, *"Once I saw three other people focusing at one time and it really helped me keep on being motivated and studying and holding on."* In this sense, the app created a form of social accountability, where the visibility of peers translated into subtle pressure to continue working.

While XP and leaderboards motivated most, a lot of testers had ideas for further development. A progression system beyond numbers just numbers, such as milestones, levels, or unlockable achievements was proposed. This indicates that while the current gamification features were effective in creating engagement, there is room to expand the system into a more layered motivational framework.

Timer Reception

The Timer emerged as one of the most central yet divisive features. On the positive side, it served as a critical anchor for study sessions. Many participants used it as their primary tool, reporting that it provided rhythm and structure to their work. As one noted, *"I was motivated to study so I wanted to keep the screen from closing. I was very satisfied when I got the XPs."* Others described using the timer in conjunction with tasks, creating a complete cycle of planning, focusing, and rewarding progress.

However, technical issues frequently undermined its effectiveness. Several reported that the timer stopped unexpectedly or failed to continue running once the phone screen closed or if they picked up a call. These bugs often led to frustration and discouraged continuous use. One participant summarised the experience simply: *"The timer didn't help me focus because of its bugs."*

Participants were also very vocal about desired improvements to the timer. A reverse countdown timer was one of the most common requests, often tied to Pomodoro-style studying habits. In addition, many suggested implementing time packets: pre-set bundles of study and break intervals, to encourage structured sessions. Aesthetic and functional requests also surfaced, such as providing playful animations such as stars or explosions to make the timer more engaging. Together, these comments suggest that while the timer has strong potential, refining its reliability and expanding its features would significantly enhance its role in sustaining focus.

General Improvements Mentioned

Beyond the timer, participants identified other areas where improvements could enhance their overall experience. The most prominent was notifications. The absence of reminders and push notifications kept some of the participants from regular use. Many argued that push notifications would be essential for sustaining engagement, with one comparing the desired style to other apps: frequent enough to keep the app present in the user's mind, but not overwhelming. *"Notifications because I need reminders to not forget it exists,"* explained one participant, highlighting the practical role of gentle nudges in habit formation.

The management of older / "Done" Tasks also drew attention. Some users noted that the long list of tasks felt overwhelming. One participant reflected, *"Once I entered the 'All Tasks' and I saw the big list with also the old tasks, so I got demotivated to add more because it felt like a huge cluster."* Suggestions included separating completed tasks with more than color or archiving them in order to maintain clarity.

Other requests focused on customisation and personalisation. Several participants wanted to be able to add photos or avatars to their profiles, customise leaderboards (e.g., by week, total, or activity type) and have the option for dark mode. Some suggestions for more interaction with peers using comments, reactions or nudges were also made. The desire for stronger community features was a recurring theme, reflecting the fact that social motivation played a key role in the app's impact and had to be developed further.

Future Ideas

When asked to imagine the app's potential future, participants provided a range of suggestions that balanced versatility with simplicity. Some envisioned using it beyond academics, applying its task and XP framework to other aspects of life such as gym workouts, cooking, or general daily planning. Others preferred to keep it focused on academic contexts, suggesting features like semester-long schedules, repeating lecture events, and academic-oriented rewards.

Despite these differences, a shared appreciation for the app's simplicity was evident. Several participants emphasised that it should avoid becoming cluttered with unnecessary features, as this might undermine its ability to keep users focused. *"I like that it doesn't have a lot of stuff because that way you actually focus on studying,"* noted one participant. Others echoed this, calling for balance between playful gamification and streamlined productivity.

Finally, when asked if they would continue using the app provided the bugs were fixed, most participants responded positively. Some acknowledged that their personal context (such as graduating or not being habitual app users) might affect long-term adoption, but the general consensus was that with reliable performance, meaningful notifications, and an active community, the app could become a valuable daily tool.

Summary

In summary, the focus group confirmed that the app succeeds in providing motivation, community, and a playful approach to studying. Nevertheless, technical reliability, reminder

mechanisms, and enhanced customisation stand out as key areas for future development to ensure sustained user engagement.

6.2.5 Questionnaire Findings

The questionnaire provided valuable insights into how students perceived and interacted with the application. When comparing their self-assessed productivity in general with their productivity while using the app, the majority of participants reported an increase. Out of the eight respondents, five indicated an improvement, two remained at the same level, and only one reported a decline. This corresponds to 62.5% of the sample showing a positive impact, 25% remaining neutral, and 12.5% experiencing a decrease. These findings suggest that the app supported academic productivity for most students, with its effect being particularly visible during periods of structured studying.

In terms of context, the application was used primarily in relation to exam preparation. Some participants also mentioned employing it for thesis writing or, in fewer cases, for everyday lifestyle tasks. This shows that while the application's strongest perceived utility was in supporting exam study, it also held some potential in broader organizational tasks. Regarding frequency, usage was described as moderate rather than constant. Most participants reported employing the app on about 30–60% of their study days, typically turning to it when they needed structure, focus, or additional motivation, rather than as a daily habit.

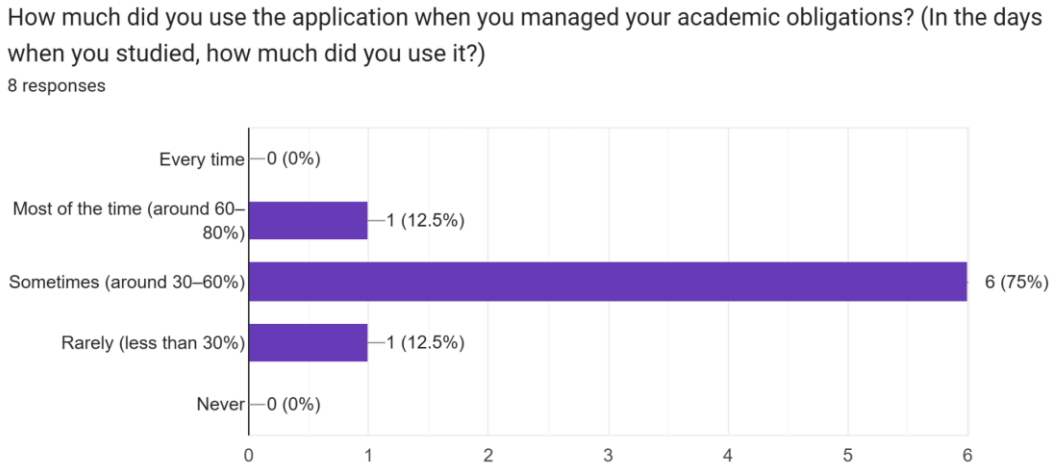


Figure 35: Frequency of the application's use

The three central pillars of the app, gamification, accountability and motivation, were rated on a six-point scale by all respondents. The average scores were 4.75 for gamification, 3.5 for accountability, and 4.75 for motivation. These results indicate that gamification and motivation were consistently appreciated and perceived as strengths of the app, while accountability was evaluated somewhat lower, though still in a positive range.

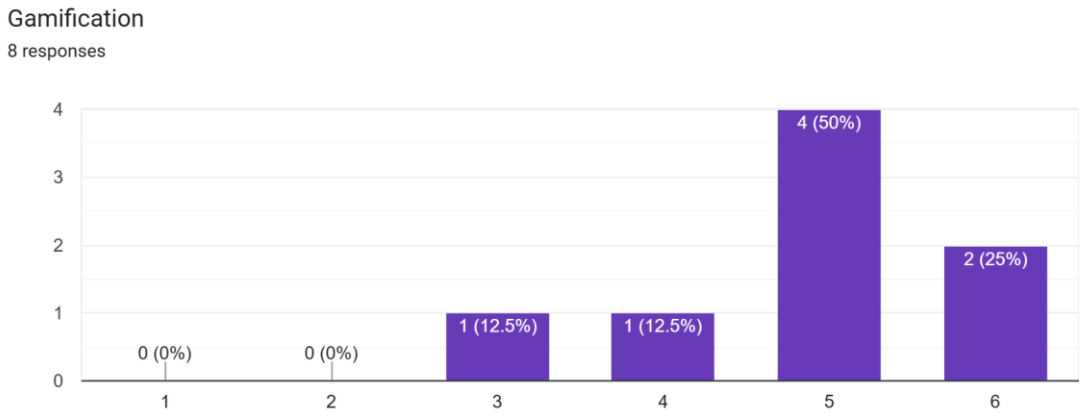


Figure 36: Answers on how much the participants saw gamification as a feature being met throughout the application.

When examining the use of individual features, distinct patterns emerged. The Tasks function stood out as the most consistently used feature, with several participants describing it as integral to their study sessions. Timer also saw regular use and was perceived as central to the app's functionality. Other features, such as Events and Leaderboard, were used occasionally but not as intensively. By contrast, Calendar, Badges and Study Buddy were used rarely, and features such as the Statistics and navigation to other user profiles were often left aside entirely.

In terms of feature evaluation, participants assessed each element of the app along dimensions such as user interface, usability, usefulness, and engagement. Tasks, the Timer and the Leaderboard received the most consistently strong ratings, both in terms of design and perceived contribution to productivity. The Calendar, Badges and Statistics features were generally seen as useful additions, though not essential. Other features, such as Events and Buddy Profiles, received more mixed responses. While they were not rated as highly as the core features, their presence did not detract from the overall perception of the app. Instead, participants seemed to selectively prioritize the tools that best supported their individual study habits.

For example, Figure 37, it is evident that the Leaderboard had a very good reception, with the test users rating it highly in most aspects. In contrast, in Figure 38, Events received mixed reviews. Even though test users did not have issues with its interface, there seemed to be a mixed perception, with users usage and found usefulness.

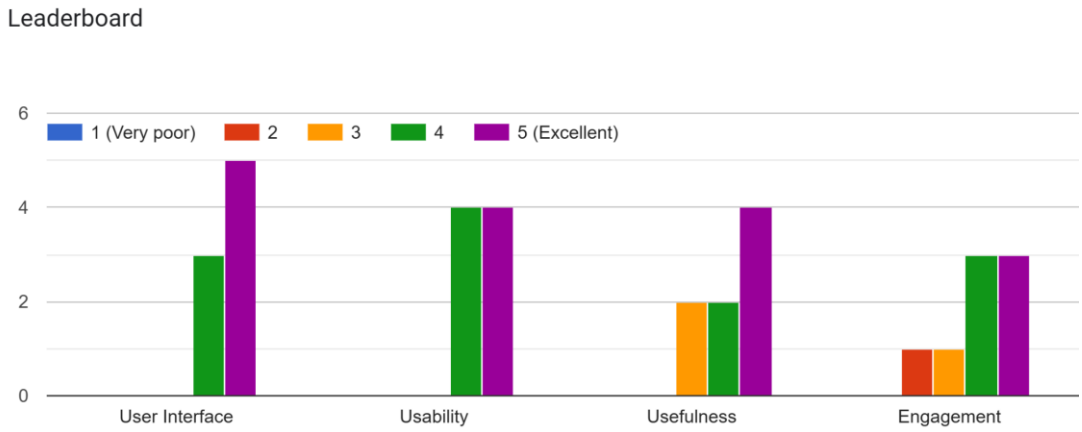


Figure 37: Overwhelmingly positive remarks on the Leaderboard function.

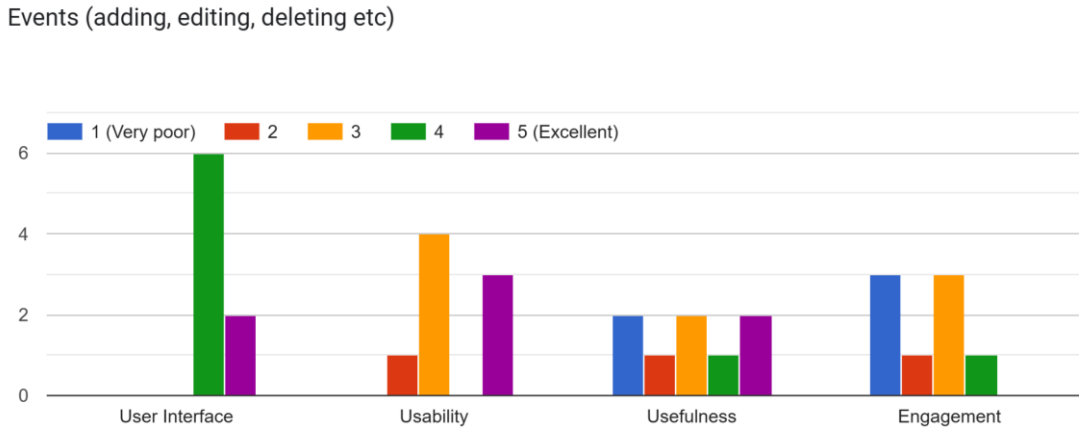


Figure 38: Mixed opinions on Events function.

Finally, when asked whether they would recommend the application to a fellow student, seven out of eight participants responded positively, and one answered "maybe." This translates to 87.5% of the respondents being explicitly willing to recommend the app, indicating a strong overall acceptance and perceived value among the student users.

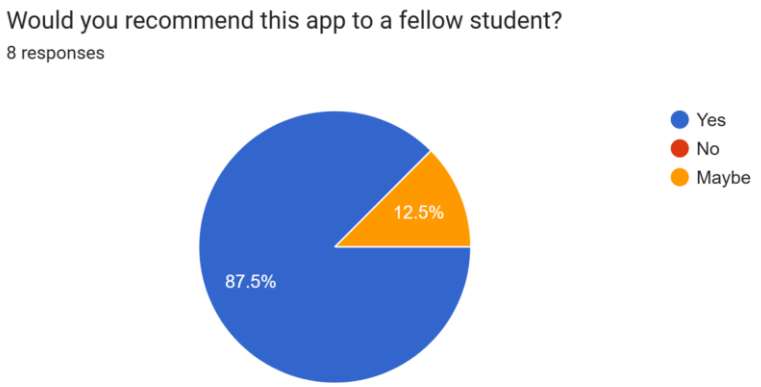


Figure 39: Results of whether the testers would recommend the application to other students.

6.2.7 Summary

This chapter presented a multi-layered evaluation of the application through different methodological lenses. The think-aloud exercise at onboarding highlighted participants' first impressions, focusing on navigation, ease of use, and initial reactions to core features such as the focus timer, tasks, events, and gamification elements. The field study provided further insights into actual usage patterns over time, documenting how participants engaged with the app in daily study routines, how they responded to motivational mechanisms, and what barriers occasionally limited interaction. The focus group discussions offered a more in-depth exploration of user experiences, addressing themes such as daily use, motivational dynamics, reception of the timer, desired improvements, and visions for future development. Finally, the questionnaire results quantified these findings, reporting self-assessed productivity changes, frequency and context of use, and evaluations of individual features across the app, alongside participants' willingness to recommend it to others. Together, these layers of analysis captured both the breadth and depth of user engagement, combining immediate reactions, monitored behaviour, reflective discussion, and structured survey data.

7. Results

7.1 Conclusions

The goal of this thesis was to create a study tool that supports students in managing their academic tasks while fostering motivation through gamification and accountability mechanisms. By integrating features such as task organisation, focus timers, XP points, leaderboards, and badges, the application sought to turn studying from an isolated obligation into an engaging, motivating, and socially supported activity.

Across development, implementation, and evaluation, the project demonstrated both achievements and limitations. On the technical side, most core task management and gamification functions were fully realised: users could register, create and track tasks, schedule events, engage with leaderboards, collect badges, and measure their progress. Particularly central were the Tasks, Focus Timer and Leaderboard functions, which consistently emerged as the most-used and best-received features. Other areas, such as personalisation, push notifications, and advanced collaboration features, remained incomplete or only partially implemented, pointing to clear directions for further iteration. Overall, the prototype delivered a solid minimum viable product that demonstrated feasibility but not yet the full planned scope.

From the perspective of user experience, the evaluation confirmed that the app was easy to navigate and intuitive to use. The think-aloud sessions revealed that participants could quickly explore and adopt core functionalities without needing explicit instructions, and they particularly appreciated the smooth task creation process. The monitoring phase further showed that the app actively shaped students' study habits: while engagement varied, participants consistently described the app as a source of structure, accountability, and motivation. Even when they did not always complete tasks as planned, they reported that the app prompted them to reflect on studying more consciously and often encouraged them to re-engage.

The focus timer stood out as a key feature, providing rhythm and accountability during study sessions, especially when users could see others focusing at the same time. At the same time, bugs and limitations in its implementation prevented it from fully realising its potential. Similarly, the gamification mechanics (XP, streaks, badges, and leaderboards) were highlighted as powerful motivators, creating a sense of progress and playful competition. While some aspects were unclear during onboarding, participants consistently described the XP system as gratifying and the leaderboard as engaging, often sparking friendly competition.

Feedback from the focus groups and questionnaires reinforced these findings. 62.5% of participants reported a productivity increase, while 88% said they would recommend the app to peers. The results show that the app's design strategies—particularly gamification and visibility of peer activity—successfully motivated most users and made studying feel more rewarding. At the same time, they also highlighted the importance of reminders, personalisation, and technical reliability to sustain long-term engagement.

Taken together, these findings confirm that the application succeeded in its main objective: it demonstrated how gamification and accountability can be used to enhance motivation and productivity in academic contexts. While not every feature was fully realised, the prototype showed clear promise as a study tool that combines organisation, motivation, and community into a single platform. The work therefore not only delivers a functional system but also provides empirical evidence of the effectiveness and challenges of applying gamified accountability to higher education.

7.2 Future Work

The results of this thesis also revealed a range of opportunities for further development and refinement. Future work can be grouped into the directions below.

Technical Improvements

- Fix timer bugs and interruptions.
- Introduce countdown and packet-based modes for the timer.
- Implement notifications and reminders.

One of the most pressing areas of improvement lies in the reliability of core features, particularly the focus timer. Future iterations should ensure full functionality across device states, as well as introduce a countdown or packet-based timer mode that aligns more closely with Pomodoro-style study habits. Alongside this, implementing reliable notifications and reminders is critical to reinforcing daily engagement. Timely nudges could help transform the tool from occasional support into an integral part of students' study routines.

Enhanced Gamification

- Expand progression beyond XP and badges with levels, milestones, and "all-time" leaderboard.

The gamification system emerged as one of the strongest motivators, but also one with room for expansion. At present, progress is primarily represented through XP accumulation, the weekly leaderboard, streaks, and badges. Future development could add a more layered progression system with levels and milestones creating a stronger sense of growth over time. Additionally, featuring an all-time XP leaderboard could help users engage long-term in climbing up. Such enhancements would sustain long-term engagement by appealing to users' intrinsic drive for mastery and completion, while avoiding the risk of monotony associated with static rewards.

Social & Accountability Features

- Add study-buddy requests, peer nudges, reactions and comments.
- Customisable leaderboards (weekly, course-based, or friend-only).

Participants consistently emphasised the role of peers in shaping their motivation, suggesting that stronger social functionality would enhance accountability. Future versions could include study-buddy requests to create defined networks, the ability to send nudges or reactions to peers' activity, and comment functions for collaborative tasks. Leaderboards could also be customised by scope (weekly, course-specific, or limited to friends), allowing for more meaningful comparisons. Importantly, these features should be developed with care to ensure they encourage healthy competition and community-building without creating undue pressure.

Personalisation & Accessibility

- Add dark mode, profile avatars and theme customisation.
- Ensure accessibility compliance (labels, colour contrast, screen-reader support).

Several participants expressed a desire for greater personalisation, such as dark mode, avatars, or theme customisation. These features not only support user satisfaction but also contribute to a stronger sense of ownership and identification with the app. At the same time, accessibility requires more systematic attention. Future development should incorporate comprehensive accessibility testing, ensuring appropriate contrast ratios, semantic labels, and screen-reader compatibility. This would align the app with inclusive design standards, broadening its reach to a more diverse student population.

Extended Testing Across Academic Cycles

- Conduct evaluations beyond exam periods to include regular semester use.

While the study primarily focused on exam-period usage, participants' experiences may differ significantly during the regular semester when academic pressures are distributed more evenly. Future testing should therefore explore how students engage with the app across different phases of the academic calendar. This would provide deeper insight into whether the app sustains motivation and productivity during routine coursework, or whether its impact is heightened primarily under high-stakes conditions. Such longitudinal evaluation would help identify patterns of engagement, refine features to suit diverse study contexts, and ensure the tool's effectiveness throughout the academic year.

Broadening the Scope

- Extend use beyond academics into fitness, personal goals or professional tasks.

Although designed with academic tasks in mind, participants suggested that the app's structure could be applied to other domains such as fitness, personal projects or professional goals. Extending the scope of the tool could broaden its appeal and allow for year-round use beyond exam seasons. At the same time, any expansion must balance versatility with simplicity, as several users cautioned against overloading the app with unnecessary functions that could distract from its primary purpose of supporting focused study.

7.3 Summary

In conclusion, this thesis demonstrated that gamification and accountability can significantly enrich digital study tools, making academic work more structured, motivating, and socially connected. The prototype was well received, with students reporting increased productivity, engagement, and enjoyment in their study routines. At the same time, technical limitations and incomplete features underscored the importance of refining functionality, ensuring reliability, and expanding personalisation and social options.

The work carried out here therefore represents both a practical step and a conceptual contribution: it shows the feasibility of combining gamification with accountability for higher education, and it provides a foundation for continued development and research. With further refinement, the application has the potential to grow from a prototype into a fully functional tool that supports students not only in completing their academic obligations but also in building sustainable, healthy study habits.

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