INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO
MESTRADO EM ENGENHARIA INFORMÁTICA




Desenho de uma plataforma de auto-ajuda gamificada para promover o envolvimento em saúde mental por parte de adolescentes e jovens adultos

JOÃO PAULO DE CASTRO OLIVEIRA
Setembro de 2025

POLITÉCNICO
DO PORTO

ISEP INSTITUTO SUPERIOR DE ENGENHARIA DO PORTO

Designing a Gamified Self-Help Platform for Mental Health Engagement in Adolescents and Young Adults

João Paulo de Castro Oliveira

Document with requirements for the curricular course of DISSERTAÇÃO (DIMEI)

Computer Engineering, Area of Specialization in

Games, Graphical, and Interactive Systems

Advisor: Carlos Vaz de Carvalho

Porto, September 2025

Statement of Integrity

I hereby declare that this academic work was conducted with integrity.

In accordance with P.PORTO Code of Conduct and Good Practices, I have not plagiarized or partaken in the fraudulent use, reproduction, alteration, or destruction of material or information in any way, nor have I falsified the results obtained during the process of its development.

Therefore, the work included in this document is original and authored by me, and has not been used for any other purpose.

I further declare that I have fully acknowledged the Code of Ethical Conduct and Good Practices of P.PORTO.

ISEP, Porto, 14 September 2024

João Paulo de Castro Oliveira

Resumo

O aumento e agravamento de problemas e perturbações relacionados com a saúde mental dos jovens têm vindo a ser associados ao aumento da utilização de plataformas online digitais, tais como aplicações para smartphones e jogos de vídeo.

O apoio tradicional à saúde mental é essencial para enfrentar e tratar os sintomas associados a estes problemas. No entanto, é raro jovens adultos procurarem ajuda profissional, preferindo lidar com as adversidades de formas menos saudáveis e formais: quer através de família e amigos, quer através de dissociarem, com recurso às plataformas online anteriormente referidas. É, portanto, importante providenciar ajuda através de ferramentas e meios com os quais se identifiquem. As intervenções digitais de saúde (DHIs) apresentam uma solução promissora, mas as taxas de retenção associadas a estas intervenções tendem a ser baixas.

A incorporação de estratégias de gamificação em DHIs tem o potencial de aumentar a retenção e então dar de certa forma uma solução a este problema. No entanto, é crucial considerar cuidadosamente as implicações éticas que surgem com a integração de certos elementos de jogo num contexto de saúde mental. Consequentemente, muitos aspectos éticos e processos de concepção devem ser cuidadosamente considerados durante o processo de concepção de uma DHI de auto-ajuda relacionada com a saúde mental.

A presente dissertação visa explorar o processo de design e implementação de uma destas plataformas, ao mesmo tempo que tenta fornecer avanços relevantes para as lacunas identificadas na investigação sobre gamificação neste contexto.

É ainda importante denotar que este tipo de plataforma não serve, de forma alguma, como substituto à ajuda profissional e terapias relacionadas. A DHI gamificada de saúde mental associada a este projeto servirá apenas como elo de ligação entre jovens adultos e os meios profissionais. O objetivo passa por reduzir o estigma associado a perturbações mentais e à procura de ajuda mental profissional, através de ferramentas que promovem conhecimento e a realização de tarefas pessoais.

Os resultados obtidos neste projeto sugerem que a gamificação baseada em teoria tem o potencial de aumentar o envolvimento a curto prazo em ferramentas de autoajuda para a saúde mental. No entanto, sustentar a mudança comportamental de utilizadores provavelmente requer suportes de hábitos mais robustos, funcionalidades sociais mais colaborativas e complexas e validação através de estudos e testes de maiores dimensões e de longa duração.

Palavras-chave: Saúde Mental, Saúde Digital, Gamificação, Auto-Ajuda, Jovens Adultos, Design, User Experience

Abstract

Youth mental health issues and disorders have been linked to the increased use of digital media platforms, particularly smartphone apps and video games. While traditional mental health support is essential, it is seldom utilized by young people, who often do not seek professional help. Therefore, it is important to provide tools that meet them where they are. Digital health interventions (DHIs) present a promising solution, but engagement rates with these interventions tend to be low.

Incorporating gamification into DHIs has the potential to enhance retention and engagement. However, it is crucial to carefully consider the ethical implications of how game elements are integrated into a mental health context. Consequently, many ethical aspects and design processes must be carefully taken into account during the design process of a mental health-related self-help DHI.

The current dissertation explores the design and implementation process of one such platform while trying to provide relevant advancements to identified gamification research gaps.

The results obtained from this project suggest that theory-driven gamification can boost short-term engagement and knowledge uptake in self-help mental health tools, but sustaining behavioral change likely requires stronger habit supports, richer social features, and validation through larger, long-term studies.

Keywords: DHI, Mental Health, Gamification, User Motivation, Self-Help, Young Adult, Design, User Experience

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AI	Artificial Intelligence
GenAI	Generative Artificial Intelligence
APP	Mobile Application
CBT	Cognitive Behavioral Therapy
CRCT	Cluster Randomized Controlled Trial
DHI	Digital Health Intervention
ERD	Entity Relationship Diagram
EXP/XP	Experience Points
FOMO	Fear of Missing Out
GAD	Generalized Anxiety Disorder
GD	Gaming Disorder
IA	Internet Addiction
I/E	Inclusion and/or Exclusion
MHL	Mental Health Literacy
MH/mHealth	Mental Health
MVVM	Model-View-ViewModel
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
RCT	Randomized Controlled Trial
RPG	Role-Playing Game
RQ	Research Question
STD	Self-Determination Theory
UI	User Interface
US	User Story
UX	User Experience

WBS Work Breakdown Structure

WHO World Health Organization

1 Introduction

This introductory chapter seeks to contextualize the problem and topic addressed in this dissertation. Here, the problem at hand is outlined as well as the motivation for exploring it, along with the main research questions that form the foundation of this thesis. Additionally, this section will highlight the objectives and anticipated contributions to the field in which the problem emerges, as well as discuss the methodology employed in this project and the ethical considerations that underpin it.

1.1 Context

It is hard to describe the world we live in today without acknowledging the influence of technology and digital media. Almost everyone carries a cell phone with them throughout the day. A 2021 study [1] conducted by the Pew Research Center revealed that 85% of adults in the United States reported owning a smartphone [1]. However, we don't need to look at recent statistics to see this high level of adoption. According to the 2003 Statistical Yearbook of Norway [2], while they may not have been smartphones (yet), 82% of individuals aged 9 to 79 already owned a mobile phone as of 2002.

This close relationship between people and mobile smartphones, in particular, has led media platforms such as “TikTok” and “Instagram” to dominate the digital media landscape, attracting not just millions, but billions of monthly active users [3]. These and other online platforms and digital media have become integral to our lives, ever deeply intertwined with our evolution and survival. They serve as powerful tools for connection, information sharing, and entertainment, with the capacity to enhance our creativity and overall productivity. However, this reliance on digital tools can also have its drawbacks. Not only do these online platforms provide, even if not intentionally, unhealthy ways of coping, especially for already mentally ill individuals, but they can also aggravate psychological symptoms and Internet Addiction (IA) by exposing users to predatory tactics and systems. This is specifically true for the current generation of young adults,

raised alongside unrestricted online cyberspaces, whose "[…] excessive use of internet, lack of control, and neglect social life are significantly correlated with mental health […]" [4].

While there is some uncertainty about the direct effects of excessive use of online digital platforms, including social media and video games, some recent studies have confirmed the existence of a correlation between IA and mental health [5]. Such records include a descriptive-analytical study conducted on Iranian university students and published in 2020 [6], which "[…] findings specified that students' excessive internet usage leads to anxiety, depression, and adverse mental health, which affect their academic performance." Additionally, cross-sectional studies conducted on students from Ilam Click or tap here to enter text.Kermanshah University of Medical Sciences [6], Belgrade High School [7], and Abadan University of Medical Sciences [8] also reported a "[…] positive correlation between the level of internet addiction […]" [7] and psychological problems, with "[…] students' excessive internet usage [leading] to anxiety, depression, and adverse mental health […]" [6].

Alarmingly, these don't seem to be isolated cases. Meta-analysis and reviews of the literature conducted upon this specific research area discovered that there is a "[…] positive correlation […] between adolescent social media use and depressive symptoms", even though "there was also high heterogeneity […] indicating substantial variation among studies" [5]. As best put by Sofija Loleska and Nada Pop-Jordanova in their review of over 300 articles found in PubMed [9]:

"All aforementioned studies confirm that adolescent mental health and physical health is associated with cell phone addiction. But we can not say with 100 % accuracy that mobile phones are the sole cause of poor mental or physiological health issues in adolescents. Parents and teachers, however, together with all those included in the environment of the developing youth should be aware of the health consequences of overuse and or addiction to mobile phones and to work on prevention."

This highlights the need for innovative approaches that meet young people where they are, providing accessible and engaging solutions for mental health support.

1.2 Problem Statement and Research Question

A 2017 published article by the "World Health Organization" (*WHO*) reported that, at the time, "[…] over 300 million people [were] estimated to suffer from depression, equivalent to 4.4% of the world's population" [10], with the number of individuals with common mental health disorders globally increasing. If this doesn't sound bad enough, *WHO* further explains that:

"The consequences of these disorders in terms of lost health are huge. Depression is ranked by WHO as the single largest contributor to global disability (7.5% of all years lived with disability in 2015); anxiety disorders are ranked 6th (3.4%). Depression is also the major contributor to suicide deaths, which number close to 800 000 per year." [10]

While traditional mental health support is essential for addressing psychological challenges, it often requires individuals to seek help and actively participate in the intervention. Unfortunately, the rates of retention and adherence to formal recommendations are low, as many individuals prefer to turn to less formal sources, such as family and friends, for assistance with mental health issues. This problem is further worsened by stigma and various cultural factors. [11]

Seeking assistance can be especially daunting for those experiencing symptoms that lead to dissociation, isolation, and anxiety, often surrounded by more appealing but unhealthy coping options, such as the Internet. As alluded to in the previous section, this phenomenon has become particularly pronounced among adolescents with Internet addiction, who frequently turn to the Internet and digital platforms as sources of escapism, raising the need for innovative approaches to persuade them into healthier habits and behaviors.

One natural and effective response to these challenges surrounding mental health are digital health interventions (DHI) [12], [13]. DHIs consist in the integration of support tools directly into one of the most available and detrimental tools, smartphones. This approach places self-help resources alongside social media platforms and video games, making mental health support more accessible to everyone. By incorporating these tools into the digital space they frequently use, we can tackle the daunting experience of face-to-face interactions that some individuals undergo.

DHIs delivered by phones and focused on mental health also offer various other advantages, including privacy, convenience, and flexibility, allowing users to interact with tools and complete tasks at their own pace. Additionally, these apps can provide personalized interventions and feedback. While this level of personalization may not match that of a real-life professional, it is always a preferable alternative compared to no intervention at all. The digital format also allows for diverse media presentations and storytelling, offering a broader range of tools that professionals may find difficult to implement in traditional settings or that could help fill gaps in care between sessions.

However, despite their potential, many existing mental health apps struggle to engage users consistently over time [14], [15]. Users often abandon these tools for various reasons, including a lack of sustained motivation and inadequate feelings of reward [16]. This disengagement undermines the effectiveness of the interventions, as mental health apps find it challenging to compete with social media and other digital platforms that use exploitative engagement tactics, such as FOMO (fear of missing out). These tactics prey on users' fears and anxieties, which is counterproductive for an app designed to alleviate such issues. It is essential for us to explore alternative methods of promoting engagement that do not exploit users' mental states or encourage addiction.

This exact issue has been encountered and documented before. A recent qualitative study [17] in this research area, “[…] conducted as part of a broader research project examining Mello—a transdiagnostic smartphone app targeting RNT for young people experiencing anxiety or

depression", found that, while *Mello* facilitated intentional reflection and was valued for its self-guided nature:

"[…] participants [reported] feeling "stuck" in their negative thoughts. To mitigate these challenges, participants suggested incorporating gamification elements, such as progress-tracking visuals, to enhance motivation and increase engagement with the app."

Gamification, the use of game design elements in non-game contexts, presents a promising solution to address engagement issues. While digital platforms have frequently employed gamified strategies in ways that can be exploitative, their potential to promote sustained motivation and participation in meaningful activities has already been shown [18], [19], [20]. Theoretically, a gamified self-help tool could leverage the inherent appeal of game mechanics to help adolescents and young adults develop healthier habits and tackle mental health issues. However, designing such a tool effectively requires a careful balance between engaging mechanics and ethical considerations, ensuring that it is both effective and safe for users. [21]

This project seeks to explore the problematic lack of engagement strategies by focusing on the design and development of a gamified self-help tool, evaluating its relative success/effectiveness in promoting adherence to healthier tasks and enhancing knowledge about the topic. The following research questions will be explored:

1. Are gamification strategies effective in promoting engagement, knowledge, or behavioral changes in self-help/mental-health-related environments aimed at young people?

2. How can we design a gamified self-help tool to address mental health issues and provide knowledge to adolescents and young adults?

3. What gamification strategies are effective in enhancing engagement with overall mental health-related tools or in influencing positive behaviors for adolescents and young adults within a self-help tool?

1.3 Objectives and Contributions

The main objective of this work is to further explore possible answers to the research questions outlined in the previous section. Additionally, the project aims to provide a foundation to developers who might intend to create a project in the related field of work, especially if it involves the creation of an mHealth digital App. These objectives will be achieved by developing, testing, and evaluating a gamified self-help tool specifically designed for adolescents and young adults aged 16 to 25. By incorporating gamification elements, the aim is to create an engaging tool that motivates users to consistently complete tasks, thereby promoting the development of healthier habits. Furthermore, the platform should provide a safe and interactive virtual environment where users can address, explore, and better understand their internal struggles,

while also addressing issues related to internet overuse and its consequences. The specific goals, which were set to achieve the overarching objective defined for this project (provide possible answers to the RQs), can be seen in Table 1.

Table 1 - Goals set for the project

	Goal	**How**	**Why**
Objective 1	Analyze some of the mental health challenges faced by individuals aged 16 to 25 and the obstacles to engagement in mental health tasks.	By conducting a literature review, an online questionnaire to the target audience, and clinician interviews.	To provide the foundation and support choices for the design of mHealth platforms.
Objective 2	Identify gamification strategies that might promote engagement while not being overly addictive.	By conducting a literature review, an online questionnaire to the target audience, and clinician interviews.	To improve user engagement in mental health tasks while aligning with ethical principles.
Objective 3	Develop prototypes of a platform that aligns with the overarching goal of the project.	By developing different functional versions that integrate the designed gamification strategies.	To serve as the foundation for testing and, as a consequence, evaluate the design choices made.
Objective 4	Test the platform with individuals from the defined target demographic.	By conducting several tests on each prototype version with different individuals from the target demographic.	To measure the platform's effectiveness in answering the problem in question.

There are to be expected some small contributions to both the theoretical and practical aspects of this research area. The aim is to build upon previous studies, such as the findings from the study of *Mello* [17], continuing the research into the development of self-help tools and how to improve these while enhancing engagement:

"Future research should explore strategies to enhance engagement for young people with low mood and motivation, such as co-design methodologies, advanced personalization features, and gamification techniques." [17]

1.4 Methodology Overview

Before anything else, it should be noted that generative Artificial Intelligence (GenAI) was utilized during the project to assist in organizing and structuring both the work done and the current document, as well as to transform notes, such as those acquired from interviews, into summary texts and facilitate comparison of results. More extensively, “Grammarly”, a GenAI tool, was used to correct grammar mistakes and improve the overall spelling and comprehension. To that end, the writing process used the following “Grammarly” AI prompts:

- "Summarize it"
- "Improve it"
- "Shorten it"

To address the RQs and achieve the proposed goals, the project adopted an action research strategy. This approach was chosen as it allows for the simultaneous resolution of the problem while studying the process of finding a solution. [22] Regarding data generation methods utilized, user interactions are observed during testing sessions to gain insights into usability and engagement with gamification elements. Some of the attributes to be monitored, as they are relevant to this project, include task completion rates, time spent on activities, and interactions with gamified features. Additionally, participants are asked to fill out structured questionnaires after each testing cycle to collect both quantitative and qualitative data on user satisfaction, perceived usefulness, and feedback on design features.

As already noted in previous works and studies, the development of a project like this requires the implementation of flexible and adaptive approaches. Several factors must be considered: research is the backbone of the project, heavily influencing the design of the platform, as the features of the app need to be backed by scientific evidence and adhere to ethical guidelines. Given that this app is tailored for a specific target demographic, it is crucial to implement adaptive and flexible development methods. Relying solely on research without direct feedback and an understanding of the target audience’s needs could hinder the ability to achieve the proposed objectives or adequately address the problem at hand. Additionally, evaluating and testing the tool is vital for measuring its effectiveness and determining the project’s contribution to the relevant research area.

Therefore, as an ally to the chosen research methodology, a hybrid project management approach, which combines different aspects of Agile and Waterfall methodologies, along with a co-design method, was adopted for the design, development, and testing phases of the project. A visual representation of the overall project’s process can be seen in Figure 1.

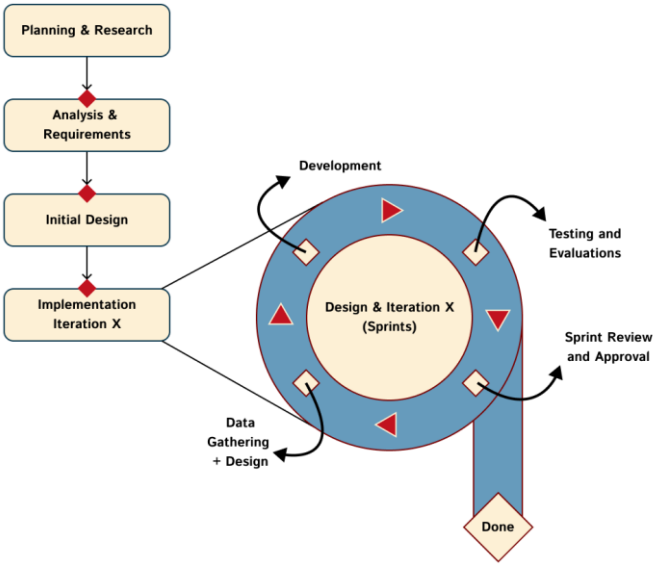


Figure 1 - Project's Hybrid Project Management Process

1.5 Motivation

The creation of this thesis and the development of this project were partially inspired by the article “Attachment Disorganization and Dissociation in Virtual Worlds: A Study on Problematic Internet Use Among Players of Online Role-Playing Games” [23].

In today's demanding and often unforgiving world, mental health issues are frequently overlooked, yet they are becoming increasingly common. Even making a small positive change in someone’s life can hold significant importance. Therefore, building upon the existing efforts in the field of mental health support is not only an honor but also a responsibility.

The motivation behind this project is to continue and expand upon the previous work done in this area. The aim is to provide additional insight into what strategies might be effective and which might require further investigation. Regardless of the outcomes of this current project, it is designed to offer future researchers and developers some valuable knowledge on how to address specific challenges in mental health digital support and how to approach their work more effectively.

1.6 Ethical Considerations

The multidisciplinary nature of this thesis, integrating software engineering and mental health interventions, requires an approach to ethics that similarly spans multiple domains. Firstly, as a student of Instituto Superior de Engenharia do Porto (ISEP), part of P.PORTO community, the P.PORTO code of conduct was followed [24]. Every article applicable to both the student and project was respected, with special attention given to the conduct described in article 6, line n), which specifies as a duty of the student community to "refrain from committing academic offenses that demonstrate fraudulent behavior […]", such as but not limited to "plagiarism or practices associated with the fraudulent use, reproduction, alteration or destruction of material […]" [24].

The ethical considerations for this project include a strong emphasis on privacy. Throughout the project's duration, we will collect and use user feedback as well as general identifying information such as age and gender. To address potential privacy concerns, we will ensure that data is only collected and used for analysis with the user's explicit consent. Data practices will be transparent, and individuals involved in this process will be provided with clear information about how their data will be handled. This commitment is reinforced by adherence to the General Data Protection Regulation (GDPR) [25].

The project will include the creation of a smartphone-directed software. Principles integral to informatics engineering will be followed, in accordance with IEEE's Code of Ethics [26]. This work is also situated within the fields of psychology and mental health and includes clinical research. Therefore, the regulations outlined by the recently created Ethics Committee of P. Porto [27] will be adhered to obtain ethical approval from this review body.

As a fallback plan, the regulations imposed solely by the Ethics Committee of the Superior School of Health of P.PORTO [28] will be adhered to in order to obtain ethical approval from this review body.

If, due to some inconvenience, these two options, directly related to the community of this project, fail, the regulations outlined by the Ethics Committee of U.Porto [29] will be adhered to obtain ethical approval from this ethics review body.

1.7 Structure of the document

With the conclusion of the introductory section here, we finish Chapter One and transition to Chapter Two, which focuses on the State of the Art in the research area and other pertinent information gathered from studies and articles.

Chapter Three will then provide a detailed overview of the project's planning, outlining the deliverables and timeline, as well as the skills development expected to be achieved through the work conducted on this dissertation.

Further chapters will be dedicated to the design, implementation, and testing of the project's self-help tool, with special care given to the followed iterative methodology of development. Then, an overview of the results will be presented, before lastly going over the limitations and conclusions of the project.

2 State of the Art

The current chapter, titled "State of the Art," aims to provide a thorough understanding of the existing knowledge and research relevant to the context and problem of this dissertation project. While some background information was presented in the previous chapter, this section expands on the foundation upon which the project will be built. This is accomplished by analyzing and synthesizing prior work in the field and identifying gaps in the research, or in other words, highlighting areas that require further investigation based on the findings of previous studies.

To this end, this section further explores the thesis's context and problem through a systematic Mapping Study (MS), which aims to determine whether there is existing research evidence on the topic and to provide an indication of the volume of that evidence [30], helping identify gaps in the research.

2.1 Literature Review through Mapping Study (MS)

As previously mentioned, a systematic mapping study was conducted to gain an overview of the research area and determine whether there is existing evidence on the topic of this thesis. This mapping study followed the PRISMA guidelines, which are the standard format for systematic reviews [31]. PRISMA stands for "Preferred Reporting Items for Systematic Reviews and Meta-Analyses", and its latest version outlines a sequence of steps to be followed for conducting the systematic review, as the PRISMA flow diagram found in Figure 2 showcases.

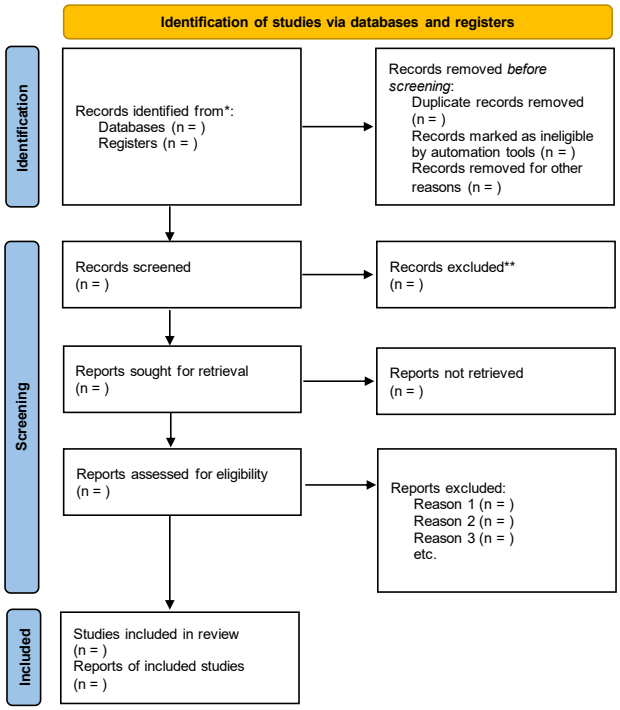


Figure 2 - PRISMA Flow Diagram [32]

The PRISMA flow diagram, available on the PRISMA website [32], begins with the collection of studies from specific research databases and libraries. Therefore, the first critical step is to define which databases will be used and to determine the appropriate search string to obtain relevant results.

2.1.1 Databases and Search String

To determine which digital libraries to search for relevant studies, we considered that this thesis falls within the fields of psychology, mental health, and software engineering. The selected databases were the "ACM Digital Library" and "PubMed," both of which are reputable and trusted resources that align with the multidisciplinary nature of this project.

To ensure a thorough and rigorous literature review, a search tool was utilized while conducting the searches in the relevant databases. This approach allowed us to effectively address the proposed research questions and create a search string for both libraries that aligns with the objectives of our mapping study. For this project, we employed PICOCS, a modified version of PICO that incorporates additional search terms. Although other options, such as SPIDER searches, were also available, our decision to use PICOCS was influenced by both the institution where this project is being undertaken and comparative studies of various search tools. A 2014 study [33] comparing PICO, PICOS, and SPIDER concluded that for projects with limited time

and resources, such as this one, PICOS is recommended, as it demonstrates lower sensitivity but greater specificity compared to both SPIDER and PICO searches.

The PICOCS framework requires translating each part of the research questions previously defined into the associated element and defining inclusion and exclusion criteria for each. This leads to the creation of substrings that will compose the full search string to be used on database searches. Figure 3 showcases the methodology applied to the research questions of this project.

PICOCS Element	RQ Part	I/E	Sub String
opulation	Adolescents and young adults (16–25 years old)	**Inclusion**: - Adolescents (13–18) - Young adults (19–25) **Exclusion**: - Focus on a particular group of people (race/region) - Focus on family groups participation	("adolescents" OR "teenagers" OR "youth" OR "young adults" OR "age 16-25" OR "college students" OR "university students")
tervention	Gamification strategies in a self-help related tool	**Inclusion:** - Studies about gamification strategies' effects - Studies about gamification strategies - Studies about games **Exclusion:** - Studies about non-online/digital gamification - conversational agents/AI/chatbots - VR systems - Robot intervention - Wearable tech	("gamification" OR "games" OR "gamification effects" OR "gamification strategies" OR "game-based design" OR "game mechanics" OR "serious games" OR "game elements" OR "gameful design")
omparision	-	-	-
utcomes	Improved engagement in mental health-related tasks, or the changing of habits/behaviors	**Inclusion**: - Studies measuring engagement in tasks - Studies reporting behavioral changes - Studies identifying the formation of habits **Exclusion**: - Studies not meantioning any of the above	("engagement" OR "task adherence" OR "motivation" OR "task completion" OR "behavioral change" OR "habit formation")
ontext	Self-help, Self-help tools, digital tools, mental health context	**Inclusion**: - Studies focusing on online self-help tools for mental health tasks or knowledge - Studies focused on mental health programs or apps **Exclusion**: - Tools unrelated to mental health or not targeting self-help usage	("self-help tools" OR "mental health" OR "digital mental health" OR "mental health support tools" OR "self-help app" OR "mental health application" OR "self-help application" OR "psychiatry app")
tudy Type	Design studies, development studies, or evaluations	**Inclusion**: - Design studies - Case studies - Evaluations - Reports - User studies - Experiments **Exclusion**: - Opinion papers - Non-empirical studies	("design study" OR "case study" OR "evaluation" OR "report" OR "user testing" OR "experimental study" OR "pilot study")

Figure 3 - PICOCS method applied to the project

By combining each substring with an "AND" operator, we are left with a raw search string (check Figure 4) that later will be adapted to each database's system, while maintaining its original purpose and direction.

```
("adolescents" OR "teenagers" OR "youth" OR "young adults" OR "age 16-25" OR "college students" OR "university students") AND
("gamification" OR "games" OR  "gamification effects" OR "gamification strategies" OR "game-based design" OR "game mechanics" OR "serious games" OR "game elements" OR "gameful design") AND
("engagement" OR "task adherence" OR "motivation" OR "task completion" OR "behavioral change" OR "habit formation") AND
("self-help tools" OR "mental health" OR "digital mental health" OR "mental health support tools" OR "self-help app" OR "mental health application" OR "self-help application" OR "psychiatry app") AND
("design study" OR "case study" OR "evaluation" OR "report" OR "user testing" OR "experimental study" OR "pilot study")
```

Figure 4 - Project's raw search string without adaptation

The purpose of using this search string was to gather a comprehensive collection of studies and records relevant to this project's topic, that might fit the description of "studies associated with gamified interventions to influence engagement or behavioral changes on a mental-health-related digital environment or tool". By doing this, we aim to proactively find answers to our research questions or identify gaps in knowledge that we can address later on.

2.1.2 Conducting the Search for Primary Studies

Once the search string was aligned with the project's goals and the databases to be used were identified, a green light was given to initiate the first step of the PRISMA flow diagram, which is the "identification of studies via databases and registers." Although modifications to the original search string were necessary for each specific database, the search terms and logic needed remained unchanged to ensure consistency in the results.

As can be seen in Figure 5, using the search string in "PubMed" yielded a total of 188 studies after applying certain restrictions. Similarly, when the same search string was applied to the "ACM Digital Library", it returned 396 results, also with restrictions in place.

Database	Search String	Last Search Date	Restrictions	Nº Studies
PubMed	(adolescents OR teenagers OR youth OR young adults OR age 16-25 OR college students OR university students) AND (gamification OR games OR "gamification effects" OR "gamification strategies" OR "game-based design" OR "game mechanics" OR serious games OR game elements OR "gameful design") AND	30/12/2024	Last 5 years, English OR Portuguese, Free full text	188
ACM Digital Library	(adolescents OR teenagers OR youth OR "young adults" OR "age 16-25" OR "college students" OR "university students") AND (gamification OR games OR "gamification effects" OR "gamification strategies" OR "game-based design" OR "game mechanics" OR "serious games" OR "game	21/12/2024	Last 2 years, English OR Portuguese, Content Type: Research Article	396

Figure 5 - Search results quantity for the selected databases

The Zotero citation Tool [34] was afterward used to compile the results and identify duplicates and retracted records. Luckily, no duplicated studies were found, and only one was retracted when mixing both database sets, and as such, only one record was eliminated, leaving us with a total of 583 records pre-screening (which includes 2 studies obtained through other sources, to be explored later).

# of records identified through database searching	# of additional records form other sources	# of retracted records	# of duplicate records	# or records after duplicates removed
584	2	1	0	585

Figure 6 - Total number of records for screening

2.1.3 Initial Screening of Gathered Studies

The screening of the gathered records was initialized once the retracted records were removed from the pool of studies. The purpose of this phase of the mapping study was to select relevant studies for coding, or in other words, identify the records that aligned with the criteria defined in the PICOCS framework, based on their title and abstract [30]. The number of screened records and records sought for retrieval for this literature review can be observed in Figure 7 - Number of screened records.

# of screened records	# of record excluded but relevant	# of records excluded but not relevant	# of records sought for retrieval
585	68	461	56

Figure 7 - Number of screened records

During the screening process, 529 studies were removed from consideration. Of these, 68 studies were deemed relevant to other aspects of the project and were set aside for future review outside of this mapping study. These studies cover a range of topics related to the main topic of the project and may be useful for developing the platform, but they did not fully align with the defined inclusion and exclusion criteria for screening.

For instance, some of the relevant but excluded studies examine projects similar to the one being developed here but do not incorporate gamification interventions into their design. Others incorporate gamification but target specific demographic groups based on race or gender. Additionally, some of the relevant studies offer design recommendations for mental health apps or review mental health-related issues and their causes in the context of digital media.

From the records that weren't excluded, some were systematic or scoping reviews, protocols, or studies that required further clarification regarding their exclusion or inclusion status, as

their abstracts did not provide sufficient context for all criteria considered. The decision to retain the reviews was made to assess their relevance according to the proposed criteria. However, these reviews would be set aside once proven relevant, to support other parts of this project's research, like the previous section of this Chapter. On the other hand, protocols were retained to determine whether their associated studies were already concluded and accessible elsewhere, especially if they had not yet been included in this pool of studies.

Afterwards, out of these 56 studies that were not excluded, we attempted to retrieve their full-text PDF file. We streamlined this process using the Zotero citation tool, successfully obtaining the full text for 42 studies. Some of these automatically obtained full-texts were incorrect, but we were able to acquire the real full-text through the associated DOI. For the remaining 14 studies, 10 of them were obtained using an institutional account for the respective databases, while the other 4 were freely available via their DOI URLs, although they were not initially detected. As a result, for this phase, 56 out of the 56 studies' full-texts sought for retrieval were retrieved and would be assessed for eligibility next.

2.1.4 Screening for Eligibility

With the full text acquired for each of the 56 studies, these were then assessed for eligibility against the previously mentioned inclusion and exclusion criteria. The studies that complied were also classified and then ordered using the "Information Source Evaluation Matrix" scores acquired for each study upon reading its full text. This matrix classifies papers according to 5 different attributes, which can be seen in Figure 8.

	1	2	3	4	5	Mark
Who? – is the author	Author background is unknown	Some evidence author works in this area but few articles	Evidence of some publications in this area by author	Author has several published works in this area	Author is a known authority in this area	
Score						
What? – is the relevance of points made	Content and arguments of little or no relevance to the task	Only of peripheral/little relevance to task being undertaken	Some of the content is relevant to task requirements	Several points made are of relevance to task	Content and arguments closely match your needs	
Score						
Where? – context for points made	Situation to which author applies points is different to that of the task	Minimal similarity between author's context and the task context	Author's situation and that of the task have some similarity	Reasonable similarity between author's and task context	Author's context and that of the task very similar	
Score						
When? – was the source published	Date is unknown or older than 20 years old	Old reference – between 10 and 20 years old	Reference is between 5 to 10 years old	Recent reference is 2 to 5 years old	Up-to-date source – published in last two years	
Score						
Why? – author's reason/purpose for writing the article	No apparent motivation seen in article	Newspaper (or online) article opinion – not evidenced	Trade magazine/ commercial paper – might have some bias	Book source/ conference paper or subject interest forum/ blog	Academic journal paper – peer reviewed	
Score						
Source/Reference:					**Total marks**	

Task/Question:

Figure 8 - Information Source Evaluation Matrix [35]

This last phase of screening for eligibility saw the premature exclusion of 14 studies. As mentioned before, some of these where reviews, both systematic and scoping, which accounted for 6 of the excluded studies. These reviews were kept for their relevance to this project, but were excluded because this systematic review does not intend to be a review of reviews. Then, there were identified 8 protocols, with 3 of them having no implementation or results analysis in a posterior study, and 3 of them being excluded when compared against the defined inclusion and exclusion criteria. This way, only 2 protocols had a continuation, which were added to the pool of studies and englobe the “records added from other sources” and have already been counter for the number of records in the pool from the beginning, as showcased in Figure 6. All protocols were then excluded.

In this final phase of eligibility screening, 14 studies were prematurely read and promptly excluded. As previously mentioned, some of these were systematic or scoping reviews, which accounted for six of the excluded studies. Although these reviews were relevant to the project and are utilized in other sections of this paper, they were excluded because this systematic review does not aim to be a review of reviews.

Additionally, eight protocols were identified and read. Three of these had no implementation or results analysis in a subsequent study, and three others were excluded after being compared against the established inclusion and exclusion criteria. Consequently, only two protocols had a continuation study with a discussion of results/implementation. These continuation studies were added to the pool of studies and were included in the "records added from other sources," which have already been counted in the total records from the outset, as illustrated in Figure 6. All protocols, even the ones with a continuation, were then ultimately excluded.

After excluding the 14 studies related to reviews and protocols, the pool was left with a total of 42 records for further analysis. Upon reading their associated full-text articles, 27 out of the 42 studies were excluded for not fully meeting the I/E criteria, leaving only 15 studies for inclusion. However, the excluded studies were still considered relevant to the project, as many were nearly identical to the current research but lacked key factors, such as a gamification-focused intervention or because they specifically targeted a group of individuals.

It is important to note that some of the 15 studies included in this review may differ slightly from the project's objectives or may not be particularly useful for this dissertation. This outcome was anticipated, as the search string established for the systematic review encompassed the three defined research questions of this project. While this broad approach allowed for the inclusion of studies that met the established inclusion and exclusion criteria but lacked relevant results or were too general in their interventions, it also helped identify studies that closely aligned with the project's goals. Therefore, it was crucial to use the previously mentioned "Information Source Evaluation Matrix" as a classification system to evaluate the papers based on their ability to answer the research questions as well as other factors, such as recency and the authors' recognition in the field of study.

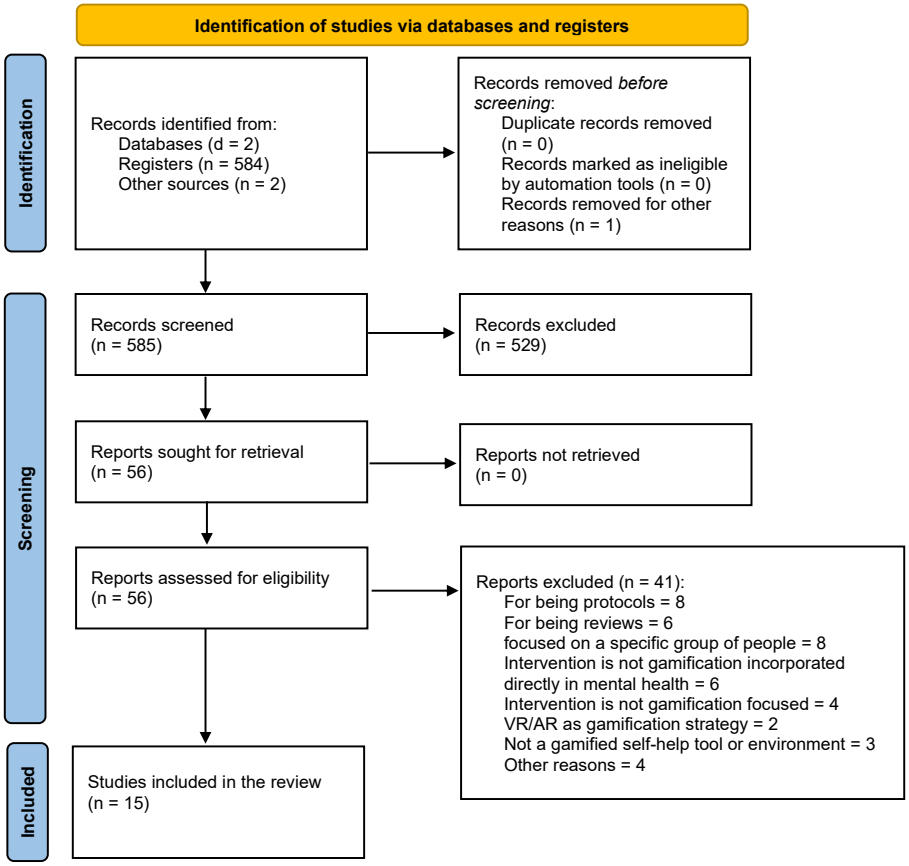


Figure 9 - Complete PRISMA diagram for this dissertation [32]

The resulting table of studies included and ordered based on their classification mark can be seen in Appendix A: Table of Included Studies in the Mapping Study.

2.1.5 Analysis and Research Gaps

As mentioned earlier, the current Mapping Study has helped gather research conducted in the specific area relevant to this project. The resulting 15 included studies focus on interventions that utilize gamification (or even games) as a first plan in digital tools or programs aimed at promoting behavioral changes or enhancing knowledge among users, in the context of mental health and self-help. The findings and the way they address our research questions are as follows:

RQ1 - Are gamification strategies effective in promoting engagement, knowledge, and/or behavioral changes in self-help/mental-health-related environments aimed at young people?

Gamification strategies have previously been linked to enhanced engagement and retention, according to earlier reviews focusing on this specific research question. The findings from the included studies support this relationship, even when associated with a self-help/mental-health-related environment whose target audience is young adults.

Most studies analyzed in this review indicate that gamification strategies in online platforms—whether in the form of games, serious games, or gamified applications like the one related to this project—helped increase engagement and knowledge retention compared to non-gamified counterparts. Additionally, there have been indications of behavioral changes following the implementation of game-based programs or platforms related to self-help and mental health.

As such, the findings obtained from this MS corroborate RQ1. The following evidences were taken directly from the included studies:

(1) The article "A Behavioral Strategy to Nudge Young Adults to Adopt In-Person Counseling: Gamification" [36] concluded that the gamified version of their intervention product helped increase the adoption of in-person counseling compared to the control group's non-gamified intervention. Moreover, it also positively affected the perception of subjective and objective usability.

(2) Another study, focused on a game-based school program for mental health literacy, named "Moving Stories" [37], found that "[...] participation in the *Moving Stories* program reduced personal stigma over time compared with participation in the control condition" [37] but that "[…] improvements in personal stigma did not continue beyond 3 months" [37]. Still, it was observed that "[…] adherence to the full program was high" [37]. This is a good sign of the possible influence gamification might have had in reinforcing engagement, considering the engagement problems that these types of interventions face.

(3) The "empowerED" related study [38], although having a disclosed small sample size, reported that:

> *"[...] by playing [...], youth developed critical skills to restructure negative automatic thoughts, which has notable implications in improving their perceptions about themselves, their ability, and their future as well as their overall mental health."* [38]

(4) Another study, on a serious game that aims to promote knowledge about suicidal thoughts among young adult students [39], observed that "the results from the knowledge test revealed that the experimental gaming group significantly performed better than the non-gaming control group" [39], which might indicate gamification influences the retention of knowledge. As for engagement, the author noted that "from the engagement questionnaire, it can be concluded that the game was highly engaging, as the overall user engagement score was 4.44" [39], a considerably high mark.

(5) A study associated with an educational program, that draws on gamification strategies to its benefit [40], found that the performed randomized control trial (RCT) "[...] provides empirical support for the effectiveness of the D.N.A. program in alleviating GD symptoms and fostering well-being [...]", albeit "Further studies are needed to examine the program's effectiveness in various cultural contexts [...]" [40].
(6) In September of 2020, a RCT study was published regarding the gamified app "eQuoo" [41], inserted in the context of mobile mental-health interventions. In it, researchers concluded that there was superiority of the gamified versus non-gamified app in increasing self-reported resilience, as well as other measures of wellbeing, while also reducing anxiety and attrition rates. The app was able to keep a 90% adherence, 21% more than the control or waitlist groups. Three years later, a large-scale RCT study for the same app was published [42]. Once again, researchers found evidence of increased resilience scores, along with decreases "[…] in depression and anxiety scores, and a significantly lower attrition rate. The results suggest that *eQuoo* is an engaging and effective means to support students' mental health and build their resilience." [42]
(7) The findings from a study conducted around a serious game for mental-health stigma reduction, showcase a "[…] significant improvement in participants' MHL scores after engaging with the game which demonstrates the possibility of game usage in educating MH" [43].

RQ2 - How can we design a gamified self-help tool to address mental health issues and provide knowledge to adolescents and young adults?

To address this research question, we examined the design and implementation methods of studies that incorporated gamification. It was hypothesized that, since improving mental health can be subjective to each user's needs, there would not be a single solution to this issue, but rather a series of suggestions and recommendations. Furthermore, we suspected that design methods would involve collaboration and iterative frameworks that closely engage stakeholders.

While this is true for the few studies that discuss the design process, the findings were still disappointing due to the lack of focus given to this aspect. This may not be surprising, as some of the studies included in the review do not really involve creating a specific tool or platform. Instead, these studies often target the gamification of an existing program or platform through case studies, modify certain aspects of already established platforms, or simply focus on testing and assessing the feasibility of their solutions through randomized controlled trials (RCTs).

Of the studies that did involve creating a game or platform, only a small fraction highlighted some of the design processes when developing a gamified tool for self-help or mental health. This oversight is surprising given the significant impact that design choices can have on the presentation of health-related content and how individuals with mental health concerns may perceive it.

As such, apart from a couple suggestions, the findings obtained from this MS do not provide RQ2 with any sort of complete answer. Based on this MS, it appears that there is a partial research gap in understanding design frameworks and methodologies that could benefit platforms in this context. The articles included primarily identify co-creation processes as valuable and recommended approaches, but not much else is defined.

This is not a final answer to RQ2, though. Throughout the project's duration, the findings related to RQ2 will be tested using the self-help tool that will be developed. Only after this testing can a more concise, direct, and well-supported answer be provided and the evidence acquired here be validated.

Some of the direct mentions in the included studies to design processes, choices, and/or recommendations include:

(1) The "Moving Stories" study establishes that "[...] programs that target mental health literacy should also, to a similar extent, focus on reducing stigmatizing attitudes." [37]
(2) In the "empowerED" related study [38], cognitive reappraisal is identified as being considered an effective emotion regulation strategy to improve youth perceptions. Moreover, it is revealed that "[...] *empowerED: Think It Through Digital Stories*, models the process of restructuring negative automatic thoughts through the application of an adapted thought record in a digital format." [38]
(3) In the article of a serious game to promote knowledge about suicidal thoughts [39], the authors mention that "five success criteria (as key performance indicators) [...] set [...] in collaboration with a psychiatry specialist [...] guided the game design to focus on specific elements" [39]. Additionally:

> *"The game's design is inspired by Sweetser and Wyeth's principles of player enjoyment, following elements within the concentration, challenge/player skills, control, clear goals, feedback, and immersion. [...] Surprise elements were implemented in the game because it is considered essential to a serious game's effectiveness."* [39]

(4) On the cocreation study of an escape game [44], the authors defend that, because the cocreation process considers the needs and preferences of users along the development of the intervention, gamification's benefits are positively influenced when the cocreation approach is used. The authors of the escape game further elaborate:

> *"[...] when developing a public health–related game, players' experience and needs are relevant for enhancing its effectiveness in promoting health and prevention. Ideally, players work alongside designers, health professionals, and researchers, to produce the intervention. The cooperation of players and other stakeholders is therefore essential to maximize end users' acceptability and adherence to the game. As a result, cocreation is usually recommended to produce a successful game, including in the mental health field."* [44]

Additionally, the escape game's creation followed the PRODUCES framework, described in the study as being "[…] among the different existing frameworks facilitating the cocreation of health-related interventions [45]" [44], that uses a systematic approach to participatory methodology.

(5) "Maze Out"'s study revolves around the process of co-production of the associated platform [46], and tested against Cahn's principles of equality. There are no other clear mentions of design processes and methodologies for the platform.

(6) The article related to D.N.A. program [40] highlights that the program was aligned with the key components of the P-A-G-E framework (psychological resilience, active coping, growth mindset, and emotion regulation), with modules designed to be self-paced. Not much else is highlighted.

(7) A thematic analysis article exploring a game-based intervention [47] concluded that future gaming interventions for young adults should adapt to user preferences, promote empathetic player interaction, and consider sensemaking of experiences and contexts. The author added:

> *"Our study also shows that game design could make interventions more entertaining and engaging but may distort the intervention if the game narrative is not properly aligned with the intervention intent and objectives. By contrast, a lack of adaptation to user needs may cause a less motivating user experience. Thus, we propose a structured approach to promote alignment between user preferences and needs, intervention objectives, and gameplay."* [47]

(8) One of the several conclusions that a case study done over three gamified focus apps reached, was:

> *"While gamification can enhance user engagement and motivation, an excessive use or a poor integration can lead to distraction and frustration. As such, our findings emphasize the need to carefully balance gamification with the app's core focus-enhancing goals. Besides, the results highlight the need for ethical considerations while implementing gamification within focus apps and the strategic adoption of storybased strategies to align with user needs and preferences."* [21]

(9) One of the most promising apps for this project, "eQuoo", combines "[…] a mix of endogenous and exogenous design features designed to maximize engagement" [42], as disclosed on their recent large-scale RCT study.

(10) On the article related to a serious game to reduce MH stigma [43], "pets" are intentionally gender-neutral, and the color palette used is white, blue, and green "[…] to create a calm feeling" [43]. Furthermore, some design recommendations are given, which include: "[…] critical need for personalized learning content that caters to users' individualized levels of prior knowledge and preferences", "the game needs to allow for the transfer of these skills to real-life conversations" and that "[…] that future designers incorporate opportunities for continued learning beyond the in-game materials to foster ongoing engagement and knowledge acquisition." [43]

RQ3 - What gamification strategies are most effective in enhancing engagement with mental health-related tasks or in influencing positive behaviors for adolescents and young adults within a self-help tool?

As indicated in the response to the first RQ, numerous studies concluded that gamification and game-based approaches have the potencial to enhance engagement, improve knowledge retention, and even promote behavioral changes. However, the results from the MS reveal a surprising lack of focus on the specific effects that different gamification strategies have in self-help and mental health contexts. Most studies that implement gamification as an intervention primarily aimed to boost engagement and retention, doing so without carefully considering ethical guidelines or determining which game elements would be most effective in their specific situations.

Additionally, there appears to be insufficient concern and knowledge about whether gamification elements, while potentially beneficial for engagement and attrition, might negatively affect users by employing predatory or addictive tactics that could be counterproductive. For example, while gamification may effectively increase user engagement in an app whose objective is to help individuals reduce their online time, the very game design strategies implemented could be counterproductive to the set goal, if they result in users spending even more time on the gamified self-help app instead of decreasing their overall screen time.

On another note, interestingly, it was observed that narrative-based games and gamification strategies, combined with various types of mini-games, were the most commonly utilized game elements in the studies reviewed, with mentions to this game element being an effective way of conveying emotional/psychological knowledge and messages.

Based on the findings provided from the MS, RQ3 currently lacks a concrete answer or solution, highlighting another research gap to explore during this project. Just as was the case for RQ2, this does not represent a final answer to RQ3. Throughout the project's duration, these findings related to RQ3 will also be tested using the self-help tool to be developed in order to provide a more concise, direct, and well-supported answer, as well as corroborate the presented evidence. It is, then, part of this project's objective to explore an answer to both RQ2 and RQ3.

The existence of this research gap is further supported in one of the few included studies that touches on this topic [21], in which the authors mention:

> *"There is, however, a gap when it comes to gamified behaviour change interventions that aim at increasing focus and productivity. Particularly, the potential of approaches such as narratives, as part of gamification, have not been fully explored in this area. Furthermore, the implementation of gamification in focus apps raises an interesting paradox that requires further exploration: the encouragement to use a digital mobile app to help curb digital mobile apps' usage. In other words, while focus apps aim to*

reduce digital distractions and provide a controlled digital environment suitable for focused work or study, they makes use of gamification's ability to increase user engagement with the app to achieve the stated goal. This incongruity fosters us to reconsider how to apply gamification in different contexts more effectively, particularly in the context of focus apps. We, therefore, consider that exploring and mapping this specific segment, with particular attention to gamification strategies, would be a worthwhile endeavour." [21]

Among the studies included, some highlight the chosen game elements for their intervention; however, almost all fail to provide a reason for selecting certain specific elements over others and do not test their relative effects and benefits. Some of the collected pieces of evidence found and that are in some capacity related to RQ3 are as follows:

(1) In the study focused on the adoption of in-person counseling [36], the authors explain they have "[...] selected environment, one of the nine game elements [48] which has not been well-studied"[36], as the gamification strategy that will differentiate the experiment from the control group. No other reason is given for the choice of this specific element, aside from it being one of the least studied game elements identified in the study. Additionally, the direct effects of the chosen gamification are never addressed nor tested.
(2) The CRCT study associated with "Moving Stories" [37] reveals that this is a narrative-based game, where players "[...] interacted with the character Lisa [...], who showed signs of depression [...]" [37], and are prompted to help her for 5 days. The narrative is here used as a way to interconnect players with someone with lived experience, but there is no indication of other game elements being taken into consideration nor the direct effects of this gamification is studied.
(3) "empowerED"'s study, which identifies the platform as an "interactive narrative-based videogame" [38], discloses that "the mechanics for [...] the *empowerED* intervention were based on a popular strategy game *Reigns*, where the player swipes among limited options to accept or reject suggestions to progress" [38]. Furthermore, "[...] each mini-story in empowerED included six short, relatable narratives [...]" [38]. Still, there doesn't seem to have existed a weighting of other game elements to be incorporated, nor are the implemented elements' effects studied.
(4) In the study of the serious videogame targeting knowledge about suicidal thoughts [39], which includes different mini-games, players follow the character Liv in a linear narrative. While the research done in the article mentions narrative as a concept crucial to serious games, there is no further explanation given as to why, nor the examination of the effects of all implemented gamification strategies.
(5) The escape game linked to the cocreation study involves escape rooms and games as a gamification intervention, with the authors emphasizing the incorporation of personified narrative components. [44] Both decisions as to why use these game elements are supported by research done by the authors, but there isn't testing related directly to the effects of the implemented gamification elements.

(6) In the included study which revolves around the “Maze Out” serious game [46], the game is described as being a narrative-centered labyrinth, where players try to escape a maze by solving a series of missions, although there is no explanation as to why this is so. Missions have choices which “[...] are associated with complex psychological processes […]. This is one of the examples through which the mentalization approach is delivered” [46], but once again there isn’t a further explanation as to why this approach is used, aside from being intuitive, nor the direct effects of the gamification elements used are studied.

(7) The article describing a D.N.A. program to prevent GD and enhance mental wellness [40] discloses the use of some game elements. Between them, badges and trophies are mentioned to have been used as reinforcement of a player’s progress, but there doesn’t seem to be deliberation regarding which game elements should be used nor are their immediate effects examined.

(8) Similar to most cases, a thematic analysis article revealed that the associated game-based intervention [47] made use of narrative for its theme. Other game elements are used, such as missions, but none seem to be the result of a weighting of different game elements or have a specific reason for being used, nor are their possible direct impacts studied.

(9) The results from the case study examining the integration of gamification on three narrative-based focus apps “Focus Quest”, “Forest”, and “Study Bunny” [21] indicated that “different gamification strategies elicit varied emotional responses from users regarding their app experiences, both positive and negative, and their perception on whether the apps effectively support concentration on their tasks” [21]. As such, the authors consider that future research should look into the effects of “different gamification strategies in different specific focus”, as this type of apps and studies are in their infancy. [21]

(10) In the recent large-scale RCT study conducted over the gamified mental-health app “eQuoo” [42], which elaborates on their 2020 finding for the same app [41], the authors note the utilization of 11 gamification elements. Although their implementation is also based in what information each game element is able to provide, the study, akin to others, showcases a lack of weighting between different strategies and the study of their impact. This fact is highlighted in the “Implications” section of the oldest of these articles, where it is noted that “another direction of future research is to compare different game elements to determine whether specific gamification strategies are associated with more benefits than others.” [41]

(11) The article on a serious game to reduce mental health stigma and increase mental health literacy (MHL) [43] discloses that the game employs a series of mini-games with varying game mechanics. These mini-games were then analyzed through feedback acquired from users to find out which strategies were most effective in communicating MHL. The findings from this study suggest “[...] that participants preferred mini-games featuring a balanced reaction-time demand and a playful scheme” [43], and the study further includes some design suggestions for game mechanics to be implemented.

(12) A study on generalized anxiety disorder (GAD) [49] provides insight into how walking simulator (WS) mechanics design can be utilized and their potential in this area of mental health. The article, which also incorporates a storytelling narrative on its central design, "[...] identifies clinician recommended WS game design principles and contextual qualities that may help game designers and mental health professionals [...]" [49] in future works. Still, there is a lack of findings that might help understand the direct effects of the implemented mechanics, when compared to others elements.

3 Conceptualization through Data

While the mapping study is a crucial component of the project, providing valuable guidance for both the design and the overall direction of the work, it is not sufficient on its own. It does not fully address some of the sub-problems and challenges that may arise in specific areas of the project. Given that the project deals with a sensitive topic such as health, it is important to gather as much information as possible—not only from existing studies but also from the various individuals involved in the project. This chapter is dedicated to presenting the additional data collected from various stakeholders relevant to the project through inquiries and interviews.

3.1 Defining the Stakeholders

Some of the earliest elements considered for this specific project were the stakeholders, who represent the "[Parties] whose interests are affected, positively or negatively, by the implementation of the Project" [50], along with an assessment of their power and interest in the developing project, where it is categorized as either Low, Medium, or High. The identified stakeholders were Users, Patients, Psychologists, Psychiatrists, and IT Professionals. With these defined, a Power by Interest matrix was constructed (see Figure 10), followed by its translation into Table 2 - Table of Stakeholders.

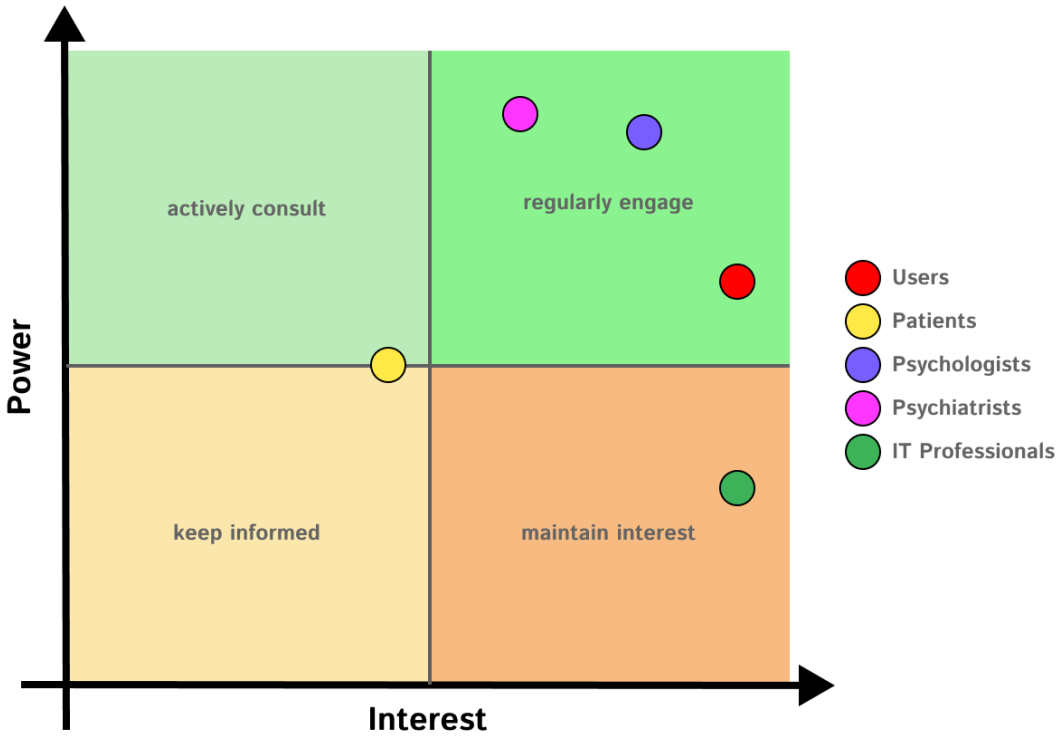


Figure 10 - Project's Power over Interest Matrix

Table 2 - Table of Stakeholders

3. Stakeholders		
Name	Power	Interest
Users	Medium	High
Patients	Medium	Medium
Psychologists	High	High
Psychiatrists	High	High
IT Professionals	Low	High

Starting with Users, they represent the individuals of the target audience of the project who are not familiar with, nor have experience dealing with, topics associated with Mental Health. The platform is developed specifically to meet their needs, making them stakeholders with a high interest in the final product. However, they have medium power over the platform's design, as

their feedback might be biased and not always scientifically accurate. On the other hand, Patients, while also stakeholders that represent the other part of the target audience, differ from Users as they are familiar with topics of MH, or be it by being currently accompanied by a psychiatrist or psychologist. They have medium power and interest in the platform, a consequence of the project's resulting tool not being intended to replace traditional therapy or medical treatments, but rather to assist users in their daily tasks in between therapy sessions

Psychologists and Psychiatrists are also key stakeholders. While they contrast with both Users and Patients by not being part of the target audience of the resulting App, they are expected to have high power over the platform's features. This is a consequence of their expertise in Mental Health, their insights being crucial to the design of the digital platform. Additionally, they might have an interest in seeing the platform be used as a complementary (but not alternative) tool to support not only their patients but the broader population.

Lastly, IT professionals are expected to have a strong interest in the platform's design, implementation process, features, and gamification strategies used, making them stakeholders in the overall project. Although their level of influence may not be as significant as that of other stakeholders, their interest in the project's outcomes is classified as high. This is particularly true because the project was developed by an IT professional using processes and tools familiar to individuals in the field. One of the project's objectives is to provide a foundational understanding of what works and what doesn't, so that future developers interested in continuing or undertaking related work will have an additional resource to draw upon.

3.2 Online Questionnaire

This chapter presents the stakeholder data that informed the design decisions for the overall dissertation project. It includes two complementary sources of formative evidence: an anonymous online questionnaire directed at the project's primary audiences, namely the stakeholders denominated "Users" and "Patients," as well as a small set of semi-structured interviews with clinicians. The results from the questionnaire are organized according to the instrument's branching logic, which flows from background information to branch-specific experiences, and then addresses common themes related to gamification, personalization, and user interface. Following this, a summary of the clinician interview findings is provided. The section concludes with a brief synthesis that connects the empirical findings to specific design choices made in the prototype.

3.2.1 Target audience questionnaire

The questionnaire was created using Google Forms, employing a branching structure as outlined in Figure 11 - Online questionnaire's structure.

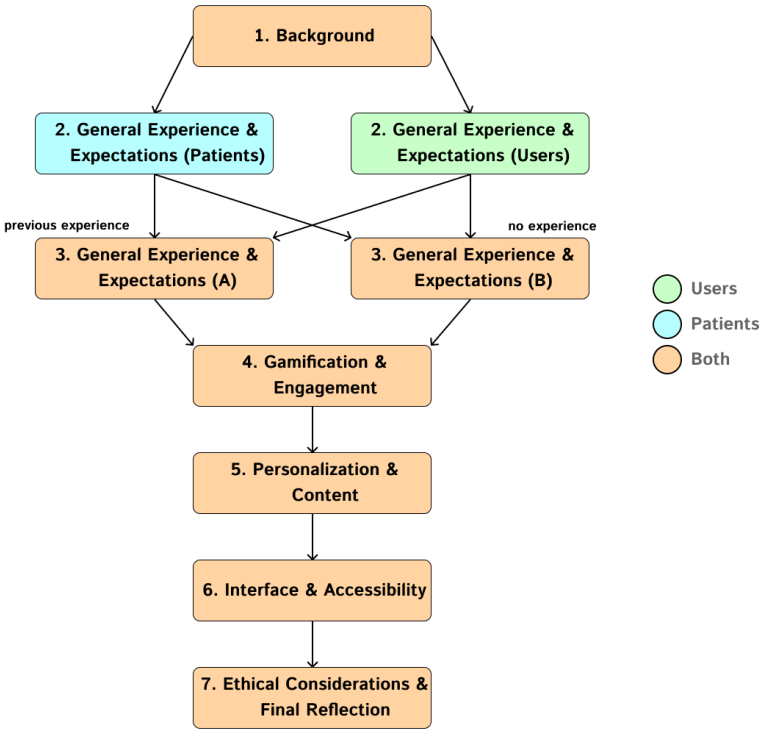


Figure 11 - Online questionnaire's structure

All respondents began by answering a brief background section, after which they were directed to one of two paths based on their experience with professional mental health support: those who had current or prior support were labeled as "Patients," while those without such support were labeled as "Users." The complete questionnaire script can be found in Appendix B: Questionnaire for the Target Audience.

The questionnaire aimed to achieve three goals: (1) characterize self-reported mental health experiences within the target demographic; (2) document prior use, expectations, and barriers related to self-help digital tools; and (3) gather preferences concerning gamification, personalization, and user interface. Additionally, the form included optional open-ended questions to capture qualitative insights that could inform wording and tone decisions.

To achieve the set goals, the survey structure was designed with branching paths. After a brief common background section, participants were directed to either the Patients or Users track based on their previous experiences with professional support. Each track contained a focused set of questions about the respondent's experiences and expectations, after which they

reconvened to answer a shared set of questions regarding gamification, personalization, and interface preferences.

3.2.2 Recruitment and Sample Characteristics

The form was distributed and remained open online for one month through Discord channels associated with Portuguese higher-education gaming communities. The survey was anonymous, and a total of 26 responses were collected, with 24 respondents falling within the target audience age range of 16–25 (see Figure 12).

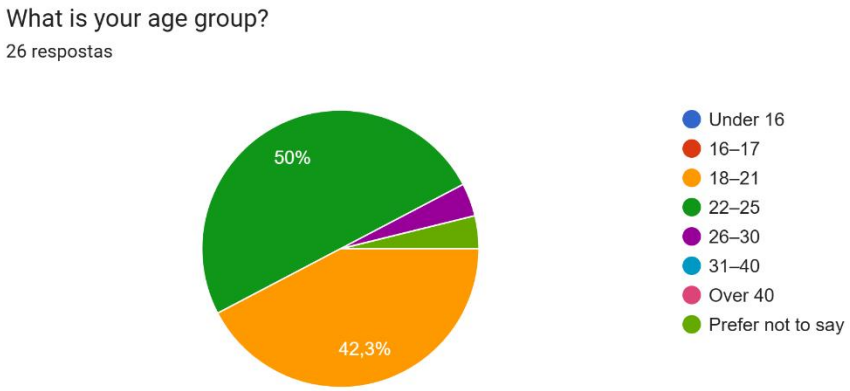


Figure 12 - Questionnaire's age range results

For the analysis, and as mentioned previously, the responses were categorized into the two stakeholder groups based on the respondents' prior experiences with professional support: Patients (n = 14; 53.8%) and Users (n = 12; 46.2%), as can be seen in Figure 13. These counts will be used in the following sections when reporting subgroup statistics.

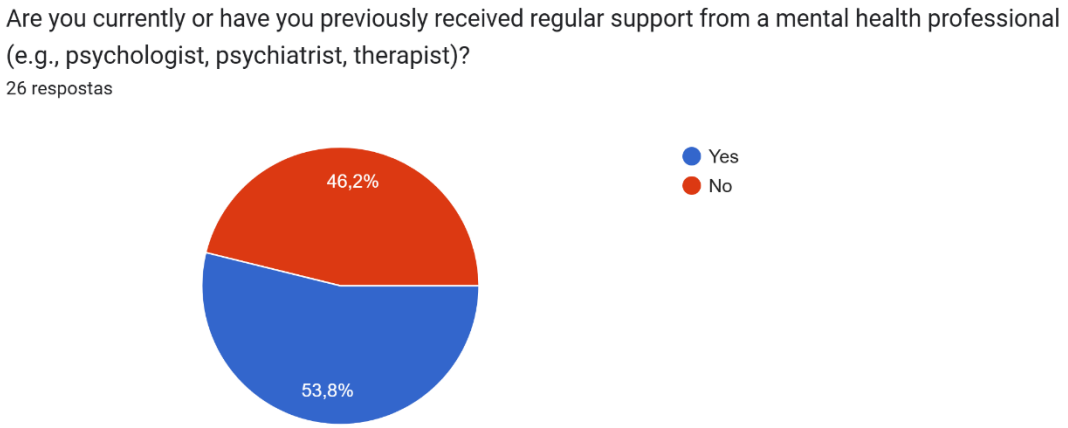


Figure 13 - Questionnaire's subdivision

Given the convenience sampling method, possible bias, and the small sample size, these results should be viewed as formative insights rather than generalizable and solid findings. However, the data did reveal patterns that were considered and used informed the prototype design of the current project.

In the posterior sections, the main quantitative observations from the questionnaire are presented. For full item-level counts and responses wording, see Appendix C: Questionnaire Results.

3.2.3 General Experience and Expectations — Patients

The "Patient" branch, based on responses from the background section of the questionnaire, captured the clinical history and help-seeking behaviors of respondents who reported prior or ongoing professional support. Key findings are as follows (Patients, n = 14):

Prevalent Symptoms Among Patients: Among the 14 respondents identified as "Patients," anxiety and depressive symptoms were the most frequently reported issues. Specifically, anxiety was noted by 13 out of the 14 individuals (approximately 92.9%). These findings indicate that anxiety is the primary concern in this sample, suggesting that early content should prioritize activities focused on anxiety management, such as short breathing exercises and grounding techniques.

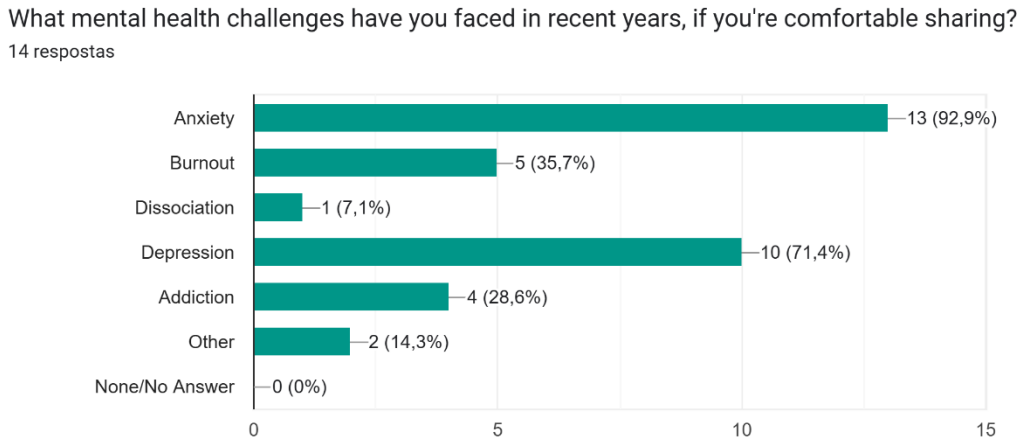


Figure 14 - Patient's reported symptoms

Duration of contact with services. "Patients" reported variable durations of professional support: while several respondents noted support for more than one year, a substantial fraction (≈42.9%) reported under one year (see Figure 15 - Patient's service duration). This heterogeneity might suggest that the prototype should support both novices and people already familiar with therapeutic concepts, even if there should be a shift in focus to this stakeholder category (e.g., provide optional advanced content and clear signposting to professional care).

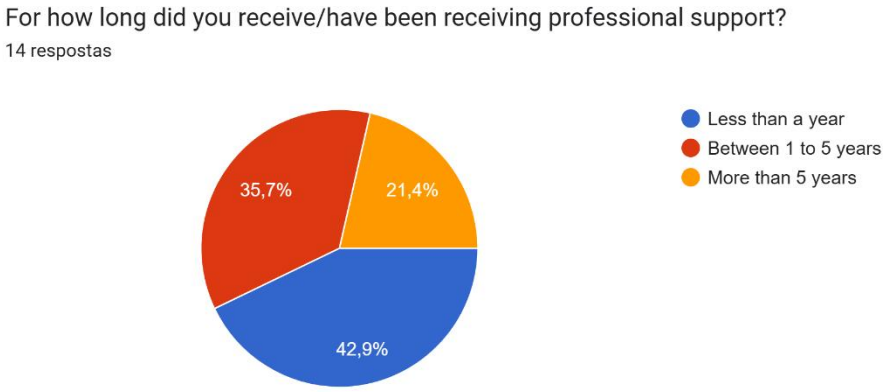


Figure 15 - Patient's service duration

Help-seeking motivation. Half of the "Patients" sample population reported having sought professional support only on their own volition, with roughly 28.6% reporting external encouragement as the only motivating factor (Figure 16 - Patient's help-seeking motivation). Then, a minority of 14.3% indicated cases where both self-initiative and external encouragement were present. This spread underscores the possible need for messaging that supports autonomous help-seeking while also enabling nudges and informational resources for those encouraged externally.

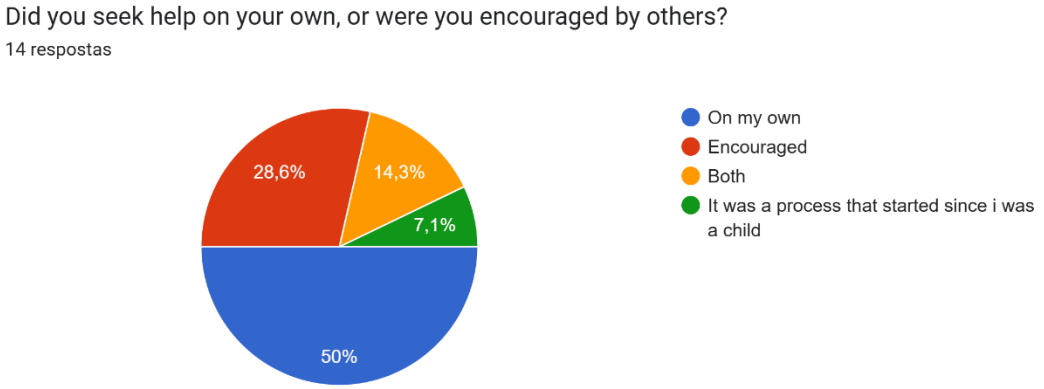


Figure 16 - Patient's help-seeking motivation

3.2.4 General Experience and Expectations — Users

The "User" branch, derived from the responses given in the background section of the questionnaire, captured the respondents who reported no prior or ongoing professional support.

The key findings are as follows (Users, n = 12):

Prior Personal Challenges: Among the 12 respondents classified as Users, 9 individuals (75%) reported having faced stress, anxiety, or mood-related issues at some point in their lives (seen in Figure 17 - General User's prior challenges). This indicates that the majority have experienced mental health struggles, even among those who had never felt the need to seek professional support, as can be observed in the next key finding.

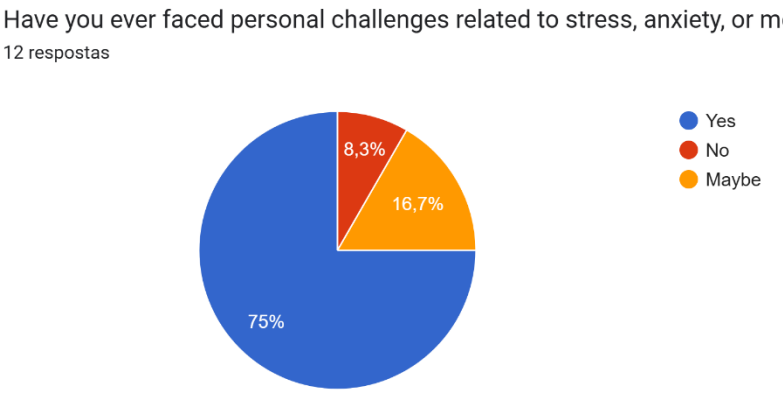


Figure 17 - General User's prior challenges

The Need to Seek Professional Support Among Users: Despite the fact that most respondents reported experiencing at least one of the challenges mentioned, only 5 out of the 12 individuals, or less than half (41.7%), considered seeking professional help (captured in Figure 18). When asked to share the reasons for their decision, participants mentioned various factors, including not having thought about seeking help or not perceiving it as relevant. Others reported feeling the need to consult an expert based on their unique circumstances and life perspectives (Figure 19 - General User's reasoning for help-seeking).

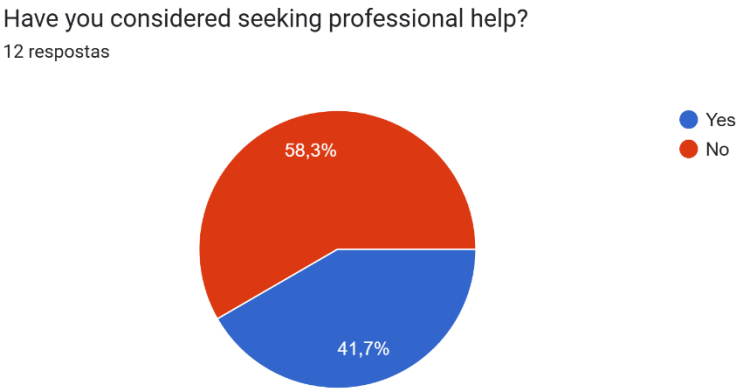


Figure 18 - General User's help-seeking consideration

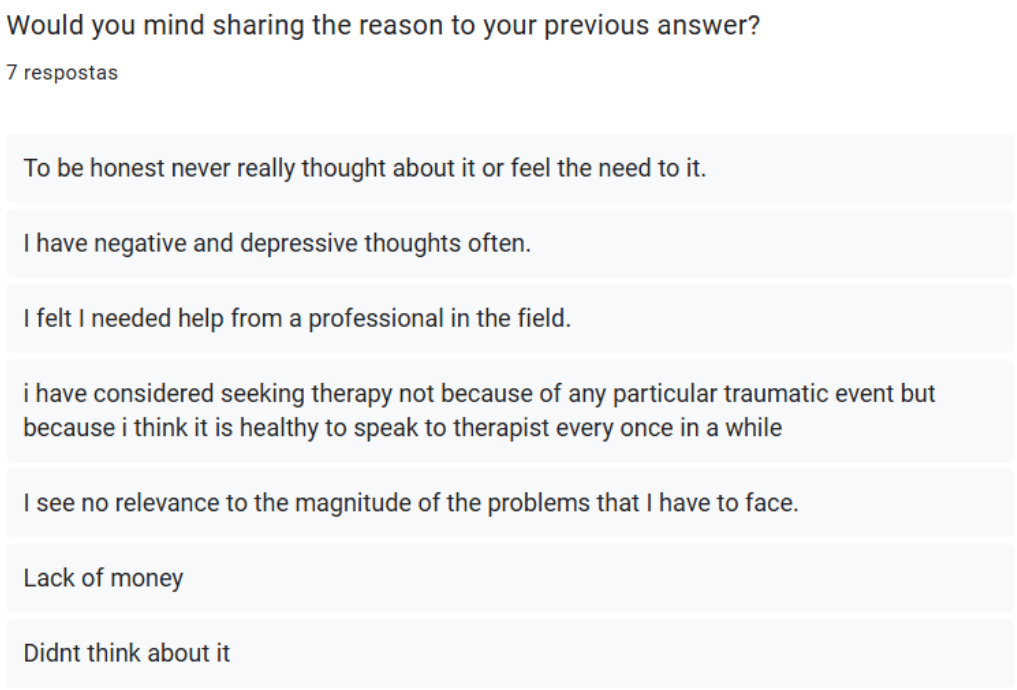


Figure 19 - General User's reasoning for help-seeking

3.2.5 General Experience and Expectations — Merged items (both branches)

The final question posed to both types of respondents in the general section asked about their prior experience with mental health-related Apps. The responses varied little between the two groups. All respondents categorized as “Users” (n = 12) reported that they had never used a mental health or self-improvement App (Figure 21). Meanwhile, only a small minority of “Patients” (2 out of 14; approximately 14.3%) reported having ever used such an App (Figure 20).

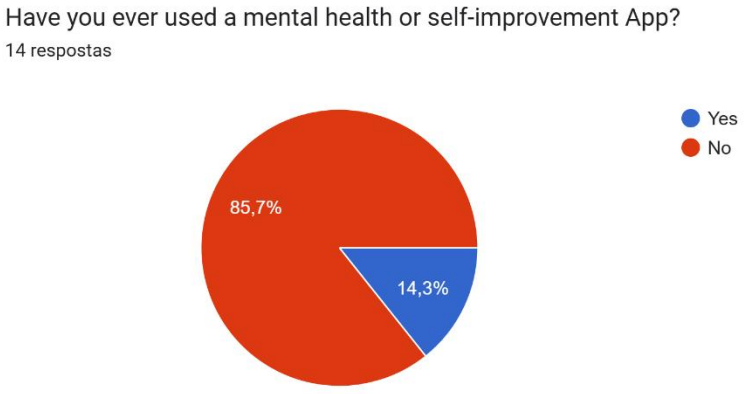


Figure 20 - Patient's prior App experience

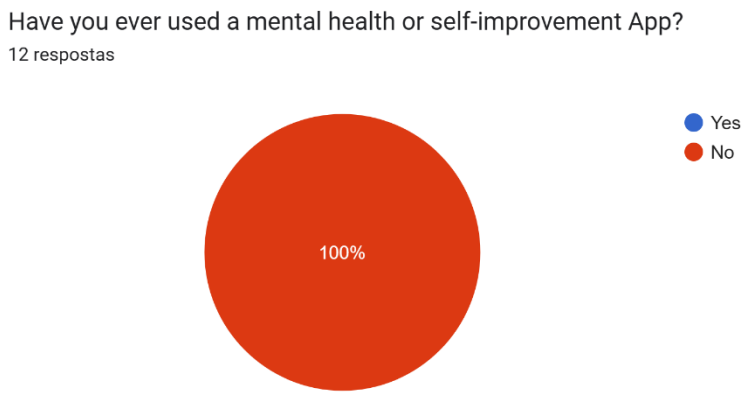


Figure 21 - User's prior App experience

While it can be said that, on average, "Patients" in this sample had slightly more experience with digital mental health tools compared to "Users," the difference between the two groups is minimal. Additionally, the small sample size prevents us from drawing any significant conclusions regarding their experiences. However, it is worth noting that in both cases, most individuals had no experience with these tools. Given the limited sample sizes, this trend is suggestive and should be validated with a larger group.

Focusing first on the two individuals who reported having previously used a self-help tool, it was observed that they engaged with those apps only occasionally or seldom (Figure 22). Additionally, one of these individuals mentioned boredom as the primary reason for disliking the App.

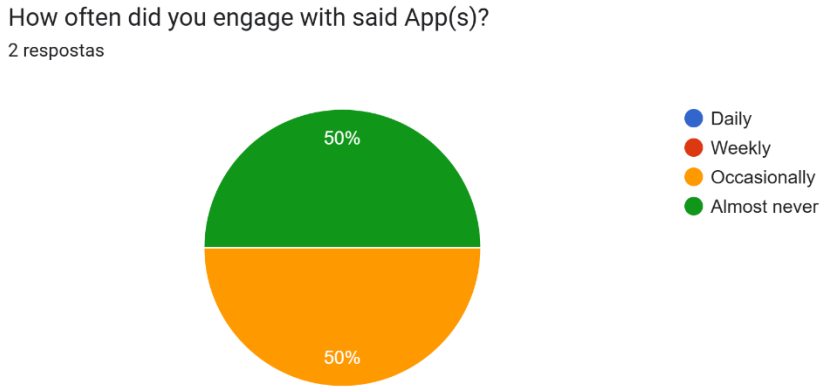


Figure 22 - Experienced Respondents' previous engagement

Then, among the respondents who had never used a self-help tool, most expressed interest in trying one. Specifically, 20 out of 24 respondents who had not previously used such an App

(about 83.3%) indicated that they would be interested in doing so (see Figure 23). This might suggest a latent openness to digital self-help among the target demographic.

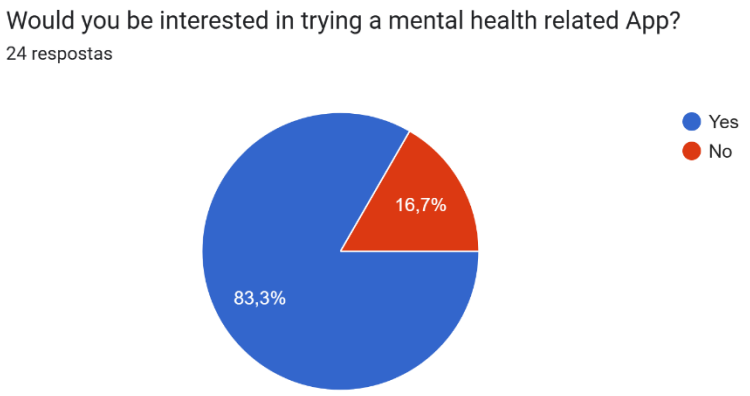


Figure 23 - Inexperienced Respondents' previous engagement

In the group of inexperienced respondents, just over half (approximately 54.9%) admitted that they would likely engage with an App of this type only occasionally or seldom (Figure 24). Surprisingly, nearly half indicated that they would use the App weekly or even daily. This discrepancy might be attributed to bias or overconfidence, but these figures still might suggest willingness and optimism among individuals when interacting with apps in this genre.

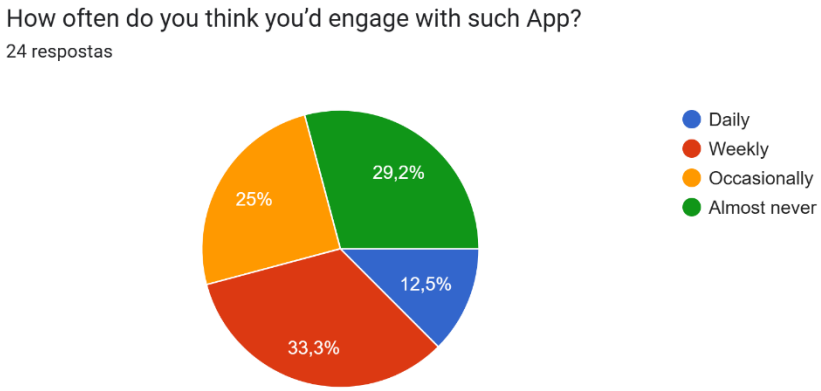


Figure 24 - Inexperienced Respondents' thoughts about how often they would engage with mental-health Apps

When it came to the respondents' preferences regarding guidance in these types of Apps, whether they preferred being guided through the content step by step or learning on their own, the results from the sample population revealed a clear division. Approximately 66.7% of individuals were comfortable with both options, while the remaining 33.3% were divided between the two choices, as can be seen in Figure 25 - Respondents' preferences towards the style of in-App guidance.

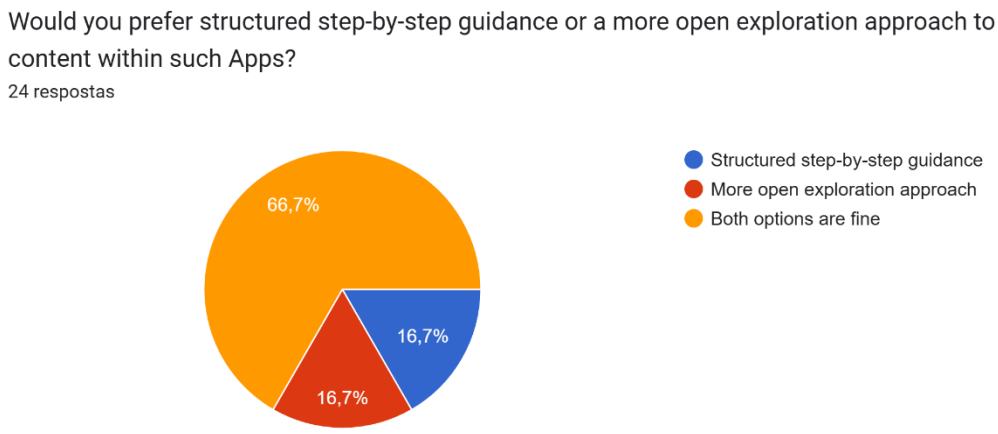


Figure 25 - Respondents' preferences towards the style of in-App guidance

3.2.6 Preferences on gamification, personalization, and UI

In exploring the general questions regarding previous experiences and expectations, the questionnaire gathered insights on preferences related to gamification and user experience (UX) design.

Gamification elements: A significant majority of respondents (around 84.6%) expressed interest in visible progress indicators, such as graphs and statistics, with in-app rewards in a not-so-close second place (57.7%). There was also a preference for story-driven content. However, less than half of the participants showed interest in social gamification or having in-app companions (see Figure 26 - Preferred gamification features among Respondents).

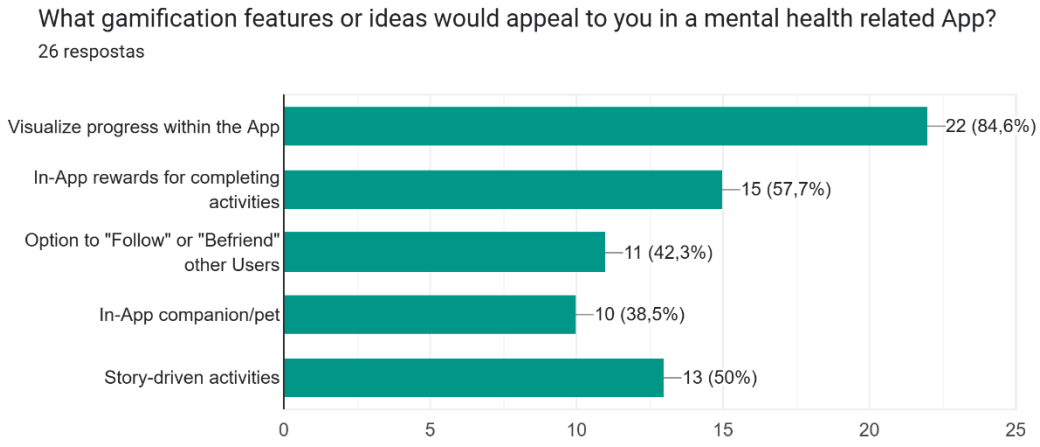


Figure 26 - Preferred gamification features among Respondents

These preferences might suggest a preference for gamification approaches that focus on personal progress and intrinsic motivation, favoring elements like skill bars, badges/achievements, and rewards over social gamification. Additionally, about half of the respondents appreciated narrative elements, showcasing also here that stories can serve as an interesting and effective means of engagement. On the other hand, social mechanics, such as "friends" and forced sharing, and in-App companionship do not seem to be widely appealing features.

Around 84.6% of the respondents also reported preferring personal progress shown as statistics and graphs, with daily streaks and skill-tree metaphors being moderately also popular choices (Figure 27 - Respondents' preferences on how to showcase personal progress).

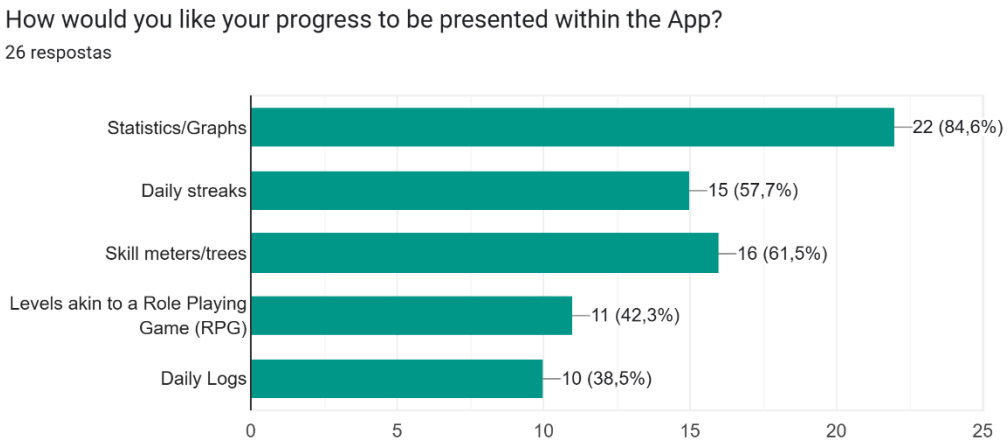


Figure 27 - Respondents' preferences on how to showcase personal progress

Content and personalization: Guided exercises, both mental and physical, along with short challenges, were the most favored content types among respondents (see Figure 28). Although there was previously no consensus between having either step-by-step guidance or the freedom to progress at their own pace, nearly all individuals (24 out of 26, or about 92.3%) reported finding the inclusion of guided exercises in a self-help mental health app to be interesting or helpful. While not as popular as guided exercises, challenges also received positive feedback, with 76.9% of respondents expressing interest in them. Among the remaining options, half of the individuals found the alternatives interesting; however, social features, particularly social forums, received the least interest, gathering only 4 votes (15.4%).

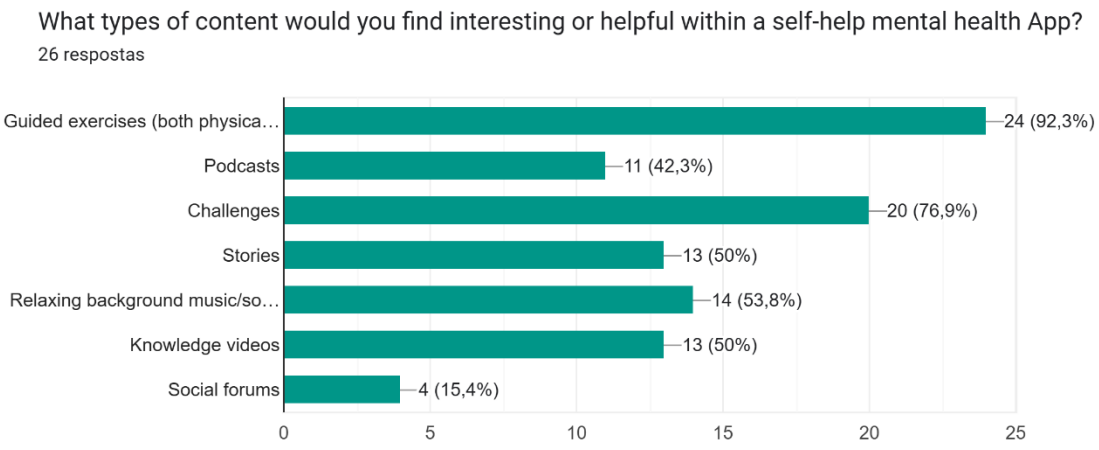


Figure 28 - Type of content Respondents would find interesting or useful in a self-help tool

Then, a significant majority of respondents (approximately 96.2%) expressed their willingness to receive personalized suggestions based on personal data provided by them (as can be seen in Figure 29), with none reporting feeling uncomfortable with the idea of completing a short quiz to facilitate this personalization (see Figure 30). The only concern mentioned was about the potential length of the quiz or test.

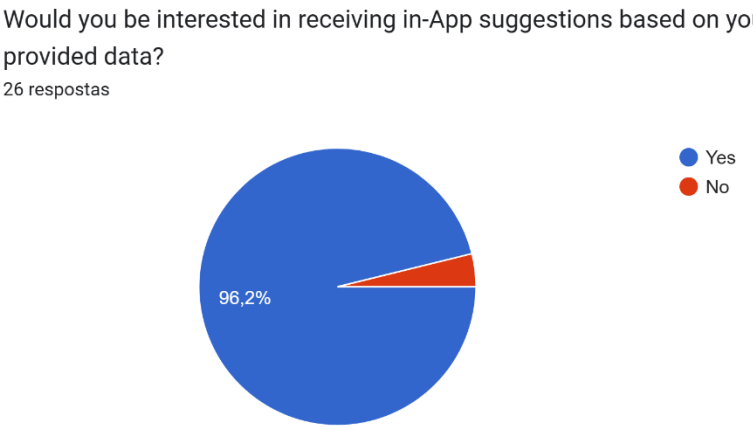


Figure 29 - Respondents' interest in personalized data

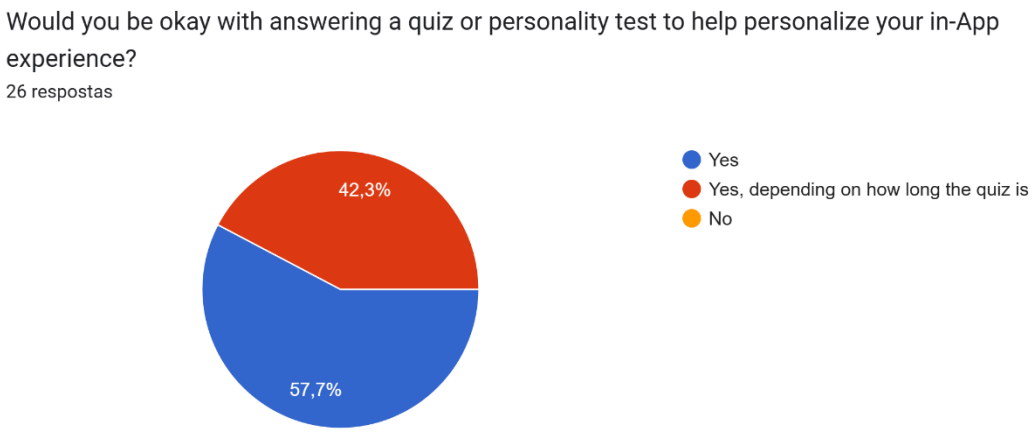


Figure 30 - Respondents' willingness to partake in a quiz/test

Interface preferences: When it came to user experience preferences, simplicity and interactivity presented themselves as top priorities (see Figure 31). Out of 26 respondents, 10 (38.5%) identified interactivity as the most important attribute of the bunch, while simplicity closely followed with 34.6%. Although there was vast interest in customization aspects before, with nearly all participants expressing at least some interest in them, the data indicates that customization—while important—does not outweigh the importance of ease of use, clarity, and interactivity within the app, according to the sampled population. Instead, it appears that it should serve more as a complement to a solid base product rather than being the main focus. It is also worth noting that interactivity and customization are often intertwined, which may explain the reason behind the choices made by respondents in this section of the questionnaire.

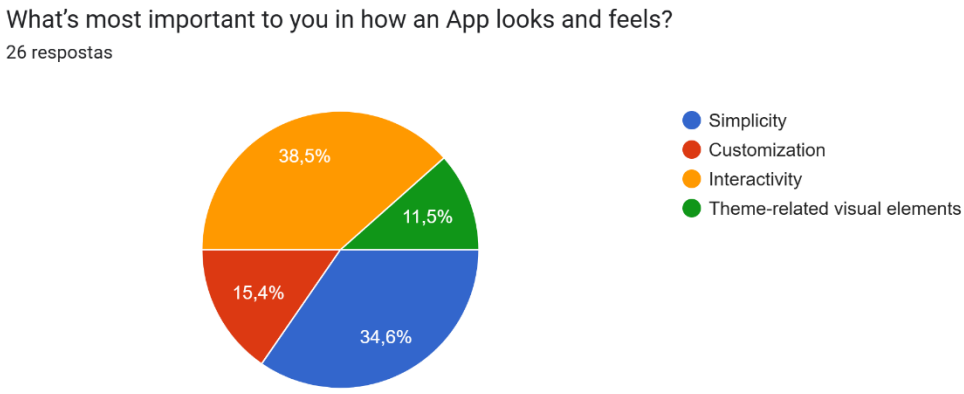


Figure 31 - Respondents' UX preferences

Additionally, many respondents reported preferring a casual, informal presentation of the content over more formal, business-like themes (as can be seen in Figure 32). While story-driven and thematic content is interesting, it was not as widely favored as casual exposition. It's also important to highlight that, regardless of whether the presentation is casual or formal, the

content can still be delivered narratively. This preference is showcased here as an option rather than the only solution.

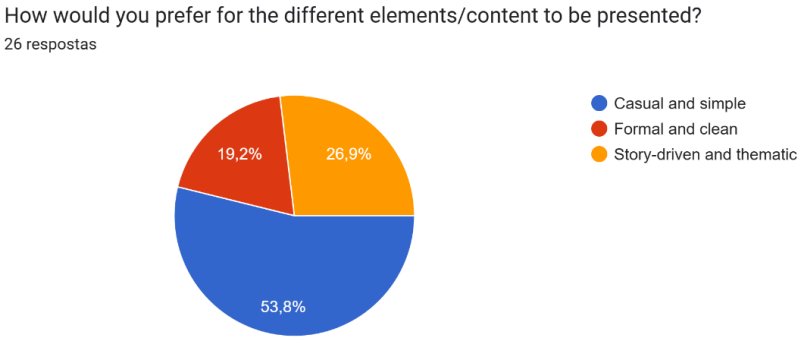


Figure 32 - Respondents' UX content presentation preferences

3.2.7 Ethical concerns and free-text themes

In the final section of the questionnaire, respondents provided optional open-text responses that offered valuable qualitative insights. For example, some individuals expressed concern about trusting a digital platform for mental health support because they believed that an app could never replace in-person support from a qualified professional (as can be seen in Figure 33). They also worried that their data could be accessed by unauthorized individuals or made public without their consent

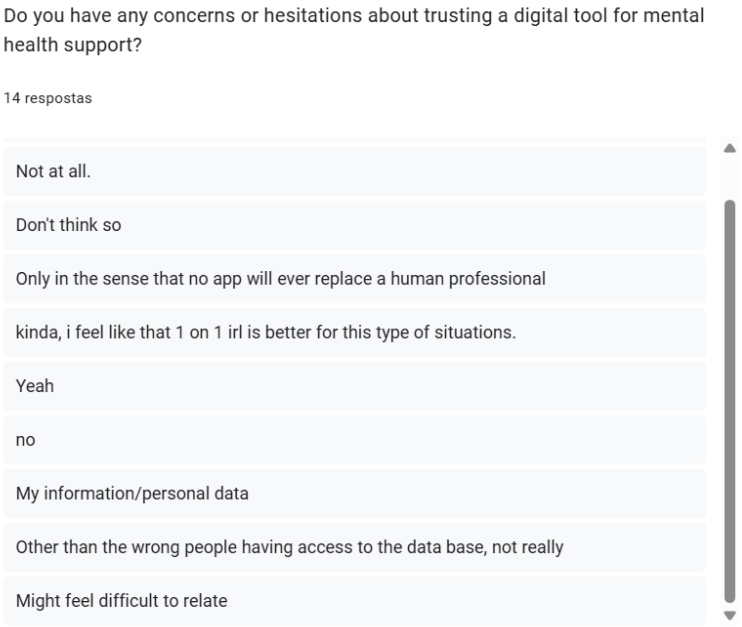


Figure 33 - Respondents' concerns about trusting a mental-health App

Additionally, respondents shared suggestions for how the app could be designed to better meet their needs. They indicated that their ideal app would include features such as journaling, AI-driven insights, and mental health-related activities that are scientifically accurate (see both Figure 34 and Figure 35 - Respondents' ideal mental-health App features Part 2).

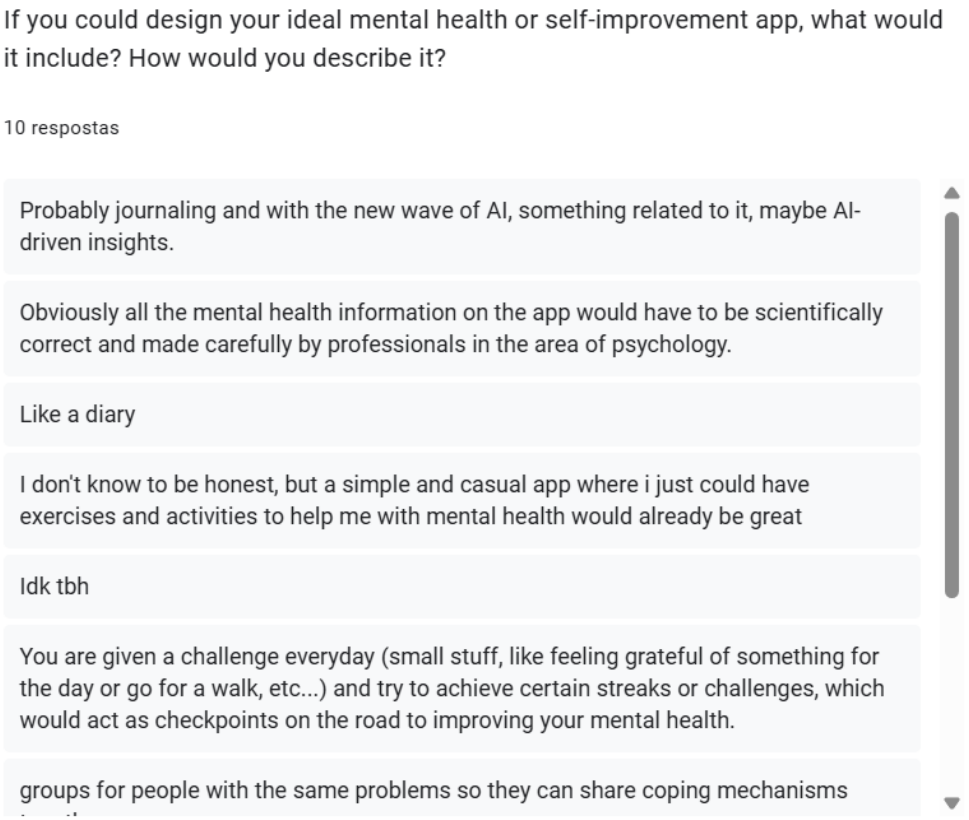


Figure 34 - Respondents' ideal mental-health App features Part 1

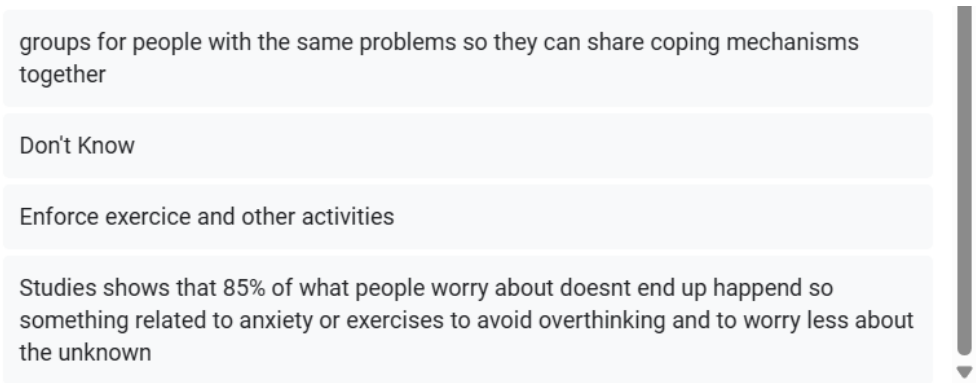


Figure 35 - Respondents' ideal mental-health App features Part 2

3.3 Clinician interviews

Before the design process could begin, three semi-structured interviews were conducted with practicing clinicians, including psychologists and psychiatrists. The purpose of these interviews was to validate design choices for and gather concrete recommendations regarding onboarding, acceptable data collection, and the ethical use of gamification. As such, the results of these interviews played a crucial role in guiding the decisions made during the design phase. They were intentionally focused on the clinical concerns that were most likely to impact product design while allowing space for clinicians to address issues based on their experience.

The interview guide is fully reproduced in Appendix D: Semi-Structured Script for Clinician Interviews. This script covered five thematic blocks that correspond directly to design decisions:

1. **Professional Experience:** Brief prompts to capture clinicians' backgrounds, typical client profiles, and common challenges clients encounter in their day-to-day lives.
2. **Overall App Utility:** Questions about the role and potential of digital tools in mental health care and the topics that should be included in a self-help app targeted at youth.
3. **Features:** Inquiries regarding essential app features, effective knowledge-transfer tools, and opinions on personality assessments for personalization.
4. **Gamification:** An exploration of suitable game mechanics and safeguards against addictive or harmful designs.
5. **Ethical and Professional Considerations:** Open questions about potential ethical concerns.

Two of the interview sessions lasted approximately 30 to 45 minutes and were conducted remotely with prior informed consent, while the last one was in-person. The three interview summaries that follow (Sections 3.3.1–3.3.3) present each clinician's key recommendations and data gathered, with section 3.4 dedicated to synthesizing crossing themes and crucial design rules derived from the interviews.

3.3.1 Clinician 1 – Psychiatrist “DA”

Dr. “DA” was the first clinician interviewed. As an early-career psychiatrist with approximately four years of clinical experience, Dr. DA focuses on diagnostic assessments, medication management, and early interventions. During the interview, they emphasized the challenges posed by diagnostic complexity and overlapping symptoms.

To exemplify these challenges, they shared an example of a case where a patient's affective presentation, which initially seemed to indicate unipolar depression, later turned out to be part of the bipolar spectrum. Dr. DA then pointed out that some conditions can manifest in ways that lead us to consider a particular treatment, but if the diagnosis is incorrect, the treatment may also be inappropriate, even if the symptoms appear similar. In this context, they

highlighted the importance of recognizing symptoms rather than solely assigning definitive diagnostic labels.

Regarding classification frameworks, they noted that psychiatrists commonly utilize systems such as the DSM-5 (the American system) and the ICD (the European variant, also known as the "International Classification of Diseases"). The Research Domain Criteria (RDoC) is often employed for research purposes because of its transdiagnostic approach. They then provided concrete examples of symptoms that can be shared across different conditions: binge behaviors can be associated with anorexia nervosa, bulimia nervosa, or depression, while emotional dysregulation may be observed in borderline personality traits, ADHD, depression, or anxiety. Dr. DA emphasized the importance of focusing on symptoms rather than relying solely on definitive labels. They highlighted that many symptom presentations are transdiagnostic (such as binge behavior and emotional dysregulation) and that initial diagnoses can change over time; therefore, early labels may not always be accurate.

As such, concerns were expressed about digital mHealth applications that provide users with direct diagnostic labels. The credibility of such diagnoses was questioned, and the potential for misinterpretation by users was highlighted. It was suggested by Dr. DA that these applications would provide more clinical value if they signaled observable symptoms or behavioral signs (for example, increased agitation or psychomotor slowing) rather than issuing definitive diagnoses.

When asked about the usual first steps with a new patient, two priorities were identified. First, the establishment of a therapeutic relationship was described as essential, since empathetic contact and trust are required for patients to disclose relevant information and to adhere to recommendations. Second, the gathering of a comprehensive clinical history was indicated as necessary — including psychiatric and family history, current medications, substance use, and other relevant details — because an accurate diagnosis sometimes only emerges after several consultations. It was further noted that, even when depressive symptoms remit with treatment, enduring personality or adaptive traits may remain and shift the emphasis of follow-up from pharmacological management toward psychotherapy.

Digital tools and lifestyle interventions were viewed by Dr. DA as potentially effective for mental health education and habit formation. The following lifestyle factors were identified by them as crucial:

- increased physical activity, which was described as exerting antidepressant and anxiolytic effects.
- a balanced diet, with specific reference to omega-3 fatty acids and probiotics as contributors to serotonin production, and adequate hydration.
- sufficient, quality sleep
- regular sun exposure.

Dr. DA emphasized that all these factors are interconnected and help regulate one another. They noted that individuals who rely solely on medication have a lower probability of

improvement compared to those who take medication while also actively adopting healthy habits. From experience, they highlighted that those who are most likely to see significant improvement are the ones who are committed, attentive, and invested in the treatment plan. These individuals leave the consultation and, in addition to taking their medication, start exercising, eating more healthily, spending time outdoors, and engaging in practices like mindfulness. In contrast, individuals with a more passive attitude tend to show less progress and improvement over time.

According to Dr. DA, the potential role of gamification in mHealth applications appears promising, especially for habit formation and psychoeducation, although the specifics of implementation are uncertain to them. It was suggested that gamified features could help users better explore and connect their subjective feelings with life events, thereby facilitating the identification of problems. Key principles of gamification were proposed: tasks should present an appropriate level of challenge to avoid boredom, clear goals should be established to maintain engagement, and reinforcement mechanisms (rewards) should be included. Additionally, providing users with a comparison of their current progress against past performance, as well as optional social comparisons, was recommended.

It was then highlighted that measuring clinical improvement depends on the constructs selected for assessment. Objective scales can be utilized for constructs like depressive symptoms, but the limitations of self-reporting (such as misreporting) were acknowledged. For depression, the frequency and duration of low mood were identified as clinically relevant metrics. The use of a general overview tool, such as the Wheel of Life, was recommended as a practical initial screening device to identify areas of deficit and to define challenges and goals. It was also advised to include informative resources on lifestyle maintenance, common conditions and symptoms, and emotional awareness. Finally, incorporating personality assessments for personalized recommendations was proposed as potentially valuable, provided that their effectiveness is validated through comparative evaluation. However, Dr. DA expressed caution regarding the risk of directing users toward unnecessary or inappropriate interventions if personality testing is solely relied upon.

3.3.2 Clinician 2 – Psychologist “MA”

Doctor "MA" was the second clinician interviewed. They are a clinical psychologist with twenty-one years of professional experience, approximately ten of which have focused on adolescents and young adults. For the past eight years, they have worked at the *Instituto Superior de Engenharia do Porto,* with responsibilities that extend across the wider polytechnic institute. Their clinical practice emphasizes individualized assessments, the development of long-term therapeutic relationships, and the management of common student concerns such as sleep disturbances, nutritional issues, stress, and social isolation. When asked about the initial steps for a new client, they explained that the process begins by attending to the individual, assessing their current mental state, and determining if significant low mood is present.

The importance of understanding each client's personal narrative was emphasized — everyone's account and approach to disclosure are unique, so tailored methods are necessary. Dr. MA noted that interventions that are effective for one individual may be ineffective or even harmful for another. The significance of the therapeutic relationship was also highlighted; technical competence alone is not sufficient if a meaningful connection with the client is not established, as a lack of rapport can hinder therapeutic progress.

On the topic of digital mental health tools, particularly applications that provide diagnostic outputs, Dr. MA expressed their concerns. The use of Apps for clinical diagnosis was described as potentially problematic and liable to produce misunderstandings, given the symptom overlap across many mental health conditions. The risk of unnecessarily alarming users was underscored, with Dr. MA recommending that applications should prioritize prompting users to seek professional consultation and should provide aggregated information about services rather than definitive clinical judgments.

Ethical risks associated with self-guided resources were reiterated by them: mental health matters are highly sensitive, and digital tools were advised to focus on information provision and facilitation of professional referral rather than on autonomous diagnosis.

Gamification and social features were then discussed during the interview. Dr. MA believes that gamification can be effectively integrated into this type of application, but it needs to be implemented carefully. She suggested that incorporating elements like medals and data sharing among users could create a fun challenge. For example, users might choose when to engage in enjoyable activities or complete tasks and then compare their efforts with others to see who has been working the hardest.

They also proposed using rewards such as medals or points, as well as optional competitive elements that allow users to compare their efforts or completion times with their peers. However, they cautioned that social comparison could have negative effects on vulnerable users. For instance, competition related to dieting could trigger disordered eating in those who are susceptible. Therefore, she emphasized that any social features should be strictly optional and include protections, such as easy opt-out options, moderation, or limits on the type of data shared. While in the context of social interaction within MH Apps, Dr. MA believes that the social aspect is important for mental health but emphasized that it should ultimately be up to the users to decide if they want to share their information.

When it comes to personalization, it was emphasized that standardized personality tests should not be used in this application context because their administration requires licensed psychologists or psychiatrists, as mandated by law. Instead, it was recommended to use simple screening questions, such as those about sleep quality, hours of sleep, and mood fluctuations. The DSM-5 was mentioned as useful only for guideline purposes, and overly medicalized or highly specific questions were advised against. Thus, a basic profile could be constructed from simple, repeated self-report items and their changes over time.

Measuring client improvement was described by Dr. MA as most effective when integrating multiple data sources rather than relying on a single framework. It was suggested that combining self-report items (like sleep and mood) with passively collected metrics (when available and with consent) could provide more informative insights than either method used alone. For instance, correlations between poor sleep, elevated heart rate, and increased anxiety could indicate anxiety, while acknowledging that these correlations should not replace clinical assessments. Indicators derived from wearables, such as heart rate variability, skin conductance, and sleep patterns, were identified by Dr. Ma as valuable complements, provided that their interpretation is cautious and limitations are clearly communicated.

Finally, the key priorities for content in a mental health tool were identified: nutrition and sleep were specifically highlighted as critical areas, with physical exercise and socialization also noted. It was recommended to incorporate socialization features where appropriate, given their relative scarcity in existing Apps.

3.3.3 Clinician 3 – Psychologist “SN”

Doctor "SN" was the third and final clinician interviewed. They reported having approximately twenty-three years of experience in mental health practice, with a career beginning in the prison system and later transitioning to clinical work serving a diverse client population.

When asked about the first step they take when meeting a new patient, their response was quite similar to that of Dr. MA, but they specifically referred to this initial interaction as "anamnesis," during which a comprehensive history is obtained. They observed that many patients seek help due to suffering that frequently traces back to maladaptive personality patterns, usually formed in response to childhood trauma and adverse experiences. These earlier adaptive strategies were described as useful for survival at the time of their development but liable to become maladaptive obstacles in later life. Consequently, Dr. SN considered it important during anamnesis to recognize both the current suffering and the constellation of predominantly “negative” emotions in which the patient may be immersed.

When asked whether digital mHealth tools could effectively enhance overall MH knowledge and facilitate habit formation, they readily acknowledged their potential benefits, while also pointing to the importance of establishing healthy habits. However, careful implementation was recommended. It was emphasized that Apps should not attempt to control or alter users’ personalities; instead, opportunities for free, non-judgmental self-expression were advocated. Dr. SN also pointed out that addiction is often linked to individual personalities, with certain personality types being more prone to developing addictions than others. Therefore, addiction-focused mechanisms should not only target the general population but should also consider the personalities that are more susceptible to developing an addiction to the product.

Then, Dr. SN reported a deficiency in the humanization of current Apps: many existing products were characterized as insufficiently attentive to users as human beings, with design decisions perceived to prioritize revenue or data collection over user comfort and healthy engagement.

The inclusion of features and aesthetics that create a cozier, more humane environment was therefore recommended.

Continuing the topic of humanization and personality, Dr. SN underscored the importance of emotions, stating that they are fundamental to all interactions. Emotions should not be ignored or discarded; instead, they need to be carefully considered and handled. While human interaction allows for a more delicate and personalized approach, mHealth apps should strive to bridge the technological-human gap by incorporating emotionally sensitive design and guidance.

Gamification was viewed favorably by Dr. SN as a potential means to support emotion regulation, habit formation, and family engagement (for example, parent–child interactions). Uncertainty was expressed regarding optimal methods of implementation, but the value of reward systems and interactive elements was emphasized by them. It was noted that gamification approaches have precedents in clinical practice (e.g., adapted board or child games) and can be applied to teach emotional literacy, manage impulsivity and anger, and suggest coping strategies.

A gamified App was recommended to combine stress relief with education about emotions, including guidance on the purpose of so-called negative emotions and practical strategies for managing them. Habit formation was once again highlighted as essential: consistent nutrition, exercise, and sleep were identified as core targets because of their direct influence on mental state. Then, the addition of story-driven narratives was proposed as a motivating design choice (for instance, illustrating a user's potential future trajectory after 3–4 years of sustained healthy habits).

3.4 Synthesis of Findings

The results obtained from both the online questionnaire and clinician interviews provided valuable insights that influenced the design phase. The questionnaire indicated that the target audience has limited prior exposure to digital self-help tools but is open to engaging with them. This underscores the need for a system that caters to both beginners and those with previous experience, ensuring it is user-friendly and does not assume users have any prior knowledge.

Preferences expressed by both groups regarding gamification, personalization, and UI highlighted the importance of striking a balance between guidance and flexibility. The app's design and implementation should prioritize simplicity and interactivity before focusing on aesthetics and customization to reduce frustration, although all these elements are essential.

Moreover, gamification features should preferably enhance the base experience rather than detract from it. Users expressed a preference for gamification options that build on existing content, such as rewards for completing activities and story-driven elements, as well as ways to visualize their progress within the App through statistics, skill trees, and daily streaks.

Interviews with clinicians reinforced and contextualized these findings while guiding the overall features to include and how to explore content. They emphasized the importance of forming healthy habits, such as nutrition, sleep, exercise, and socialization. Additionally, they highlighted the need for tools that promote emotional awareness without attempting to control or pathologize users' personalities. Clinicians cautioned against making disease diagnoses and using superficial methods, stressing the importance of humanization, empathy, and personalization, while also being careful of symptoms and mood fluctuations.

Overall, the findings suggest that the system should prioritize accessible language, acknowledge the type of user it is dealing with and their personality, respectful gamification, and flexible personalization paths that recognize diverse user experiences. These considerations directly influenced the design of the App, particularly in the incorporation of adaptive routines, activity tracking, and non-addictive gamification elements.

4 Overall System and Gamification Design

Based on the information gathered from the mapping study and feedback from the questionnaire and interviews, this chapter describes the design of the project's gamified self-help platform. The main goal at this stage was to use these insights to make design choices and ensure the system follows the gathered ethical and clinical recommendations.

In the first phase of the design process, the focus was on defining what the upcoming mHealth App needs to do (functional requirements) and how it should work (non-functional requirements). This involved reviewing the feedback exposed in the previous chapter and translating that into features for the App. To clearly communicate these requirements, the choices were turned into *User Stories*, which capture specific functions from the user's point of view. An overall view of the defined User Stories is present in Table 3.

Table 3 - Summarized User Stories

Summarized User Stories		
ID	Title	Priority
US01	User Authentication	High
US02	Account Profile	High
US03	Navigation Tutorials	Low
US04	Emergency Help	High
US05	Routine Creation	High
US06	Activities	Medium
US07	Topic Exploration	Medium
US08	Resource Tools	Low
US09	Skill Tree	High
US10	General Home Tab (Leaderboard+Streak)	Medium

4.1 Base Requirements Specification through User Stories

In the subsections below, the full User stories for the base App (without gamification elements) are presented, along with their rationale and the thought process behind them.

4.1.1 US01 – User Authentication

Through the insights gained from stakeholders, one key element identified as crucial for the success of the project is allowing customization. The personalization of the user experience is essential here, especially when aiming to create a cozy and humanized environment that resonates with each user's needs and preferences.

Achieving this requires capturing personal user data and establishing a system to utilize this information effectively. Therefore, it is important to be able to identify users in order to associate the data with an individual, enabling the system to later on provide tailored suggestions and customized feedback. As such, this *User Story* exists to address the need for personalization and to enhance the connection between the system and the individual behind the screen:

- "**As** a new user, **I want to** securely create an account and sign into the App, **so that** I can view my progress, sync information across devices, and be given customized experiences and feedback"

Table 4 - US01 Acceptance Criteria

US01 Acceptance Criteria		
Given	When	Then
A new User	They register with email + password	An account is created, and the user is logged in and redirected to the Home screen
An existing User	They sign in with email + password	They are logged in and redirected to the App's Home screen
An authenticated User	They open the App after having logged in	They are automatically redirected to the Home screen
A user who wants to reset their password	They request a password reset	They receive a reset link in their associated email
Any authentication event	It occurs	Consent to be able to capture personal data is given

4.1.2 US02 – Account Profile

The same reasoning behind the existence of User Story number 1 also highlights the necessity of having an Account Profile. This profile is essential for storing and displaying personal data associated with a user, and allows users to access this data at any time. Additionally, the account profile acts as a central hub where users can further customize their in-app appearance and view their personal data presented as statistics and visual progress within the app. As such, we have the following *User Story*:

- **"As** an authenticated user, **I want to** have a personal profile where my personal data is displayed, **so that** I can review my progress and edit preferences."

Table 5 - US02 Acceptance Criteria

US02 Acceptance Criteria		
Given	When	Then
A new User	They register with email + password	An account profile is also created with a chosen *Avatar*, and the user is logged in and redirected to the Home screen
An authenticated User	They select to navigate to the Profile screen	They redirected to the overall Profile Screen, where their personal stats are displayed
An authenticated User	They arrive at the Profile screen	Their avatar is displayed, along with an option to log out of the App
An authenticated User	They select their own *Avatar*	They are allowed to change their current *Avatar*

4.1.3 US03 – Navigation Tutorials

Effective user navigation is a crucial element of user experience (UX). To achieve our objectives, reduce app abandonment, and encourage engagement, the UX needs to be simple, responsive, and clean. This conclusion is supported by the responses obtained from the online questionnaire, where respondents indicated that simplicity and interactivity were their most important factors in determining how the app is perceived.

Considering the current target audience, which also consists of individuals used to seeking dopamine-driven experiences, it is vital to acknowledge that, as psychologist Dr. Silvia pointed out, users who create an account and enter the App will probably already be feeling distressed and overwhelmed with negative emotions. Therefore, ensuring a non-frustrating user experience is imperative.

But the initial UX is influenced not only by how intuitive the app navigation is, but also by how clearly users understand what actions they can take, how to perform them, and how to navigate through the app. The option to view a tutorial can be an essential tool for providing such clarity, preventing frustration, and reducing the likelihood of users quitting due to confusion or the aforementioned. With this in mind, the following *User Story* was defined:

- **"As** an authenticated user, **I want to** be able to access a tutorial on what I can do within the App, **so that** I clearly know what features there are and how to utilize them."

Table 6 - US03 Acceptance Criteria

US03 Acceptance Criteria		
Given	When	Then
An authenticated User	They select the tutorial button	A tutorial on what the User can do and how to do it is displayed

4.1.4 US04 – Emergency Help

The option to access emergency hotlines is essential for any mHealth tool. It's once again important to remember that individuals seeking help through the app may already be feeling distressed and overwhelmed by negative emotions. Therefore, offering additional support is necessary, especially when these emotions exceed what the app can adequately address. As highlighted by the clinicians interviewed, the App's purpose should never be to diagnose or provide any sort of treatment for whatever medical issues that may arise. Instead, it should focus on providing support and guiding users to professionals and qualified institutions or hotlines when needed. This *US* aims to accomplish exactly that: to offer assistance and redirect users in emergency situations when they require further qualified help.

There are various ways to implement this feature in the system. For instance, a smartwatch could be used to monitor real-time body statistics to identify potential health risks or symptoms. However, due to time and knowledge constraints in the project, we will not explore such complex data capture methods. Instead, the App will simply display and assist whenever the user requests it. This leads us to the following *user story*:

- **"As** an authenticated user, **I want to** be able to access emergency hotlines and tools whenever the need to do so arises, **so that** I can adequately deal with what I'm feeling and be redirected to the adequate sources."

Table 7 - US04 Acceptance Criteria

US04 Acceptance Criteria		
Given	When	Then
An authenticated User	They decide to trigger the emergency button	A high-visibility screen shows local emergency contacts, a one-tap call to local emergency, and breathing exercises

4.1.5 US05 – Routine Creation (Scheduling)

During the data gathering and analysis of results conducted in previous chapters, several ideas emerged regarding the features that could be included in the App. After considering various factors, particularly the insights provided by the interviewed clinicians, it was decided that the platform would primarily focus on scheduling and promoting healthy habits through a scheduling system.

This decision was made after careful consideration of multiple aspects. The feedback from clinicians emphasized that the App should never diagnose users under any circumstances. Its goal should be to provide support and redirect users to qualified sources of professional help when needed. This tool aims to assist individuals in their daily lives and alleviate their suffering without attempting to replace the essential role of a professional.

Additionally, the App should not implement personality tests or ask overly personal or medical questions, nor should it seek to intervene in or treat any diseases or influence the user's personality.

Beyond these limitations, the App should serve as a source of mental health knowledge and help users manage overwhelming emotions. Habit formation and lifestyle changes frequently emerged as viable options during interviews, as habits significantly impact individuals' mental states and can exacerbate fluctuations in well-being. Consequently, promoting habit formation does not violate the previously mentioned guidelines and appears to be one of the best features the App could offer.

As such, by focusing on habit formation, the tool positions itself as a bridge between users and clinicians. It would be able to promote mental health knowledge, support users, and alleviate their suffering while staying within the boundaries of its intended purpose. Due to this, the following *User Story* was introduced:

- **"As** an authenticated user, **I want to** improve my own life by creating/planning daily routines composed of micro-activities, **so that** I can have a consistent routine and engage in healthy habits."

Table 8 - US05 Routine Creation

US05 Acceptance Criteria		
Given	When	Then
An authenticated User	They create an account	An empty schedule is associated with the User and displayed in the home screen
An authenticated User	They selected to create a micro-activity	They are asked to fill an activity creation form
A micro-activity form	It is filled and submitted, and the micro-activity doesn't overlap with another existing micro-activity	The micro-activity is added to the User's routine/schedule
A micro-activity	The scheduled time is due	The system notifies the user

4.1.6 US06 – Activities

The implementation of the scheduling system (US05 – Routine Creation (Scheduling)) is essential but not sufficient for engaging users and promoting mental health (MH) knowledge. Currently, the scheduling system does not significantly differ from standard phone calendar applications available on modern smartphones. Therefore, complementary features need to be added to align the App with the objectives set out for it. One such feature is the incorporation of "activities," which will be developed as a separate US, since these activities can be implemented independently. Regardless, in the context of the current App, they will be integrated with user routines.

"Activities" will replace the simple micro-activities found in the basic calendar. When the time for an activity arrives, users will not just receive a reminder to complete it; instead, "activities" will offer additional engagement methods for completing the task. When it's time for an activity, users can opt to start it within the scheduled time. Starting an activity will redirect them to a new screen within the app, where they will need to complete the challenge associated with that activity.

These activities can take various forms. Given their nature, they serve both as a source of knowledge and as a means of engagement through the act of completion. This design also allows for the potential use of gamification to further enhance the activities, although this aspect falls outside the scope of the current project due to time constraints. The types of activities currently planned are:

- **Time-based:** Encourages screen detachment and calmness through non-interaction, promoting screen breaks and impulse control.
- **Text-entry (journaling):** Allows users to reflect on a topic through writing as a form of emotional expression and thought processing.

- **Choice-based reflection (CBT):** Prompts users to reflect on and choose cognitive responses based on cognitive restructuring and perspective-taking.
- **Breathing exercise:** Reduces anxiety through guided breathing techniques.
- **Mood check-in:** Users select their current emotion, acting as an emotional tracking system that provides awareness of mood and its evolution.

As such, this set of activities and their system comprises the following *User Story*:

- **"As** an authenticated user, **I want to** be able to interact and complete activities when the scheduled time arrives, **so that** I can further engage with my routine and develop healthier habits."

Table 9 - US06 Acceptance Criteria

US06 Acceptance Criteria		
Given	When	Then
An activity in the user's routine	The scheduled time arrives	The user can select to start the activity
An authenticated User	They selected to start an activity	They are redirected to a specific screen given the activity type, where they must complete the given challenge/action

4.1.7 US07 – Topic Exploration

While the activities provided in the App are able to offer users challenges and actions that promote knowledge, they can be complemented and enhanced by incorporating specific topics related to mental health within the platform. The concept of these topics is straightforward: users can view and explore various subjects within the app. The information available to users is based on these topics, and certain activities can be linked to specific topics to deliver relevant knowledge and insights during their completion.

Although topics and activities function independently, they complement one another, helping the App achieve its objectives. Initially, "healthy eating" and "physical exercise" were considered as potential topics for early implementation. However, due to time constraints during the testing phase, it was decided to focus on topics more directly related to mental health. The goal was to assess whether this tool could effectively convey those MH concepts and enhance user engagement with such subjects. As a result, the early implementation of the app will include the following topics:

- Mindfulness
- Self-awareness

The list of these topics can be compared to a collection of books in a library, with each topic representing a different book. Users can access this library at any time to explore the content of each "book." Additionally, specific activity types can be associated with a topic, allowing the content displayed within the activity to change based on the selected topic.

With this reasoning, the following *User Story* was defined:

- "**As** an authenticated user, **I want to** be able to explore topic modules of different topics related to MHealth, **so that** I can learn from both topic exploration and activity completion."

Table 10 - US07 Acceptance Criteria

US07 Acceptance Criteria		
Given	When	Then
An authenticated User	They select to list the Topics available	They are redirected to a screen where all Topics are displayed, and a search bar to find Topics based on keywords
An authenticated User	They select a specific Topic from the list of Topics	They are redirected to that Topic's page
An authenticated User	They arrive at a specific Topic screen	They are presented with different routines that they can view and activate

4.1.8 US08 – Resource Tools

To complement the previous US (US07 – Topic Exploration), resource tools will be added within each topic as extra sources of knowledge. These tools will consist of external sources of knowledge that users may find useful or preferable. Users can access these tools within each topic and explore them of their own volition, and they will include resources related to that specific subject. Each resource will be categorized under one of the following types of tools:

- Podcast
- Guide
- Background music
- Video

Resource tools comprise the following *User Story*:

- **"As** an authenticated user, **I want to** be able to find curated resources within each topic, **so that** I can further learn about said topic on my own."

Table 11 - US08 Acceptance Criteria

US08 Acceptance Criteria		
Given	When	Then
A new User	They register with email + password	An account profile is also created with a chosen *Avatar*, and the user is logged in and redirected to the Home screen
An authenticated User	They select to navigate to the Profile screen	They redirected to the overall Profile Screen, where their personal stats are displayed
An authenticated User	They arrive at the Profile screen	Their avatar is displayed, along with an option to log out of the App
An authenticated User	They select their own *Avatar*	They are allowed to change their current *Avatar*

4.2 Gamification Features Design

Gamification can be referred to as the strategic use of game-like elements in non-game applications. As such, it's important to clarify that the gamification of the App does not mean transforming it into a game or even a serious game. Instead, the game elements serve as enhancements rather than being the focus. Therefore, it is essential to recognize that these elements are additional features to a "base" App, one which is designed without gamification. For that reason, the first part of the design phase of the project, exposed in the previous section of this chapter, is dedicated to defining the base App to be developed.

As a reminder, the goals set for the gamification within this project are to potentially **increase engagement** and **improve motivation** when interacting with a mental health digital tool.

That said, gamification elements should not and cannot be randomly added to an App in hopes of achieving these objectives. Without taking into consideration certain aspects while planning them, they may not have the desired effect and could even be detrimental, leading to counterproductive outcomes. As Dr. "MA" noted during their interview, every approach has its downsides and risks. Thus, it is crucial to minimize potential harm by carefully evaluating the types of gamification elements implemented, especially when dealing with such sensitive topics. Any negative aspects should be mitigated as effectively as possible, ensuring that the benefits outweigh these drawbacks. This section of the document is dedicated to examining which gamification elements can be useful, how they should be employed, and the process by which these elements were defined.

4.2.1 Understanding User Motivation

To determine which gamification elements would be most beneficial for the project (and given that the gamification objectives were already established in the initial stages), it is first essential to understand the reasons behind why people engage in various activities, their motivation. Without this foundational understanding, incorporating gamification risks becoming merely a superficial gimmick, which could be ineffective or even detrimental, as mentioned before.

This further highlights the importance of the data gathered from the online questionnaires targeting the audience and interviews with clinicians. The data acquired not only informs the overall design of the App but also allows us to shape the design of the gamification elements according to the needs of the project.

Nevertheless, motivation can be defined as the set of biological, emotional, social, and cognitive forces that initiate and sustain goal-directed behavior. It is generally divided into two categories: intrinsic and extrinsic. [51], [52]

- Intrinsic motivation: arises from within the individual, leading them to engage in an activity for its inherent satisfaction or meaning.
- Extrinsic motivation: relies on external rewards, such as praise, monetary incentives, or recognition.

While both types of motivation are valuable, intrinsic motivation aligns more closely with the goals defined for the project, as it is more sustainable and beneficial for long-term engagement and well-being. Ideally, users should be motivated to engage with the content due to personal interest and the desire for self-improvement, rather than solely for the sake of receiving rewards. Extrinsic elements can still be incorporated as supportive tools to provide a short-term boost, but they should not be the primary reason for participation and require additional carefulness when implemented, due to their nature and possible chance of promoting addictive behaviors. [52]

While knowing the type of motivation to be captured is essential, understanding the origins of the individual's motivation is also crucial to the design. Maslow's "Hierarchy of Needs" (displayed in Figure 36) is particularly relevant in this context. Maslow proposed that human behavior is influenced by the desire to fulfill various levels of needs, ranging from basic physiological requirements to self-actualization. Notably, intrinsic motivation tends to thrive when higher-level needs are satisfied, while extrinsic motivation is often linked to meeting lower-level or more immediate needs. [53], [54]

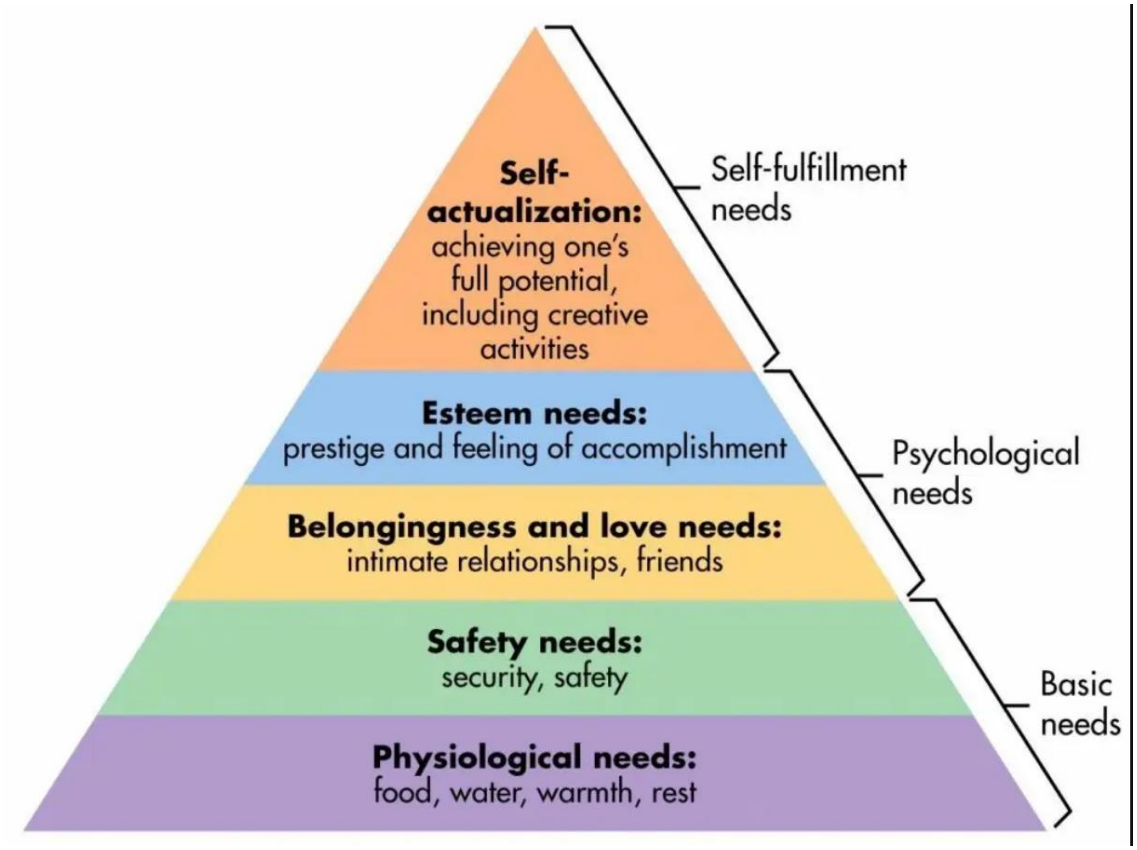


Figure 36 - Maslow's Hierarchy of Needs [54]

As such, the project's objectives and audience's needs, as well as those of other mHealth digital tools that may follow its example, align with the upper levels of Maslow's hierarchy:

- Belongingness and love needs: Feeling accepted and connected with others.
- Esteem needs: Gaining confidence through personal progress, skill mastery, and recognition.
- Self-Actualization: Realizing one's full potential and pursuing personal growth.

This approach helps underscore that the game mechanics to be implemented here should aim to cultivate intrinsic motivation by somehow addressing users' needs for belonging, esteem, and growth, rather than merely providing superficial rewards.

In addition to knowing what intrinsic motivation is and the human needs related to it, it is also of great interest to know how intrinsic motivation can be achieved. As such, to add to the previous perspectives, the design of gamification can also take into consideration principles from "Self-Determination Theory" (SDT), showcased in Figure 37 - Self-Determination Theory Diagram. [52], [55]

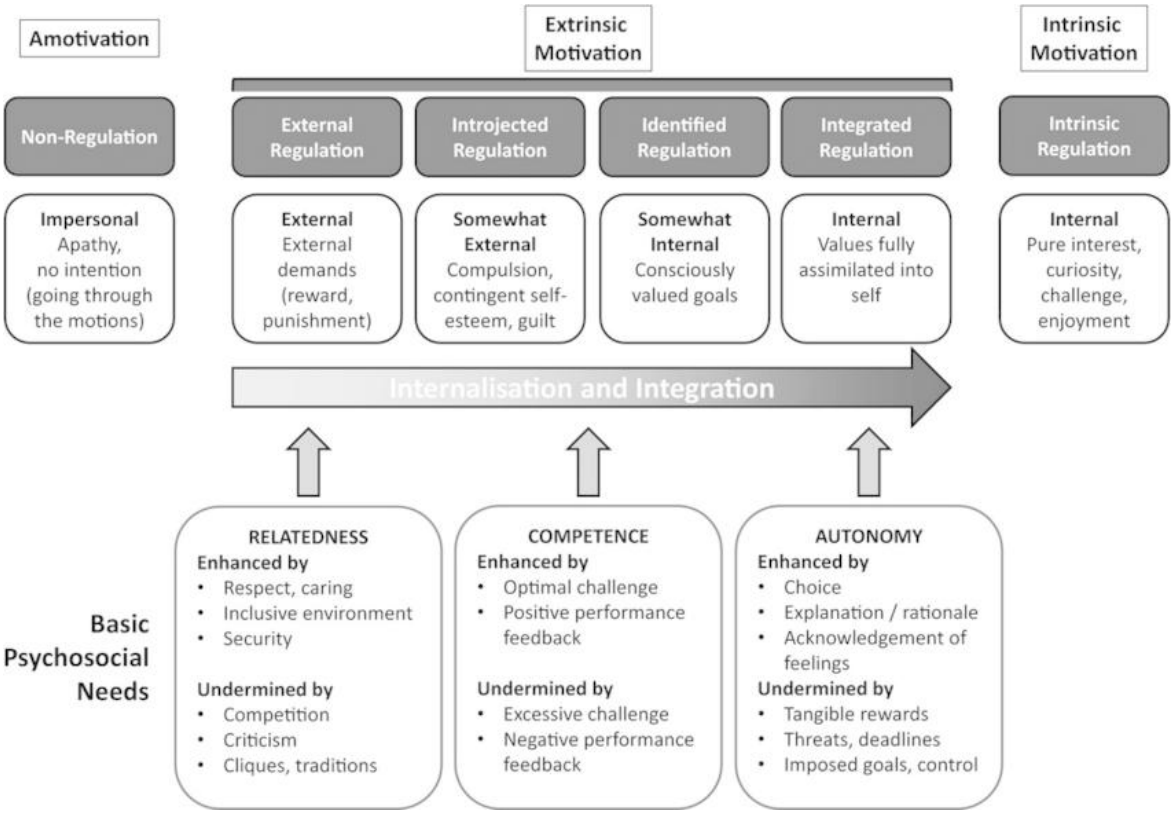


Figure 37 - Self-Determination Theory Diagram [55]

SDT adds to the already mentioned types of motivation, describing motivation as a spectrum that ranges from amotivation to various types of extrinsic motivation, leading to intrinsic motivation. At one end of this spectrum, amotivation indicates a lack of intention or drive, while at the other end, intrinsic motivation emerges from personal interest, enjoyment, or curiosity. Between these extremes lies extrinsic motivation, which begins as behavior driven solely by external rewards or punishments and can gradually shift towards being more self-endorsed. As individuals internalize and integrate external values and goals, their actions begin to reflect their own sense of self. [52], [55]

“Self-Determination Theory” underscores that the shift from external to internal motivation depends on the fulfillment of three basic psychological needs: [52]

- Relatedness: Feeling connected to and supported by others.
- Competence: Feeling effective and improving through effort.
- Autonomy: Feeling in control of one’s own actions and choices.

The needs identified closely correspond to the upper levels of Maslow's hierarchy, which makes Self-Determination Theory (SDT) also a valuable framework to guide the decision of which gamification strategies can be beneficial. In conclusion, people are motivated when their needs

are met. Maslow provides insight into which needs to target, SDT explains how to support those needs, and the concepts of intrinsic and extrinsic motivation help differentiate which types of motivation to cultivate.

4.2.2 Ethical Considerations in Gamification

Before outlining the game elements to incorporate, it is essential to assess the ethical implications associated with gamification. This is particularly important given the health-related focus of the project, which addresses sensitive mental health issues. The ethical considerations presented here complement those discussed in Chapter 1 of this dissertation, but with a specific emphasis on gamification elements.

Ethics can be defined as a set of principles that help determine which behaviors are beneficial or harmful. These principles guide the design of solutions that promote positive and desirable outcomes for users.

While game elements have the potential to encourage positive behaviors, even in the realm of mental health, as evidenced by the mapping study conducted, they can also manipulate, pressure, or harm users if misused. As Yu-kai Chou emphasizes, users should always have the option to choose to engage with gamified systems knowingly, rather than being subtly coerced into adopting behaviors they did not intend to embrace. Ethical design entails ensuring that game-like elements support users' well-being rather than exploit their psychology. This involves anticipating potential risks and planning safeguards early in the design process. [56], [57]

As such, and with the knowledge obtained already from, for example, the interview with clinicians, a set of ethical concerns was identified, and each concern was analyzed on how it could be tackled through the design imposed. This set of concerns can be consulted in the subsequent subsections, following the principles presented by Vaz de Carvalho, professor at Instituto Superior de Engenharia do Porto. [58]

4.2.2.1 Manipulation and Autonomy

One of the main ethical risks of gamification is its potential to be used to manipulate user behavior. Game mechanics are specifically designed to influence decisions, often using psychological triggers. This can lead to a crossing of the line from “motivating” users to “coercing” them. Elements such as streaks, countdown timers, and fear of loss or missing out (FOMO) on rewards can (and often do) pressure users to act, a majority of the time out of obligation rather than personal choice. This can lead to decisions that may not be in their best interest. In the context of mHealth, this manipulation can be especially harmful. Users may experience feelings of guilt, stress, or shame for not “keeping up,” which can directly undermine their overall well-being or exacerbate already existing problems. [59]

To prevent this, there are a couple of design aspects that can and should be considered to encourage engagement but keep the user in control, respecting their autonomy:

- Making gamification optional and clearly explaining how it works, providing users with the autonomy to opt in or out consciously rather than being automatically enrolled.
- Transparency about mechanisms employed, avoiding hidden persuasive techniques or mechanics that try to exploit user emotions without their awareness.
- Providing self-chosen goals, allowing users to decide which challenges or progress paths to follow

4.2.2.2 Addiction and Overuse

Addictive behaviors are a common risk often associated with game elements, which is especially concerning in the context of this project. As previously mentioned, addiction and obsessive behaviors are already significant problems among gamers and individuals in the target audience, and a primary reason for the existence of this project. Games and gamified systems can become compulsive, encouraging people to continue interacting even when it becomes unhealthy or unproductive. This behavior is particularly evident in teenage gamers who frequently play MMORPGs or competitive-focused games. In the context of mental health digital tools, this problem could be even more dangerous, with excessive use of the App becoming another source of pressure or obsession instead of serving as a supportive tool, exacerbating issues in already weakened individuals. Moreover, overuse may even crowd out offline well-being practices or moments of rest. [59], [60]

To mitigate this, gamified Apps should prioritize balanced and sustainable use over continuous daily engagement. Design strategies include:

- Avoiding elements that punish absence (like strict streaks that reset after one missed day).
- Focusing rewards on meaningful milestones, rather than constant small hits of dopamine that encourage compulsive checking.
- Including reminders to take breaks and framing activities as part of a flexible routine, rather than as obligations.
- Monitoring engagement patterns to detect signs of overuse and adjusting elements accordingly.

4.2.2.3 Equity and Fairness

Moreover, the employment of gamification in this and similar contexts can unintentionally benefit certain groups of users while discouraging those who might be struggling. Features like reward systems associated with leaderboards and public rankings often contribute to this issue by favoring high-performing or competitive users, leaving lower-performing individuals feeling excluded or inadequate. This can be particularly demotivating for users who are already dealing with mental health challenges. In extreme cases, such practices can reinforce feelings of inadequacy, which undermines the intended purpose of mHealth digital tools. [61]

To fend off cases where this problem persists, the design of game elements (and other aspects included) should emphasize personal growth or collaboration over competition, with strategies such as:

- Focusing on self-comparison by, for example, showing users their own progress over time rather than direct comparisons with others.
- Offering multiple pathways to success by, for example, providing different ways to complete challenges and not making them just about “winning” or “being the best.”
- Making rewards attainable at different difficulty levels so both beginners and advanced users can succeed.
- Design inclusive game elements that provide support to those who might be facing other issues.

4.2.2.4 Real-World Impact

Finally, while gamification can influence user actions within a game or App, it can also have unintended effects on real-world behavior. Because it has the potential to shape habits and emotions, it might inadvertently reinforce unhealthy behaviors, such as encouraging overwork, perfectionism, dissociation, or avoidance of failure. This is particularly concerning in the context of mental health, as the system must never reward behaviors that could harm users’ emotional or psychological well-being. It should be taken into consideration that the behaviors encouraged are positive.

To prevent negative consequences and ensure that gamification supports well-being rather than undermining it for the sake of engagement, the design process should include:

- Tracking the impact of gamification through not only engagement metrics, but also user feedback about how their emotions and routines are being affected.
- Consider removing or redesigning elements if there are indications that they cause negative outcomes or behaviors, such as, for example, stress or anxiety, although they might boost engagement or interest.
- Continuous evaluation of the gamified tool with professionals.

4.2.3 Gamification Framework: Octalysis

Once the psychological needs that require support and the ethical considerations that must be taken into account are addressed, one can begin to translate these principles into actual gamification elements. To achieve this, the design process can (and will do so for this project) use the “Octalysis” framework developed by Yu-kai Chou (displayed in Figure 38). This human-centered gamification design is widely used for designing engaging systems and breaks down human motivation into eight “core drives” that can be intentionally activated through design. [57], [62]

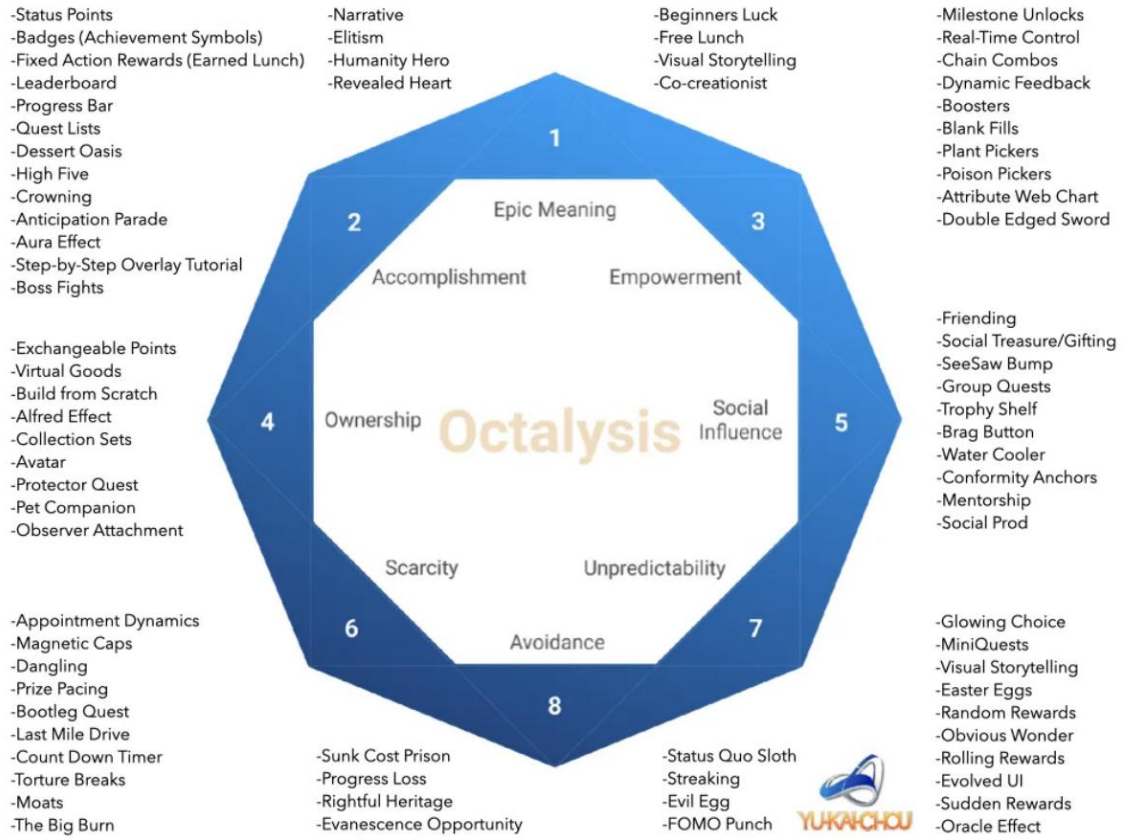


Figure 38 - "Octalysis" Framework Diagram [62]

Instead of focusing solely on surface-level mechanics such as points and badges, “Octalysis” analyzes why individuals find experiences engaging and how to align those motivational forces with the desired goals of a system. The eight core drives proposed by Chou are: [57], [62]

1. **Epic Meaning**: The feeling of being part of something greater and more meaningful than oneself.
2. **Accomplishment**: The drive to make progress, develop skills, and achieve mastery.
3. **Empowerment**: The motivation to experiment, express creativity, and receive direct feedback on one’s actions.
4. **Ownership**: The urge to collect, own, or improve things that feel like they belong to oneself.

5. **Social Influence**: The motivation derived from social connections, competition, collaboration, and social validation.
6. **Scarcity**: The desire for what is rare, exclusive, or temporarily unavailable.
7. **Unpredictability**: The drive to explore the unknown and be surprised by new outcomes.
8. **Avoidance**: The motivation to prevent losing progress or missing out on something valuable.

Each one of these drives can be used to boost engagement, but they affect people in various ways. Chou classifies these methods using two main categories. First, there are White Hat and Black Hat motivations. White Hat drives, such as “Epic Meaning”, “Accomplishment”, and “Creativity”, empower people and give them a sense of control. In contrast, Black Hat drives, like “Scarcity”, “Unpredictability”, and “Avoidance”, create urgency through pressure, uncertainty, or fear of missing out. While White Hat drives promote positive, long-term engagement, Black Hat drives can lead to quick motivation but may cause stress, anxiety, or burnout if overused. The second category is Left Brain versus Right Brain motivations. Left Brain drives, such as ”Accomplishment”, “Ownership”, and “Scarcity”, focus on analytical and external factors, while Right Brain drives, including “Epic Meaning”, “Empowerment”, “Social influence”, and “Unpredictability”, appeal to emotions and internal desires. This framework shows the importance of balance. [57], [62]

As such, the “Octalysis” framework connects to earlier exposed motivation theories, such as Maslow's hierarchy and Self-Determination Theory. For example, the need for belonging from Maslow relates to “Social Influence”. Using those theories within this framework helps in selecting gamification elements not just because they are enjoyable, but because they meet specific motivational goals. This way, an organization in this context can make sure that the designs support intrinsic motivation and well-being, while steering clear of excessive Black Hat techniques that might pressure or manipulate users.

For the current project, the main goal is to primarily utilize White Hat and Right Brain drives that promote autonomy, creativity, social connections, and personal growth. Black Hat techniques should only be applied sparingly to ensure users' well-being. To clarify this approach, an “Octalysis” analysis has been conducted for the project's App to identify which of the eight core drives the system aims to activate and to what extent. The resulting octagon, made using the official “Octalysis Tool” [63], can be seen in Figure 39 - Project's "Octalysis" Octagon.

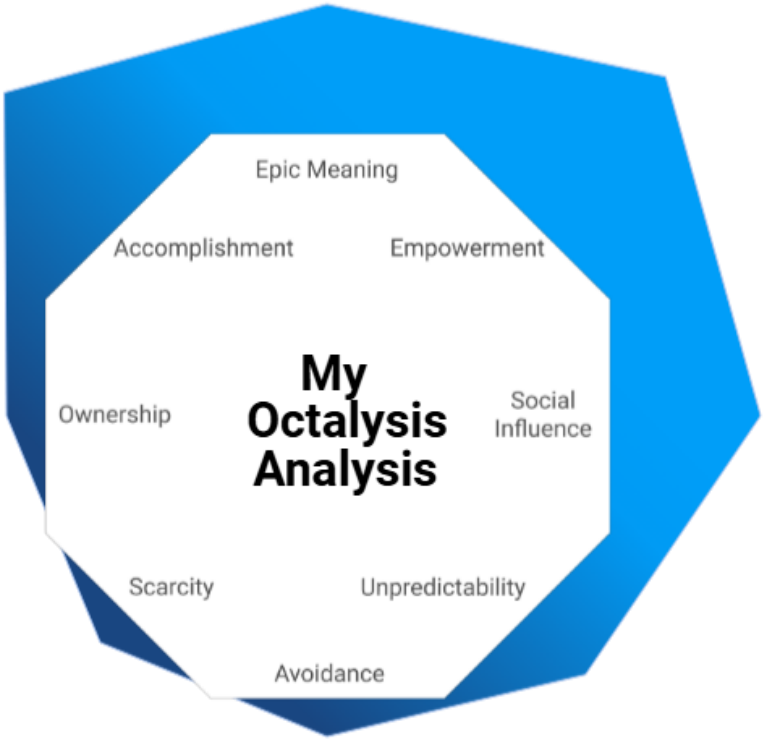


Figure 39 - Project's "Octalysis" Octagon [63]

As can be seen, the project's focus is on creating a profile that promotes Development and Accomplishment by incorporating progress tracking, achievement recognition, and feedback on learning experiences. With the values provided, the “Octalysis Tool” provided a score of 270 to the project’s octagon, describing it as “White Hat and Good Motivation”:

“Your experience is heavily focused on White Hat Core Drives, which means users feel great and empowered. The drawback is that users do not have a sense of urgency to commit the desired actions. Think about implementing light Black Hat Techniques to add a bit more thrill to the experience. / Also, you seem to have a great balance between Left Brain and Right Brain Core Drives, which means you likely have a good balance between Intrinsic and Extrinsic Motivation. Just be very careful because Extrinsic Motivation designed badly may kill Intrinsic Motivation.” [63]

4.2.4 Selected Gamification Elements

With the motivational foundations and ethical considerations defined, and the “Octalysis” analysis completed, the final step was to translate these insights into concrete gamification features. This step involved selecting elements that support the key motivations previously identified, such as Accomplishment, Empowerment, and Social Influence. Each of the chosen features should not just be a fun addition; they are a purposeful tool designed to encourage positive engagement. This means promoting regular use, supporting users’ confidence and independence, building a sense of community, and helping users learn about mental health in a safe way.

The next subsections will show the gamification elements included in the application, presented as *User Stories*, similar to what happened with the features of the base App.

4.2.4.1 US09 – Skill Tree

The concept of the "Skill Tree" was the first to be defined in the gamification strategy. This feature serves as a central mechanic to represent user progress and encourage continuous engagement with the platform. Inspired by progression systems commonly seen in video games like Skyrim [64], the Skill Tree visually maps the acquisition of skills and knowledge in a branching structure. Each completed activity, whether derived from template routines or custom ones, contributes to unlocking levels at various nodes within the tree. These nodes then symbolize competencies such as resilience, emotional regulation, and self-care habits.

From a design perspective, the Skill Tree addresses several key motivational needs identified previously. It primarily activates the “Accomplishment” drive from the “Octalysis” framework by allowing users to observe tangible progress toward meaningful goals. This aligns with the “competence” need outlined in Self-Determination Theory and the “esteem” level found in Maslow’s hierarchy. Additionally, it engages the “Empowerment of Creativity & Feedback” drive by providing users the freedom to choose which branches to explore, along with immediate visual feedback on their actions. This sense of autonomy bolsters users’ intrinsic motivation, while the personalized branching paths reflect their individual interests and priorities, enhancing their sense of ownership and self-direction.

Stakeholder input significantly influenced the design choice of implementing a Skill Tree. Participants from the questionnaire expressed a desire for indicators of progress and opportunities for personalization, while clinicians highlighted the importance of framing growth in terms of healthy habits and emotional awareness, rather than rigid performance metrics. They noted that visualizing progress and providing rewards could promote adherence to self-care practices. To ethically meet these requirements, the Skill Tree was designed to emphasize self-referenced growth over social comparison.

Importantly, the Skill Tree avoids relying on Black Hat drives like” Scarcity”, “Unpredictability”, or “Loss”, which are often linked to compulsive behaviors. Unlike mechanics such as loot boxes,

which exploit uncertainty and fear of missing out, the Skill Tree is predictable, transparent, and user-driven. Users always know which skills are available, while also being able to know what actions contribute to unlocking them, and how close they are to achieving their next milestone. This clarity reduces anxiety, supports user autonomy, and adheres to the ethical principle of minimizing manipulative or coercive design patterns.

From an implementation perspective, the Skill Tree integrates directly with the activity system. As users complete activities, their progress in the tree is automatically updated, providing immediate and rewarding feedback. The branches are modular and can easily be expanded with new skills or themes through the database, allowing for future scalability of the project without having to undergo major redesigns or disrupt the existing structure.

Overall, the Skill Tree fosters intrinsic motivation, supports autonomy and competence, and encourages long-term commitment to self-help practices within the App. All these considerations concluded with the definition of the following *User Story*:

- **"As** an authenticated user, **I want to** be able to keep track of my progress within the App, **so that** I can compare my current self with my past self, view which skill sets I have made progress in, and be motivated to continue."

Table 12 - US09 Acceptance Criteria

US09 Acceptance Criteria		
Given	When	Then
An authenticated User	They arrive at the Profile screen	A section of the page displays the various branching skills available for tracking and the progress (level) made on each one
An authenticated User	They complete an activity	They are provided with Exp for the skills associated with the completed activity

4.2.4.2 US10 – General Home Tab (Leaderboard and Weekly Streak)

Social gamification has been introduced as a complementary mechanism to foster a sense of community and reduce feelings of isolation and emptiness within the App. Concerns about these issues emerged as recurring themes during clinician interviews, with Dr. "MA" highlighting the potential value of incorporating social features into a digital mHealth platform. This feature includes two leaderboards and a streak-tracking display that shows users which days of the current week they have completed activities on. No rewards are tied to these systems; their primary purpose is to provide social reinforcement and a sense of shared presence rather than to encourage competition-driven behavior.

The design features two leaderboards: one ranks the top three users with the highest experience points (EXP, tied to US09) gained during the day, while the other ranks the top three users with the most completed activities. Importantly, the users displayed on these leaderboards are only those with whom the individual has explicitly consented to interact, and the rankings reset daily. This approach was taken to create low-stakes moments of social motivation without establishing ongoing competitive hierarchies that could lead to demotivation through pressure or anxiety or even exacerbate existing inequalities between users.

Regarding the streak tracking feature, it aims to allow users to visualize consistency without imposing punitive loss mechanics for missed days, avoiding fear-based motivation. This design primarily draws on the “Social Influence” drive from the “Octalysis” framework, addressing the psychological needs for “belonging” (as described by Maslow) and “relatedness” (as outlined in Self-Determination Theory). It also lightly taps into the “Development and Accomplishment” drive by allowing users to see their performance acknowledged in a visible space.

From a motivational standpoint and in order to balance out, this design can provide a short-term boost by activating elements of “Scarcity” and “Avoidance”, classified as Black Hat drives as seen before. However, these elements are intentionally contained through various design constraints. Only the top three positions are displayed, the scope of competition is limited to mutually consenting peers, and there is no long-term accumulation of rank or status.

By resetting the leaderboard daily and excluding persistent rewards or punishments, the system is designed to offer episodic recognition while trying not to promote any sort of pressure or compulsive engagement. This approach also addresses insights from the stakeholder analysis. While questionnaire respondents did not consistently express interest in social features, clinicians emphasized the potential of social elements. Ethical concerns about competitiveness and pressure were central to how the design of these US ended up being.

Functionally speaking, and akin to US09, the leaderboard system integrates with the existing activity tracking while also taking advantage of experience points mechanisms from the Skill Tree. As users complete activities and their data is stored and updated on the database, their

data is used to update the tables connected to the daily rankings. Then, at the end of each day, the leaderboard resets, giving every participant an equal opportunity to appear.

Overall, these social gamification features are designed to spark motivation through short-term social visibility while respecting ethical boundaries and supporting intrinsic engagement with the App's self-care routines. The following *User Story* captures this functionality.

- **"As** an authenticated user, **I want to** be able to consent to share my performance in activity completion daily, **so that** I can compare my progress with the top performers within the App and aspire to reach the top one day."

Table 13 - US10 Acceptance Criteria

US10 Acceptance Criteria		
Given	When	Then
An authenticated User	They are in the Profile Screen	They are able to toggle the permission to share daily performance indicators (EXP)
An authenticated User	They arrive at the Home screen	The leaderboards for the top 3 EXP gainers and task completers for the current day are showcased
An authenticated User	They gain EXP by completing activities	Their daily EXP counter is updated, and so are the leaderboards

4.3 Tools to be used and Architectural Design

During the early design process, after the requirements were defined and established, the focus shifted to evaluating the tools and programming languages that would best support the successful and complete implementation of those requirements. Additionally, this phase involved defining how the various elements and systems would interact and outlining the architecture to be used. This section of Chapter 4 aims to clarify all the design decisions made regarding these aspects.

4.3.1 Chosen Programming Language, IDE, and Other Tools

From the very initial stages of the project, it was established that the final product would be a digital platform in the form of a smartphone App. As mentioned in the earlier chapters of this dissertation, smartphones are widely used by the target audience. They also provide proximity to users, allowing us to tackle one of our objectives: reducing the number of hours users spend interacting with malicious and unhealthy addictive content on their smartphones.

With this in mind, the choice of tools was somewhat limited yet still quite broad. Several factors influenced the final decision, including the availability of systems for testing and obtaining direct feedback during implementation, ease of use and access to the tools, the extent to which requirements could be implemented using those tools, their customization options, and the benefits of learning to use them.

Taking all these factors into consideration, it was decided to develop a native Android app using Kotlin and Jetpack Compose, with the official Android Studio IDE chosen for coding. These seemed to be the best option for several reasons. First, Android phones are readily available for use, unlike other platforms such as iOS, which could pose a challenge for implementation and testing. Additionally, focusing solely on a single platform (being multiplatform out of scope for this project) meant that using Kotlin with Jetpack Compose would be the most straightforward choice for creating an Android build. This approach also allows for better customization and management of features, as it leverages a framework used directly by Android, such as notifications and phone state interactions, which are often restricted in other development platforms due to permission limitations.

This choice was also motivated by the opportunity to learn how to create smartphone Apps from scratch. While there are low-code and no-code options available for App development, using Kotlin and Jetpack Compose promotes learning valuable skills and insights into the inner workings of smartphone applications, which are increasingly in demand. This approach allows for a higher level of customization, which is also essential for our project.

4.3.2 Architectural Choices

The official documentation for Android developers outlines best practices and recommendations for creating high-quality Android Apps. It emphasizes the use of readily available Android functions and classes and recommends a suitable app structure. The documentation highlights common architectural principles that assist in creating scalable, robust, and testable Android applications. These principles include: separation of concerns, driving UI from data models, maintaining a single source of truth, and implementing unidirectional data flow. [65]

Based on these principles, the Android documentation advises that Apps should consist of a minimum of two layers: the “UI layer”, which displays App data on the screen, and the “data layer”, which contains the business logic. An additional layer, known as the “domain layer”, can be optionally added to simplify and enhance the interactions between the UI and data layers (see Figure 40). [65]

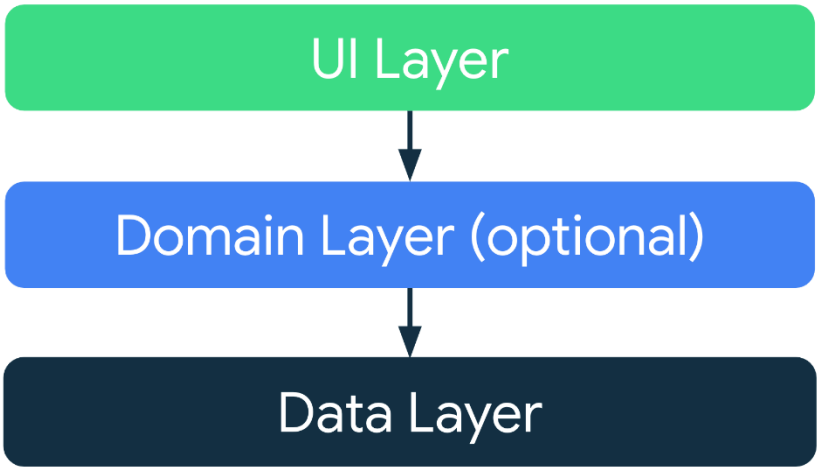


Figure 40 - Android recommended App architecture [65]

Also influential to the final architecture structure was the principle of “Clean Architecture” presented by Robert C. Martin, also known as Uncle Bob. “Clean Architecture” is a software design paradigm that organizes systems into concentric rings of responsibility, insulating high-level policies from low-level implementation details. The core components include “Entities” and “Use-Case” layers, surrounded by “Interface Adapters” and “Frameworks & Drivers” layers (see Figure 41). It enforces a “Dependency Rule”, ensuring that dependencies point inward, which keeps business logic independent of external factors [66][67]. As best described by Uncle Bob in his blog [67]:

“The overriding rule that makes this architecture work is ‘The Dependency Rule.’ This rule says that source code dependencies can only point inwards. Nothing in an inner circle can know anything at all about something in an outer circle. In particular, the name of something declared in an outer circle must not be mentioned by the code in the an inner circle. That includes, functions, classes. variables, or any other named software entity.
By the same token, data formats used in an outer circle should not be used by an inner circle, especially if those formats are generate by a framework in an outer circle. We don’t want anything in an outer circle to impact the inner circles.” [67]

This approach enhances testability and allows for the easy replacement of components without impacting core behavior. Robert C. Martin emphasizes that architecture should highlight the system’s use cases, treating frameworks and databases as replaceable details for better adaptability and maintenance. By centralizing changeable code at the periphery, “Clean Architecture” supports isolated unit testing, clearer separation of concerns, and lower coupling, making it beneficial for evolving systems. [66][67]

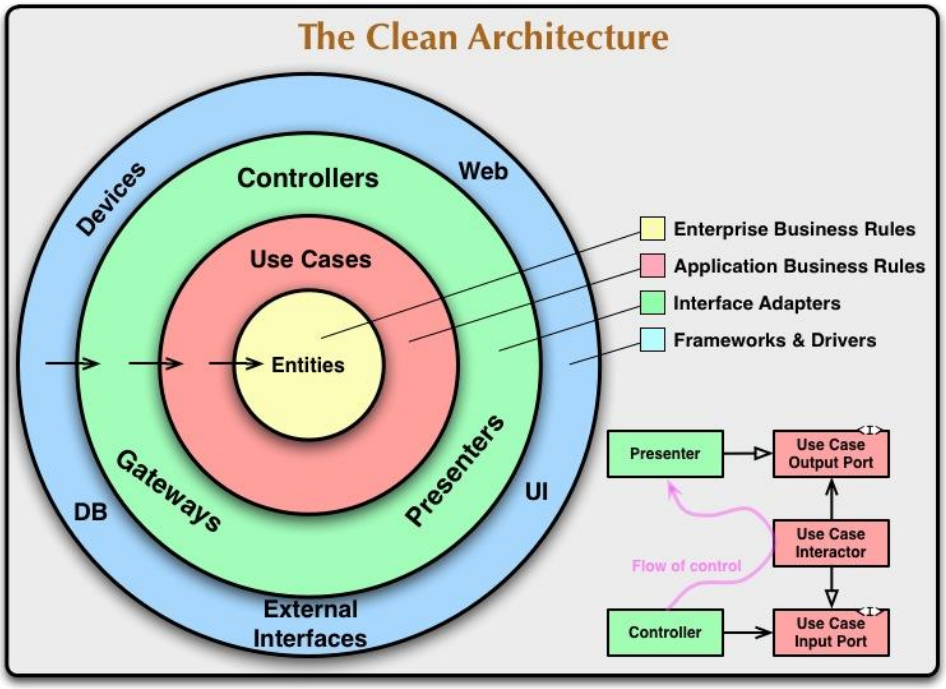


Figure 41 - "The Clean Architecture" Idea diagram by Uncle Bob [67]

Influenced by both Android documentation and Robert C. Martin's idea, the architecture used for this project's App is that of Clean Architecture MVVM (Model-View-ViewModel). A diagram made in Figma of the architecture's structure can be seen in Figure 42 - Project's App Architecture.

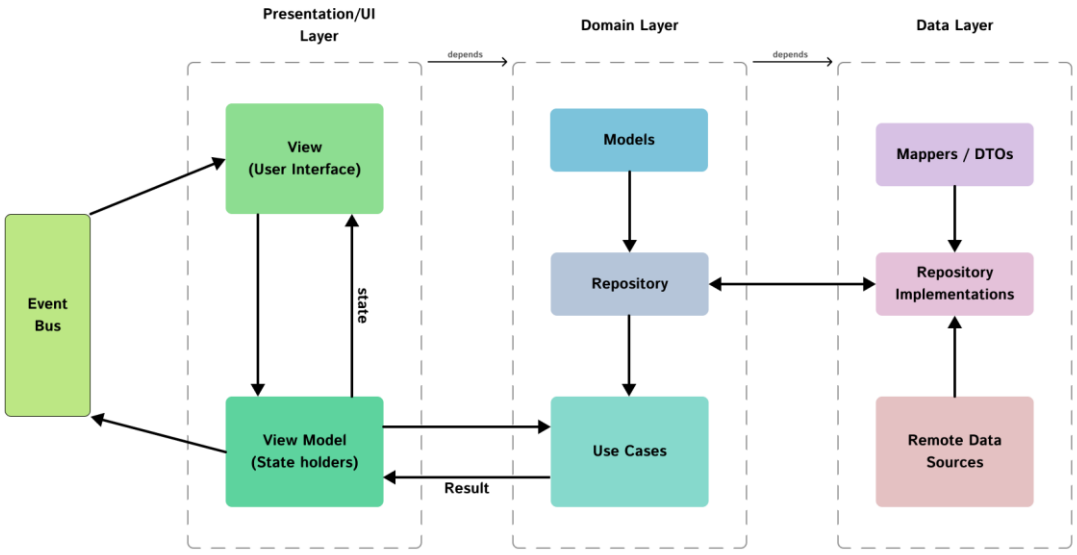


Figure 42 - Project's App Architecture

4.4 Overall Theme and User Interface (UI)

Before defining and designing the various components of the user interface, the overall theme of the App was established. It was decided that the App's theme would be based on the worlds of high fantasy Role-Playing Games (RPGs) and narratives.

This choice may not come as a surprise, given the already mentioned project's motivation: fantasy RPGs are a common interest among the target audience. Moreover, these types of games are often associated with individuals who use them as a means of escapism, allowing gamers to immerse themselves in RPG worlds and experience a false sense of comfort through dissociation. Massively Multiplayer Online RPGs (MMORPGs) are particularly known for attracting individuals who may struggle with socialization and social skills, leading some to become trapped or even addicted to these virtual environments. Since the project also aims to serve as a bridge for young adults (many of whom are gamers or struggle with internet addiction) between the online world and real life, as well as promote mHealth, it made sense to base the App on the themes common in high fantasy RPGs.

Consequently, the project's App was named *MentalPotion*, inspired by the familiar mana and health potions often found in the RPG genre.

Figure 43 - *MentalPotion's* logo, generated using *ChatGPT* and edited with *GIMP*

From the logo used (Figure 43) to the various elements and colors, the App was heavily inspired by the fairy, otherworldly, and dreamy aspects of high fantasy stories. The chosen color palette (shown in Figure 44) also reflects this inspiration.

Figure 44 - *MentalPotion's* color palette

Furthermore, the visual identity and color palette of *MentalPotion* were also designed based on principles of color theory. The goal was to create an interface that conveys calmness, coziness, and approachability while minimizing overstimulation, especially because, as was previously discussed, users who seek the App might be overstimulated by negative emotions. The chosen palette features muted earthy tones, such as beige and soft greens, combined with cooler shades of teal and blue, along with deeper purples and darker hues.

Narratively, this palette aims to reflect the project's view of mental health as a journey that is both deeply personal and transformative, evoking "otherworldly" landscapes where growth, resilience, and transformation occur. To grow as a person should be viewed here as a journey up a mountain into the far reaches, where even the sky is not the limit. Cosmic elements are also used as a metaphor of mental health being something unknown, just beyond our grasp and our comprehension, but there to be explored and expressed: to grow mentally is to ascend. This is perfectly encapsulated by the background created for the App using *FIGMA*, seen in Figure 45.

Figure 45 - The first themed element created for "MentalPotion"

From a psychological perspective, the colors and tones used in the platform aim to evoke a sense of coziness, trust, growth, and natural calmness. These qualities reinforce the *MentaPotion's* role as a supportive and non-threatening companion.

Teal and blue dominate the visual landscape and are applied to most elements of the App. Although these are cold colors, they are commonly associated with positive concepts such as trust, calmness, and wisdom. This aligns perfectly with the app's theme and overall concept. While blue can sometimes be linked to sadness, in this context, it may foster a sense of relatability for users who might find solace in sadder environments and, therefore, feel more inclined to open up about their feelings. [68]

Furthermore, the inclusion of purples and darker accents alongside the blue elements helps create a cozier and introspective atmosphere. Purple is often associated with mystery, creativity, and wisdom, further enhancing this effect. Although not prominently featured, red is used to highlight emergency and important elements due to its associations with danger and warning. Then, balance and contrast are achieved through the addition of earthy yellow and golden elements, which are colors positioned opposite the darker shades of blue and purple on the color wheel. These lighter tones of yellow provide a sense of optimism, warmth, and energy to the App. [68]

5 Iterative Development and Testing

This chapter outlines the development and evaluation process for the MentalPotion platform. As previously mentioned in the Methodology Overview section from Chapter 1, the project adopted a hybrid approach that combined elements of Agile and Waterfall methodologies, progressing through two distinct iterations in the case of this project. Each iteration involved cycles of design refinement, implementation, and then testing, reflecting the methodology chosen for this dissertation, as detailed in Figure 46.

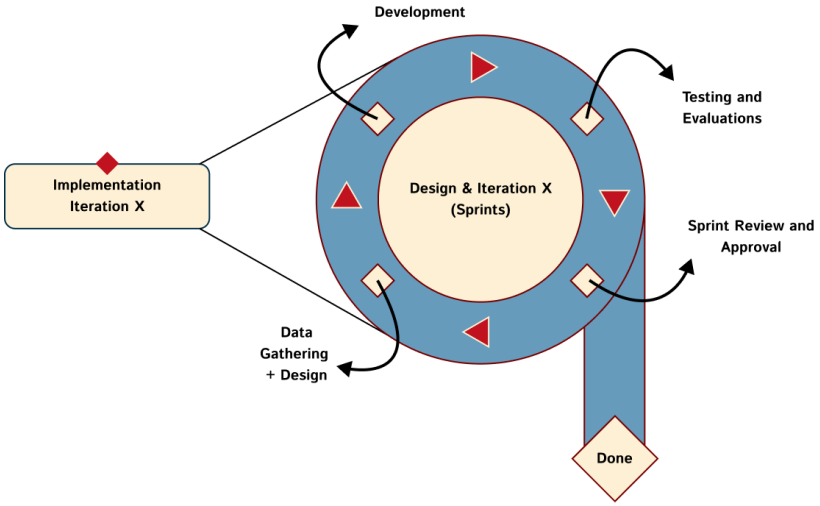


Figure 46 - Implementation Iteration process

The idea behind this structure, as also mentioned before, is straightforward: the project aimed not only to create a functional prototype but also to validate the effectiveness of gamification strategies in enhancing engagement with an MH-related self-help tool. Consequently, testing was conducted concurrently with development, influencing subsequent design choices and implementation steps.

This chapter is organized as follows: first, it presents the recruitment process for testers, providing context about who participated in the testing. Next, it explains the testing structure and plan, detailing how testers interacted with the platform parallel to its development, and how feedback was collected. Finally, each iteration is presented in detail, with subsections dedicated to its specific design refinements, feature implementation, and the results of the testing phase.

5.1 Data Storage and Structure

The crucial first step of the development phase, especially for complex projects that depend so much on stored data and data handling, such as this one, was defining where and how the data will be stored. This section is dedicated to outlining these aspects and how the App will be distributed.

Two main types of data will be stored during the App's lifecycle: relational data and non-relational data. Relational data includes entities such as the user's schedule and profile settings, while non-relational data consists of items like images used for in-app topics.

For relational data, the choice of tools is facilitated by Android Studio and the chosen programming language. *Firebase*, a *Google*-backed Backend-as-a-Service (BaaS) platform, is officially supported and provides in-IDE integration within Android Studio. Three *Firebase* services will be utilized to manage the project's data: "Firebase Authentication" allows users to sign in to the App with email and password and to request password resets while keeping their personal information secure. "Firestore Database" will store the App's relational data, and "Firebase App Distribution" will provide simple deployment of the App and its versions for testers.

Relational data will follow the structure of the Entity Relationship Diagram (ERD) produced code that is present in Appendix E: Entity Relationship Diagram ".dbml" Format.

Non-relational data, such as images, will be stored using *Supabase*, which is a relatively well-known alternative to "Firebase Storage". This choice is made to avoid overloading *Firebase* with requests and to maintain operations within the free usage quota. When using "Supabase Storage", images that are uploaded to it create a hyperlink that allows access to the images externally. This is how images will be loaded within the App.

5.2 Tester Recruitment and Characteristics

To test the App, seven individuals were recruited to participate over a four-week period, serving as co-informants within the iterative cycles of implementation. Selection focused on demographic fit (adolescents and young adults aged 16–25, the project's target audience), availability for in-person interviews, and willingness to engage throughout the testing cycles. Because invitations were limited to trusted personal contacts who met these criteria, the participant pool ended up being small, but this ensured a high level of trust and openness during the process.

Given the small and intentionally selective group, the testing phase followed a qualitative rather than quantitative approach. As a result, the insights gained are valuable but cannot be generalized to broader populations. Additionally, reliance on personal contacts may introduce potential bias and social influence. However, it also encouraged participants to share candid feedback.

All participants were volunteers who were fully informed about the scope of their involvement, but were not told about the objective of the project nor the features of the App. While not everyone had prior clinical experience or familiarity with similar digital health tools, they represented potential end-users, making their contributions important for validating design assumptions and measuring the effectiveness of the project

The technical distribution of the App was managed through *Firebase App Distribution*, allowing testers to remotely install development builds on their Android devices and simplifying version control.

5.3 Testing Structure and Plan

The primary goal of the testing phase was to evaluate how well the developed *MentalPotion* platform and its features, as outlined in the User Stories, resonate with the audience. The focus was particularly on user engagement and the perceived usefulness of the App. To accomplish this, user reactions and qualitative feedback on the platform were gathered, both before and after the introduction of gamification features.

The testing process was designed to run in parallel with the development iterations, allowing for ongoing evaluation rather than postponing it until the project's completion. This approach ensured that feedback could directly inform each new version of the app.

The structure of the testing phase followed an iterative design process, divided into two key stages, each corresponding to a specific build of the application. These stages can be seen in Figure 47.

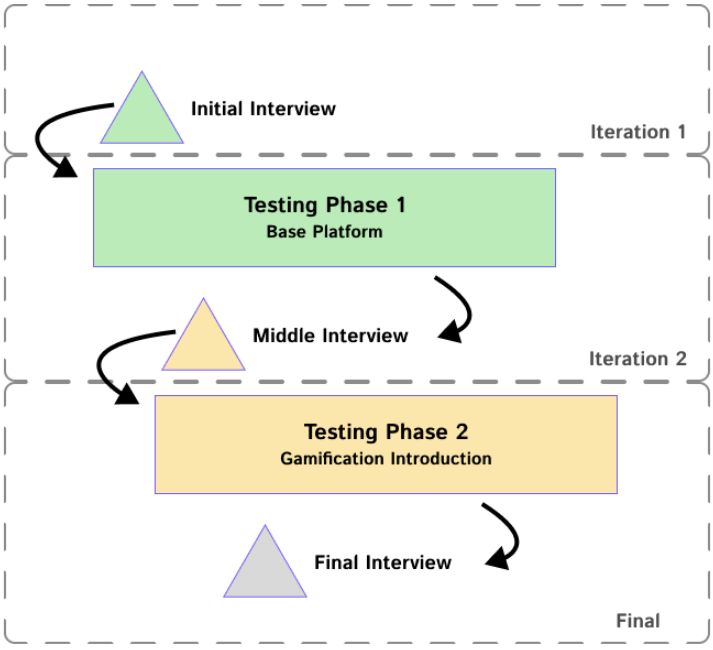


Figure 47 - Testing phase structure

The duration of each defined key stage was 2 weeks. It should be noted that the initial interview was conducted during the first development iteration, while the middle interview was conducted in the second iteration. The final interview, on the other hand, was conducted after overall development was completed and during the final stretch of the project. The timeline for the overall testing phase is displayed in Table 14 - Timeline table for the testing phases.

Table 14 - Timeline table for the testing phases

Phase	Duration	Description
Initial Interview	Day 0	App onboarding and initial impressions
Testing Phase 1	~2 weeks	Bug correction and App usage without gamification and without a tutorial
Middle Interview	End of Week 2	Feedback + introduction of gamified version and tutorial
Testing Phase 2	~2 weeks	App usage with gamification
Final Interview	End of Week 4	Final feedback + comparative reflection

In the first stage of testing, participants were introduced to a basic, incomplete version of the App that intentionally excluded gamification elements and a tutorial, specifically missing US03, US09, and US10. This served as a control to assess baseline engagement and identify potential bugs or usability issues. By omitting gamification features, the effects of their presence and absence in this genre of Apps could be further inferred and possibly support the work done in this project. The decision to exclude a tutorial was made to evaluate its impact on user clarity

and frustration, and to bring changes that could detract users from giving full focus to gamification in the second version of the App. While the questionnaire results indicated no clear preference between in-App guidance and complete self-sufficiency (similar to what some other Apps do), doing this might help determine whether users feel frustrated or satisfied when left to navigate the app on their own.

After two weeks of independent use, a mid-phase interview was conducted to collect feedback. The second stage introduced the gamification features of US09 and US10, along with a tutorial on the App. Participants then used the App for another two weeks, after which a second interview gathered insights on how these elements influenced engagement, motivation, and usability.

A final interview was held at the end of the study to reflect on the overall experience and compare non-gamified with gamified usage. Throughout the study, ongoing feedback was also collected asynchronously via a private group chat, where participants could report bugs, share impressions, and receive updates.

5.4 Development Iteration 1

The first iteration marked the initial full development cycle of the project. The version of the App produced in this iteration focused on the core architecture, essential features, and an initial user interface. The primary goal was to validate the project's foundations and gather early impressions from testers. The *User Stories* that were implemented in this version can be seen in Table 15 - v1 Implemented User Stories.

Table 15 - v1 Implemented User Stories

v1 Implemented User Stories		
ID	Title	Priority
US01	User Authentication	High
US02	Account Profile	High
US04	Emergency Help	High
US05	Routine Creation	High
US06	Activities	Medium
US07	Topic Exploration	Medium
US08	Resource Tools	Low

Instead of aiming for completeness or polish, this stage prioritized building a minimal but usable version that could support the App's basic and future features. This approach allowed feedback gathered during testing to focus on fundamental aspects such as navigation and clarity of purpose, without the influence of gamification. It also enabled inferring whether gamification

elements were aspects that testers would suggest as future improvements and whether their responses regarding engagement would differ once gamification was implemented.

The following subsections describe the design decisions made for this initial base version, the technical implementation work carried out, and the main results obtained from the testing phase.

5.4.1 Version 1, Step 1: Initial UI Design and Detailed Wireframes

With the overall themes for the App previously defined in Chapter 4, the iteration began with designing the base version's user interface (UI) using the design tool FIGMA. The UI screens created during this phase provided a more refined version of the usual wireframes and were based on the established theme and color palette. These screens served to illustrate how the defined user stories would be presented within *MentalPotion*.

Starting with the landing page, which is the first screen users encounter upon entering the App, users should be able to choose between logging in or creating a new account. Both the wireframes for the login and registration screens have been drafted and are present in Figure 48 - Authentication Flow Wireframes

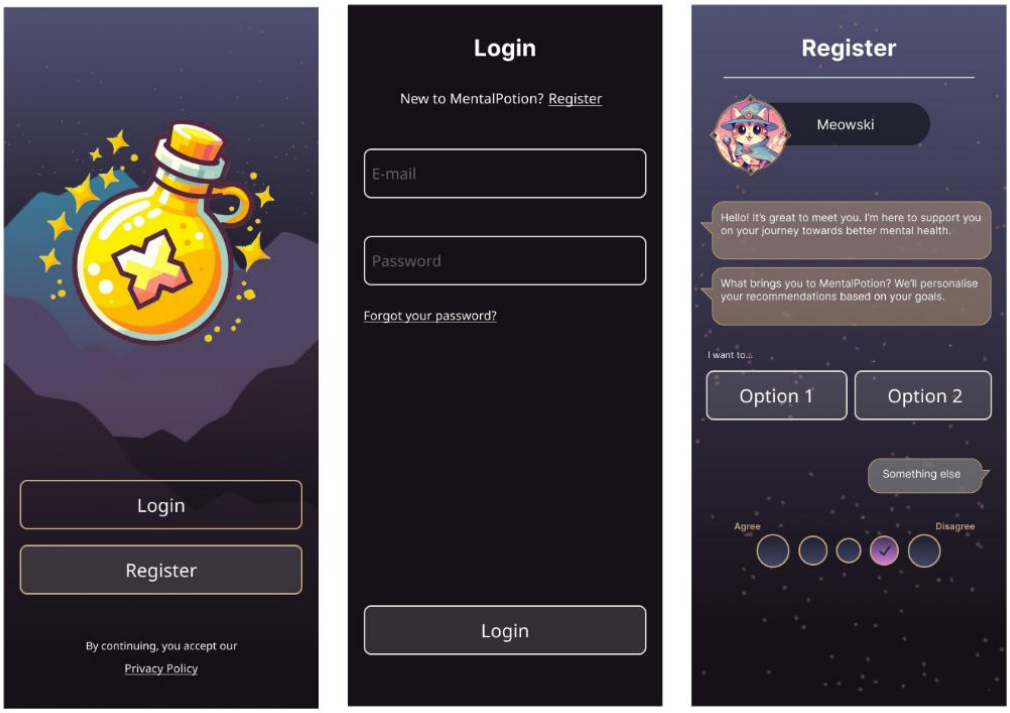


Figure 48 - Authentication Flow Wireframes

At the end of this flow, regardless of the user's choice, they will be redirected to the “Home” screen. This page will showcase the main components of the App through a tab system. The user's schedule will prominently feature on this page, along with a list of activities scheduled for the current day. Additionally, the feature addressing User Story 04, emergency help, will also appear on this screen as a “crisis” button, highlighted in red. These elements are illustrated in Figure 49 - v1 Home Screen Wireframes, which depicts the drafted UI for the home page.

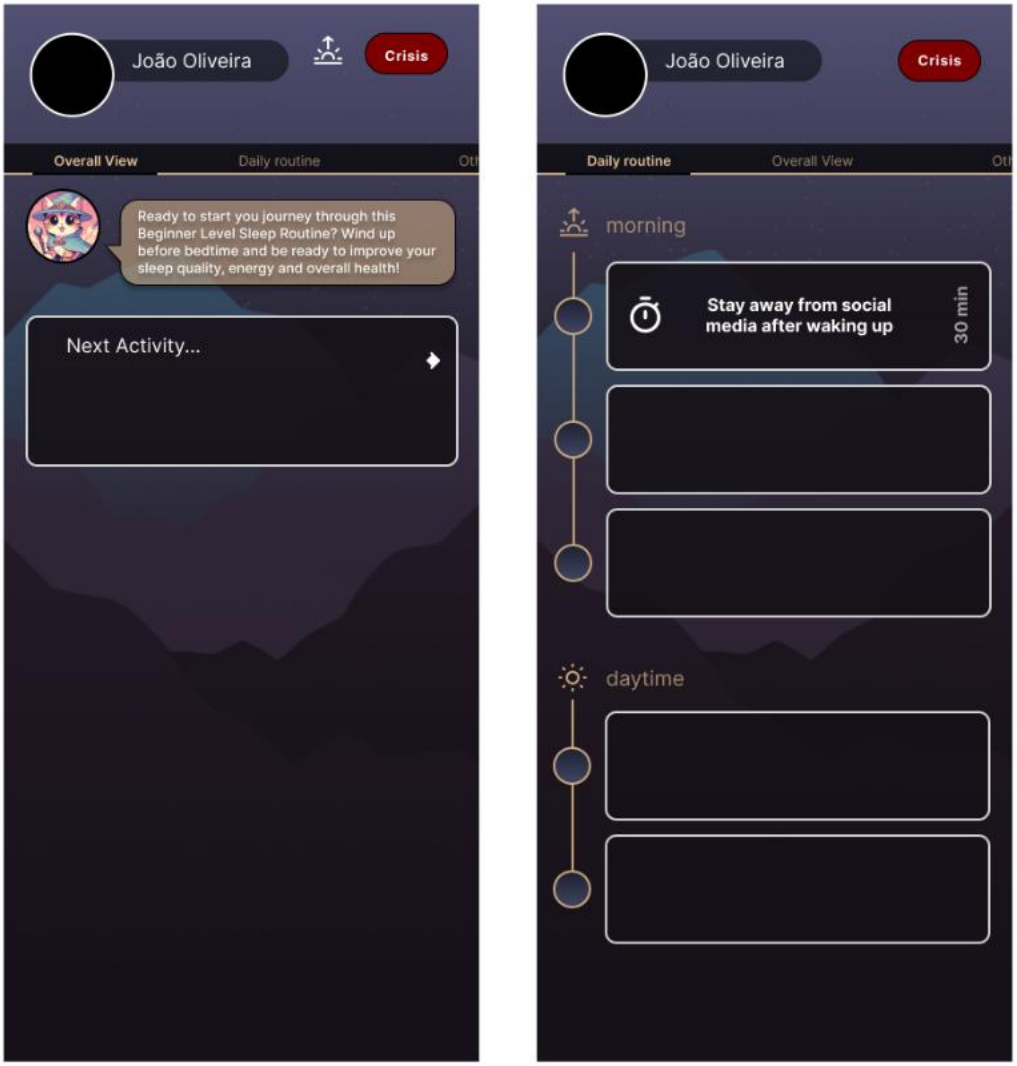


Figure 49 - v1 Home Screen Wireframes

To accommodate User Story 02 (account profile), a dedicated screen for the user's profile was developed, where their username and avatar are displayed and can be changed. Most of the drafted UI was specifically left empty to accommodate future features, such as the user's progress. The drafted design for the profile is showcased in Figure 50 - v1 Profile Screen Wireframe.

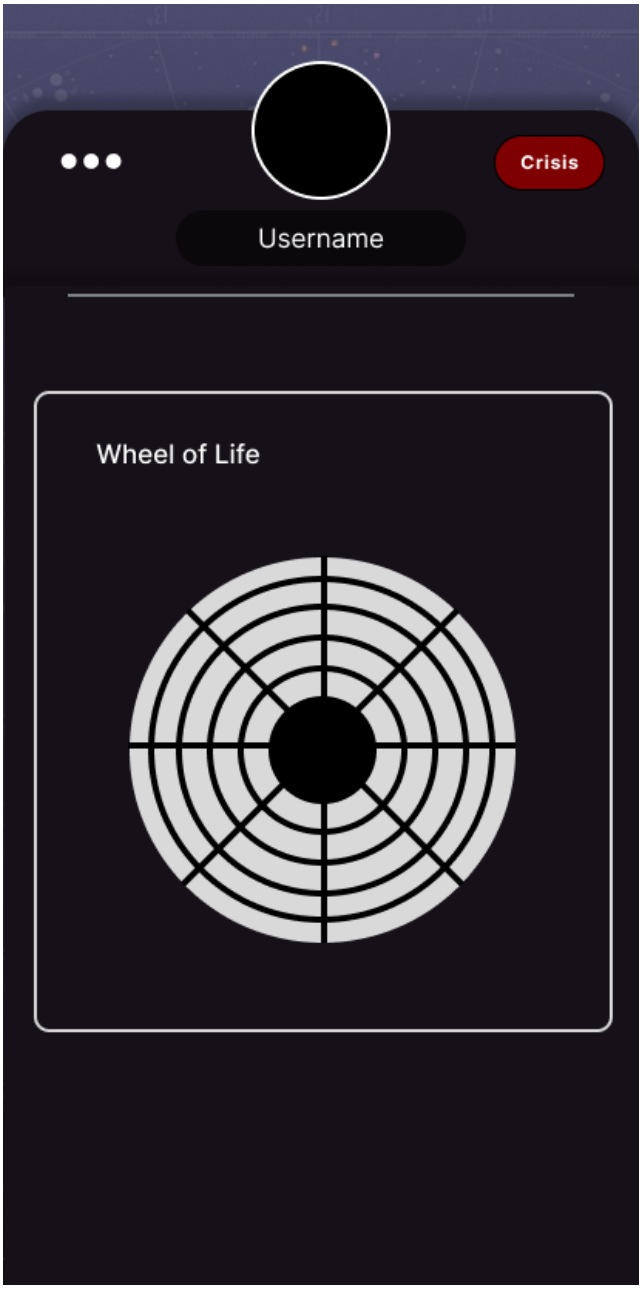


Figure 50 - v1 Profile Screen Wireframe

The remaining screens drafted for design pertain to features related to US07 (topic exploration) and US08 (resource tools). Initially, users can view a list of available topics and search for specific topics or keywords using a search bar located at the top of the topics list screen. Once a topic is selected, a dedicated topic page opens, allowing users to view routines associated with that topic, organized by difficulty. This enables them to easily add routines to their schedule. At the bottom of the topic detail screen, there is a resource section that categorizes the available resources into tabs for users to access. These design choices and related screens can be seen in Figure 51 - Topic Flow Wireframes.

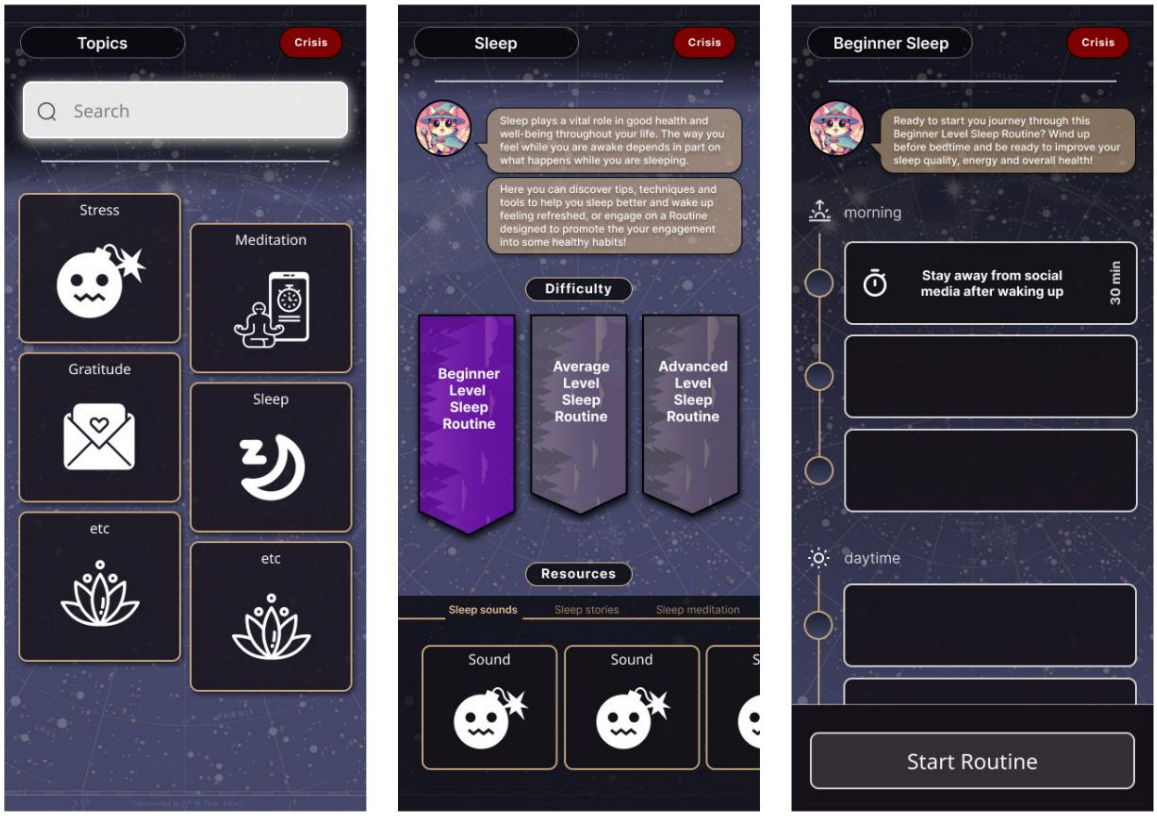


Figure 51 - Topic Flow Wireframes

5.4.2 Version 1, Step 2: Implementation of the Base Version

The implementation of this project is outlined in the following subsections, each corresponding to a specific User Story. In these sections, how each User Story was implemented will be described alongside the tools used in the process. Since the implementation details are not the primary focus of the project and do not provide as much valuable information as other sections, this overview will be a summarized version of the key aspects of the implementation.

5.4.2.1 US01 – User Authentication Implementation

The project was developed using Kotlin Compose in Android Studio. This choice of Integrated Development Environment (IDE) and programming language facilitated easy integration with various Google Firebase tools and infrastructure (see Figure 52). One of these essential tools, which was used to implement this US, is the *Firebase Authentication* system, enabling the integration of an authentication system through multiple login providers or a custom authentication solution.

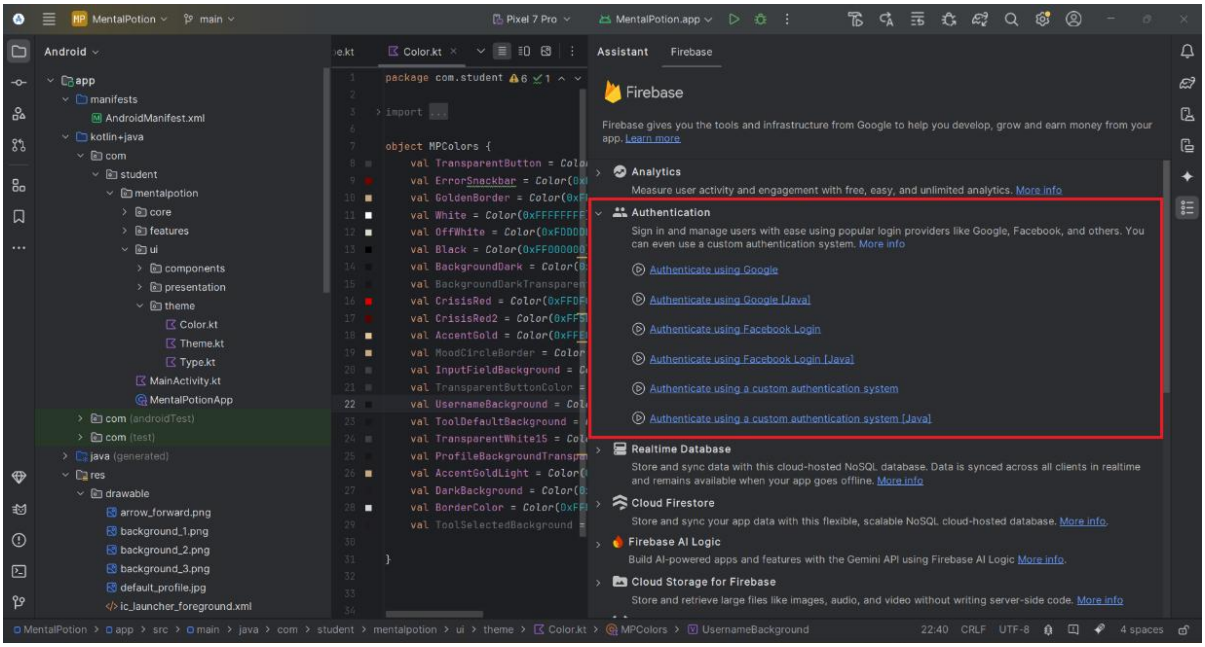


Figure 52 - Android Studio display of Firebase tools

For the current scope of the project, only email and password login is required and implemented, which was deemed sufficient for this phase of the project. Utilizing *Firebase's* authentication system not only ensured security for handling login-sensitive data but also provided additional resources that enhanced overall UX and App quality. Following the documentation and tutorials provided by *Firebase* and *Android Studio*, it was straightforward to associate the App with *Firebase*.

Another advantage of using this authentication system was access to resources such as email verification and password reset methods (as can be seen in Figure 53), which were employed in *MentalPotion*.

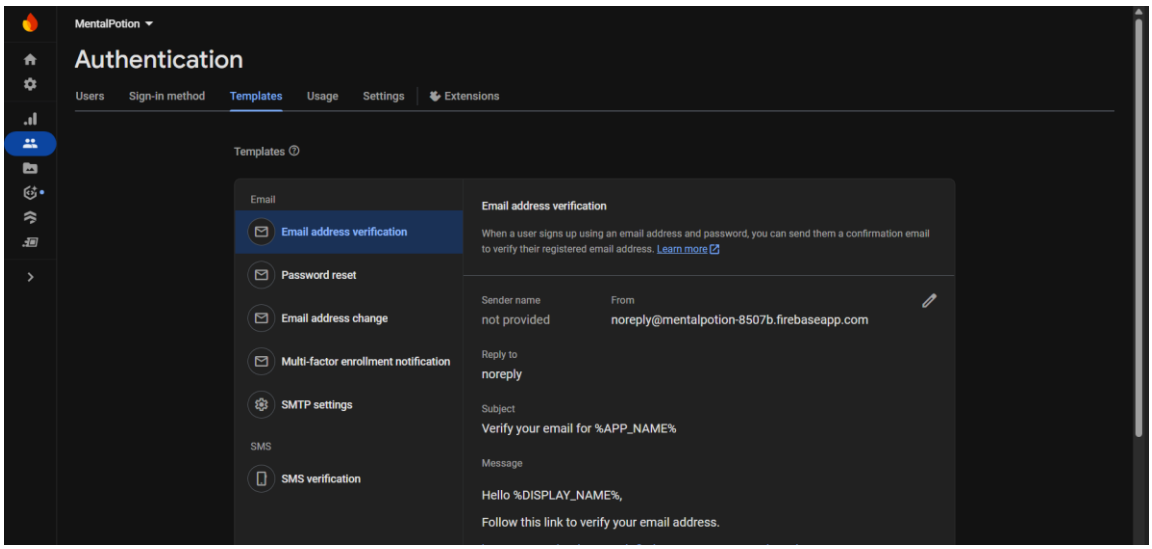


Figure 53 - Firebase's available resources for Authentication handling

The implemented code adheres to a structure where it is organized into data, domain, and presentation layers. In the presentation layer, the theme and user interface (UI) were designed to closely follow the intended design, resulting in the final product showcased below, in Figure 54.

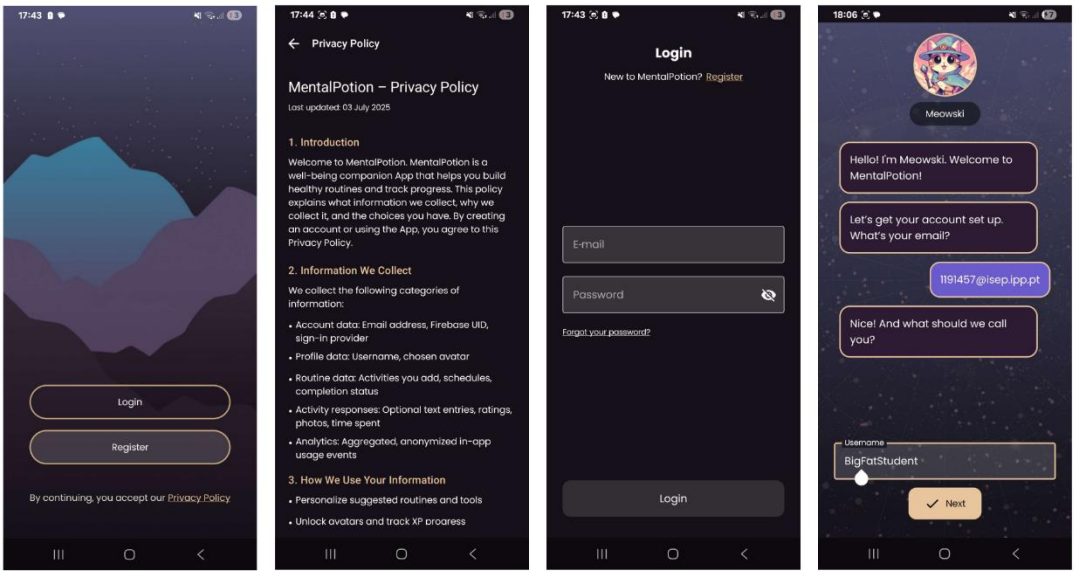


Figure 54 - v1 Authentication UI

5.4.2.2 US02 – Account Profile Implementation

To implement *User Story 02*, which focuses on displaying the user's in-App account, *Firebase's Firestore Database*, a relational database system, was used. This choice once again provides a more secure environment compared to custom databases while still allowing customization as needed and maintaining the main tools used in the same *Firebase* environment.

The database entities outlined in *MentalPotion's* architecture and ERD were defined within *Firestore*, along with some initial template values to populate various aspects of the App, such as user avatars. The related documents for each user are created upon registration in the App. The rules for accessing each database table were also defined here.

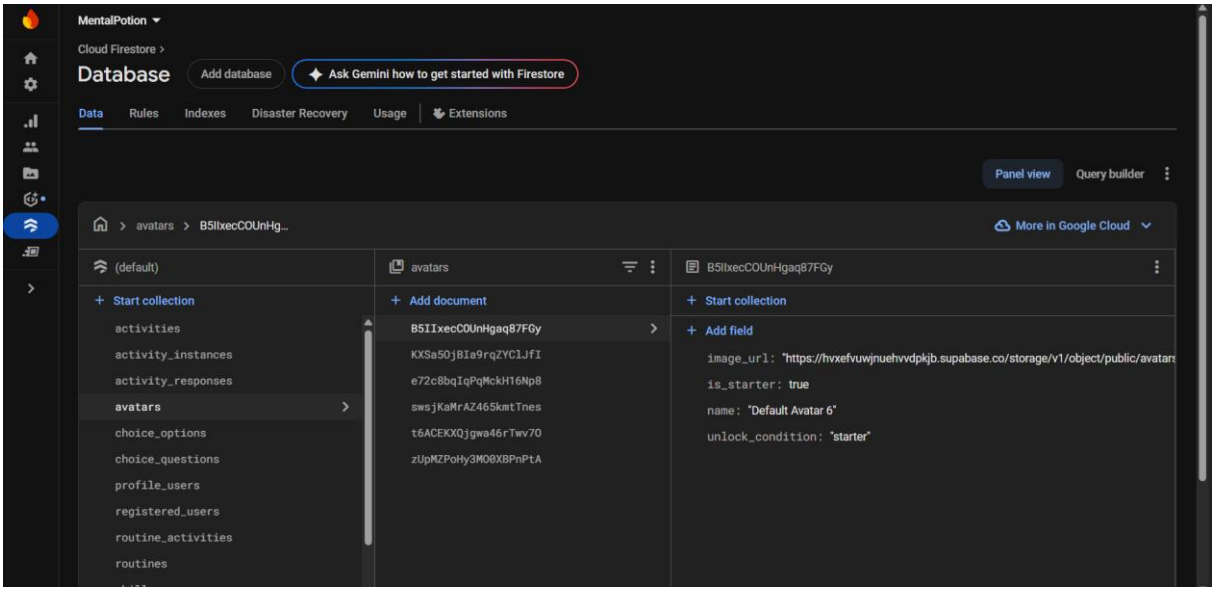


Figure 55 - Firebase's Firestore Database for MentalPotion

For non-relational data storage, such as images, *Supabase Storage* was used. This choice was made primarily to minimize potential workload and billing costs associated with *Firebase* tools. For the avatars, each image was uploaded to *Supabase*, and once uploaded, an associated URL was linked to the relevant entity document in *Firestore*.

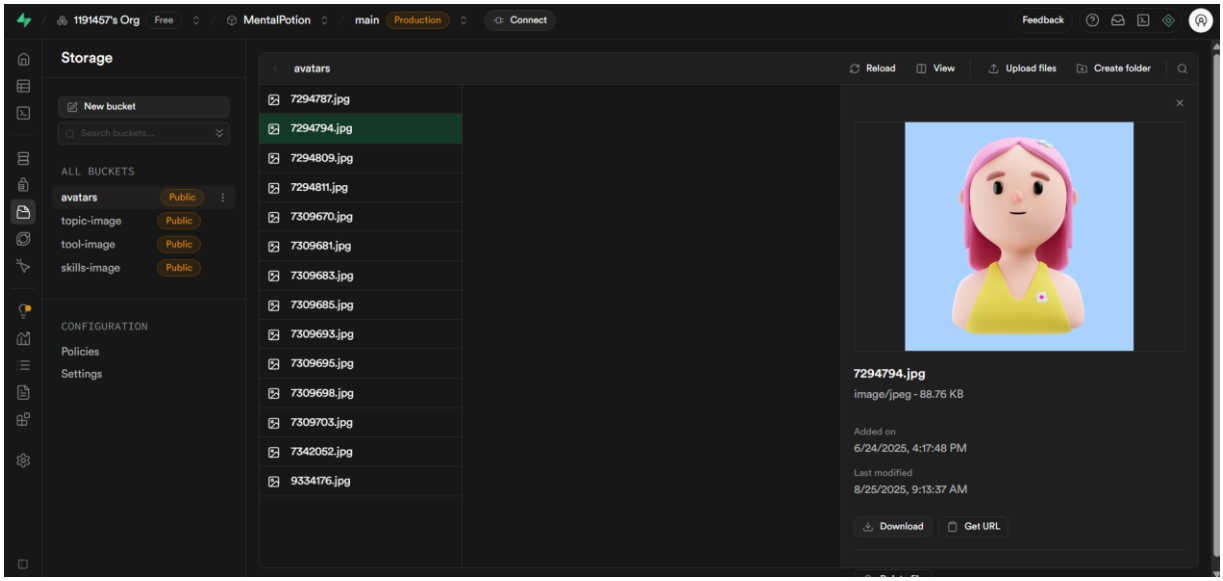


Figure 56 - Supabase's Storage for MentalPotion

Additionally, the profile screen features a dropdown menu that includes an option to log out, utilizing once again *Firebase's* Authentication resources. The resulting UI screen for the user's profile is shown in Figure 57.

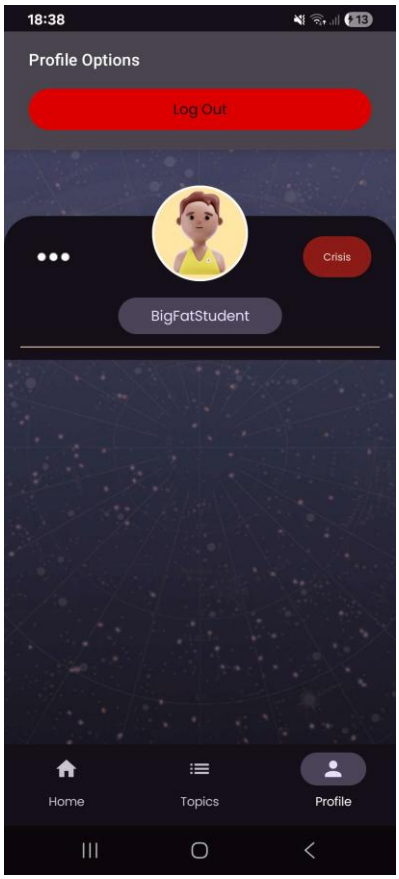


Figure 57 - v1 Account Profile UI

5.4.2.3 US04 – Emergency Help Implementation

As previously discussed, the emergency feature of US04 has been implemented within the *MentalPotion* App to provide immediate access to crisis resources. This feature is accessible through a persistent entry point in the main user interfaces, such as the home and profile screens.

When users open this feature, they will see a dedicated screen that displays a predefined set of emergency contacts stored locally, including international helplines and local crisis numbers. Additionally, users have the option to save their own personal contacts in local storage. From this screen, users can directly initiate calls or open links using Android intents, without any extra confirmation steps, to minimize delays in urgent situations.

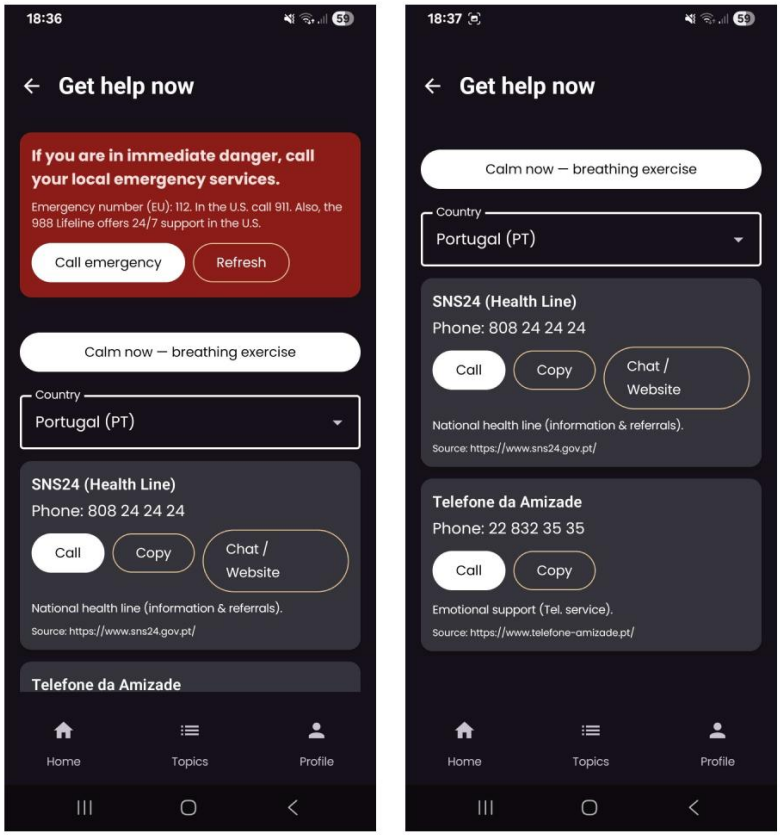


Figure 58 - Emergency UI

This module follows the MVVM structure of the App but operates independently from the core data layer. Its ViewModel provides static resources and locally stored contacts from a local repository, avoiding dependencies on Firebase or network access. The UI observes this ViewModel to render the contact list and trigger native actions, using a minimal interface designed to remain usable under stress. Since it relies solely on local resources, the emergency feature functions without network connectivity.

5.4.2.4 US05 – Routine Creation Implementation

To set up the routine and schedule for users, the focus was on both the database and code development, as this process involved a lot of creating and testing the code related to the schedule. The result of this work is two distinct screens: one for the Home page that shows the day's schedule and another for managing that schedule, both seen in Figure 59 - v1 Home and Schedule Manager UI.

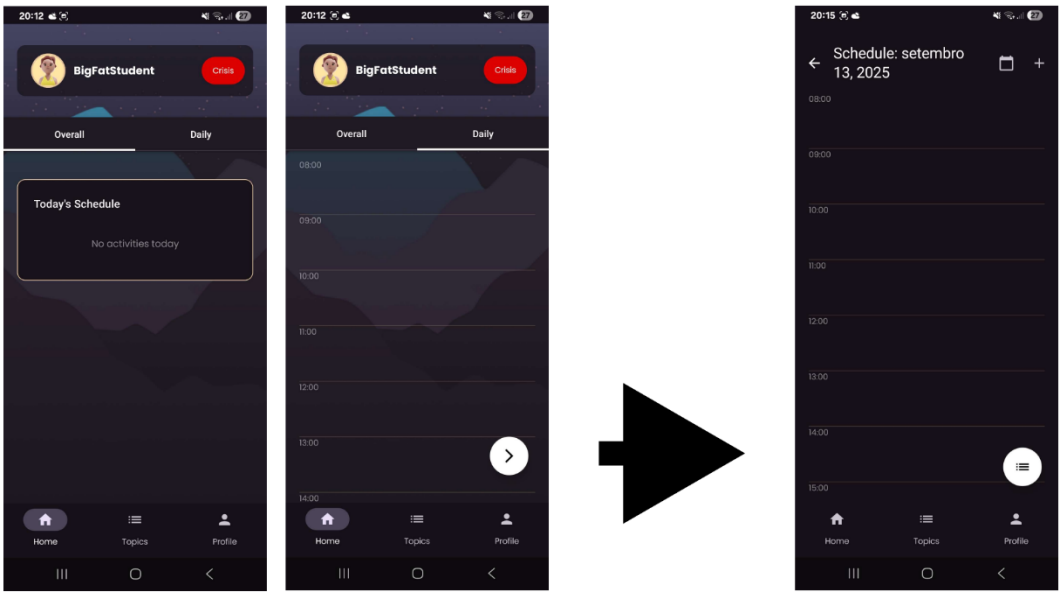


Figure 59 - v1 Home and Schedule Manager UI

The Home screen features a header that displays general user information and provides a link for users to navigate to their profile screen. Below this header, a tab interface has been implemented using "Material Design 3," which is *Google's* open-source design system, which can be seen in Figure 60 - Code implemented for the Home tab system. This tab section includes two distinct tabs: the "Overall" tab and the "Daily" tab.

The "Overall" tab presents today's scheduled activities and will eventually include leaderboards. The "Daily" tab displays the user's schedule for today in a calendar format. When users click on an activity in the "Daily" tab, the system attempts to open it. If the current time is not within the scheduled time block for that activity, a Snackbar notification appears to warn the user.

```
221         Surface(
222             modifier        = Modifier
223                 .fillMaxWidth()
224                 .height(50.dp),
225             color           = DarkBackground,
226             shadowElevation = 4.dp
227         ) {
228             TabRow(
229                 selectedTabIndex = pagerState.currentPage,
230                 containerColor   = Color.Transparent
231             ) {
232                 HomeTab.entries.forEachIndexed { index, tab ->
233                     Tab(
234                         selected = pagerState.currentPage == index,
235                         onClick  = {
236                             scope.launch { pagerState.animateScrollToPage(index) }
237                             onTabSelected(tab)
238                         },
239                         text = { Text(tab.name) }
240                     )
241                 }
242             }
243         }
```

Figure 60 - Code implemented for the Home tab system

The home page can also be used to clearly illustrate the structure of the project's architecture. Its tab system is part of the "View" in the MVVM (Model-View-ViewModel) framework, belonging to the presentation layer. This layer also includes the UI state, responsible for managing the flow of data from the home "ViewModel." These components together form the presentation layer, which is tasked with rendering the interface and responding to user interactions. The file structure from the project aligns with this layer, as seen in Figure 61.

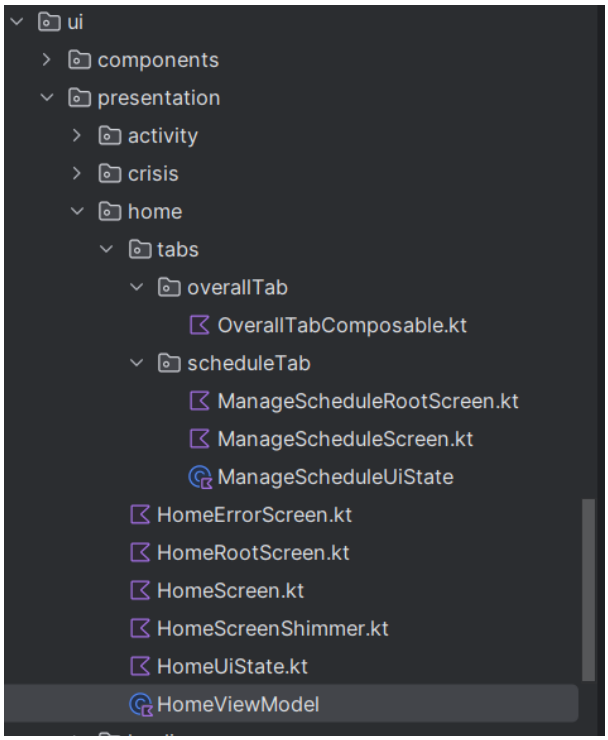


Figure 61 - File structure of the presentation layer for the Home screen

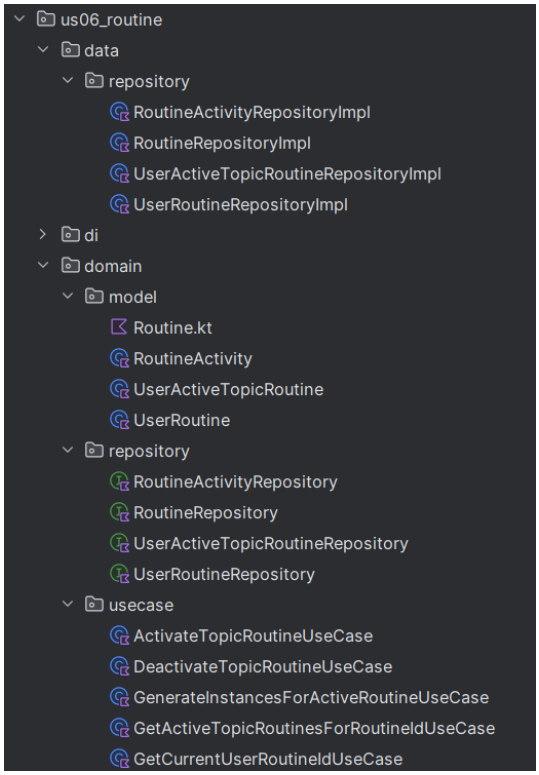


Figure 62 - File structure of the domain and data layer for the routine feature

Then, the "ViewModel" serves as an intermediary between the presentation layer and the domain layer. It communicates with “Use Cases” located in the domain layer that contain the core application logic and operate on the domain models. These use cases depend on repository interfaces to access data. The actual implementations of these repositories reside in the data layer, where interactions with external data sources, such as the *Firestore database*, are managed. For example, when the home page needs to display the user's schedule, the “ViewModel” calls the appropriate “Use Case”, which retrieves data through a repository implementation (which can be seen in Figure 63) in the data layer that queries *Firestore* and returns the results back up the chain.

```
class RoutineRepositoryImpl(
    private val firestore: FirebaseFirestore
) : RoutineRepository {

    private val routineLinkCol get() = firestore.collection("user_active_topic_routines")
    private val routineActivitiesCol get() = firestore.collection("routine_activities")
    private val instancesCol get() = firestore.collection("activity_instances")

    override suspend fun getRoutineById(id: String): Result<Routine, NetworkError> {
        return try {
            val doc = firestore.collection("routines")
                .document(id)
                .get()
                .await()

            val dto = doc.toObject(RoutineDto::class.java)
            if (dto != null) {
                Result.Success(dto.copy(id = doc.id).toDomain())
            } else {
                Result.Error(NetworkError(ApiError.NotFound, Throwable("Routine not found for id=$id")))
            }

        } catch (e: Exception) {
            Result.Error(e.toNetworkError())
        }
    }
```

Figure 63 - Repository Implementation of Routines in the Data layer

Going back to the UI of the home screen, in the bottom right corner of this tab section, a floating action button (seen in Figure 64) directs the user to the schedule manager screen.

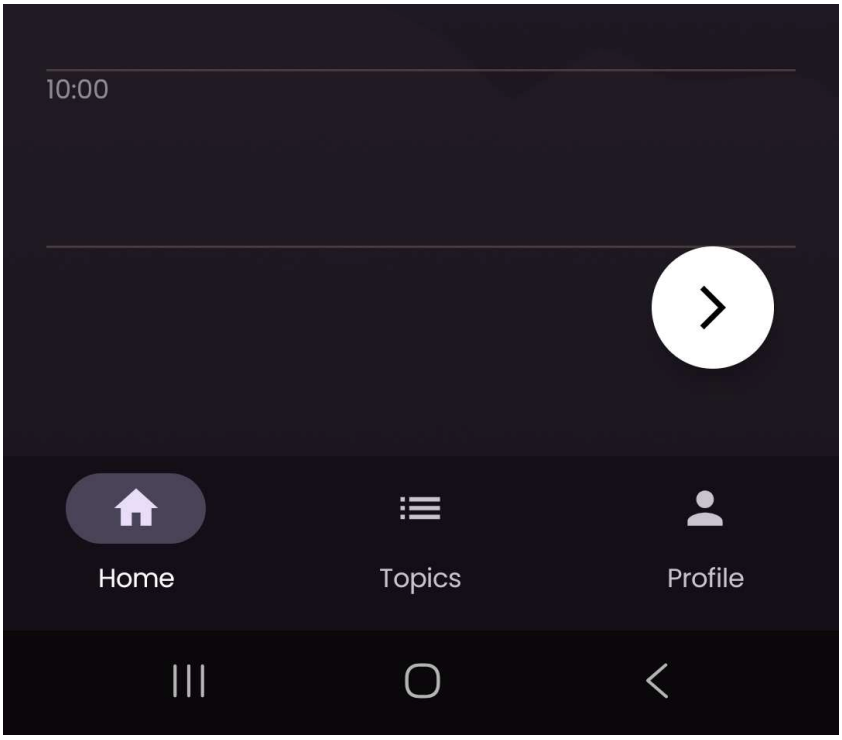


Figure 64 - v1 Home UI schedule's floating button

Users can create or delete custom activities and view their schedules for various days, including both past and future dates, on this schedule manager screen (detailed in Figure 65). This screen interacts with the *Firestore Database* to manage documents related to the user's routine. Here, users can add activities to their schedule with the intention of integrating these activities into their daily routine. The types of activities that can be created within the routine will be further detailed in the subsequent section on US06, which focuses on transforming static activities into dynamic in-app activities.

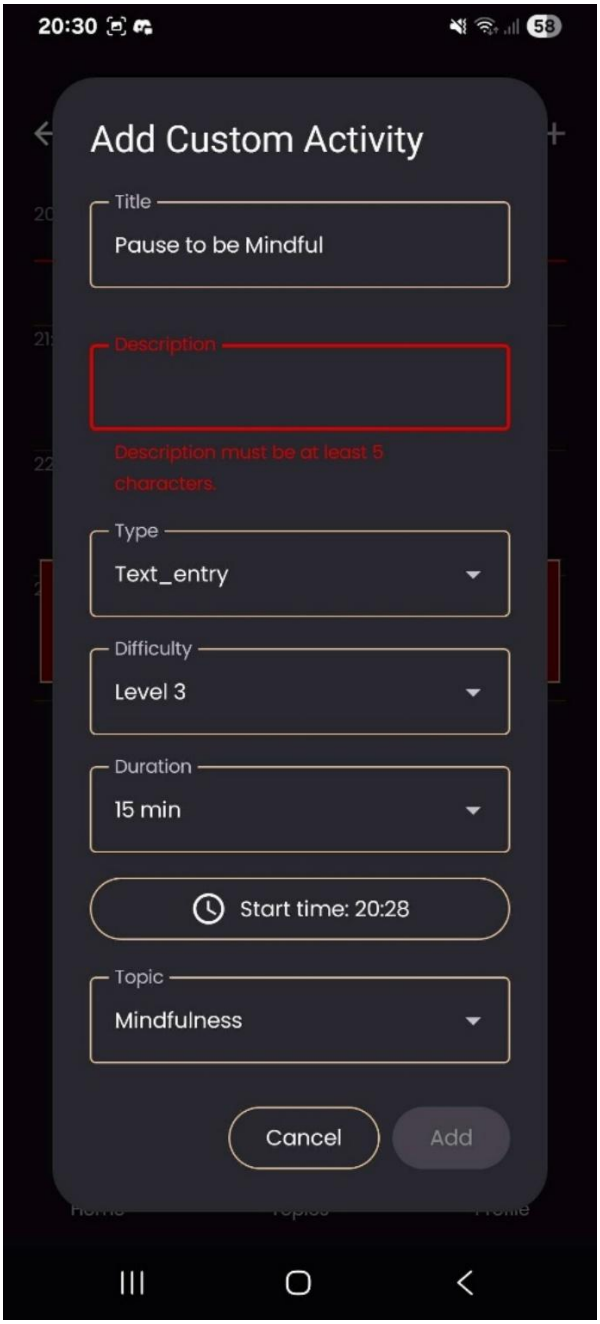


Figure 65 - UI dialog for activity creation

5.4.2.5 US06 – Activities

To enhance the user experience, various types of activities were implemented to complement the previous *User Story* and provide users with the means to learn and complete tasks while within the App. This implementation utilized an Enum class named "ActivityType," which can be seen in Figure 66. The Enum class was employed to determine whether a specific type of

activity could be created as a custom activity, using a boolean value, while also providing a readable name through a string value.

The values from the Enum allow activities to be associated with one of the showcased activity types and for this association to persist in the database. Also importantly, the Enum enables differentiation between types, allowing the code to recognize each type of activity and redirect the user to the appropriate screens in the user interface.

```
enum class ActivityType(
    val creatable: Boolean,
    val displayName: String
) {
    TEXT_ENTRY(true, "Text entry"),
    TIME_BASED(true, "Time-based"),
    BREATHING(true, "Breathing"),
    MOOD_CHECKIN(true, "Mood check-in"),
    CHOICE_BASED(true, "Choice-based"),
    UNKNOWN(false, "Unknown");

    companion object {
        fun creatableEntries() = values().filter { it.creatable }

        fun fromString(value: String): ActivityType {
            val v = value.trim()
            // try matching by enum name, ignoring case
            ActivityType.entries.firstOrNull {
                it.name.equals(v, ignoreCase = true) }?.let { return it }

            // try match by displayName, ignoring case
            ActivityType.entries.firstOrNull {
                it.displayName.equals(v, ignoreCase = true) }?.let { return it }

            // fallback
            return TEXT_ENTRY
        }
    }

    fun readableName(): String = displayName
}
```

Figure 66 - Code for the Enum class "ActivityType"

As mentioned, this approach enables the App to offer a range of fundamentally different activities that can be completed in various ways, yet are treated uniformly by *MentalPotion*. This is particularly significant for features like experience point (EXP) attribution, which will be implemented later, as well as for the schedule display in the UI component.

Due to such, the various types of activities planned earlier can each be implemented independently, both in terms of UI and underlying logic. This independence is also evident in the file structure used for the presentation layer of these activities, found in Figure 67.

```
@Composable
fun ActivityEntryScreen(
    navController: NavHostController,
    uiState: ActivityEntryUiState,
    onDone: () -> Unit
) {
    val screenRegistry: Map<
            ActivityType,
            @Composable (NavHostController, String, () -> Unit) -> Unit
            > = mapOf(
        ActivityType.TEXT_ENTRY to { nav, id, done ->
            TextEntry_ActivityRootScreen(nav, id, done)
        },
        ActivityType.TIME_BASED to { nav, id, done ->
            TimeBased_ActivityRootScreen(nav, id, done)
        },
        ActivityType.BREATHING to { nav, id, done ->
            Breathing_ActivityRootScreen(nav, id, done)
        },
        ActivityType.MOOD_CHECKIN to { nav, id, done ->
            EmotionCheckIn_ActivityRootScreen(nav, id, done)
        },
        ActivityType.CHOICE_BASED to { nav, id, done ->
            ChoiceBased_ActivityRootScreen(nav, id, done)
        }
    )

    when {
        uiState.isLoading -> {
            ActivityLoadingScreen()
        }
```

presentation > activity > activityTypeScreens > breathing > Breathing_ActivityScreen.kt 1:1 CRLF

Figure 67 - Presentation Layer code for redirecting Activities to specific screens, according to their type

An example of independence and differentiation can be seen when examining two different activities. The "Mood Check-in" activity enables users to select various feelings and associate reasons for each one (as can be seen in Figure 69). In contrast, "Choice-based" activities, present in Figure 68, consist of multiple-choice questions, each linked to a specific database entity that provides prompts and answers to be displayed to the user. This setup allows activities of this latter type to be associated with different topics (to be discussed in the next section). Consequently, they offer varying prompts based on the selected topic and provide users with feedback on their chosen answers.

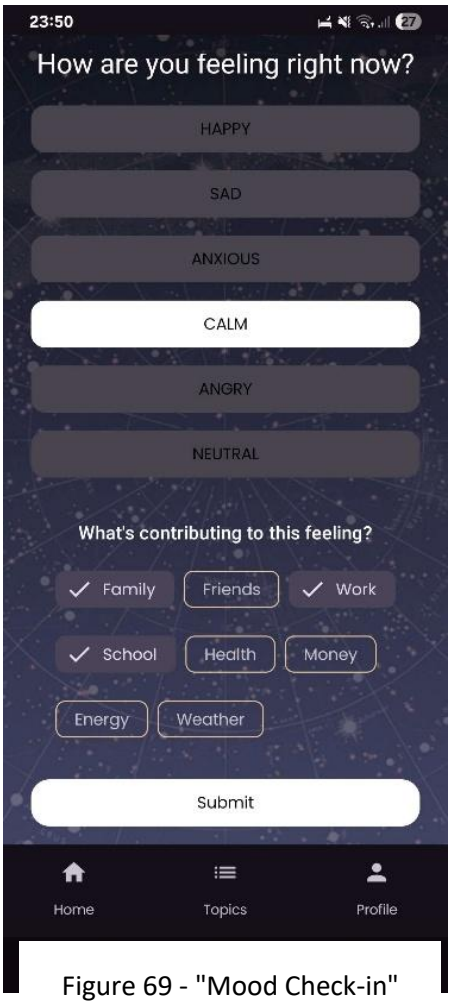


Figure 69 - "Mood Check-in" Activity UI

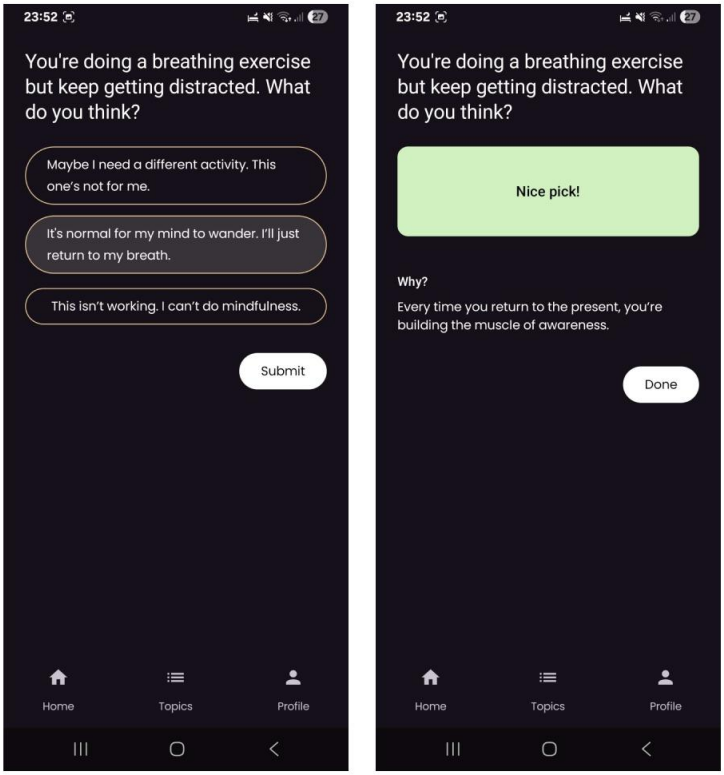


Figure 68 - "Choice-Based" Activity UI

5.4.2.6 US07 – Topic Exploration

To enhance learning about various topics related to mental health and to provide prompts for specific activities, a virtual "library" of mental health topics was implemented following what is outlined in US07. This feature allows users to search and explore different subjects available in the *MentalPotion* database. Prints from the MentalPotion App that showcase the UI implemented for this library can be seen in Figure 70.

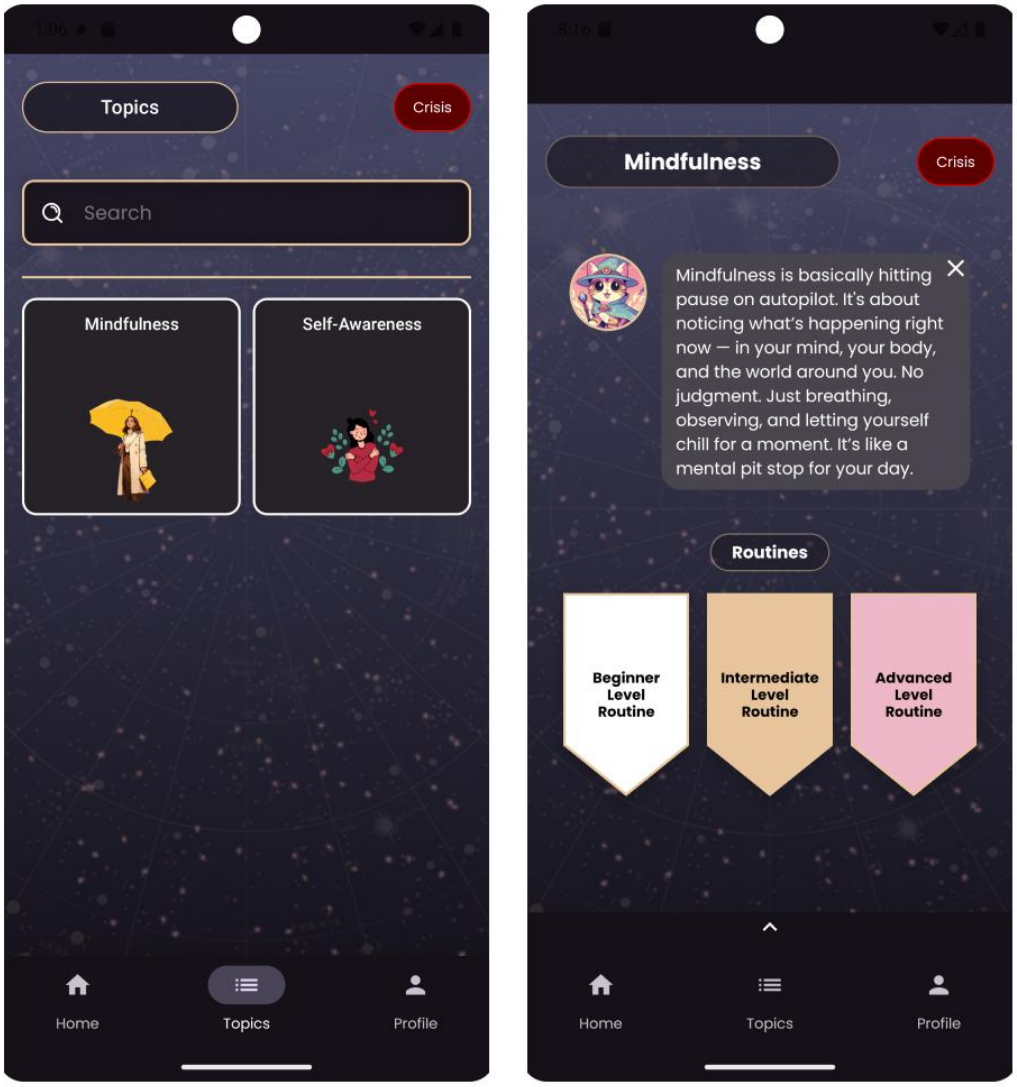


Figure 70 - Topic-related UI

When the user navigates to the topic listing page, the available topics are retrieved from the *Firestore Database* using a dedicated “Use Case” that fetches all documents from the “Topics” entity, following the architecture showcased previously. Once the documents are loaded, the screen displays them to the user along with their associated images, stored in *Supabase*. While browsing the list of topics, users can search for specific topics by entering keywords in a search bar. The search method, illustrated in Figure 71, compares the entered text with the titles and descriptions of the loaded topics to identify and display any matches.

```
@HiltViewModel
class TopicListViewModel @Inject constructor(
    private val getAllTopicsUseCase: GetAllTopicsUseCase
) : ViewModel() {

    private val _uiState = MutableStateFlow(TopicListUiState())
    val uiState: StateFlow<TopicListUiState> = _uiState.asStateFlow()

    init {
        loadTopics()
    }

    fun onQueryChanged(query: String) {
        val allTopics = _uiState.value.allTopics
        val filtered = if (query.isBlank()) {
            allTopics
        } else {
            allTopics.filter {
                it.title.contains(query, ignoreCase = true) ||
                        it.description.contains(query, ignoreCase = true)
            }
        }

        _uiState.update {
            it.copy(query = query, filteredTopics = filtered)
        }
    }


    private fun loadTopics() {
        viewModelScope.launch {
```

> mentalpotion > ui > presentation > topicList > TopicListViewModel

Figure 71 - Topic List screen ViewModel excerpt

Upon navigating to within each topic, users can choose to view template routines that vary in difficulty, as demonstrated in Figure 72. These routines are a set of predefined activities, stored in the database, that can be activated if not already. Once the user activates one of these template routines, the associated activities will be added to the user's schedule if no activity overlaps with already existing ones from the user.

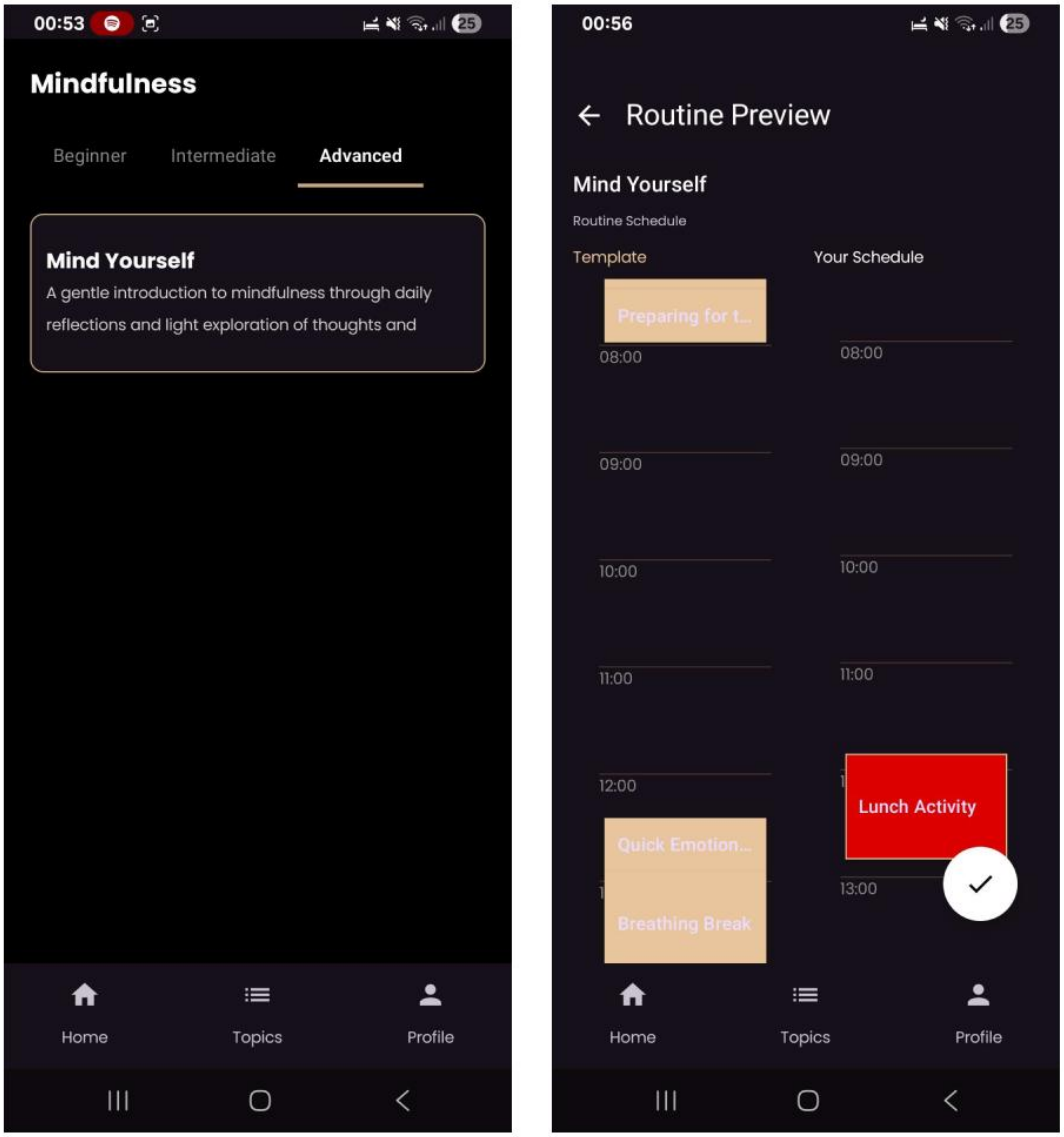


Figure 72 - Template Routine-related UI

5.4.2.7 US08 – Resource Tools

In the previously demonstrated topic-specific screen, a set of resource tools related to the topic was implemented, as outlined in User Story 08. These tools are stored in the Firestore Database (see Figure 73 - Firestore Database view of the "Tools" table) and are categorized based on their association with a specific topic, as well as by their type, which is defined by an Enum class called “ToolType” (present in Figure 74). Akin to what happens with activity types, this Enum class helps distinguish the various types of tools within each topic in the system.

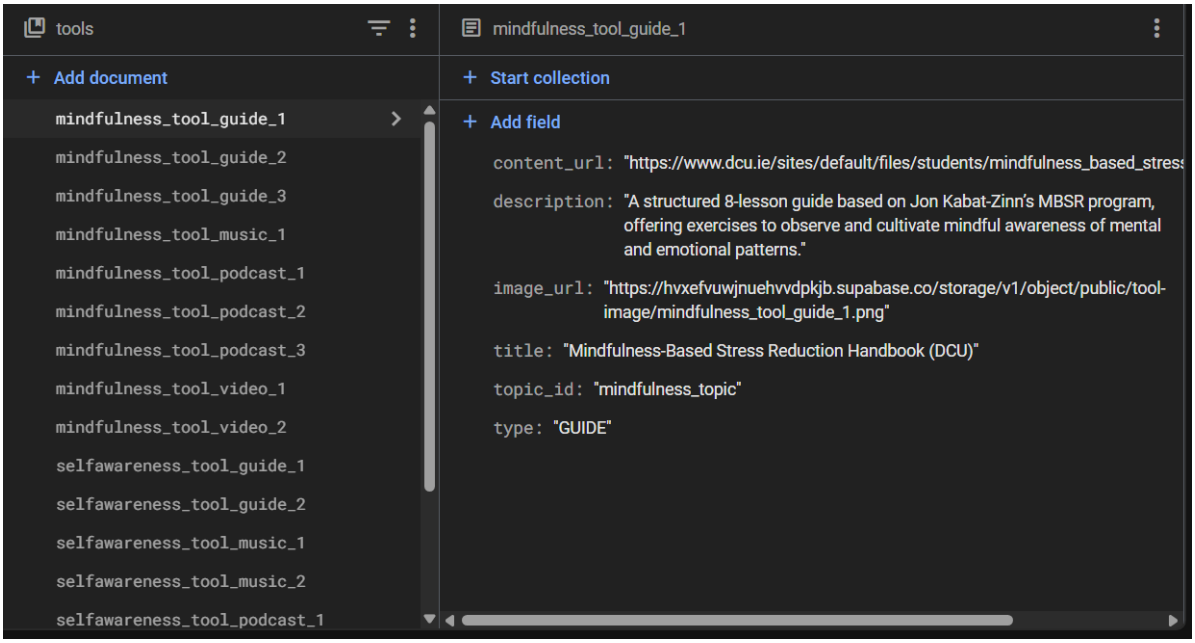


Figure 73 - Firestore Database view of the "Tools" table

```
data class Tool(
    val uid: String,
    val topicId: String,
    val type: ToolType,
    val title: String,
    val description: String,
    val imageUrl: String,
    val contentUrl: String
)

enum class ToolType {
    PODCAST, GUIDE, MUSIC, VIDEO
}
```

Figure 74 - “Tool” and “ToolType” classes

To create the Resources section, where these tools are displayed to the users, a combination of components from “Material Design 3” was utilized, as can be seen in Figure 75. This includes the aforementioned tab system and the grid of components used in both the home screen and the topic list screen. Additionally, to ensure that the resource tab can be hidden and functions independently from the other sections of the screen, the “Scaffold” component from the same library has been employed, resulting in the UI seen in Figure 76.

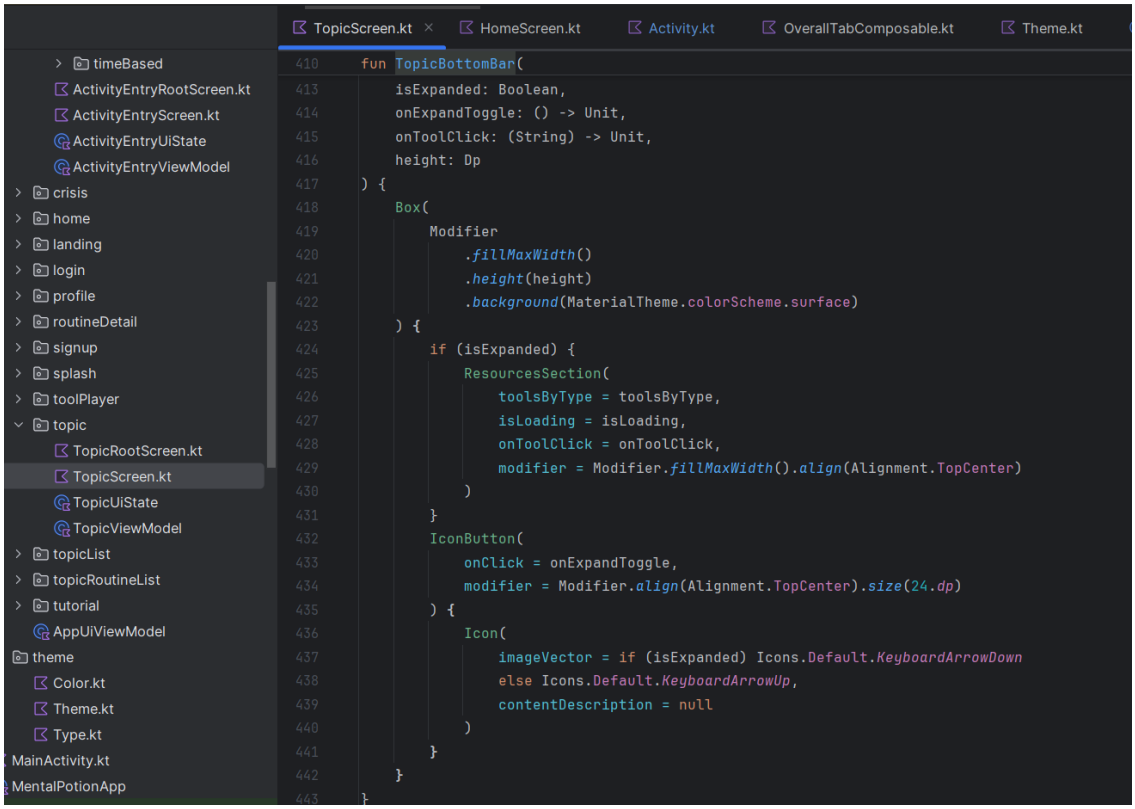


Figure 75 - Code snippet for the Resource Tools section

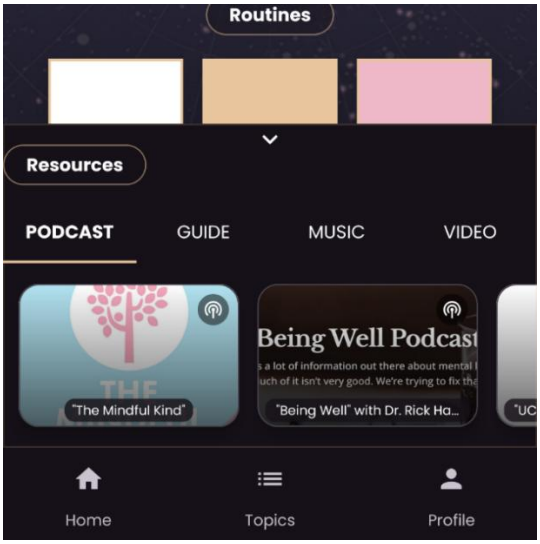


Figure 76 - Resource Tools UI

5.4.3 Version 1, Step 3: Testing of the Base Version

The testing process for each participant began with an initial interview, as outlined in the testing plan. The planned testing stage for this iteration was exactly that: the initial interview was conducted before testers used the App for two weeks, after which a second interview was conducted during iteration 2 of development. This semi-structured interview aimed to assist testers in setting up the App on their phones, obtaining their consent to participate in the project, and providing them with a partial explanation of the project. Mentions of gamification elements were intentionally omitted during this phase to avoid biasing testers about the features to be included in the second version of the App, and to observe if they would independently suggest gamification elements as potential improvements.

During the interview, general questions regarding mental health issues and experiences were addressed, and participants' first impressions of the App were recorded. The semi-structured script used for this interview can be observed in Appendix F: Semi-Structured Script for Initial Testing Interview.

5.4.3.1 Tester A

Tester A was a 25-year-old individual with a degree in computer engineering and around one year of professional experience. They mentioned that they had never consulted a psychiatrist or psychologist and had no prior experience with self-help or mHealth applications. Although they had considered seeking professional help in the past, especially before starting their job, they never followed through for no particular reason. While they found the idea of mental health Apps interesting and potentially useful for others, they were unsure if such tools would be personally relevant for them currently.

After installing the App and exploring it freely, they provided feedback on several interactive aspects. They often felt unsure about what to do next, especially after registering, and requested clearer guidance. They expressed frustration with some features, particularly the separation between scheduling and schedule management options, which they described as unintuitive. In contrast, they appreciated the emergency help feature and found the overall visual design cozy, especially enjoying the in-App cat mascot, “Meowski.”

They pointed out several visual issues, such as misaligned time blocks in the schedule and the use of red for activities, which they associated with errors. They felt that the layout of the scheduling section was confusing and suggested combining the start activities and schedule management into a single view. Additionally, they noted the absence of reminders, such as notifications or vibrations, which they believed were crucial for their consistent use of the App.

Tester A also suggested including tooltips to explain the purpose of each activity type, as well as a tutorial or guidance system to help orient new users upon onboarding. They also recommended using the mascot to provide occasional motivational pop-ups that users might appreciate.

When asked about the App's potential usefulness for them, they stated it could be helpful but currently fell short, particularly due to the lack of reminders and the inability to reschedule or customize template activities. They felt that with these improvements, the App could become a viable alternative to their current paper-based scheduling. However, they admitted that some of the existing activities felt "cringe," which would discourage them from using it.

They mentioned that the App did not currently motivate them to return on its own, as it relied heavily on self-discipline. They suggested adding rewards for completing activities or daily login bonuses, along with occasional motivational quotes, which they believed could be designed thoughtfully to avoid becoming addictive.

5.4.3.2 Tester B

Tester B was a 24-year-old with a background in fashion and graphic design, who had been working as an illustrator and designer for about two years. They had been seeing a psychologist for over a year but had no prior experience with self-help or mHealth Apps.

Tester B viewed *MentalPotion's* concept as a positive and supportive tool. During their first use, they provided detailed feedback on the App's interface and design. They described the App as cozy and visually pleasing, particularly enjoying the resources section and the time-based activities that encouraged taking breaks from the phone. However, they often felt lost while navigating the App and suggested utilizing the mascot, Meowski, as a guide to explain features for first-time users. They were also particularly positive about the crisis section, noting that it felt supportive and nicely implemented, with bonus points for having a breathing exercise.

They noted visual inconsistencies between the mascot, avatars, and topic images, recommending a more unified art style that aligns with the App's RPG-inspired theme. Additionally, Tester B felt that the navigation bar appeared cluttered and could be simplified by using only icons. They also mentioned that the overlap between time blocks and the schedule's time made it difficult to read. More broadly, they believed the App could further embrace a game-like feel to enhance its uniqueness and immersion, as it currently felt like an in-between without a certain identity.

To make the App more appealing, they proposed adding challenge-like features similar to those found in Duolingo, such as daily streaks, experience points (EXP), and cosmetic rewards for customizing avatars. They also suggested incorporating social features, like connecting with friends, cooperative challenges, or shared streaks.

When asked if they would return to the App on their own, they expressed uncertainty and felt they would likely use it out of obligation. They did not find it personally useful in its current state but recognized its potential, especially if it encouraged more outdoor activities with rewards for completing them.

5.4.3.3 Tester C

Tester C was a 24-year-old participant with a degree in accounting. They had no prior experience with professional psychological support or with self-help or mental health digital tools. During their first interaction with *MentalPotion*, Tester C reported feeling somewhat lost and requested a brief introduction to the available features. While exploring the App, they pointed out several usability issues. For instance, they noted the lack of a confirmation prompt when deleting custom activities; deleting them with a single tap felt risky. Additionally, they observed that overlapping activities could not be created on the schedule, which they found unintuitive. Instead of outright blocking the action, they proposed that the App could suggest alternative time slots or highlight which activity was causing the conflict.

Despite these issues, Tester C considered the App to be a solid first version, both visually and functionally. After about 15 minutes of use, they described the UI, especially the home page, as cozy and simple to navigate. They appreciated that it didn't feel overly complex, but believed a short tutorial would benefit first-time users. They also suggested adding tooltips to explain features like activity types and using the mascot "Meowski" to present the tutorials.

When asked what they disliked, Tester C pointed to the topics page, which they found cluttered and difficult to interpret, mainly due to overlapping elements. Regarding whether the App would be useful to them, they acknowledged its potential but admitted they might not typically install an App like this. They stated that their opinion might change if it provided more personalized insights, though they were skeptical about using it regularly.

In the context of personalized insights, they suggested incorporating personalization using AI to provide custom feedback on open-text activity entries or mood check-ins, so the App could offer tailored suggestions. They believed this would make activities feel more meaningful and make the App feel less empty.

Tester C also discussed features from other Apps and games that motivate them to return, such as battle passes, daily streaks, and reward systems. They emphasized that streaks should be gentle, similar to what happens in *Duolingo*, without harsh penalties. They proposed allowing users to spend earned points from activities on avatar customization or streak freezes and mentioned that they would enjoy collectibles, achievements, and motivational statistics (like "users who complete X activities improve Y% over Z days"). They also liked the idea of visual statistics, such as mood trends over time, to help users see tangible progress.

5.4.3.4 Tester D

Tester D was a 23-year-old participant who had previously received psychological support, having worked with a psychologist for about a year, two years prior to the interview. At the time of the assessment, they were considering resuming therapy and had no prior experience with digital mental health tools. Their first interaction with the App began on a lighthearted note as they laughed at "Meowski." They quickly grasped most features and navigated through

them easily, although they were unsure how template routines worked. While exploring these routines, they inquired whether it was possible to adjust the template activity times to better align with their own schedule, as the current times didn't fit their habits.

Although generally positive about the App, they raised several usability concerns. They found the crisis button to be too prominent, making it tempting to press accidentally. They suggested altering its color or placement but praised the content within the crisis screen. They also felt confused by what the different activity types meant and requested clearer explanations. After about 5 minutes of interaction, they asked for a broader overview of how the App functioned overall. Once their questions were clarified, they identified key missing features, particularly notifications to remind users when activities were about to start, which they considered essential for the App's effectiveness. Furthermore, they reiterated that template routines would benefit from drag-and-drop scheduling or adjustable starting times. They also recommended including a short tutorial for first-time users and tooltips to explain the various activity types.

From a design perspective, they disliked the layout of the topic pages, stating that the resource tabs overlapped with other elements, making the interface feel cluttered. They suggested reorganizing these tabs into a single-column layout. On the plus side, they appreciated having preset routines, noting that they were helpful for users who were unsure how to create their own healthy routine. They described the overall design as friendly, cozy, and pleasantly simple. On how they would prefer guidance to be displayed, they mentioned preferring short tooltips over lengthy tutorials, fearing that long explanations might become tedious.

They believed the App could be useful, especially during stressful or low-mood periods, but acknowledged that their low phone use might limit their engagement. They predicted they might use *MentalPotion* intensively at first but then rely on memory rather than interact directly with the scheduled activities. They admitted that they didn't feel compelled to open the App spontaneously and were more likely to use it out of obligation during the testing scenario rather than personal interest. They attributed this partly to their overall low smartphone use and partly to the App's lack of active encouragement for repeated engagement. Nevertheless, they were curious to explore more of the App and emphasized that it did not come across as attempting to keep users hooked in a manipulative way.

Finally, they suggested adding more flexible, optional activities that could be done outside the home, such as walking or taking photos of objects or places. These activities could reward users with points, making progress feel more meaningful. While they were unsure how this progression should be displayed, they felt that a points system and visible progress would make the activities more rewarding.

5.4.3.5 Tester E

Tester E was a 23-year-old participant currently being followed by a psychologist. They had some prior experience with digital MH tools, having briefly used an mHealth app called Finch,

though that usage had been sporadic. Their first impressions of *MentalPotion* were mixed. They found the interface visually appealing and described the overall user interface as pleasant. However, they felt that some screens, especially the profile page, looked empty and underdeveloped. They also mentioned that the crisis button drew excessive attention, calling it visually tempting to press, and suggested reducing its prominence to avoid accidental use. Still, they appreciated the inclusion of a breathing activity in the crisis section, calling it thoughtful.

When asked about their likes and dislikes regarding the base App, Tester E emphasized the desire for greater customization. They wanted the ability to change the colors of activities on the schedule for better organization, add more types of activities, and have more flexible activity durations, as the current options felt too rigid. They also expressed frustration over the inability to change the scheduled time of template activities, suggesting that activities should be draggable into the user's schedule to make customization easier and possible.

Regarding usefulness, Tester E found the concept interesting but believed the App would likely not be helpful to them in its current form. They explained that they often struggle to stick with Apps over time and felt that *MentalPotion* lacked strong engagement elements to encourage regular use. To improve this, they suggested having the possibility of adding widgets to their phone's home screen as reminders and even including a virtual companion or pet that evolves as the user progresses. They stressed the importance of showing progress tangibly, through elements that visually grow or change with completed activities.

They also noted that the App lacked feedback when completing activities or navigating the UI, which made activities feel flat and somewhat meaningless. While they found the App mostly intuitive, they pointed out that the page for activating template routines was less clear and intuitive than the rest of the interface.

When asked if they felt motivated to keep using the App, Tester E stated that they did not. While they were curious to see how some activities would unfold, curiosity alone wouldn't drive regular use for them. When asked what typically motivates them in other Apps or games, they mentioned collectibles, the ability to complete activities with friends, and other social features that create connections between users.

5.4.3.6 Tester F

Tester F was a 22-year-old participant who, at the time, was being followed by both a psychologist and a psychiatrist. However, they had no prior experience with self-help or mental health digital tools. When asked about their first impressions of *MentalPotion*, they described the App as very visually appealing, noting that the user interface (UI) and overall theme were pleasant. However, they found the App unintuitive, especially after the onboarding process, and felt uncertain about what actions were available or how they were expected to use its features.

They highlighted the thematic presentation as one of their favorite aspects. While they didn't mention any specific features they disliked, they felt the App was incomplete and suggested that it could be implemented more cohesively. They believed it would likely not be useful to them, expecting they would use it only for a few days before forgetting about it, as they usually do with all sorts of Apps. Although they appreciated the presence of template activities, the inability to customize their initial scheduled times was a significant drawback, as the default blocks did not fit their personal routine.

When questioned further on whether they could see themselves using the App regularly, they said no, citing the same reasons as before. They also noted that the App lacked motivating elements to encourage consistent use. To address this, they suggested adding gamification features such as missions or objectives with rewards, explaining that the abstract idea of self-improvement wasn't enough to keep them and possibly other users engaged; they needed tangible goals and rewards.

Additionally, they felt the App didn't provide enough feedback upon completing activities, which made the experience feel meaningless. They wanted a clear way to view their progress and understand if their completed activities were meaningful, recommending systems like activity history or progress statistics to track achievements or fluctuations over time. They expressed that nothing in the App currently motivated them beyond their own curiosity on the overall project. Furthermore, their lack of understanding about what each activity type entailed reduced their willingness to explore, and the absence of customizable timings for template activities further discouraged them. They stressed that these issues didn't frustrate them but weakened their desire to return.

To make the App more motivating, they recommended adding an onboarding tutorial to guide new users, ideally featuring the mascot "Meowski" as a narrator to introduce features through dialogue. They felt the App relied too heavily on users' self-motivation during the initial setup and needed more structured guidance. They reiterated that visualizing personal progress would be vital for engagement, suggesting statistical systems like mood graphs to show the impact of their efforts over time.

5.4.3.7 Tester G

Tester G was a 25-year-old participant who was at the time being followed by both a psychologist and a psychiatrist. They had prior experience with self-help tools but typically stopped using them after about a week. Their first impressions of *MentalPotion* were mixed. They described the overall theme as cozy and particularly liked the RPG and cosmic-inspired theme and color palette. They perceived most screens as clean and pleasant, but they felt the App lacked interactivity and content. After the onboarding process, they mentioned feeling somewhat lost and unsure about which features existed or how to access them. However, once they understood the concept of activities, they mentioned that navigation felt quite intuitive.

They highlighted the App's aesthetics as its strongest aspect and saw potential in the schedule and activities to be fun and useful. Nonetheless, they described the App as feeling empty, especially the profile and topic screens, which they disliked. They noted the absence of tooltips or tutorials explaining what each activity did prior to trying them, which made the experience confusing.

When asked if the App could be useful to them, they acknowledged its potential but mentioned that, in its current state, they would likely stop using it after a short time, although it was an App they manifested having much interest in. They felt they might forget about it because, aside from its aesthetics, the App didn't feel captivating or offer enough features to maintain their interest. They pointed out several aspects that felt incomplete. They noted the lack of personalization in the profile and said that while template routines were a positive feature, they were hard to follow because the scheduled times didn't match their own routine. They suggested allowing users to change the scheduled times of template activities or reorder them via drag-and-drop. Although they understood why templates might be non-editable and recognized the existence of custom activities, they admitted they would feel too lazy to build their own routines from scratch.

They also identified the absence of progress tracking as a significant gap, describing it as essential. They felt that topic-specific pages could benefit from additional content to help with emotional management or related issues, which would make the App more useful. Lastly, they mentioned that *MentalPotion* lacked a motivating or captivating element, though they weren't certain what that might be.

When asked what could motivate them to continue using the App, they stated that being able to view their progress would be the most important baseline feature. They were open to different methods of showing progress but thought an experience or leveling system could work since the App seemed RPG-inspired, even if its implementation might be challenging. They also suggested having a pet or avatar that evolves with the user's progress, expressing that they find more motivation in visualizing their growth in external growth in external sources. Moreover, they mentioned that customization rewards for avatars or for the overall App's appearance, such as unlockable avatars or backgrounds, could also serve as motivation elements.

5.5 Development Iteration 2

The second iteration was built upon the feedback and foundations established during the first development cycle. In this version of the App, the focus was on refining the existing design, while addressing issues raised by testers, and incorporating the previously set gamification features to evaluate their impact on engagement and usability. The USs implemented in this version of the App can be seen in Table 16 - v2 Implemented User Stories.

Table 16 - v2 Implemented User Stories

v1 Implemented User Stories		
ID	Title	Priority
US03	Navigation Tutorials	Low
US09	Skill Tree	High
US10	General Home Tab (Leaderboard+Streak)	Medium

Testing during this iteration aimed to assess not only functionality but also how these new design choices influenced user motivation and interaction patterns.

The following subsections describe the design improvements made for this second version, the implementation of its new features, and the results obtained from its testing phase.

5.5.1 Version 2, Step 1: Refinement of the Wireframes

The feedback from testers during the initial interview indicated that the overall theming, layout, and color scheme of the user interface (UI) were very well received. The theme and UI were, by far, the most positively noted aspects of the App. As a result, only minor adjustments were made to the overall design of the App's screens, primarily concerning the features to be implemented in this iteration and the colors of certain elements, which will be explored here.

For the profile screen wireframe, displayed in Figure 77, the previously empty space was redesigned to include the skill tree and progress system associated with *User Story* 09 (US09). The different branches of the skill tree, along with the user's acquired experience points (EXP) and level for each one, are displayed below the user's name and avatar. Skills are visually represented through various icons. Additionally, below the skill tree, users can view their progress within the App through graphs that provide statistics over time on different elements, such as mood, collected through specific activities.

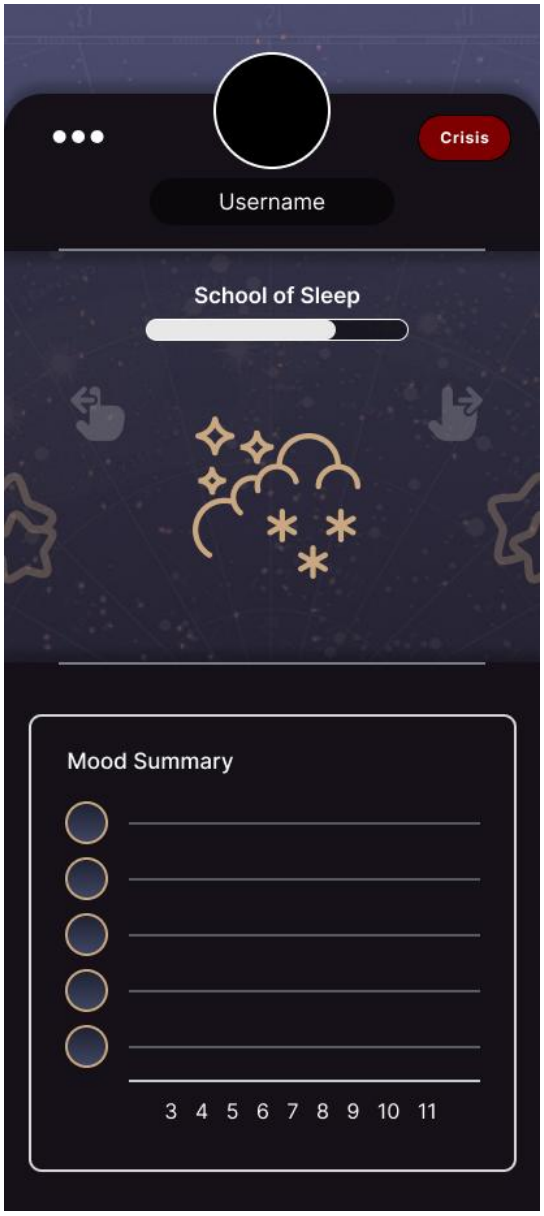


Figure 77 - v2 Profile Screen Wireframe

Regarding the home screen wireframes, present in Figure 78, in addition to displaying the user's schedule and activities to be completed for the day, the layout now includes US03 and US10. A tutorial for the App has been introduced through a button located near the top right corner of the home screen. When users click on this button, they can access a simple tutorial featuring images that illustrate the available features and navigation pathways within the App.

Additionally, in terms of social gamification, leaderboards have been added to the home page. Users will be able to view the top three befriended users for the day based on both EXP gained and the number of activities completed.

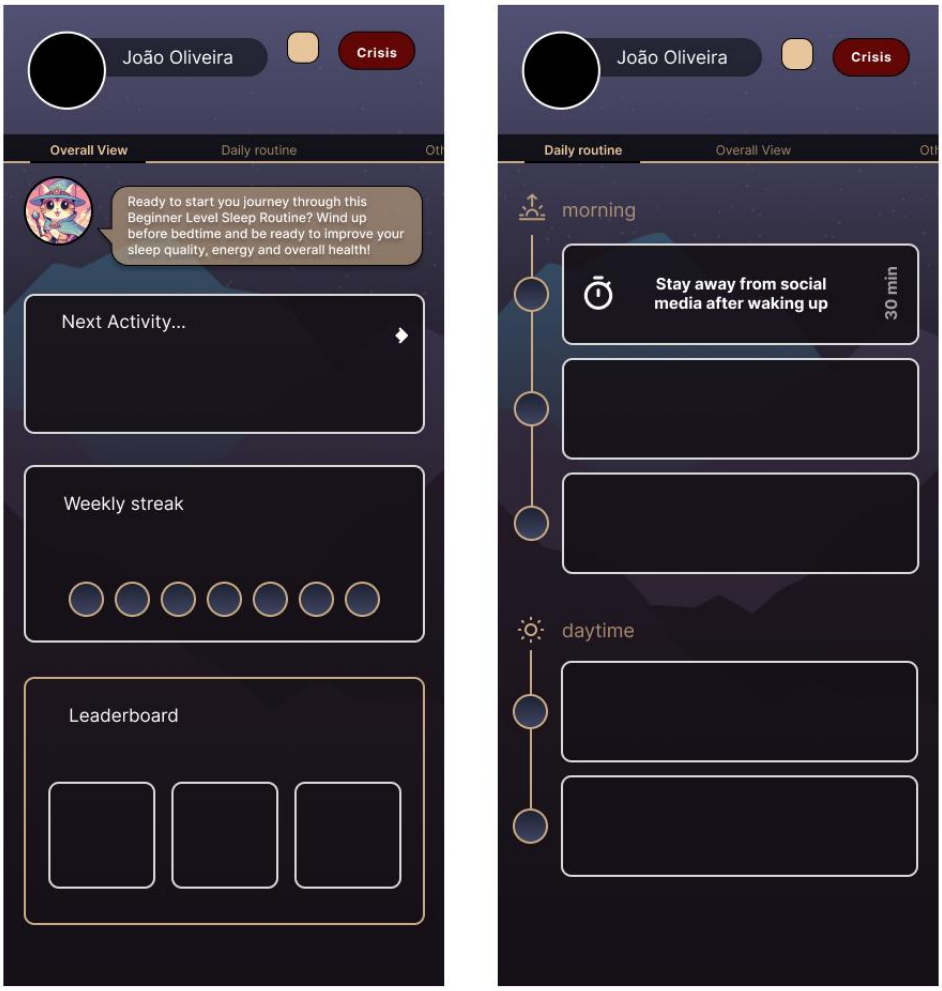


Figure 78 - v2 Home Screen Wireframes

5.5.2 Version 2, Step 2: Implementation of the Gamified Version

The second implementation process for the *MentalPotion* App is outlined in the following subsections. In these sections, how each *User Story* was implemented will be described alongside the tools used in the process. Since the implementation details are not the primary focus of the project and do not provide as much valuable information as other sections, this overview will be a summarized version of the key aspects of the implementation.

5.5.2.1 Improvement of the Base Features

The second iteration's implementation phase of the project began with correcting code issues, implementing bug fixes, and making general improvements to the App, including updates to the UI, inspired mostly by feedback from the initial tester interviews. Several quality-of-life

enhancements were made before addressing the specific *User Stories* for this iteration. Although these improvements could have been released to testers during their two-week access to the base version of the App, they were intentionally held back to be introduced alongside the gamification features. This decision aimed to ensure that any enhancements to the App's usability or overall polish would not influence users' perceptions of the base version. Additionally, it allowed us to observe whether the gamification elements would draw attention away from these quality-of-life changes when both were released together.

The first change implemented was an update to the landing page UI, which now better aligns with the original wireframes and includes the *MentalPotion* logo and name (as seen in Figure 79).

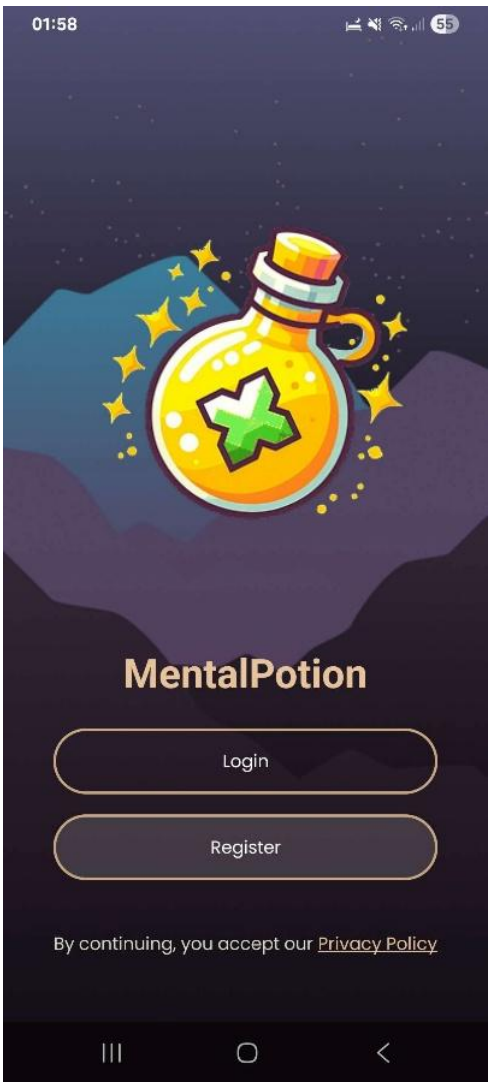


Figure 79 - v2 Landing Screen UI

Then, at the end of the registration flow, a new prompt was added to request users' permission to receive notifications from the App. On the home screen, the previous "Schedule" tab and the "Schedule Manager" screen were merged into a single view, seen in Figure 80. This adjustment

followed the structure presented in the wireframes and responded to feedback from testers, who found the separation of these screens confusing.

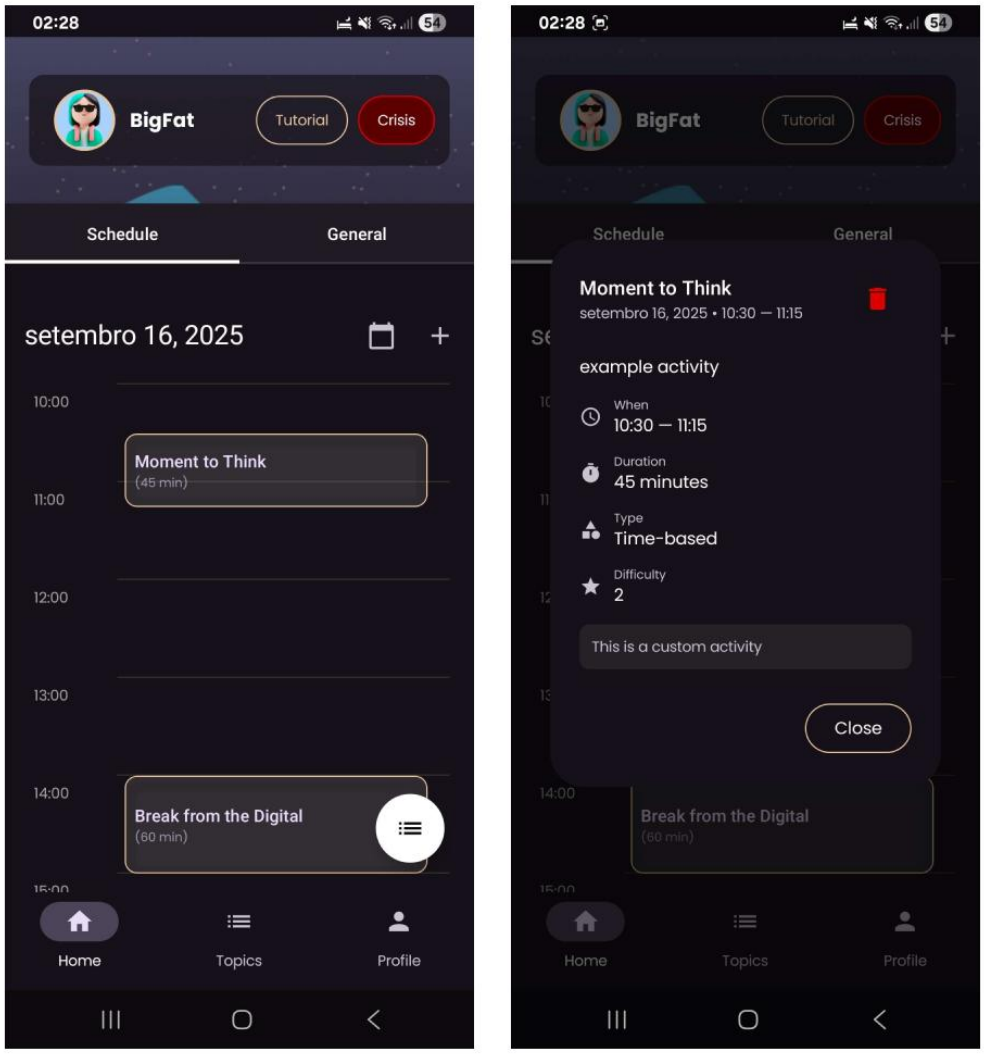


Figure 80 - v2 Home Schedule Tab UI

The underlying code for displaying the schedule was also refactored. Activity colors were updated, and blocks no longer overlap the time labels on the schedule. The rendering logic was adjusted to prevent activity blocks from drifting away from their scheduled times. Finally, based on feedback from the initial interviews, scheduled activities now send notifications to users when their scheduled time is reached, helping to remind them to engage with the App throughout the day.

5.5.2.2 US03 – Navigation Tutorial

To enhance user experience after the onboarding process, a simple, optional tutorial was included based on feedback from testers. This tutorial appears as a pop-up in "Material 3" dialog format and can be accessed by clicking a button on the Home page.

```
@Composable
fun TutorialDialog(
    modifier: Modifier = Modifier,
    pages: List<TutorialPage>,
    onDismiss: () -> Unit,
    initialPage: Int = 0
) {
    // Provide the pager state
    val pagerState = rememberPagerState(
        initialPage = initialPage,
        pageCount = { pages.size }
    )

    val scope = rememberCoroutineScope()

    Dialog(
        onDismissRequest = onDismiss,
        properties = DialogProperties(usePlatformDefaultWidth = false)
    ) {
        Box(
            modifier = Modifier.(...),
            contentAlignment = Alignment.Center
        ) {
            Surface(
                modifier = modifier.(...),
                shape = RoundedCornerShape(16.dp),
                color = MaterialTheme.colorScheme.surface,
                tonalElevation = 8.dp
            ) {...}
        }
    }
}
udent > mentalpotion > ui > components > TutorialDialog.kt > TutorialDialog
```

Figure 81 - Code excerpt of the Tutorial Dialog

The tutorial button is located at the top of the screen, near the crisis button, and features less contrasting colors to blend in. When the tutorial button is clicked, we check if the dialog component for the tutorial should be displayed. If it is meant to be visible, it will then be shown to the user. This is a straightforward process.

5.5.2.3 US09 – Skill Tree

The implementation of the Skill Tree feature, associated with US09, involved several changes. First, the user profile was updated to display users' branching skills and their current experience points (EXP), as can be seen in Figure 82 - v2 Profile Screen UI. Additionally, new assets were created for these skills.

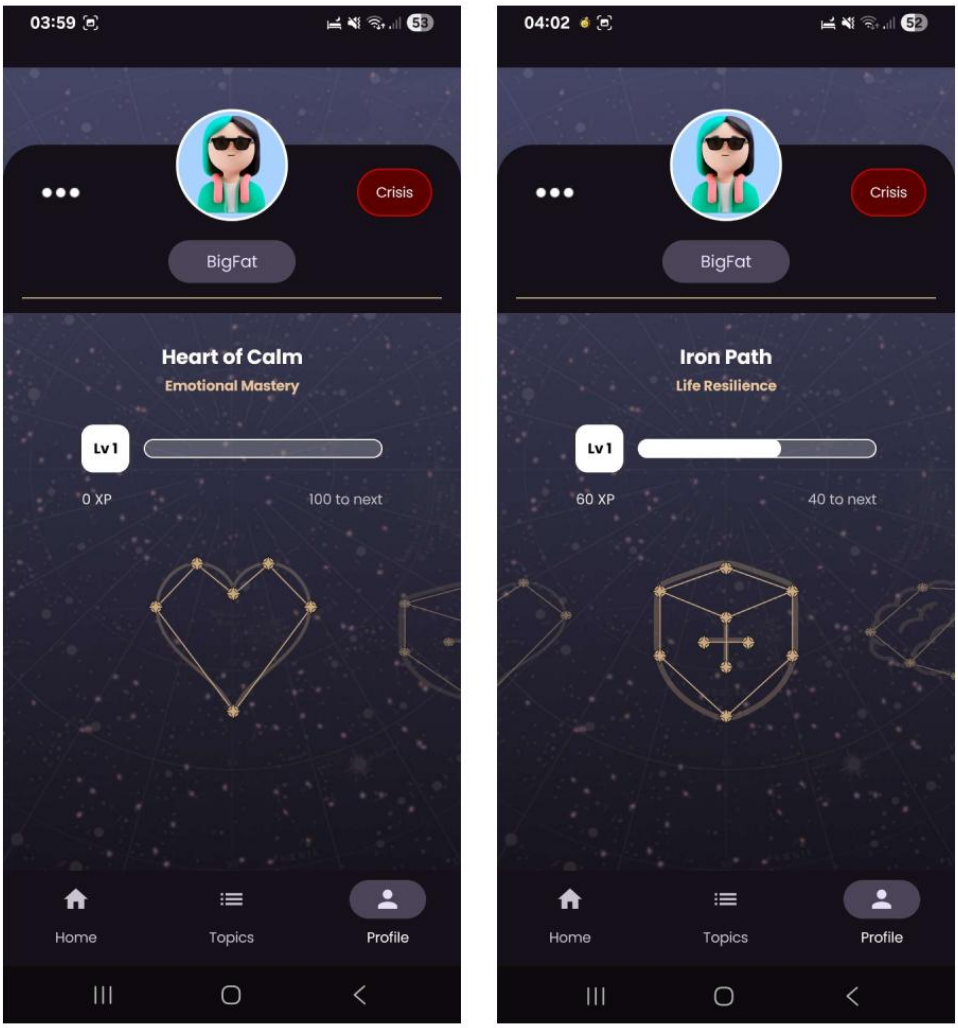


Figure 82 - v2 Profile Screen UI

The logic for activities was also modified; this was accomplished by developing new use cases based on the newly created Skill Tree-related domain models. One of the main Use Cases developed, which awards the user with skill EXP given a completed activity, can be seen in Figure 83.

```kotlin
/**
 * Award EXP to the user's skills based on the completed activity.
 * - Accepts the full Activity so we can route by type & difficulty.
 * - Splits EXP across skills via weights.
 * - Applies difficulty multipliers.
 * - Handles multi-level-ups.
 */
class RewardExpForActivityUseCase(...) {

    // Skill IDs
    companion object {...}

    // Base EXP per activity type
    private val baseXpByType: Map<ActivityType, Int> = mapOf(...)

    /** Routing: which skills get EXP (and in what proportion) for a given activity. ...*/
    private fun route(activity: Activity): List<SkillWeight> = when (activity.type) {...}

    suspend operator fun invoke(
        user: RegisteredUser,
        activity: Activity
    ): Result<ExpGrantResult, NetworkError> = try {
        val userId = user.uid

        // Calculate base xp
        val base = baseXpByType[activity.type] ?: 10
        val multiplier = activity.difficulty / 10
        val totalXp = (base + base * multiplier).coerceAtLeast(1)

        // Distribute the xp by the user skills
        val routes = route(activity)
```

_skillTree > domain > usecase > RewardExpForActivityUseCase.kt > RewardExpForActivityUseCase 25:

Figure 83 - Excerpt of code from the EXP Award Use Case

When a user completes an activity, the system updates the database only after the activity is marked as completed in the *Firestore Database*. At this point, the system calls the mentioned Use Case to update the database table for user skills with the awarded EXP. The amount of EXP given is calculated in this Use Case and takes into consideration factors such as the type of activity completed, its difficulty level, and the weight assigned to each skill that the completed activity corresponds with. An example of this process can be seen in the ViewModel code for the breathing-type activities, exposed in Figure 84.

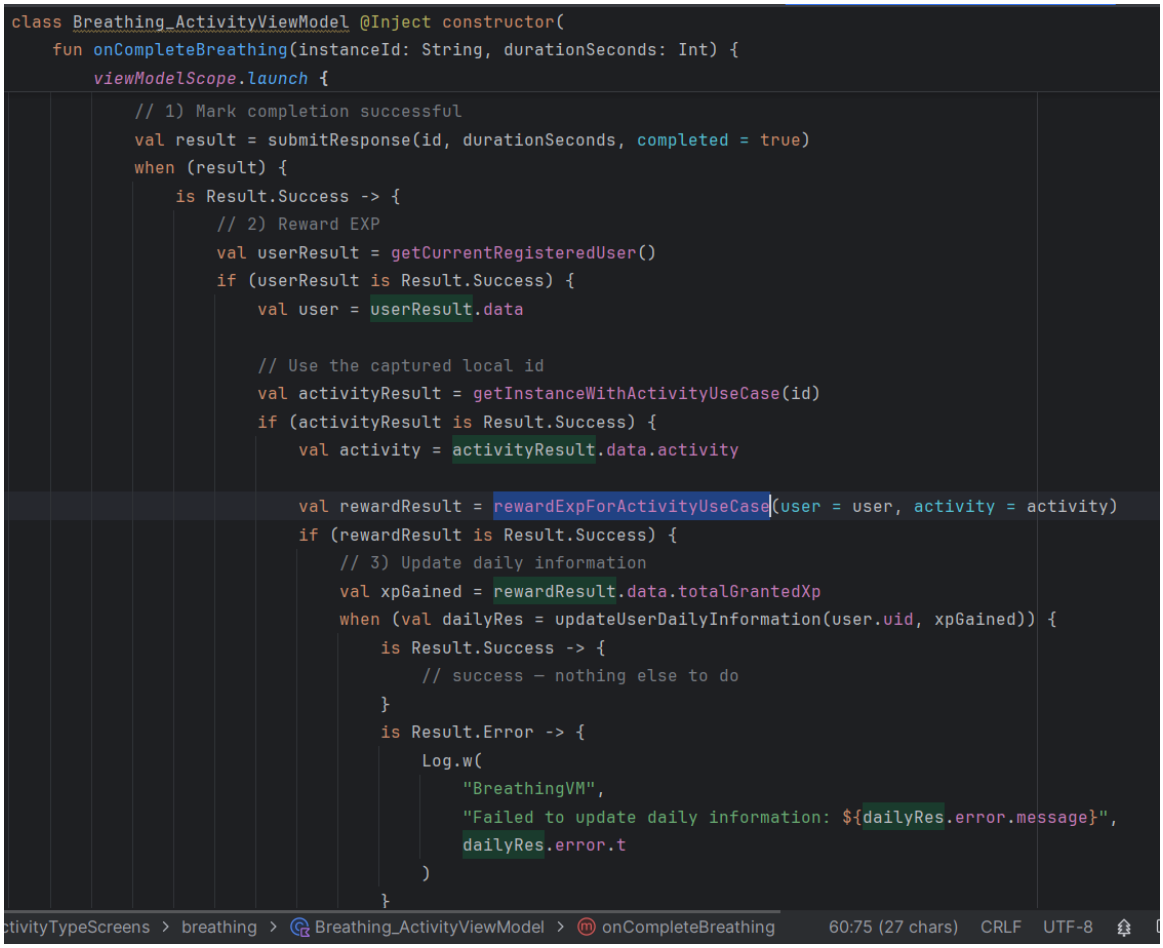


Figure 84 - Code excerpt from Breathing Activities ViewModel

5.5.2.4 US10 – General Home Tab (Leaderboard and Weekly Streak)

The implementation of the general home tab involved creating two leaderboards that ranked the top three EXP earners and top three activity completers among friends for the current day. Additionally, a weekly streak section that shows the days of the current week on which the user completed at least one activity was also implemented. These elements can be seen implemented in *MentalPotion* through Figure 85.

The implementation mainly involved reusing existing code and repositories, as most of the necessary classes and methods were already available. For US10, a new repository was created to store users' daily statistics, and three use cases were developed to manage the daily streak and the various leaderboards.

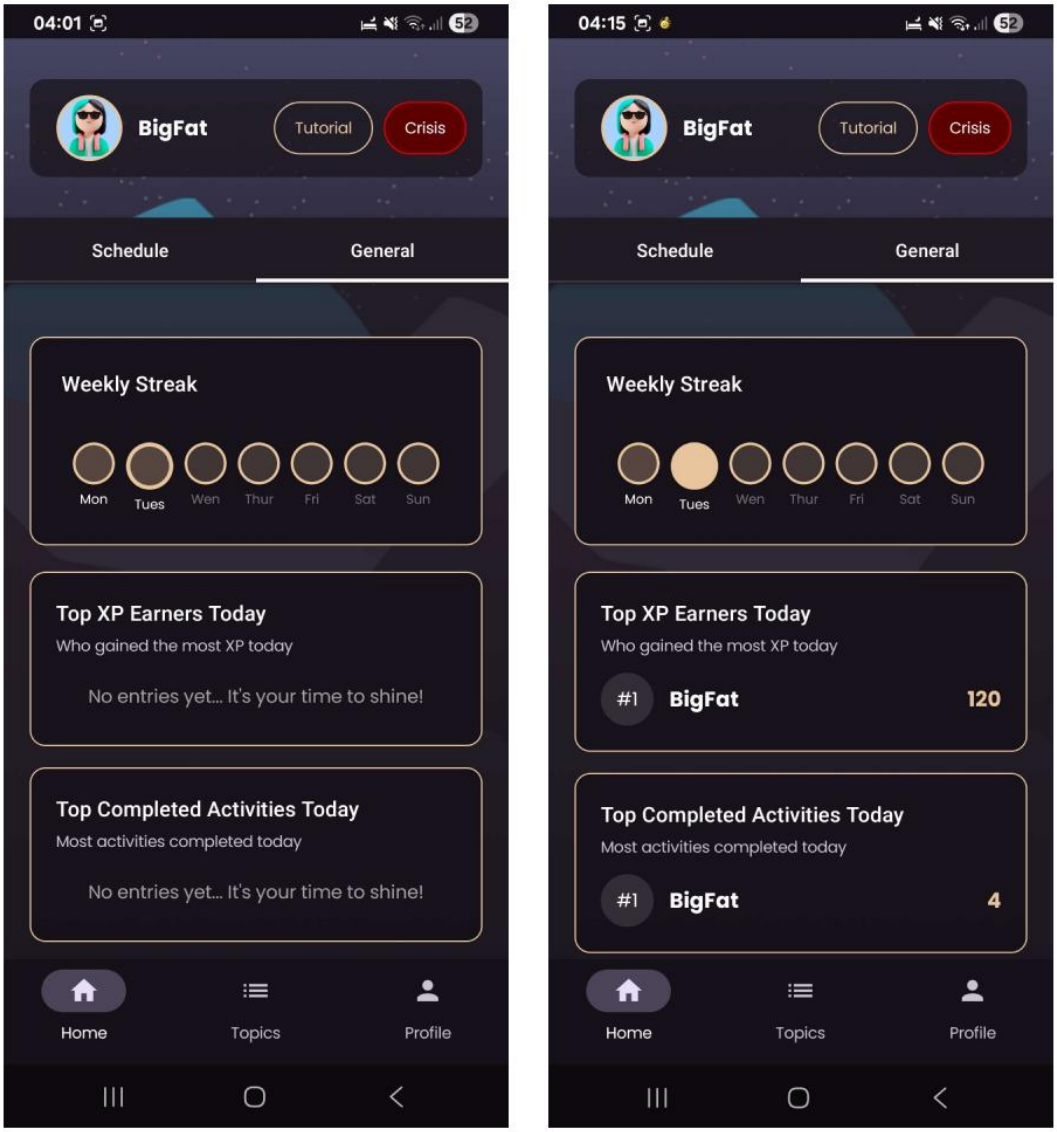


Figure 85 - v2 Home Screen General Tab UI

These use cases are utilized in the home screen's ViewModel to update the UI elements designed to display the leaderboards to the user, as exposed in Figure 86.

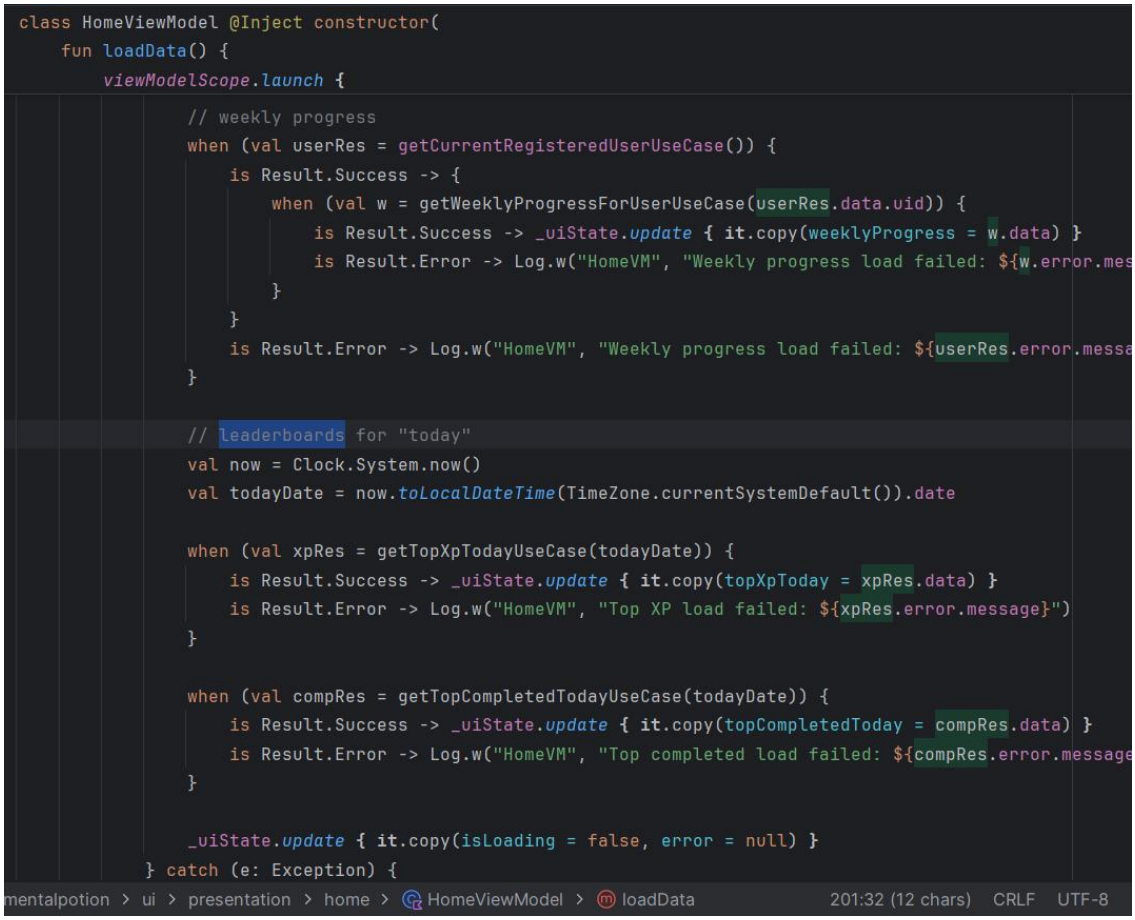


Figure 86 - Excerpt of code related to Social Gamification from the Home ViewModel

5.5.3 Version 2, Step 3: Testing of the Gamified Version

After two weeks of testing the base version of MentalPotion, and in parallel with the implementation of the gamified version, each participant was invited to a mid-interview as outlined in the testing plan. This semi-structured interview aimed to gather information on the overall usage of the base App during the two weeks and to assist testers in setting up the second/gamified version of the App on their phones.

After downloading the gamified version, participants' early reactions and feedback regarding the new version compared to the base one were recorded. During this second interview, general questions were asked about which aspects of the App seemed to have improved and user experience (UX) considerations were addressed. It is important to note that the questions focused on the App as a whole, rather than isolating or emphasizing the gamification elements. This approach was taken to observe if the gamification features were the ones participants identified as most prominent in their responses about what improved (or did not improve) the overall App and their engagement with it.

5.5.3.1 Tester A

Two weeks later, Tester A returned for their second interview to try the new, gamified version of the App. They admitted that they hadn't used the original version during the 2 weeks after the initial interview, explaining that they simply forgot about it and didn't feel interested or motivated to return.

However, after using the updated build, they expressed clear preference for this new version, describing it as more complete and engaging. They noted that the schedule looked more polished and visually appealing, and they were particularly impressed with the new profile and progress systems, especially the skill tree, which they described as a "cool feature" that gave their actions more purpose.

They suggested expanding on the constellation-inspired design of the skill tree. They proposed that branches could start incomplete and gradually form as users level them up, creating a more rewarding sense of progress. Additionally, they mentioned that unlocking or leveling up a branch currently lacks feedback, recommending that the App should display a small visual indicator or in-App notification to acknowledge these achievements.

The tester remarked that they now felt more motivated to use the App than before, with the leaderboard particularly sparking their interest and providing a reason to return. However, they also admitted that remembering to open the App would still be a challenge, even if notifications were added.

As a final suggestion, they referenced the "BeReal" App, which prompts users to take a daily photo. They proposed implementing something similar, such as a daily check-in photo or a quick way to log real-life progress, which could make it easier to develop the habit of returning to *MentalPotion* regularly.

5.5.3.2 Tester B

Two weeks later, Tester B returned for their second interview and admitted they hadn't used the original version at all during that time, explaining that they never felt compelled to do so between their busy days. However, after trying the updated gamified version, they found it much more engaging and structured than before. Tester B praised the redesigned calendar for being more organized and intuitive and appreciated the new tutorial. Additionally, they liked how the topic's images now felt more thematic, which contributed to a sense of cohesion in the content.

When discussing the new gamification features, Tester B found the weekly experience points (EXP) system "cool" and thought the skill tree looked appealing and motivating, finally providing a sense of progress. The leaderboard was another highlight for them, as it would encourage them to try harder, given their personal motivation for competition. Despite their positive feedback, Tester B did mention a few dislikes. They felt that some topics seemed a bit flat, and

they didn't care for the background images used, suggesting that more vibrant or cohesive colors could enhance the App's attractiveness.

When asked if this version made them feel more motivated to engage with *MentalPotion*, they responded with a confident "yes," primarily due to their competitive nature and enjoyment of the sense of "winning." However, they didn't believe they would become overly reliant on their competitiveness; rather, they expected to use it as a helpful tool they could return to when needed, without feeling pressured, but that engagement could still be an issue.

5.5.3.3 Tester C

Two weeks later, Tester C returned for their second interview to share their experiences with both the original and the newly updated gamified versions of the App. They reported using the base App for just over half of the days during the two-week period, more specifically, about a week and three days in total. On the days they didn't use the App, it was mainly because they forgot. Tester C admitted that their primary motivation during this period was the testing process itself, rather than personal interest. They primarily used the App to provide feedback for the project, rather than because they found it engaging or useful for their own needs. Regarding the base version of *MentalPotion*, they suggested giving "Meowski" a more active role. They imagined that the mascot could use AI to provide personalized feedback about user progress, comment on completed activities, and offer motivational prompts to keep users engaged.

Upon trying the updated gamified version, they expressed a preference for it over the original, describing it as more complete and refined. They noted that the daily streak system and the skill tree were the most interesting new features, as these elements added structure and a sense of purpose. They also found the leaderboard fun, although they felt it was less motivating on a personal level. However, they pointed out that the skill tree and daily streaks did not reward milestones, which made progress feel somewhat empty. They suggested adding milestone rewards to reinforce the sense of progress. Furthermore, they reiterated that template routines, while a good tool, should allow for customizing time blocks before activation, as the lack of flexibility made these features harder to use.

When asked if they felt more motivated now to use the App, they indicated that the only feature likely to keep them engaged consistently would be the leaderboard, but only if they were competing with friends. If social features are expanded, they emphasize the need for a private mode, allowing users to remain anonymous and avoid judgment or comparisons.

In terms of what else might motivate them, they noted that it wouldn't be any single feature but a collection of small yet meaningful improvements. Since they don't usually seek out mental health tools, they felt that the current content was not compelling. However, they mentioned that they might use the App more if the topic exploration section resembled a library even more, allowing users to also search for exercises or advice based on their current feelings. They also suggested that it would be helpful to search for broader feelings, such as anxiety, to understand

what those feelings might mean, why they might be experiencing them, and what actions to take. They proposed that this could even be a conversational feature with Meowski, although they acknowledged that this could be complex to implement.

5.5.3.4 Tester D

Two weeks later, Tester D returned for their second interview to discuss their experience with the base version of the App and to try out the newly updated gamified version. They reported having used the App for about a week before gradually stopping, primarily because they forgot to open it rather than losing interest.

After testing the new build, they expressed a strong preference for it, highlighting several changes as significant quality-of-life improvements. They seemed content with the implementation of notifications, as these were particularly beneficial in helping to keep the App present in their daily routine. They also appreciated the redesigned schedule system, noting that merging the home screen schedule with the schedule manager made navigation less confusing.

Tester D mentioned feeling more motivated to engage with the App. The new skill tree and the ability to track their progress were especially motivating, which provided a sense of advancement. They had positive impressions of other new features as well. They liked the inclusion of a tutorial, though they did not find it necessary for themselves, they recognized its value for other users. They mentioned that the leaderboard could serve as an additional motivator, especially by displaying friends' scores, which they described as a "nice" feature that could enhance social engagement. Despite these positive impressions, Tester D pointed out areas that still felt incomplete. The main issue was the continued lack of customization options for the scheduled times of template routines, which they considered a major limitation. They also noted that the App needed more variety in its activities and topics, as they had already begun to see repeated prompts for activities.

Reflecting on their overall experience, they stated that the App now felt much more captivating than before. While the activities were already interesting, they believed they could become even more engaging with additional content and further quality-of-life improvements.

5.5.3.5 Tester E

Two weeks later, Tester E returned for a second interview to reflect on their experience with the base App and try the new gamified version of *MentalPotion*. They mentioned that they had only opened the base App about four times during that period, mainly out of curiosity, but often forgot to use it, mainly due to a lack of motivation. After testing the updated version, they expressed a clear preference for it over the original, describing most of the changes as welcome improvements that made the App feel more polished. They highlighted the visual changes to the schedule as especially impactful; the time labels were now unobstructed, and the

redesigned activity block colors made it easier to read and visually appealing. They also noted that the profile screen felt less empty thanks to the new features added to it. However, what stood out the most was the introduction of leaderboards. As a naturally competitive person, they found this feature highly interesting and said it became one of their favorite aspects of the App.

They also appreciated the new experience (EXP) and skill tree systems, which provided a sense of progression that was previously lacking. Tester E then reiterated that the leaderboard system was a major motivator for them, sparking a strong desire to engage more with the App, admitting it even made them want to complete more activities just to climb the rankings. However, when asked about it, they also noted a potential downside: the risk of shifting their focus from personal growth to competition. They explained that this risk would depend on how the leaderboards were structured. If the leaderboards only included friends, the risk of unhealthy competition would be low. On the other hand, if they were global, they admitted they would likely feel more motivated but might also become obsessed with using the App simply for that aspect.

In terms of features that still felt missing, Tester E mentioned that while the new notifications were helpful, they would not be enough to make them return consistently. They mentioned that they typically ignore notifications and felt a persistent home screen widget would be a much more effective way to draw them back in, as mentioned in their initial interview. As additional feedback, they noted that the tutorial was a nice touch, though not strictly necessary for them. Finally, they suggested adding more social features, such as the ability for users to share completed activities or collaborate with others on activities.

5.5.3.6 Tester F

Two weeks later, Tester F returned for a follow-up interview. They mentioned that they had only opened the App on two different days since the first interview, primarily due to forgetting about it and lacking motivation to do so. After testing the updated gamified version of the App, they expressed a clear preference for it over the base version. They described the earlier version as incomplete and somewhat lacking, while the new build felt more polished and provided a sense of progression that had previously been missing.

The addition of experience points (EXP) stood out as a significant improvement for them, offering immediate feedback after completing activities. They also noted that the revamped visuals made a considerable difference. They viewed the leaderboard as a nice addition, though not the primary reason for their renewed interest, and the changes to the schedule's color scheme and structure and the toned-down crisis button made the interface feel less clunky. However, they reiterated that the most impactful change for them was really the ability to track their progress through EXP, which gave meaning and significance to completing activities.

Despite these positive impressions, they still saw room for improvement. They considered the new tutorial a step in the right direction but found it too simple and somewhat boring. They

suggested that it should be more narrative-driven to capture attention, possibly using “Meowski”. When asked about concerns, they mentioned that the competitive nature of leaderboards could lead to negative effects, such as users “spamming” activities just to climb the rankings. They suggested implementing a ranking system similar to *Duolingo’s* leagues, where users would compete only with others who were at the same rank to reduce competitive pressure.

They emphasized that competition should remain optional and not be the central focus, as it could demotivate some users or create unnecessary stress. They also proposed that the App should implement ways to prevent leaderboard abuse, discouraging meaningless activity spam, and recommended exploring collaborative features instead of purely competitive ones. They argued that collaboration aligns better with the supportive, mental health-focused nature of the Spp. However, they stressed that collaboration and competition should not overlap, as collaboration should center on mutual support rather than competitive challenges, which could have counterproductive effects.

5.5.3.7 Tester G

In the second interview, Tester G stated that they used the App during the first three or four days of the two-week testing period. They attributed not continuing to do so primarily to forgetting about the App and noted that it lacked something that would encourage them to return. When asked if their usage was motivated more by personal interest or their role as a tester, they indicated it was primarily driven by genuine interest, although being a tester may have played a minor role. They expressed that the App showed potential and was something they would like to use, but in its current state, they couldn't envision using it consistently.

After trying the new gamified version, Tester G definitely preferred it over the base version. They described the earlier version as empty and incomplete, while the new iteration felt more alive and polished. They liked the new topic images and the refined UI, especially in the schedule, which they viewed as central to the App. Beyond aesthetics, what impressed them most was that the profile screen no longer felt bare. They found the skill tree an interesting and creative way to represent progress, and they felt that the leaderboard made the App feel more interesting and alive, while also preventing the home screen from appearing empty. They even mentioned that, after seeing two of their friends on the leaderboard during testing, they felt surprisingly more motivated.

When asked about their favorite aspect of the new App version, they highlighted the ability to visualize progress, which they found to be the most motivating feature to them overall. However, they also pointed out that some areas still felt incomplete. They mentioned that the new optional tutorial was helpful but suggested it could be more engaging by presenting it as a narrative involving the mascot “Meowski.” They reiterated that the topics and template routines had not changed and still had the same issues as before. Although the profile screen had improved, they still felt it lacked customization options. Overall, they noted that the App

felt more alive than before but still seemed somewhat empty or missing some element that they could not describe.

When asked about it, tester G indicated that they now felt more motivated to use the App, primarily due to the visible progress and secondarily because of the leaderboard. However, they cautioned that leaderboards could produce negative effects if users became overly competitive, though they believed this risk was low if users had the option to choose not to share their data. As an additional suggestion, they recommended focusing on collaborative rather than competitive features. For instance, users could share routines or activities with friends, completing them only if both parties participated. They added that incorporating more collaborative activity types could further enhance motivation to engage with the App.

5.6 Final Tester Interviews and Tester Summary

After a two-week testing period of the gamified version of the App, the testers were invited to a final interview to share their suggestions and opinions. The purpose of these interviews was to understand how they perceived the gamified App after the testing period was over. This section of the document also summarizes the feedback collected from each tester during their interviews.

5.6.1 Tester A

In the final interview, Tester A explained that they had opened the app only once during the two-week testing period. They noted that even with notifications enabled, they often forgot about it and didn't feel motivated to return on their own. While they acknowledged that the app appeared improved and more polished than before, it still did not capture their interest enough to encourage regular usage. Tester A also reflected that they might not inherently be the type of person drawn to this kind of application, and their opinions on the previously discussed topics had not significantly changed.

Throughout the three interviews, Tester A consistently expressed difficulties with motivation and engagement. They showed interest in the concept and appreciated several design aspects, particularly the emergency help feature, gamification elements, the mascot, and visual improvements in later builds. However, this appreciation did not translate into sustained use. Tester A clarified that much of their engagement stemmed from wanting to provide feedback as part of the testing process rather than from genuine personal interest, further illustrating their lack of intrinsic motivation to adopt the tool.

Their feedback often focused on structural and usability issues, such as the lack of reminders, an unintuitive scheduling system, and the absence of onboarding or guidance. Although the introduction of notifications, progress tracking, and gamified elements initially improved their perception of the app, this boost was not strong enough to overcome their tendency to forget about it or their general disinterest in such tools. Tester A highlighted the importance of more

proactive engagement systems, such as daily check-ins, progress tracking, and motivational prompts. However, their testing behavior suggested that even with some of these features implemented, they might not become a regular user.

Overall, their case emphasized that while gamification and design refinements can enhance initial impressions, they may not be sufficient to engage users who are not already inclined to seek out or rely on mental health apps in their daily routines.

5.6.2 Tester B

During the final interview, Tester B shared that they had opened the App only twice in the last two weeks of testing. While they viewed *MentalPotion* as a promising and potentially useful idea, and appreciated the enhancements made in the gamified version, they acknowledged that even the addition of leaderboards was not sufficient to encourage consistent use. They admitted to struggling with maintaining interest, although there were times when they felt the desire to use the App, particularly when they wanted to read or spend some time alone. Ultimately, however, they did not follow through on those urges.

Tester B explained that their main obstacles were a lack of social interaction and motivation, as well as not feeling the need for a structured schedule like the one the App offers (a format that simply did not align with their habits). They believed that being able to directly compete with other users on activities or collaborate more closely with them could enhance the experience and make it more engaging and memorable. Additionally, they suggested incorporating more targeted tools for managing negative emotions, especially during stressful moments. They felt these tools would make the App more personally relevant.

Across all interviews, Tester B emphasized the importance of visual appeal, a stronger thematic identity, and a firmer application of game mechanics and theming to make *MentalPotion* feel more complete and engaging. They appreciated features such as the skill tree, leaderboard, and calendar improvements, which contributed to a more structured and motivating experience. However, the absence of social features and emotionally supportive tools ultimately seemed to prevent them from forming a lasting connection with the App.

5.6.3 Tester C

In the final interview, Tester C mentioned that they had only opened the App on about three different days of the last two weeks of testing. They noted that on several other occasions, which were not the three mentioned cases, they had briefly opened the App but closed it again after realizing it was not yet time for any scheduled activities. This behavior reinforced their earlier point that, while they were curious about the App, it was somewhat empty feature-wise and rarely felt compelling enough to hold their attention or motivate them to engage.

Throughout all three interviews, Tester C's feedback remained largely consistent. From the beginning, they appreciated the App's visual design, describing it as cozy and easy to navigate. However, they repeatedly expressed feeling lost during their first session and called for a clearer onboarding experience, ideally featuring “Meowski” as a tutorial guide. They also highlighted usability issues such as the lack of tooltips, cluttered topic pages, and the inability to reschedule template routines.

By the second interview, they expressed a clear preference for the gamified version, particularly the daily streak system and skill tree, which they felt provided the App with a sense of structure and purpose. Despite this, they emphasized that these elements still lacked meaningful rewards, that the App still felt somewhat empty, and that greater flexibility in scheduling template routines was necessary.

Even with these improvements, Tester C admitted that their primary motivation for using *MentalPotion* in the testing phase was still the study itself, rather than a personal inclination to use the App. They explained that, for someone like them who does not typically seek out mental health tools, no single feature would be sufficient on its own. Instead, a combination of small but meaningful enhancements would be required to make the experience worth their time. They suggested features like expanding the searchable topic library with mood-related exercises and tools, AI-powered personalization to provide meaningful feedback, and optional social elements such as friend-limited competition and interaction. Furthermore, they then mentioned that the App did help them mentally engage with “deeper” personal topics and be more aware of them, although they did not feel any significant change to their routine habits.

Overall, their feedback demonstrated that while the gamification mechanics systems employed helped improve their perception of the App, these elements alone were not enough to turn curiosity into consistent engagement without deeper personalization, flexibility, and contextual relevance.

5.6.4 Tester D

In the final interview, Tester D shared that they used the App a maximum of three times during the last two weeks of testing. They noted that this decrease in usage was mostly due to the notifications unexpectedly stopping working after a bit, although perhaps this was likely not the only reason. Interestingly, despite their reduced usage, they found the newer, gamified version of the App to be much more motivating and enjoyable than the basic version, expressing a clear preference for the updated build.

When asked which features stood out to them, they highlighted the leaderboard and the mastery/skill system as their favorites. They mentioned that there were no features they would want to remove, as nothing felt unnecessary or out of place. However, they reiterated that their biggest displeasure with the App was the inability to customize the scheduled times of template routines. They emphasized that while custom activities exist as an alternative, creating them can be hard for new users who are unsure of what to do or which activity types to choose. They

also suggested implementing specific tutorials for each activity type. Additionally, they admitted that they had barely used the topic section of the App. They explained that the resources there didn't stand out or feel captivating, leading them to forget about it altogether. They proposed that activities could serve as an entry point to encourage users to access those resources.

Despite these criticisms, Tester D described the new gamification features as well-balanced, stating that they enhanced the overall experience without distracting from the App's main purpose. They pointed out that since the system offered no real tangible rewards aside from visual progression, it avoided feeling addictive or exploitative. Reflecting on their experience, they mentioned that *MentalPotion* had actually helped them build a healthier routine and engage more with mental health topics than before. For instance, they described how they now started their mornings with a scheduled activity designed to reduce phone usage right after waking up, which ultimately prompted them to be more mindful and present with their thoughts.

Overall, their feedback emphasized that while gamification and visible progress systems can effectively support motivation, they need to be paired with improved flexibility, clearer guidance, more customization, and better integration of content to maintain user engagement over time.

5.6.5 Tester E

In the final interview, Tester E shared that they had only engaged with the App during the first two days of the last two-week testing period before abandoning it entirely. As they had explained before, this behavior was typical for them, as they often lose interest in most Apps after an initial burst of curiosity. This outcome reinforced the concerns they had expressed in their previous interviews about struggling to remain engaged without stronger external motivators.

Throughout all their sessions, Tester E consistently described *MentalPotion* as visually appealing and well-designed but lacking compelling engagement mechanisms. While they appreciated the aesthetic improvements in the gamified version, such as the redesigned schedule, a less empty profile screen, and the addition of the leaderboard and skill tree systems, these enhancements were insufficient to maintain their interest for long. They admitted that the leaderboard briefly sparked motivation due to their competitive nature, but this drive quickly faded without more persistent prompts or mechanisms encouraging them to return or more useful features.

Tester E emphasized the importance of visible progress, customization, and social features as potential motivators. They suggested ideas such as home screen widgets, customizable schedule colors, a virtual companion that evolves with progress, and collaborative activity modes to strengthen long-term engagement. They also noted that notifications alone would not be effective for them, as they tend to ignore them.

Ultimately, Tester E's experience highlighted that while the employed gamification elements can generate short-term motivation, they are not enough to sustain engagement for users who naturally struggle to maintain long-term interest in digital tools. For these users, more persistent engagement hooks, personalization, and social connection features are essential for encouraging consistency.

5.6.6 Tester F

In the final interview, Tester F explained that they had not used the App at all during the last two weeks of the testing period. Their impressions and opinions also had not changed since the previous session, reinforcing the points they raised during the mid-test interview about motivation and engagement. Over the course of the three interviews, Tester F consistently described MentalPotion as visually appealing and thematically pleasant but ultimately not intuitive or engaging enough to hold their interest.

They emphasized that while the introduction of gamification elements, such as experience points (EXP), a skill tree, and a leaderboard, made the App feel more complete and rewarding, these additions were not sufficient to overcome their tendency to forget about it and their general lack of habit in using such tools. They described the base version of the App as feeling empty, while the new version was much more polished; however, it still lacked the motivation required to encourage regular use.

Tester F's feedback heavily focused on the importance of visible progress and meaningful feedback. They suggested that *MentalPotion* should better showcase users' achievements through progress tracking, statistics, or growth-based visual systems. They also expressed concerns about the competitive nature of leaderboards, worrying that it could lead to unhealthy behavior, such as spamming meaningless activities just to climb the ranks. To address this, they proposed a league-based system similar to *Duolingo's*, where users compete only with others at their level. They stressed that competition should remain optional and not the central focus.

Ultimately, Tester F's experience highlighted that while gamification and progress systems can significantly improve perceived value, they are not enough on their own to engage users who lack an existing motivation to seek mental health support tools. Without stronger customization and stronger motivational mechanisms, they felt they would continue to abandon the App after only brief use.

5.6.7 Tester G

In the final interview, Tester G shared that they had engaged with *MentalPotion* for approximately a week and a half of the days during the last two-week testing period, though they were unsure of the exact number.

They noted that their overall opinions and suggestions remained largely consistent with their previous interviews, but their perception of certain features had shifted. In particular, they now found the leaderboard to be more motivating than the EXP system. While they appreciated the EXP points, they felt that the lack of intermediate milestones or concrete rewards beyond leveling up made the system feel less impactful. In contrast, seeing friends appear on the leaderboard provided them with a stronger sense of activity and presence within the App, encouraging them to complete more activities and helping them remember to use it. However, they described this as a double-edged sword: on days when the leaderboard was mostly empty, the App felt lifeless and flat again, which harmed their motivation.

They further mentioned that the App prompted them to think more often about mental health topics and engage in self-reflection, although they clarified that this effect might not be unique to the App, as they tended to feel similarly when exposed to deeper or mental health-related subjects in general. Nonetheless, they noticed an ever-so slight shift in their daily habits; they had begun to associate certain times of day with specific activities from their schedule, suggesting that the App had helped instill some routine-based behaviors, or at least remember them.

Across their three interviews, Tester G consistently praised the App's cozy aesthetics and the introduction of systems like the skill tree and leaderboard, which to them enhanced the overall experience. However, they continued to emphasize the lack of customization, the need for additional tools in the topics section, the emptiness of certain places, such as topics, and the need for stronger social or collaborative elements or features. Their experience indicated that while social visibility through the implemented leaderboard could significantly improve engagement, it must be consistent and populated to be effective; otherwise, it risks backfiring and reinforcing the sense of emptiness they felt in earlier builds. Moreover, features like the skill tree should be more rewarding and captivating, and customization and more game elements perhaps would be essential to further improve *MentalPotion.*

6 Conclusions

This final chapter brings the project full circle, tying together the development process, the user testing phase, and the key insights drawn from both. The goal is to reflect on what was learned, evaluate how well the project addressed its objectives, and discuss the broader implications of its results.

While the study was intentionally small in scale and focused on qualitative data, it still provided valuable perspectives on how young adults engage with gamified mental health tools, what elements can drive or hinder their motivation, and how design decisions shape the user experience.

The following sections summarize the main findings from the testing phase, connect them back to the original research questions, and explore the contributions, limitations, and possible next steps emerging from this work.

It is important to note that this project, along with the methodologies involved and its conclusions, will also be published as an article in a scientific journal.

6.1 Summary of the work

The goal of this dissertation project was, among other things, to design a gamified mobile application focused on digital mental health. The aim was to explore how gamification could be effectively integrated into a digital mental health platform to increase user engagement, motivation, and enhance the learning experience, while also maintaining appropriate ethical safeguards for such a sensitive context. To achieve this goal and gather insights on the effectiveness of the project's content, a digital self-help App named "MentalPotion" was designed and developed.

The development process was structured in distinct phases. The first phase concentrated on defining the methodologies necessary for success and gathering stakeholder data to guide the App's design and related decisions. Insights were collected from various sources, including online questionnaires for end-users and interviews with mental health professionals, as well as a study of existing mental health-related gamified applications and works. These findings helped inform both the identification of user needs and the ethical considerations that needed to be addressed.

The next phase focused on designing the App's base features and gamification elements with the acquired data. This involved determining which core features and game mechanics should and would be implemented, guided by established theoretical frameworks on motivation, such as Self-Determination Theory and Maslow's hierarchy of needs, as well as ethical considerations in gamification design and Yu-kai Chou's "Octalysis" framework. These models were used to map psychological needs to potential game elements and assess their ethical implications. The outcome was a set of gamification features to be integrated into *MentalPotion*, aimed at enhancing user engagement while prioritizing autonomy and well-being.

Following this, a base version of the application was implemented without any gamification elements. This included designing the system architecture, modeling the data structure, and implementing core functionalities such as activity scheduling, progress tracking, and topic-based routines. This initial version served as a foundation for future enhancements and allowed for the isolation of gamification effects during subsequent testing. Once the base version without gamification was complete, a testing phase was conducted with a small group of users. The purpose of this phase was to gather qualitative feedback on usability, functionality, and overall experience, as well as to establish baseline engagement levels.

The final major phase involved refining the base design by integrating the previously defined gamification elements, informed by feedback acquired from testers during their initial interactions with the App. Following this refinement, the gamified version of the *MentalPotion* was provided to testers for further evaluation, allowing for the collection of their final feedback.

6.2 Key Findings and Insights

Section 6.2 synthesizes evidence gathered from the systematic mapping study, co-design activities, clinician input, and small-scale user testing conducted for this project. The objective here is to address the three research questions outlined in Chapter 1. The following sections provide the responses achieved for each one based on the data and evidence found during the project's run. Each subsection summarizes the most relevant findings from the literature, questionnaires, clinician interviews, and testers, notes the confidence levels and key limitations of the evidence, and outlines brief design and ethical implications.

Since the empirical work is exploratory (based on a small sample of n=7 and a short follow-up), the language used is intentionally cautious. Phrases such as "suggests" or "indicates" are

employed where causal claims cannot be supported. Each answer concludes with a brief comment on the extent to which it can be generalized.

6.2.1 RQ1 – Are gamification strategies effective in promoting engagement, knowledge, or behavioral changes in self-help/mental-health-related environments aimed at young people?

Testing of the base version of the App revealed that, while the concept and user interface (UI) were well-received, sustained user engagement was tricky and inconsistent. Several testers used the App on fewer than half of the days dedicated to testing, often missing sessions due to forgetfulness or low motivation. Some participants admitted that their usage was driven more by a perceived obligation to provide feedback than by genuine interest, despite reminders that they could use the App at their discretion. This aligns with what is known from Self-Determination Theory (SDT): the base App did little to support users' psychological needs for "autonomy" (sense of choice), "competence" (sense of progress/mastery), or "relatedness" (sense of connection). "Octalysis" analysis of the base version also reveals few active core drives, suggesting a possible over-reliance on extrinsic motivation. This explains why user engagement waned once novelty, pressure, and curiosity diminished.

In response to these issues, the gamified version of the pp incorporated elements specifically designed to meet these needs. the "Skill Tree" and visible progress indicators aimed to support users' sense of "competence" and align with *Octalysis's* "Accomplishment" drive. Providing users with the ability to choose their progression paths aimed to foster "autonomy" and the "Empowerment" drive. Additionally, the optional social features, which consisted of small leaderboards and a weekly streak view, were introduced to foster a sense of "relatedness" and tap into the "Social Influence" drive, while deliberately being designed/constrained to avoid pressure-based or competitive mechanics.

In small-scale testing of the gamified version that took place, these theory-driven elements did produce some short-term effects. Most testers reported increased curiosity and a greater interest in returning frequently to unlock progress milestones or advance within the Skill Tree. However, even if they expressed this interest, actual usage did not always increase, although the small sample of testers does not permit to infer anything about these fluctuations. The clearer feedback and intermediate goals appeared to help trigger feelings of "competence" and mastery. Some participants indicated that the social gamification features made the experience feel "more alive" or "less empty" when they noticed peers actively using the App, supporting the idea that cues related to "relatedness" can enhance engagement, especially in low-stakes environments. However, these spikes in engagement were typically temporary. Interest diminished after the novelty wore off, and most participants did not develop stable daily routines during the four-week test period. Some of the social elements also posed risks when there were few active users; for instance, seeing only one or no users on the leaderboard discouraged some testers, leading them to perceive that the App's community was "dying."

These findings resonate with the systematic mapping study insights acquired, which suggest that while gamification is not a universal solution, it has the potential to alleviate engagement issues. This perspective is also supported by clinician interviews, during which experts highlighted that gamification was an interesting option to effectively spark interest and provide structure. However, they cautioned against reliance on coercion, pressure, or long-term competition, advocating instead for a focus on fostering personal growth and emotional awareness.

In summary, the evidence suggests that theory-driven gamification can meaningfully boost short-term engagement and enhance UX in mHealth digital tools, but it is insufficient on its own to create lasting behavioral change. Converting initial interest into stable routines likely requires stronger habit anchors, longer-term social connections or collaboration, and extended follow-up periods. This interpretation is intentionally cautious, as the empirical work here was exploratory (involving a convenience sample of n = 7 over four weeks) and serves more to inform future design directions rather than making broad causal claims about effectiveness. Larger, longer-term studies would be necessary to confirm and refine these results.

6.2.2 RQ2 – How can we design a gamified self-help tool to address mental health issues and provide knowledge to adolescents and young adults?

The findings from the mapping study, questionnaires, and interviews indicated that mental health tools targeted at young people often struggle to balance user engagement with ethical responsibility. The mapping study and overall exploration identified recurring gaps in existing Apps, such as limited personalization, a lack of social connectivity features, and an excessive reliance on external rewards instead of fostering internal meaning. Clinicians echoed these concerns, emphasizing that any digital tool should prioritize emotional awareness, personal growth, and the development of healthy habits, while also avoiding competitive pressure or feelings of guilt if users choose to disengage. These insights align with the principles of Self-Determination Theory (SDT), which suggest that for engagement to be sustainable, the tool must support users' “autonomy”, “competence”, and “relatedness”. Additionally, the “Octalysis” framework revealed that the foundational app activated very few "White Hat" core drives, such as “Accomplishment”, “Empowerment”, and “Social Influence”. Instead, it mostly relied on self-initiative, which made motivation fragile and inconsistent, especially considering the type of individual who might find these types of tools helpful.

Based on this analysis, the design process for the gamified version deliberately focused on embedding structural support for these psychological needs:

- “Competence” + “Accomplishment” drive: The “Skill Tree” and clear progress indicators gave users a visible sense of mastery and forward movement, showing how each activity contributed to larger goals.

- “Autonomy” + “Empowerment” drive: Users were allowed to choose a different skill path to pursue from the “Skill Tree” branches, making their journey self-directed and personally meaningful instead of linear.

- “Relatedness” + “Social Influence” drive: Optional social features (leaderboard and weekly streak view) created a light social presence and recognition without introducing persistent competitive hierarchies or special rewards based on performance. Users had to opt in, and only the top three daily rankings were shown to minimize pressure.

This design strategy also applied ethical constraints from the beginning. Drawing on the clinician input and dark pattern literature, Black Hat drives (“Scarcity”, “Unpredictability”, or “Avoidance”) were limited to very controlled situations, although still existent to provide balance. The aim was to prevent compulsive use, stress, or FOMO dynamics while interacting with the App. In this context, gamification was framed as a motivational scaffold rather than a persuasive or addictive system. Feedback from small-scale testing indicated that these design choices were largely effective in shaping the user experience.

Most testers identified the “Skill Tree” as the feature that "made the app feel meaningful," as it helped them visualize growth and provided a reason to return. The social features also received very positive reviews and piqued users’ interest, although some concerning opinions also arose: while they increased engagement when peers were actively using the App, they could also make the App feel "empty" or demotivating when few or no users were present. This highlighted the inherent fragility of design based on relatedness when social density is low. Importantly, no testers reported feeling pressured or guilty when missing days, which suggests that ethical guardrails were at least partly effective.

Overall, he design process and insights acquired show that a gamified self-help tool for mental health must be built around user needs, rather than just rewards to boost engagement. Features should emerge from psychological theory and stakeholder values rather than from generic game mechanics. This project illustrated a viable design pattern: leverage White Hat drives to support SDT needs (competence, autonomy, relatedness), keep Black Hat elements constrained and transparent but use them for balance, and embed ethical constraints into the design process rather than treating them as an afterthought. These findings not only address RQ2 by outlining not just *what* gamification elements can be used, but also *how* they must be implemented to be safe, meaningful, and engaging for young users. With that said, this approach remains exploratory, having only been tested with a small, possibly biased sample (n = 7) over four weeks. Larger and more diverse studies are needed to validate whether these design principles can scale effectively and maintain ethical standards in longer-term real-world conditions.

6.2.3 RQ3 – What gamification strategies are effective in enhancing engagement with overall mental health-related tools or in influencing positive behaviors for adolescents and young adults within a self-help tool?

Evidence collected from the small-scale test offers only tentative indications into which gamification strategies may be promising in this context. Since the study involved a tiny convenience/tester sample (n = 7) and a brief follow-up period of four weeks, any observed patterns should be interpreted with caution as exploratory design insights rather than conclusive results.

Test participants responded positively to various elements, though there was notable variation among individuals. Interest tended to cluster around two main types of strategies. First, mechanics associated with White Hat drives from the “Octalysis” framework (“Accomplishment”, “Empowerment”, and “Social Influence”) seemed to resonate most with testers who engaged with the App more frequently. The Skill Tree feature, which provides visible progress and user-chosen paths, was most often described as the most prominent/motivating feature by these participants. This aligns with Self-Determination Theory, which emphasizes that progress enhances perceived “competence”, and branching paths promote “autonomy”.

Second, the optional social features, which include the leaderboards and weekly streak view, generated curiosity and excitement, particularly when they displayed familiar names or highlighted active participation. Several testers mentioned checking back to view rankings and completing activities to compete with friends, or to maintain their activity streak. However, others expressed some indifference or even found empty leaderboards demotivating. Additionally, while testers expressed interest in these features, their feedback seems to point out that this motivation was sporadic and not sustainable long-term, with the testers who showed the most interest in them also being the ones who disengaged with the App sooner. This mixed reaction suggests that while social-based strategies can encourage engagement through a sense of relatedness, their effectiveness might diminish long-term and may be heavily dependent on having enough active users to foster a sense of community and on the average personality traits of the target audience.

Notably, the design employed constrained these mechanics rooted in Black Hat drives (“Scarcity”, “Unpredictability”, or “Avoidance”), which were flagged as high-risk by clinicians and the literature. The absence of negative feedback (e.g., no punishment for missed days) or pressure through exclusive rewards was appreciated by some testers, helping them engage at their own pace. This reinforces that low-pressure mechanics can preserve autonomy and emotional safety, even if they generate smaller engagement boosts than more coercive designs.

These early results do not point to a single "most effective" strategy. However, they suggest that approaches that support SDT needs are likely to be more ethically sustainable than pressure-based designs in the area of digital mHealth. Particularly, strategies that incorporate White Hat mechanics, like progress tracking and self-chosen goals, seem promising.

Nonetheless, these approaches alone did not lead to stable long-term routines during the testing period. This indicates that stronger habit-building support, enhanced social infrastructure, and extended follow-up may be necessary for better outcomes. This might also indicate that more intrusive or potentially addictive features might be considered, as the implemented ones might have been too lightweight. Future studies with larger and more diverse samples are essential to verify whether these patterns hold at scale and to explore whether less limited, but carefully controlled Black Hat elements could be used safely to strengthen engagement without undermining well-being.

6.3 Future Work

This project provided initial insights into the design and potential of a gamified self-help tool for mental health aimed at a young audience (16 to 25 years of age). However, its exploratory nature opens several paths for future research and development. The top priority is to conduct larger-scale, longitudinal studies to assess the impact of the proposed gamification strategies and of the design structure followed on MH App engagement, knowledge acquisition, and behavioral change over longer, extended periods. A longer follow-up would help determine whether the short-term increases observed in this study can translate to stable routines and lasting effects beyond initial user interest.

Future research should focus on testing the generalizability of these findings across diverse populations, as this project was based on a small test sample of just seven participants with relatively similar backgrounds. Expanding the sample to include and analyze a wider range of demographics, such as varying ages, cultural contexts, levels of mental health literacy, and baseline motivation, could reveal significant differences in how individuals perceive gamification and the effectiveness of specific strategies for different groups. Broader sampling may also help identify unintended negative effects or accessibility barriers that were not evident nor explored in this project.

Another promising direction for research is to implement more solid and refined game elements, including the ones employed here, and a systematic exploration of alternative gamification elements and their effects and correlation with users' needs. This project specifically focused on strategies aligned with White Hat drives, such as progress tracking, skill trees, and low-pressure social mechanics, due to their alignment with Self-Determination Theory and their ethical considerations. However, other design approaches, such as narrative-driven mechanics or cooperative group challenges (features which were mentioned by the testers), could also support different psychological needs when implemented following the design structure used in this project. Future work should experiment with mapping a wider range of game elements to specific psychological needs and empirically test which combinations are most effective at fostering intrinsic motivation without creating pressure or undermining autonomy.

Furthermore, future iterations should consider integrating stronger habit-building supports and customizable and social infrastructures, such as routines anchored to existing daily habits,

richer peer interaction systems, or mentorship features. These additions could help transform the short-term engagement effects observed in this project into sustainable behavioral change.

Overall, future work on this area should view gamification not as a fixed set of features but as a design space to navigate carefully, balancing motivational impact with ethical responsibility. Establishing connections between gamification strategies, psychological needs, and measurable behavioral outcomes could provide a stronger evidence base for designing mental health tools that are both engaging and safe in this context.

References

[1] B. Andrew Perrin, A. Perrin, R. Analyst Haley Nolan, and C. Manager, “Mobile Technology and Home Broadband 2021,” vol. 3, p. 2021, 2021, Accessed: Dec. 23, 2024. [Online]. Available: www.pewresearch.org.

[2] O. -Kongsvinger, “Statistical Yearbook of Norway 2003 122nd issue Statistisk sentralbyrá Statistics Norway Official Statistics of Norway”, Accessed: Dec. 23, 2024. [Online]. Available: http://www.ssb.no/

[3] “Biggest social media platforms by users 2024 | Statista.” Accessed: Dec. 23, 2024. [Online]. Available: https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/

[4] Y. Veisani, Z. Jalilian, and F. Mohamadian, “Relationship between internet addiction and mental health in adolescents,” *J Educ Health Promot*, vol. 9, no. 1, Nov. 2020, doi: 10.4103/JEHP.JEHP_362_20.

[5] E. J. Ivie, A. Pettitt, L. J. Moses, and N. B. Allen, “A meta-analysis of the association between adolescent social media use and depressive symptoms,” *J Affect Disord*, vol. 275, pp. 165–174, Oct. 2020, doi: 10.1016/J.JAD.2020.06.014.

[6] J. Y. Lebni *et al.*, “A study of internet addiction and its effects on mental health: A study based on Iranian University Students,” *J Educ Health Promot*, vol. 9, no. 1, Aug. 2020, doi: 10.4103/JEHP.JEHP_148_20.

[7] N. Banjanin, N. Banjanin, I. Dimitrijevic, and I. Pantic, “Relationship between internet use and depression: Focus on physiological mood oscillations, social networking and online addictive behavior,” *Comput Human Behav*, vol. 43, pp. 308–312, Feb. 2015, doi: 10.1016/J.CHB.2014.11.013.

[8] A. Arzani-Birgani, J. Zarei, L. Favaregh, and E. Ghanaatiyan, “Internet addiction, mental health, and sleep quality in students of medical sciences, Iran: A cross-sectional study,” *J Educ Health Promot*, vol. 10, no. 1, Nov. 2021, doi: 10.4103/JEHP.JEHP_1506_20.

[9] S. Loleska and N. Pop-Jordanova, “Is Smartphone Addiction in the Younger Population a Public Health Problem?,” *Pril (Makedon Akad Nauk Umet Odd Med Nauki)*, vol. 42, no. 3, pp. 29–36, Dec. 2021, doi: 10.2478/PRILOZI-2021-0032.

[10] “Depression and Other Common Mental Disorders.” Accessed: Jan. 04, 2025. [Online]. Available: https://www.who.int/publications/i/item/depression-global-health-estimates

[11] L. Picco *et al.*, “Beliefs about help seeking for mental disorders: Findings from a mental health literacy study in Singapore,” *Psychiatric Services*, vol. 67, no. 11, pp. 1246–1253, Nov. 2016, doi: 10.1176/APPI.PS.201500442/SUPPL_FILE/APPI.PS.201500442.DS001.PDF.

[12] M. E. Pennant *et al.*, “Computerised therapies for anxiety and depression in children and young people: A systematic review and meta-analysis,” *Behaviour Research and Therapy*, vol. 67, pp. 1–18, Apr. 2015, doi: 10.1016/J.BRAT.2015.01.009.

[13] D. D. Ebert *et al.*, “Internet and Computer-Based Cognitive Behavioral Therapy for Anxiety and Depression in Youth: A Meta-Analysis of Randomized Controlled Outcome Trials,” *PLoS One*, vol. 10, no. 3, p. e0119895, Mar. 2015, doi: 10.1371/JOURNAL.PONE.0119895.

[14] J. Torous, J. Lipschitz, M. Ng, and J. Firth, “Dropout rates in clinical trials of smartphone apps for depressive symptoms: A systematic review and meta-analysis,” *J Affect Disord*, vol. 263, pp. 413–419, Feb. 2020, doi: 10.1016/J.JAD.2019.11.167.

[15] J. Torous, J. Nicholas, M. E. Larsen, J. Firth, and H. Christensen, “Clinical review of user engagement with mental health smartphone apps: evidence, theory and improvements,” *BMJ Ment Health*, vol. 21, no. 3, pp. 116–119, Aug. 2018, doi: 10.1136/EB-2018-102891.

[16] J. Park, “Understanding Disengagement in Just-in-Time Mobile Health Interventions,” *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol*, vol. 7, no. 2, p. 27, 2023, doi: 10.1145/3596240.

[17] L. Valentine *et al.*, “A Personalized, Transdiagnostic Smartphone App (Mello) Targeting Repetitive Negative Thinking for Depression and Anxiety: Qualitative Analysis of Young People’s Experience.,” *J Med Internet Res*, vol. 26, no. 1, p. e63732, Nov. 2024, doi: 10.2196/63732.

[18] E. Gkintoni, F. Vantaraki, C. Skoulidi, P. Anastassopoulos, and A. Vantarakis, “Promoting Physical and Mental Health among Children and Adolescents via Gamification—A Conceptual Systematic Review,” *Behavioral Sciences 2024, Vol. 14, Page 102*, vol. 14, no. 2, p. 102, Jan. 2024, doi: 10.3390/BS14020102.

[19] S. Liverpool *et al.*, “Engaging children and young people in digital mental health interventions: Systematic review of modes of delivery, facilitators, and barriers,” *J Med Internet Res*, vol. 22, no. 6, p. e16317, Jun. 2020, doi: 10.2196/16317.

[20] D. Johnson, S. Deterding, K. A. Kuhn, A. Staneva, S. Stoyanov, and L. Hides, “Gamification for health and wellbeing: A systematic review of the literature,” *Internet Interv*, vol. 6, pp. 89–106, Nov. 2016, doi: 10.1016/J.INVENT.2016.10.002.

[21] T. Pavavimol *et al.*, “Focus At Play: Exploring Gamification through A Case Study Of Narrative-Based Focus Apps,” *ACM International Conference Proceeding Series*, pp. 12–23, Oct. 2024, doi: 10.1145/3681716.3681717.

[22] R. M. Davison, M. G. Martinsons, and N. Kock, “Principles of canonical action research,” *Information Systems Journal*, vol. 14, no. 1, pp. 65–86, Jan. 2004, doi: 10.1111/J.1365-2575.2004.00162.X.

[23] “(PDF) Attachment disorganization and dissociation in virtual worlds: A study on problematic Internet use among players of online role playing games.” Accessed: Dec. 24, 2024. [Online]. Available: https://www.researchgate.net/publication/234129558_Attachment_disorganization_and_dissociation_in_virtual_worlds_A_study_on_problematic_Internet_use_among_players_of_online_role_playing_games

[24] “Diário da República, 2.a série PARTE E Artigo 2.o”.

[25] “General Data Protection Regulation (GDPR) – Legal Text.” Accessed: Jan. 04, 2025. [Online]. Available: https://gdpr-info.eu/

[26] “IEEE - IEEE Code of Ethics.” Accessed: Jan. 04, 2025. [Online]. Available: https://www.ieee.org/about/corporate/governance/p7-8.html

[27] “Comissão de Ética — P.PORTO | Ensino Superior Público.” Accessed: Jan. 03, 2025. [Online]. Available: https://www.ipp.pt/sobre/organizacao/comissao-de-etica

[28] “Comissão de Ética — Escola Superior de Saúde.” Accessed: Jan. 03, 2025. [Online]. Available: https://www.ess.ipp.pt/investigacao/comissao-de-etica

[29] “U.Porto - Regulamento Comissão de Ética da Universidade do Porto.” Accessed: Jan. 03, 2025. [Online]. Available: https://sigarra.up.pt/up/pt/legislacao_geral.ver_legislacao?p_nr=5134

[30] R. Da Literatura, “Preparação para a Dissertação”.

[31] M. J. Page *et al.*, “The PRISMA 2020 statement: An updated guideline for reporting systematic reviews,” *The BMJ*, vol. 372, Mar. 2021, doi: 10.1136/BMJ.N71.

[32] “PRISMA 2020 flow diagram — PRISMA statement.” Accessed: Dec. 29, 2024. [Online]. Available: https://www.prisma-statement.org/prisma-2020-flow-diagram

[33] A. M. Methley, S. Campbell, C. Chew-Graham, R. McNally, and S. Cheraghi-Sohi, “PICO, PICOS and SPIDER: A comparison study of specificity and sensitivity in three search tools

for qualitative systematic reviews," *BMC Health Serv Res*, vol. 14, no. 1, pp. 1–10, Nov. 2014, doi: 10.1186/S12913-014-0579-0/TABLES/7.

[34] "Zotero | Your personal research assistant." Accessed: Dec. 29, 2024. [Online]. Available: https://www.zotero.org/

[35] "Information Source Evaluation Matrix", Accessed: Jan. 03, 2025. [Online]. Available: www.library.dmu.ac.uk

[36] S. Piao and J. Joo, "A Behavioral Strategy to Nudge Young Adults to Adopt In-Person Counseling: Gamification," *Behavioral Sciences 2022, Vol. 12, Page 40*, vol. 12, no. 2, p. 40, Feb. 2022, doi: 10.3390/BS12020040.

[37] A. Tuijnman, M. Kleinjan, M. Olthof, E. Hoogendoorn, I. Granic, and R. C. Engels, "A Game-Based School Program for Mental Health Literacy and Stigma on Depression (Moving Stories): Cluster Randomized Controlled Trial.," *JMIR Ment Health*, vol. 9, no. 8, p. e26615, Aug. 2022, doi: 10.2196/26615.

[38] C. S. F. Fernandes *et al.*, "A Pilot Randomized Controlled Trial to Evaluate a Cognitive Behavioral Videogame Intervention: empowerED," *https://home.liebertpub.com/g4h*, vol. 12, no. 1, pp. 42–52, Jan. 2023, doi: 10.1089/G4H.2021.0118.

[39] T. Bjørner *et al.*, "A Serious Game for Promoting Knowledge about Suicidal Thoughts for Students at Higher Education," pp. 342–349, Sep. 2024, doi: 10.1145/3677525.3678680.

[40] C. Cheng, S. Li, and S. Chen, "Evaluation of a multicomponent positive psychology program to prevent gaming disorder and enhance mental wellness in primary pupils: A randomized controlled trial," *J Behav Addict*, vol. 13, no. 3, pp. 871–883, Sep. 2024, doi: 10.1556/2006.2024.00052.

[41] S. Litvin, R. Saunders, M. A. Maier, and S. Lüttke, "Gamification as an approach to improve resilience and reduce attrition in mobile mental health interventions: A randomized controlled trial," *PLoS One*, vol. 15, no. 9, p. e0237220, Sep. 2020, doi: 10.1371/JOURNAL.PONE.0237220.

[42] S. Litvin, R. Saunders, P. Jefferies, H. Seely, P. Pössel, and S. Lüttke, "The Impact of a Gamified Mobile Mental Health App (eQuoo) on Resilience and Mental Health in a Student Population: Large-Scale Randomized Controlled Trial.," *JMIR Ment Health*, vol. 10, no. 1, p. e47285, Jul. 2023, doi: 10.2196/47285.

[43] S. S. Anvari, J. Hammer, and R. R. Wehbe, "'More than just a game, it's an app that builds awareness around Mental Health': Mental Health Stigma Reduction Using Games for Change," *Proc ACM Hum Comput Interact*, vol. 8, no. CHI PLAY, Oct. 2024, doi: 10.1145/3677090.

[44] D. Labrosse, C. Vié, H. Hajjam, C. Tisseron, D. Thellier, and I. Montagni, “An Escape Game on University Students’ Mental Health During the COVID-19 Pandemic: Cocreation Study.,” *JMIR Serious Games*, vol. 12, no. 1, p. e48545, Mar. 2024, doi: 10.2196/48545.

[45] C. F. Leask *et al.*, “Framework, principles and recommendations for utilising participatory methodologies in the co-creation and evaluation of public health interventions,” *Res Involv Engagem*, vol. 5, no. 1, pp. 1–16, Jan. 2019, doi: 10.1186/S40900-018-0136-9/FIGURES/4.

[46] M. M. Guala *et al.*, “An in-depth understanding of stakeholders’ experiences about their participation in the co-production of ‘Maze Out’: a serious game for the treatment of eating disorders,” *J Eat Disord*, vol. 12, no. 1, pp. 1–14, Dec. 2024, doi: 10.1186/S40337-024-01136-3/FIGURES/2.

[47] I. J. Straand, A. Følstad, and J. R. Bjørnestad, “Exploring a Gaming-Based Intervention for Unemployed Young Adults: Thematic Analysis.,” *JMIR Hum Factors*, vol. 11, no. 1, p. e44423, Jan. 2024, doi: 10.2196/44423.

[48] W. L. Bedwell, D. Pavlas, K. Heyne, E. H. Lazzara, and E. Salas, “Toward a Taxonomy Linking Game Attributes to Learning,” *http://dx.doi.org/10.1177/1046878112439444*, vol. 43, no. 6, pp. 729–760, May 2012, doi: 10.1177/1046878112439444.

[49] C. Catalan, L. Gega, and J. Hook, “Storytelling Games for General Anxiety: Clinician Perspectives on Walking Simulator Games as Intervention,” *Proc ACM Hum Comput Interact*, vol. 8, no. CHI PLAY, Oct. 2024, doi: 10.1145/3677104/SUPPL_FILE/V8CHIP339AUX.ZIP.

[50] A. B. Pereira, “Planeamento da Dissertação Project Charter”.

[51] “Motivation: The Driving Force Behind Our Actions.” Accessed: Sep. 17, 2025. [Online]. Available: https://www.verywellmind.com/what-is-motivation-2795378

[52] R. M. Ryan and E. L. Deci, “Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being,” *American Psychologist*, vol. 55, no. 1, pp. 68–78, 2000, doi: 10.1037/0003-066X.55.1.68.

[53] A. H. Maslow, “A theory of human motivation,” *Psychol Rev*, vol. 50, no. 4, pp. 370–396, Jul. 1943, doi: 10.1037/H0054346.

[54] “Maslow’s Hierarchy of Needs.” Accessed: Sep. 17, 2025. [Online]. Available: https://www.simplypsychology.org/maslow.html

[55] D. A. Cook and A. R. Artino, “Motivation to learn: an overview of contemporary theories,” *Med Educ*, vol. 50, no. 10, pp. 997–1014, Oct. 2016, doi: 10.1111/MEDU.13074.

[56] T. W. Kim and K. Werbach, “More than just a game: ethical issues in gamification,” *Ethics Inf Technol*, vol. 18, no. 2, pp. 157–173, Jun. 2016, doi: 10.1007/S10676-016-9401-5/METRICS.

[57] Y.-Kai. Chou, *Actionable gamification : beyond points, badges, and leaderboards*. Octalysis Group, 2019.

[58] C. Vaz De Carvalho, “SERIOUS GAMES AND GAMIFICATION: Ethics of Gamification,” 2024.

[59] JANNE. TYNI, *DARK PATTERNS IN GAME DESIGN : the black book of player exploitation*. ADMIT HUB REF SERVICE PR, 2025.

[60] D. King, P. Delfabbro, and M. Griffiths, “Video Game Structural Characteristics: A New Psychological Taxonomy,” *Int J Ment Health Addict*, vol. 8, no. 1, pp. 90–106, Jan. 2010, doi: 10.1007/s11469-009-9206-4.

[61] K. Seaborn and D. I. Fels, “Gamification in theory and action: A survey,” *Int J Hum Comput Stud*, vol. 74, pp. 14–31, Feb. 2015, doi: 10.1016/j.ijhcs.2014.09.006.

[62] “The Octalysis Framework for Gamification & Behavioral Design.” Accessed: Sep. 17, 2025. [Online]. Available: https://yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/

[63] “Octalysis Tool.” Accessed: Sep. 17, 2025. [Online]. Available: https://www.yukaichou.com/octalysis-tool/

[64] “Skills (Skyrim) | Elder Scrolls | Fandom.” Accessed: Sep. 05, 2025. [Online]. Available: https://elderscrolls.fandom.com/wiki/Skills_(Skyrim)

[65] “Guide to app architecture | App architecture | Android Developers.” Accessed: Sep. 05, 2025. [Online]. Available: https://developer.android.com/topic/architecture#recommended-app-arch

[66] R. Martin, “Clean Architecture,” 2017.

[67] “Clean Coder Blog.” Accessed: Sep. 05, 2025. [Online]. Available: https://blog.cleancoder.com/uncle-bob/2012/08/13/the-clean-architecture.html

[68] G. MELIKSETYAN, “THE PSYCHOLOGICAL MEANING OF COLOR IN DESIGN: A SEMANTIC REVIEW,” *Main Issues Of Pedagogy And Psychology*, vol. 12, no. 1, pp. 6–28, Apr. 2025, doi: 10.24234/MIOPAP.V12I1.64.

Appendix A: Table of Included Studies in the Mapping Study

Title	DOI	Who?	What?	Where?	When?	Why?	Mark
The Impact of a Gamified Mobile Mental Health App (eQuoo) on Resilience and Mental Health in a Student Population: Large-Scale Randomized Controlled Trial.	10.2196/47285	4	4	5	5	5	23
Gamification as an approach to improve resilience and reduce attrition in mobile mental health interventions: A randomized controlled trial.	10.1371/journal.pone.0237220	4	5	5	4	5	23
"More than just a game, it's an app that builds awareness around Mental Health": Mental Health Stigma Reduction Using Games for Change	10.1145/3677090	4	4	4	5	5	22

The REThink Online Therapeutic Game: A Usability Study.	10.3390/children10081276	3	4	3	5	5	20
Focus At Play: Exploring Gamification through A Case Study Of Narrative-Based Focus Apps	10.1145/3681716.3681717	3	4	4	5	4	20
Exploring a Gaming-Based Intervention for Unemployed Young Adults: Thematic Analysis.	10.2196/44423	3	2	4	5	5	19
A Pilot Randomized Controlled Trial to Evaluate a Cognitive Behavioral Videogame Intervention: empowerED.	10.1089/g4h.2021.0118	3	2	4	5	5	19
Storytelling Games for General Anxiety: Clinician Perspectives on Walking Simulator Games as Intervention	10.1145/3677104	2	3	3	5	5	18
Experiences of Users with an Online Self-Guided Mental Health Training	10.1007/s41666-022-00124-z	4	1	3	5	5	18

Program Using Gamification.							
A Game-Based School Program for Mental Health Literacy and Stigma on Depression (Moving Stories): Cluster Randomized Controlled Trial.	10.2196/26615	4	2	3	4	5	18
A Serious Game for Promoting Knowledge about Suicidal Thoughts for Students at Higher Education	10.1145/3677525.3678680	3	3	3	5	4	18
Evaluation of a multicomponent positive psychology program to prevent gaming disorder and enhance mental wellness in primary pupils: A randomized controlled trial.	10.1556/2006.2024.00052	3	2	3	5	5	18
A Behavioral Strategy to Nudge Young Adults to Adopt In-	10.3390/bs12020040	3	2	3	4	5	17

Person Counseling: Gamification.							
An Escape Game on University Students' Mental Health During the COVID-19 Pandemic: Cocreation Study.	10.2196/48545	2	2	3	5	5	17
An in-depth understanding of stakeholders' experiences about their participation in the co-production of 'Maze Out': a serious game for the treatment of eating disorders	10.1186/s40337-024-01136-3	2	2	2	5	5	16

Appendix B: Questionnaire for the Target Audience

Designing a Gamified Self-Help App for Mental Wellness (Thesis Study)

This questionnaire is part of a Master's thesis project undertaken at ISEP (Instituto Superior de Engenharia do Porto) by student 1191457 (João Oliveira), as a requirement for the MSc in Computer Engineering – Games, Graphics and Interactive Systems.

Project Goals:
The project's focus is to investigate how a gamified mobile platform can enhance emotional and mental health among adolescents and young adults (ages 16–25) while encouraging the development of healthy habits.

The aim of the current questionnaire is to gain insight into users' preferences, concerns, and habits, regardless of whether they are currently receiving support from a mental health professional. Your responses will inform the ethical design of a self-help app that incorporates game-like features to promote healthy habits and alleviate stigma surrounding mental health.

Important Information:

1. The questionnaire is open to individuals aged **16 or older.**
2. All responses will be kept **anonymous** and used **solely for academic research.**
3. No attempts will be made to identify any individual through their responses.

Your honest answers are greatly appreciated — thank you for contributing to this project!

* Indica uma pergunta obrigatória

1. Do you consent to participate in this anonymous academic research questionnaire? *

Marcar apenas uma oval.

- ◯ Yes *Avançar para a pergunta 2*
- ◯ No *Avançar para a secção 11 (End of the Questionnaire)*

Background

2. What is your age group? *

Marcar apenas uma oval.

- ◯ Under 16 *Avançar para a secção 11 (End of the Questionnaire)*
- ◯ 16–17
- ◯ 18–21
- ◯ 22–25
- ◯ 26–30
- ◯ 31–40
- ◯ Over 40
- ◯ Prefer not to say

3. Are you currently or have you previously received regular support from a mental health professional (e.g., psychologist, psychiatrist, therapist)? *

Marcar apenas uma oval.

- ◯ Yes *Avançar para a pergunta 4*
- ◯ No *Avançar para a pergunta 8*

General Experience & Expectations (Patients)

4. What mental health challenges have you faced in recent years, if you're comfortable sharing? *

Marcar tudo o que for aplicável.

- ☐ Anxiety
- ☐ Burnout
- ☐ Dissociation
- ☐ Depression
- ☐ Addiction
- ☐ Other
- ☐ None/No Answer

5. For how long did you receive/have been receiving professional support?

Marcar apenas uma oval.

- ◯ Less than a year
- ◯ Between 1 to 5 years
- ◯ More than 5 years

6. Did you seek help on your own, or were you encouraged by others?

Marcar apenas uma oval.

- ◯ On my own
- ◯ Encouraged
- ◯ Outra: _____

7. Have you ever used a mental health or self-improvement App? *

Marcar apenas uma oval.

- ◯ Yes *Avançar para a pergunta 12*
- ◯ No *Avançar para a pergunta 16*

Avançar para a pergunta 19

General Experience & Expectations (General Users)

8. Have you ever faced personal challenges related to stress, anxiety, or mood? *

Marcar apenas uma oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

9. Have you considered seeking professional help? *

Marcar apenas uma oval.

- ◯ Yes
- ◯ No

10. Would you mind sharing the reason to your previous answer?

_____

_____

_____

_____

_____

11. Have you ever used a mental health or self-improvement App? *

Marcar apenas uma oval.

- ◯ Yes *Avançar para a pergunta 12*
- ◯ No *Avançar para a pergunta 16*

Avançar para a pergunta 19

General Experience & Expectations (A)

12. What mental health related App(s) have you used before?

Marcar tudo o que for aplicável.

- ☐ Headspace
- ☐ MindHealth
- ☐ Quabble
- ☐ Finch
- ☐ Outra: _____

13. How often did you engage with said App(s)? *

Marcar apenas uma oval.

- ◯ Daily
- ◯ Weekly
- ◯ Occasionally
- ◯ Almost never

14. What did you dislike about them?

15. Do you prefer structured step-by-step guidance or a more open exploration approach to the content within such Apps? *

Marcar apenas uma oval.

- ◯ Structured step-by-step guidance
- ◯ More open exploration approach
- ◯ Both options are fine

Avançar para a pergunta 19

General Experience & Expectations (B)

16. Would you be interested in trying a mental health related App? *

Marcar apenas uma oval.

- ◯ Yes
- ◯ No

17. How often do you think you'd engage with such App? *

Marcar apenas uma oval.

- ◯ Daily
- ◯ Weekly
- ◯ Occasionally
- ◯ Almost never

18. Would you prefer structured step-by-step guidance or a more open exploration approach to the content within such Apps? *

Marcar apenas uma oval.

- ◯ Structured step-by-step guidance
- ◯ More open exploration approach
- ◯ Both options are fine

Avançar para a pergunta 19

Gamification & Engagement

19. What gamification features or ideas would appeal to you in a mental health related App? *

Marcar tudo o que for aplicável.

- ☐ Visualize progress within the App
- ☐ In-App rewards for completing activities
- ☐ Option to "Follow" or "Befriend" other Users
- ☐ In-App companion/pet
- ☐ Story-driven activities
- ☐ Outra:

20. How would you like your progress to be presented within the App? *

Marcar tudo o que for aplicável.

- [ ] Statistics/Graphs
- [ ] Daily streaks
- [ ] Skill meters/trees
- [ ] Levels akin to a Role Playing Game (RPG)
- [ ] Daily Logs
- [ ] Outra: _____

Personalization & Content

21. What types of content would you find interesting or helpful within a self-help mental health App? *

Marcar tudo o que for aplicável.

- [ ] Guided exercises (both physical and mental)
- [ ] Podcasts
- [ ] Challenges
- [ ] Stories
- [ ] Relaxing background music/sounds
- [ ] Knowledge videos
- [ ] Social forums
- [ ] Outra: _____

22. Would you be interested in receiving in-App suggestions based on your needs, habits and/or provided data? *

Marcar apenas uma oval.

- ◯ Yes
- ◯ No

23. Would you be okay with answering a quiz or personality test to help personalize your in-App experience? *

Marcar apenas uma oval.

- ◯ Yes
- ◯ Yes, depending on how long the quiz is
- ◯ No

Interface & Accessibility

24. What's most important to you in how an App looks and feels?

Marcar apenas uma oval.

- ◯ Simplicity
- ◯ Customization
- ◯ Interactivity
- ◯ Theme-related visual elements
- ◯ Outra: _____

25. How would you prefer for the different elements/content to be presented? *

Marcar apenas uma oval.

- Casual and simple
- Formal and clean
- Story-driven and thematic

Ethical Considerations & Final Reflection

26. Do you have any concerns or hesitations about trusting a digital tool for mental health support?

27. If you could design your ideal mental health or self-improvement app, what would it include? How would you describe it?

End of the Questionnaire

Thank you for taking some of your time aside in order to complete this questionnaire!

Your thoughts, experiences, and suggestions are incredibly valuable to this project. Only through a close relationship between us - the user and the development team - will this project find success.
Every response will help bring us closer to building a mental health related App that can truly be useful and worthy of your time.

For further inquiries, or to share additional suggestions and/or your experience, be sure to reach out to me via email at **1191457@isep.ipp.pt** .

Appendix C: Questionnaire Results

Designing a Gamified Self-Help App for Mental Wellness (Thesis Study)

26 respostas

Publicar estatísticas

Do you consent to participate in this anonymous academic research questionnaire?

Copiar

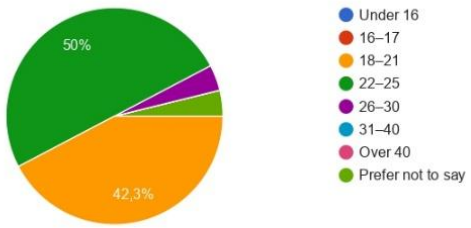
26 respostas

Background

What is your age group?

Copiar

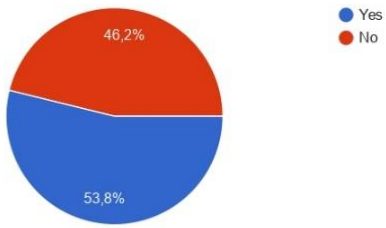
26 respostas



Are you currently or have you previously received regular support from a mental health professional (e.g., psychologist, psychiatrist, therapist)?

Copiar

26 respostas

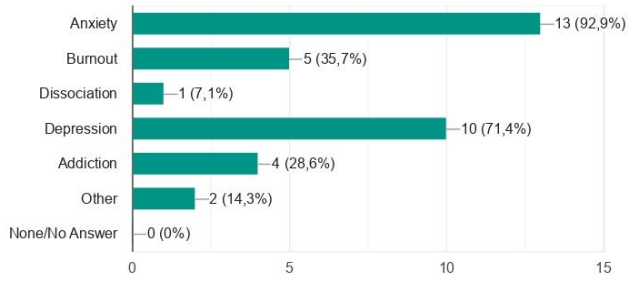


General Experience & Expectations (Patients)

What mental health challenges have you faced in recent years, if you're comfortable sharing?

Copiar

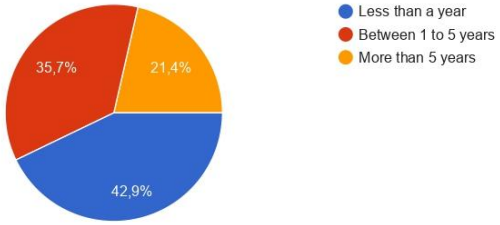
14 respostas



For how long did you receive/have been receiving professional support?

Copiar

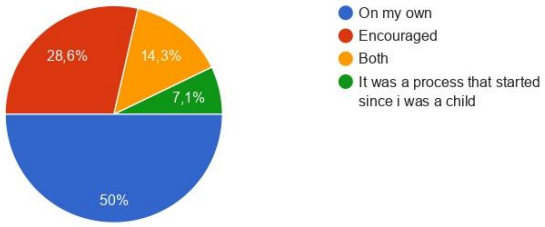
14 respostas



Did you seek help on your own, or were you encouraged by others?

Copiar

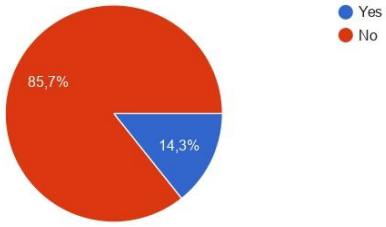
14 respostas



Have you ever used a mental health or self-improvement App?

Copiar

14 respostas

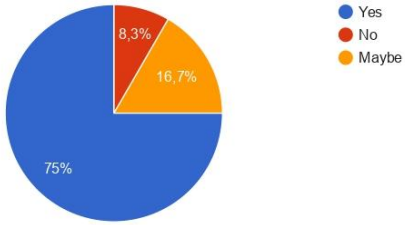


General Experience & Expectations (General Users)

Have you ever faced personal challenges related to stress, anxiety, or mood?

Copiar

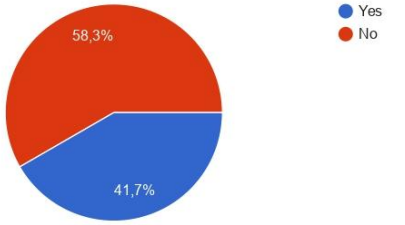
12 respostas



Have you considered seeking professional help?

Copiar

12 respostas



Would you mind sharing the reason to your previous answer?

7 respostas

To be honest never really thought about it or feel the need to it.

I have negative and depressive thoughts often.

I felt I needed help from a professional in the field.

i have considered seeking therapy not because of any particular traumatic event but because i think it is healthy to speak to therapist every once in a while

I see no relevance to the magnitude of the problems that I have to face.

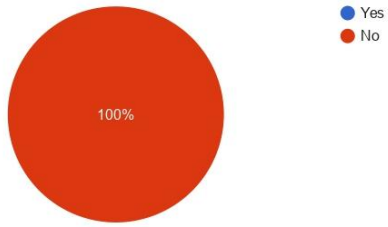
Lack of money

Didnt think about it

Have you ever used a mental health or self-improvement App?

Copiar

12 respostas

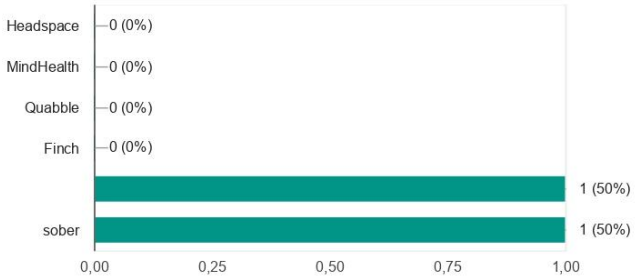


General Experience & Expectations (A)

What mental health related App(s) have you used before?

Copiar

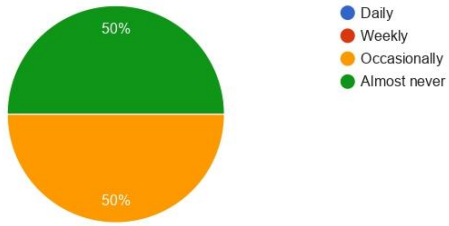
2 respostas



How often did you engage with said App(s)?

Copiar

2 respostas



What did you dislike about them?

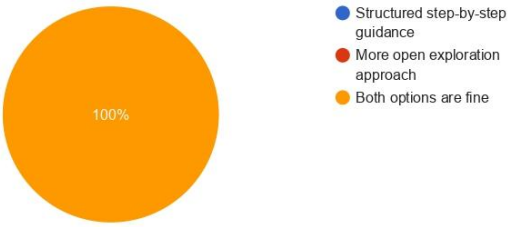
1 resposta

just a little boring

Do you prefer structured step-by-step guidance or a more open exploration approach to the content within such Apps?

Copiar

2 respostas

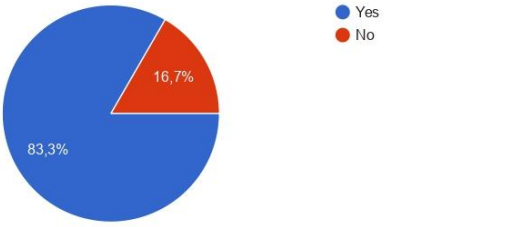


General Experience & Expectations (B)

Would you be interested in trying a mental health related App?

Copiar

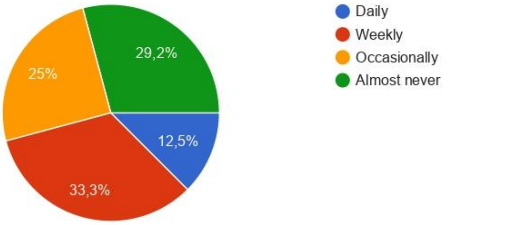
24 respostas



How often do you think you'd engage with such App?

Copiar

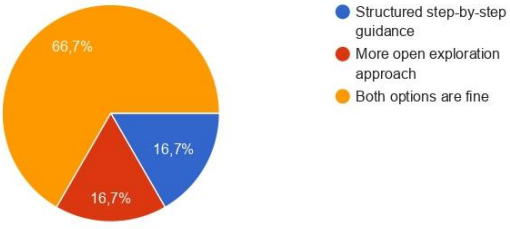
24 respostas



Would you prefer structured step-by-step guidance or a more open exploration approach to the content within such Apps?

Copiar

24 respostas

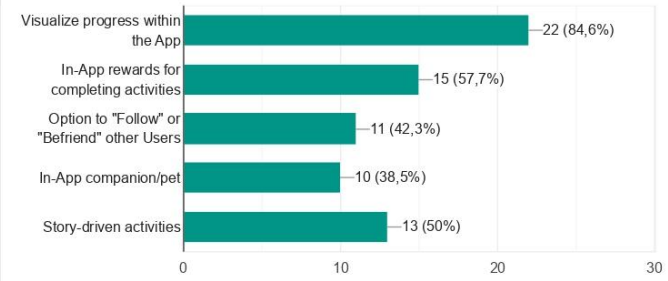


Gamification & Engagement

What gamification features or ideas would appeal to you in a mental health related App?

Copiar

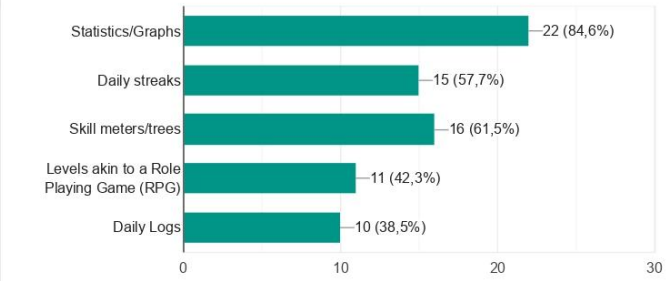
26 respostas



How would you like your progress to be presented within the App?

Copiar

26 respostas

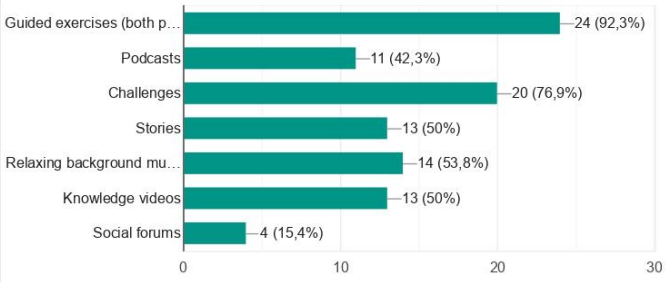


Personalization & Content

What types of content would you find interesting or helpful within a self-help mental health App?

Copiar

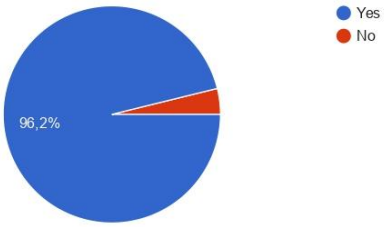
26 respostas



Would you be interested in receiving in-App suggestions based on your needs, habits and/or provided data?

Copiar

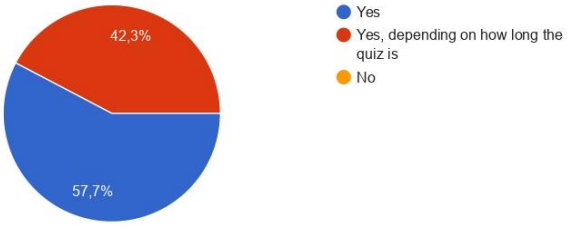
26 respostas



Would you be okay with answering a quiz or personality test to help personalize your in-App experience?

Copiar

26 respostas

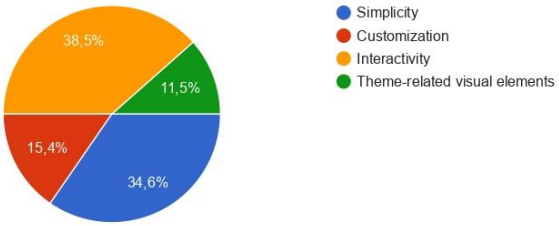


Interface & Accessibility

What's most important to you in how an App looks and feels?

Copiar

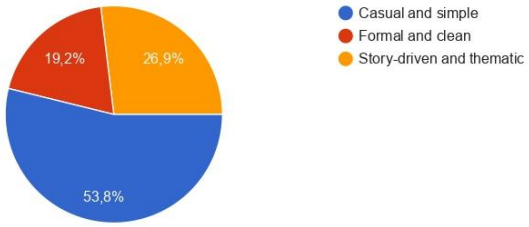
26 respostas



How would you prefer for the different elements/content to be presented?

Copiar

26 respostas



Ethical Considerations & Final Reflection

Do you have any concerns or hesitations about trusting a digital tool for mental health support?

14 respostas

No

Not at all.

Don't think so

Only in the sense that no app will ever replace a human professional

kinda, i feel like that 1 on 1 irl is better for this type of situations.

Yeah

no

My information/personal data

Other than the wrong people having access to the data base, not really

Might feel difficult to relate

If you could design your ideal mental health or self-improvement app, what would it include? How would you describe it?

10 respostas

Probably journaling and with the new wave of AI, something related to it, maybe AI-driven insights.

Obviously all the mental health information on the app would have to be scientifically correct and made carefully by professionals in the area of psychology.

Like a diary

I don't know to be honest, but a simple and casual app where i just could have exercises and activities to help me with mental health would already be great

Idk tbh

You are given a challenge everyday (small stuff, like feeling grateful of something for the day or go for a walk, etc...) and try to achieve certain streaks or challenges, which would act as checkpoints on the road to improving your mental health.

groups for people with the same problems so they can share coping mechanisms together

Don't Know

Enforce exercice and other activities

Studies shows that 85% of what people worry about doesnt end up happend so something related to anxiety or exercises to avoid overthinking and to worry less about the unknown

End of the Questionnaire

Appendix D: Semi-Structured Script for Clinician Interviews

Clinician Interview Script

Psychologists and Psychiatrists are key stakeholders. They possess significant expertise and are expected to have high power over the platform's features. Their insights are crucial as they can use the platform as a complementary (but not alternative) tool to support their patients and the broader population.

Professional Experience

- How long have you worked in the area of mental health?
- What seem to be the biggest obstacles clients usually face on their day to day life?
- What are the most common topics aboarded during therapy?
- What is usually the first step you take when meeting a new client?
- Have you noticed any set patterns of steps one can take in order to feel better or improve in some way?
- What would be some important precautions to take when regarding an individual's mental health?

Overall App

- Do you think digital mental health tools can be a helpful ally improving overall mHealth knowledge and habit formation?

If yes	If no
- What seem to be the biggest challenges clients face when using digital media?	- Why not?
- Do you think employing gamification can improve the effectiveness of mHealth apps?	- Would employing gamification within such apps change your opinion on their usefullness?

- What topics are essential/should be present in this type of app?
- How should be the app's content be structured to potentialize the app's effectiveness?

Features

- What features do you think are essential for a mHealth app to be genuinely helpful?

- What type of tools are usually most effective in the transmition of knowledge?

- How should these features be presented within the app?

- What are your thoughts on integrating personality assessments/tests into these type of apps for personalized recommendations?

- What personality test do you think would fit best in this case?

Gamification

- How do/would you measure a client's mental health improvement?

- What skills should be measured to analyze user's improvement? Is there a framework (such as Wheel of Life) that you think would best describe an individual's prowess at any given moment, in this contest?

- Are you familiar with any gamification strategies or serious games that would be usefull in the context of such apps?

- What precautions should be taken into account regarding gamification feature's potential for addiction?

Ethical & Professional Considerations

- Are there any risks or ethical concerns one should keep in mind when providing self-guided mental health resources through an app?

Appendix E: Entity Relationship Diagram ".dbml" Format

```
/* ------------------ Core Activities ------------------ */

Table activities {
  uid varchar [pk]
  title varchar
  description text
  type varchar
  difficulty int
  duration_minutes int
  suggested_time timestamp
  custom boolean
}

Table activity_instances {
  uid varchar [pk]
  user_routine_id varchar [ref: > user_routines.uid]
  activity_id varchar [ref: > activities.uid]
  scheduled_time timestamp
  completed boolean
  source_routine_id varchar [ref: > routines.uid]
  topic_id varchar [ref: > topics.uid]
}

/* Activity responses split by type (sub-collections) */

Table activity_responses_time_based {
  uid varchar [pk]
  instance_id varchar [ref: > activity_instances.uid]
  created_at timestamp
  started_at timestamp
  ended_at timestamp
  time_spent_seconds int
  interrupted boolean
}

Table activity_responses_text_entry {
  uid varchar [pk]
  instance_id varchar [ref: > activity_instances.uid]
  created_at timestamp
  prompt_id varchar [ref: > text_prompts.uid]
  response_text text
}

Table activity_responses_breathing {
  uid varchar [pk]
  instance_id varchar [ref: > activity_instances.uid]
  created_at timestamp
  duration_seconds int
  completed boolean
}

Table activity_responses_emotion_checkin {
  uid varchar [pk]
  instance_id varchar [ref: > activity_instances.uid]
  created_at timestamp
```

```
  mood varchar
  tags json
}

Table activity_responses_choice_based {
  uid varchar [pk]
  instance_id varchar [ref: > activity_instances.uid]
  created_at timestamp
  question_id varchar [ref: > choice_questions.uid]
  selected_option_id varchar [ref: > choice_options.uid]
}

/* ------------------ Avatars & Profiles ------------------ */

Table avatars {
  uid varchar [pk]
  name varchar
  image_url varchar
  unlock_condition text
  is_starter boolean
}

Table users {
  uid varchar [pk]
  username varchar
  avatar_id varchar [ref: > avatars.uid]
  created_at timestamp
}

Table user_avatars {
  user_id varchar [ref: > users.uid]
  avatar_id varchar [ref: > avatars.uid]
  unlocked_at timestamp
  drawable_res int
  Note: "Composite primary key on (user_id, avatar_id)"
}

/* ------------------ Choice & Prompt ------------------ */

Table choice_questions {
  uid varchar [pk]
  question_text text
  created_at timestamp
}

Table choice_options {
  uid varchar [pk]
  question_id varchar [ref: > choice_questions.uid]
  text text
  explanation text
  is_helpful boolean
}

Table topic_choice_questions {
  topic_id varchar [ref: > topics.uid]
```

```
  question_id varchar [ref: > choice_questions.uid]
  Note: "Composite primary key on (topic_id, question_id)"
}

Table text_prompts {
  uid varchar [pk]
  prompt_text text
  created_at timestamp
}

Table topic_text_prompts {
  topic_id varchar [ref: > topics.uid]
  text_prompt_id varchar [ref: > text_prompts.uid]
  Note: "Composite primary key on (topic_id, text_prompt_id)"
}

/* ------------------ Topics & Tools ------------------ */

Table topics {
  uid varchar [pk]
  title varchar
  description text
  image_url varchar
}

Table tools {
  uid varchar [pk]
  topic_id varchar [ref: > topics.uid]
  type varchar
  title varchar
  description text
  image_url varchar
  content_url varchar
}

/* ------------------ Routines ------------------ */

Table routines {
  uid varchar [pk]
  title varchar
  topic_id varchar [ref: > topics.uid]
  description text
}

Table routine_activities {
  routine_id varchar [ref: > routines.uid]
  activity_id varchar [ref: > activities.uid]
  Note: "Composite primary key on (routine_id, activity_id)"
}

Table user_routines {
  uid varchar [pk]
  user_id varchar [ref: > users.uid]
  start_date date
  created_at timestamp
```

```
  end_date date
}

Table user_active_topic_routines {
  user_routine_id varchar [ref: > user_routines.uid]
  routine_template_id varchar [ref: > routines.uid]
  activated_at timestamp
  Note: "Composite primary key on (user_routine_id, routine_template_id)"
}

/* ------------------ Skills & XP ------------------ */

Table skills {
  uid varchar [pk]
  name varchar
  label varchar
  description text
  icon_url varchar
}

Table user_skills {
  user_id varchar [ref: > users.uid]
  skill_id varchar [ref: > skills.uid]
  level int
  xp int
  Note: "Composite primary key on (user_id, skill_id)"
}

Table user_daily_information {
  uid varchar [pk]
  user_id varchar [ref: > users.uid]
  total_xp int
  activity_count int
  created_at timestamp
}
```

Appendix F: Semi-Structured Script for Initial Testing Interview

Initial Interview Script: Pre-Gamification

Setup Checklist
+ Explain the project.
+ Acquire verbal consent where they must confirm they're okay with participating and understand it's voluntary.
+ Mention that feedback provided is fully anonymous and that no personal identifying data is collected.

App Walkthrough

1. Show how to install the app via Firebase App Distribution and how it works.
2. Download the App on their phone.
3. Let them explore the first screens and create an account.
4. Softly explain how to start & finish a routine activity.

Note: Not to mention that gamification elements will come later (perhaps the element of surprise during the second interview would provide more genuine reactions and/to let them discover the changes themselves and see if they prefer it)

Core Questions

Mental Health Habits
Do you currently do anything to take care of your mental health?
Do you use or have used any sel-help/mental-health apps or tools?

Overall Impressions/Questions (UX)
What were your first impressions?
Was there anything you particularly liked or disliked?
How would you describe what this app does, in your own words?

Usage
Would this kind of app be useful for you personally? Why or why not?
Can you imagine yourself using this app regularly?
What would make you open the app again after today?

Usability & Feedback
Did anything feel missing or incomplete?
Was there any point where you didn't know what to do?

Motivation Baseline
How motivated did you feel to partake in one of the available routines?
Does the app encourage you to keep going or try more in any shape or form?

Gamification tease? To further support the interest/need
How could the app encourage you further to not only to explore its contents, but also activate and follow a routine?
What features usually motivate you, be it in a mental-health-related setting or not, or even in a mobile game, to actively visit the app and interact with its contents?
Do you think there is a change of addiction or do you feel addicted when exposed to any of the features mentioned previously?