Project Report Title

Subtitle if required

By

Your Name

Submitted to
The University of Roehampton

In partial fulfilment of the requirements
for the degree of

BACHELOR OF SCIENCE IN COMPUTING

Declaration

I hereby certify that this report constitutes my own work, that where the language of others is used, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of others.

I declare that this report describes the original work that has not been previously presented for the award of any other degree of any other institution.

Enter your name here

Date: Enter the date here

Signed (apply signature below)

Acknowledgements

First and foremost, I express my deepest gratitude to Allah (SWT), the Most Gracious and the Most Merciful, whose infinite blessings and guidance have enabled me to complete this project. Without His wisdom, strength, and countless blessings, I am nothing, and none of this would have been possible. All praise belongs to Him, and I humbly pray for His continued guidance and support in all my endeavours.

Abstract

GUIDANCE: Up to 300 words

A short summary of your project to include the problem, the main literature reviewed, your implementation and your findings.

Write this after you have finished the entire report!

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1. Introduction

GUIDANCE: Up to 1000 words

Mental health is a critical component of a student's overall well-being, directly impacting academic performance, social relationships, and personal development. University students face unique challenges such as academic pressures, financial responsibilities, and social transitions. Despite growing awareness of mental health concerns, many students lack access to tailored, accessible mental health support. Counselling services are often overwhelmed, leaving students with delayed or insufficient assistance. This issue can exacerbate stress, anxiety, and burnout, resulting in academic failure and long-term emotional challenges.

The MindBalance project addresses this problem by introducing a mobile application that leverages AI-driven solutions and integrates local mental health resources. The app aims to provide students with personalised mental health recommendations, real-time support, and guidance to access borough-level self-referral services. By incorporating user-friendly interfaces and non-medical, evidence-based interventions such as mindfulness exercises and journaling, MindBalance offers a practical and scalable solution to improve student well-being [1].

1.1. Problem Description, Context and Motivation

This problem primarily affects university and college students, particularly during critical academic periods such as exam seasons, assignment deadlines, and transitions between academic years. These challenges manifest as lower academic performance, social withdrawal, and in some cases, increased dropout rates [3]. The repercussions extend beyond individuals, negatively impacting universities' retention rates, reputations, and broader student satisfaction.

It is crucial to address this problem to foster healthier academic environments. Effective mental health support can lead to improved emotional well-being, enhanced academic performance, and better overall quality of life for students [4]. By empowering students to manage their mental health effectively, universities can create supportive environments that enable students to thrive academically and socially.

1.2. Aims

The primary aim of the MindBalance project is to develop a scalable and practical mobile application to address mental health challenges among university students. Specifically, the project aims:

1. To enhance students' emotional well-being by providing targeted mental health support specifically designed to address common stressors such as anxiety, academic pressures, and social isolation. The aim is to empower students with tools and interventions that foster resilience, improve stress management skills, and support their overall mental health, contributing to better coping strategies rather than offering a direct cure for clinical mental health conditions.[5].
2. To develop an AI-driven mobile application equipped with features such as a personalised recommendation engine that adapts to user input, mood tracking, and data-driven insights. The application will utilise natural language processing (NLP) to analyse users' emotional states based on journaling entries or responses to prompts. It will also include predictive analytics to anticipate periods of heightened stress based on input patterns, academic

calendars, or user history, providing timely, relevant mental health interventions and resources.

3. To facilitate access to borough-level mental health resources, such as Citizen London websites and Improving Access to Psychological Therapies (IAPT) self-referral services [6].

1.3. Objectives

The project objectives are as follows: By November 2024, the first objective is to conduct comprehensive research on student mental health challenges. This research will focus on identifying common stressors such as academic deadlines, financial instability, and social isolation. Evidence-based strategies like mindfulness exercises, journaling, and guided breathing will be integrated into the AI recommendation engine. This step ensures the app delivers validated, non-medical mental health interventions that align with student needs [5].

By February 2025, the project will design and develop the MindBalance mobile application. The app will feature a clean, intuitive user interface, making it accessible to students with varying technical proficiencies. The backend architecture will incorporate AI-powered tools for personalised mental health support and seamless access to local self-referral services such as IAPT [6].

By March 2025, iterative user testing and feedback loops will be implemented to evaluate the app's functionality, usability, and effectiveness. Testing phases will involve university students who provide qualitative and quantitative feedback on the app's recommendations, design, and overall performance. The aim is to achieve a minimum satisfaction rate of 80% for usability, accessibility, and user experience [7].

1.3.1 Project Timeline and Key Milestones:

Milestone	Description	Due Date	Duration
Research & Planning	Conduct research on student mental health needs	Nov 2024	1 month
Milestone 02: Mid-Project Review	Present progress and gather feedback	16th Jan 2025	2 weeks
Development Phase 1	Develop core app features	Dec 2024 - Jan 2025	2 months
Prototype Testing	Initial user testing with student focus groups	Early Feb 2025	2 weeks
Development Phase 2	Refine app based on feedback, add advanced features	Mid Feb - Early March 2025	3 weeks
Final Testing & Launch Preparation	Finalise testing, bug fixes and deployment preparation	Mid March 2025	1 week
Milestone 03: Exhibition & Artefact Demonstration	Showcase app to peers, educators and stakeholders	24th March 2025	9 days
Milestone 04: Project Report Submission	Submit final project report	31st March 2025	1 week
Launch	Official release of app	31st March 2025	n/a

As indicated in the accompanying table, a thorough timeline with significant checkpoints has been created to guarantee the project's successful completion. This schedule breaks the project down into

manageable phases with clear objectives, showing how it progresses from basic planning to the final launch. From the proposal and mid-project review to prototype testing and final deployment, every milestone helps to keep things focused and efficiently monitor progress. The project seeks to maintain an organised approach by meeting these specified timelines, guaranteeing high-quality results while attending to crucial elements like stakeholder involvement, testing, and user input. In addition to offering clarity on deliverables, this framework makes swift revisions possible, guaranteeing that the project will accomplish its goals by the projected launch date of March 31, 2025.

1.4. Legal

The development of MindBalance requires strict compliance with data protection laws, particularly the General Data Protection Regulation (GDPR). Given the sensitive nature of mental health data, user privacy and confidentiality are critical [8]. The following measures will be implemented to ensure legal compliance:

User data will be anonymised, encrypted, and stored securely on Firebase servers to prevent unauthorised access. GDPR-compliant policies will be implemented to allow users to request access, correction, or deletion of their data.

A comprehensive terms of service agreement will provide transparency, informing users about how their data will be collected, stored, and processed. It will outline user rights and limitations of the app's services.

All third-party tools, such as TensorFlow Lite for machine learning and Firebase for backend services, will be appropriately licensed. Intellectual property laws will be followed to ensure the ethical and legal use of libraries, datasets, and frameworks [9].

1.5. Social

The app aims to overcome social barriers to mental health support, such as stigma, cultural insensitivity, and accessibility challenges. MindBalance will integrate culturally sensitive content, ensuring that mental health strategies resonate with diverse student populations. This is particularly important for international students who may experience additional stressors due to cultural and linguistic differences [10].

Localised support services, such as borough-level resources and NHS IAPT self-referral programs, will be integrated into the app to provide professional assistance when needed. This combination of personalised AI tools and professional self-referral resources ensures students receive both practical and clinical support in a seamless manner.

The app's user-friendly interface will prioritise accessibility for all students. This includes compliance with accessibility standards, such as WCAG (Web Content Accessibility Guidelines), to support students with visual or cognitive impairments. By providing a stigma-free, inclusive platform, MindBalance will empower students to take proactive steps toward improving their mental health [6].

1.6. Ethical

Ethical considerations are central to MindBalance's design and development. The app focuses exclusively on non-medical interventions, such as guided breathing exercises, journaling, and mindfulness activities. These techniques are evidence-based and non-clinical, ensuring the app does not diagnose or treat medical conditions [11].

For users experiencing severe emotional distress, the app will include borough-level self-referral options like IAPT. Explicit informed consent will be required during the registration process, ensuring users are aware of how their data will be used. To further protect user privacy, all collected data will be anonymised and encrypted following GDPR guidelines.

Regular reviews of the app's recommendations will be conducted in collaboration with mental health professionals to ensure content remains safe, accurate, and appropriate for students.

1.7. Professional

The MindBalance project upholds professional standards across software development, mental health practices, and user experience design. A multidisciplinary approach will be followed to ensure the application is robust, reliable, and aligns with industry best practices.

The Agile methodology will be explicitly adopted for the project lifecycle. Agile is the most beneficial and specific methodology for MindBalance due to its iterative approach, which allows for frequent testing, user feedback, and incremental improvements. In a project like MindBalance, where user experience and mental health support are paramount, Agile ensures that the app evolves in direct response to real-world user needs. By delivering functional prototypes throughout the development process, Agile promotes transparency and adaptability, leading to a polished, user-friendly final product.

- Mental Health Validation: Mental health professionals will validate all app content, ensuring recommendations and techniques are evidence-based, culturally appropriate, and aligned with industry guidelines.
- User-Centric Design: Focus groups and surveys involving university students will help inform the design and functionality of the app. User testing phases will provide data to refine user interface and experience (UI/UX), ensuring it remains intuitive and accessible.
- Quality Assurance: Comprehensive testing will include functional, security, and stress testing to identify and address issues prior to deployment. Post-launch, performance metrics such as user satisfaction, engagement rates, and feedback will be monitored continuously to guide future improvements.

By combining mental health expertise, Agile methodology, and user-focused development practices, MindBalance will deliver a reliable, effective, and secure platform that aligns with professional standards for both software development and mental health support.

1.8. Background

Mental health challenges are increasingly recognised as significant barriers to academic success and personal development, particularly among university students. Academic pressures, including tight

deadlines and high expectations, often lead to stress and anxiety. Social factors, such as forming new relationships or dealing with isolation, further compound these challenges. Financial burdens, a common concern for students, have also been identified as key contributors to mental health issues [2]. These problems are magnified by the stigma surrounding mental health, which discourages many from seeking timely support.

The MindBalance project focuses on leveraging AI and non-clinical interventions to address these challenges in an educational context. Research highlights that university students are at higher risk of experiencing psychological distress compared to the general population, making targeted support essential [3]. By integrating evidence-based strategies and professional resources, this project aims to fill gaps in accessibility, personalisation, and stigma-free support. The relevance of this work extends beyond individual well-being, impacting academic institutions' retention rates and fostering a healthier learning environment

1.9. Report overview

This report provides a comprehensive analysis of the MindBalance project, detailing its objectives, methodologies, and outcomes. The following sections are included:

1. Literature and Technology Review: This section explores existing research and technological solutions relevant to mental health challenges and AI-driven interventions.
2. Methodology: A detailed account of the project's design, testing, and evaluation phases, with justifications for the tools and methods used.
3. Project Management: An outline of the Agile approach adopted for managing the project, including tools and strategies for ensuring collaboration and risk mitigation.
4. Results and Discussion: A presentation of findings from the app's development and testing phases, along with an analysis of its impact and potential improvements.
5. Conclusion and Future Work: A summary of the project's contributions and recommendations for further research or enhancements.

By providing this roadmap, the report ensures clarity and coherence, guiding the reader through the various aspects of the MindBalance project.

2. Literature - Technology Review

GUIDANCE: Up to 1500 words

2.1. Literature Review

The Literature Review examines existing research on mental health challenges among university students, AI-driven mental health tools, and the role of non-medical interventions in stress management.

The theory of domain for this project focuses on the mental health needs specific to university students. University life represents a unique environment defined by academic pressure, social expectations, and the transition to independence as shown in Figure 1. According to Stallman [1], the academic environment amplifies stress through factors like deadlines, exams, and competitive performance, leading to psychological distress. Social pressures such as forming new relationships, isolation, and financial burdens further exacerbate mental health challenges [2].

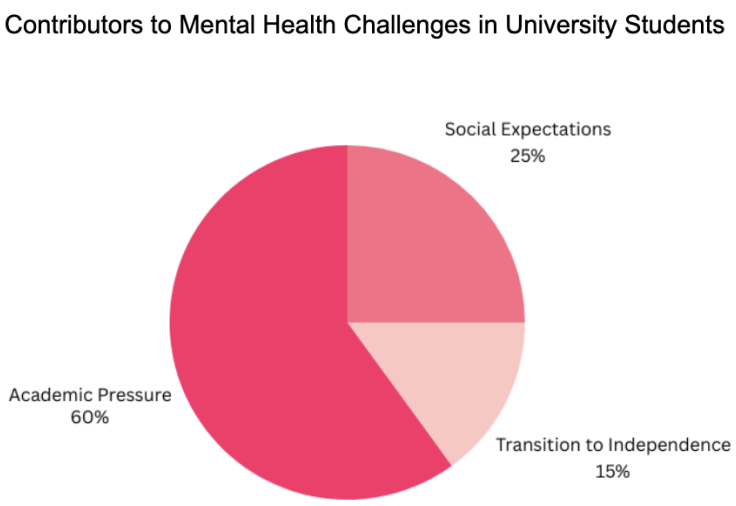


Figure 1. Contributors to Mental Health Challenges in University Students

Research highlights that mental health problems like anxiety and depression are prevalent among students, often going unaddressed due to stigma, lack of accessibility, or inadequate support [3]. Addressing this domain requires solutions that account for the combination of personal, social, and institutional factors influencing students' mental well-being. By leveraging AI-driven tools, personalised interventions, and seamless access to professional services, MindBalance directly addresses these needs.

The Mental Health Crisis in Students University students face disproportionately high levels of stress and anxiety. Stallman [1] reports that 83% of students experience significant psychological distress, primarily due to academic pressures and social isolation. Similarly, Evans et al. [2] highlight financial burdens as a key contributor to mental health challenges. Addressing these issues requires accessible solutions that can provide tailored support for students.

AI-Powered Mental Health Tools AI-driven tools offer scalable and cost-effective solutions for delivering mental health interventions. D'Alfonso et al. [3] demonstrate the ability of AI technologies to provide personalised support through cognitive behavioural exercises, real-time recommendations, and stress management strategies as shown in Figure 2. However, Torous et al. [4] argue that existing platforms lack cultural sensitivity and individualisation, limiting their effectiveness for diverse users. The MindBalance app bridges this gap by tailoring recommendations to individual stressors.

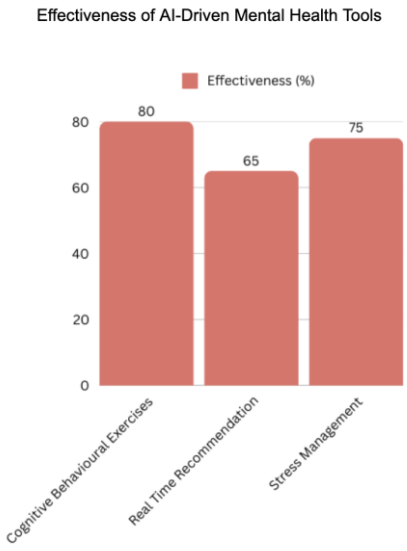


Figure 2. Effectiveness of AI-Driven Mental Health Tools

Integration with Professional Services Programs like NHS's Improving Access to Psychological Therapies (IAPT) have proven effective in reducing barriers to mental health care through self-referral options [6]. Kleinman [5] emphasises the importance of combining digital tools with professional support to ensure users have access to clinical interventions when necessary.

Non-Medical Interventions Mindfulness exercises, guided breathing techniques, and journaling have been shown to reduce stress and anxiety effectively as shown in Figure 3 Firth et al. [7] report significant improvements in emotional regulation among students who engage with smartphone-based mindfulness practices. These findings justify the inclusion of non-clinical interventions in the MindBalance app to promote emotional well-being.

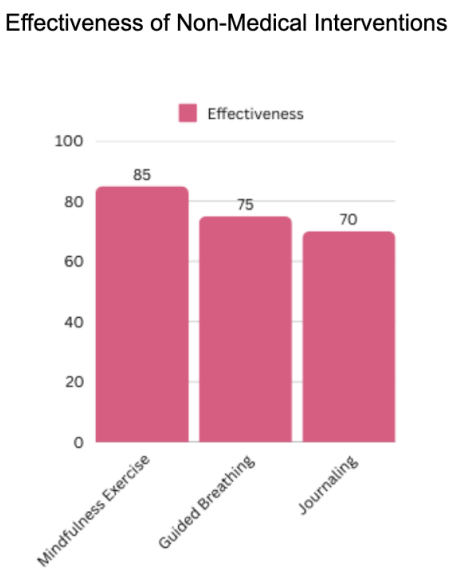


Figure 3. Effectiveness of Non-Medical Interventions

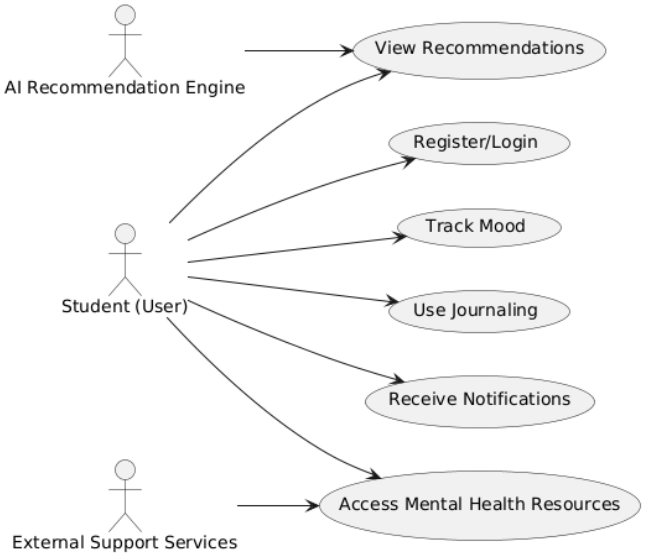
2.1.1. UML Diagrams:

A potent tool for designing, visualising, and documenting system architecture in software development is the Unified Modelling Language (UML) [13]. The two main categories of UML diagrams are structural and behavioural diagrams [14]. By showing how users (actors) interact with a system and its different features, behavioural diagrams, like the Use Case Diagram, aim to depict the dynamic characteristics of a system [15]. Insights into the system's functionality and user-centric design are provided by highlighting the use cases, user interactions, and relationships [13].

However, by simulating the system's fundamental structure, structural diagrams—like the Class Diagram—focus on the static characteristics of the system. Class diagrams serve as a blueprint for the implementation of a system by describing its objects, characteristics, operations, and relationships [16]. The class diagram shows the internal organisation of the mental health app, including important elements like the user, journaling, mood tracking, and AI-driven recommendation engine, while the use case diagram describes the interactions between users, AI recommendations, and outside services. When combined, these diagrams provide a thorough understanding of the architecture and operation of the system [17].

2.1.2 Use Case Diagram:

The use case diagram represents the core functionalities and interactions within the mental health app project. Below is a detailed explanation of its elements:



- Actors -

1. Student (User): The main app user, in charge of utilising its features to control their mental health.
2. AI Recommendation Engine: An automatic mechanism built into the application that makes tailored suggestions depending on user inputs like journaling and mood monitoring.
3. External Support Services: Third-party services or organisations, such as therapists, mental health hotlines, or educational materials, that users can access through the app.

- Use Case -

1. Register/Login: Allows users to safely log in or create an account. This is essential for storing and retrieving customised information.
2. Track Mood: Enables users to record their feelings and see trends over time. Analysis of this data yields conclusions and suggestions.
3. Use Journaling: This tool allows users to record their daily events, feelings, and thoughts. This facilitates emotional processing and mindfulness.
4. Receive Notifications: To keep users engaged and encourage healthy habits, send them reminders, inspirational messages, or advice on mental health.
5. View Recommendations: Shows activities or advice that are specifically catered to the user's past and present mood, as determined by the AI Recommendation Engine.
6. Access Mental Health Resources: Provides users with extra assistance beyond the capabilities of the app, including emergency hotlines, by connecting them to outside support resources.

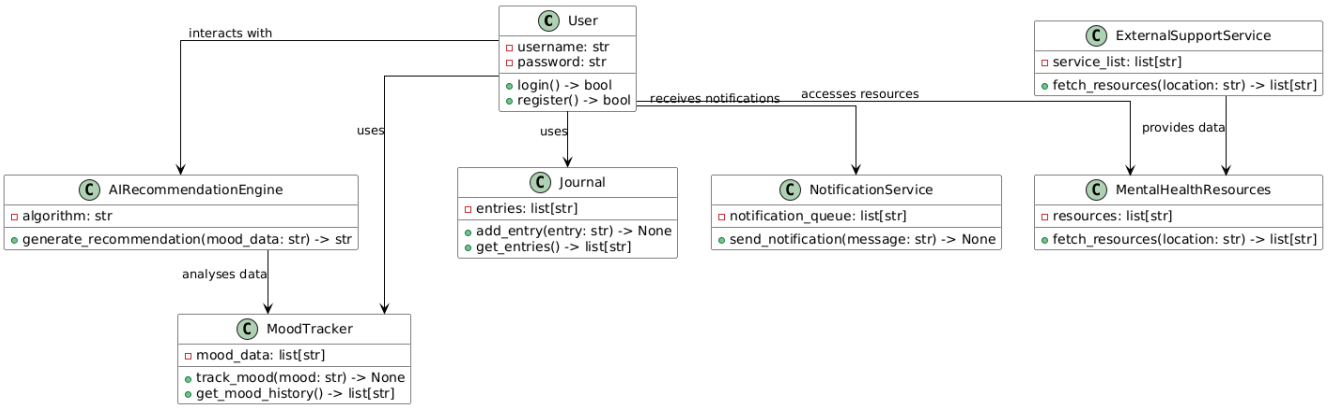
- Interactions -

❖ Features like journaling, mood tracking, and creating tailored suggestions are all directly supported by the AI Recommendation Engine to help users efficiently.
❖ By providing access to external support services, the app guarantees that users will have greater access to mental health resources when they need them.

<u>Purpose of the Use Case Diagram:</u>

The app's objective of offering thorough and individualised mental health support is highlighted in this diagram. It illustrates how the app uses AI to provide personalised recommendations while engrossing users with interactive features like journaling, mood tracking, and notifications. It also places a strong emphasis on integrating outside support services to guarantee that users have access to resources and expert assistance that go beyond what the app can offer.

2.1.3 Class Diagram:



The main elements of the mental health app are represented object-oriented in this class diagram. An explanation of the classes and their connections within the project's framework can be found below:

Classes and Attributes:

1. User
   - ❖ Attributes:
     - → Username: Stores the user's unique identifier.
     - → Password: Stores the user's authentication credentials.
   - ❖ Methods:
     - → login(): Allows users to log in to the app.
     - → register(): Allows new users to create an account.
   - ❖ Role: Represents the primary user of the app and facilitates access to the app's functionalities.
2. AIRecommendationEngine
   - ❖ Attributes:
     - → Algorithm: Defines the logic or algorithm used for generating recommendations.
   - ❖ Methods:
     - → generate_recommendation(mood_data:str): Processes mood data to provide personalised recommendations.
   - ❖ Role: Analyses user data (e.g. mood) to deliver actionable advice and suggestions.
3. MoodTracker
   - ❖ Attributes:
     - → Mood_data: A list that stores historical mood entries logged by the user.
   - ❖ Methods:
     - → track_mood(mood:str): Allows users to record their current mood.
     - → get_mood_history(): Retrieves the history of the user's mood data.
   - ❖ Role: Tracks and stores the user's mood over time, providing data for the recommendation engine.
4. Journal
   - ❖ Attributes:
     - → Entries: A list of journal entries created by the user.
   - ❖ Methods:
     - → add_entry(entry:str): Allows users to create new journal entries.

- → get_enteries(): Retrieves all journal entries.
- ❖ Role: Acts as a personal diary for users to express and reflect on their thoughts and emotions.

5. NotificationService
   - ❖ Attributes:
     - → Notification_queue: A list of messages queued for the user.
   - ❖ Methods:
     - → send_notification(message: str): Sends a notification (e.g. reminders, motivational quotes) to the user.
   - ❖ Role: Keeps users engaged by sending timely reminders and updates.
6. ExternalSupportService
   - ❖ Attributes:
     - → Service_list: A collection of external support services.
   - ❖ Methods:
     - → fetch_resources(location: str): Retrieves support services based on the user's location.
   - ❖ Role: Provides a bridge to external mental health resources.
7. MentalHealthResources
   - ❖ Attributes:
     - → Resources: A list of mental health resources available to users.
   - ❖ Methods:
     - → fetch_resources(location: str): Retrieves relevant resources based on the user's location.
   - ❖ Role: Supplies users with curated mental health materials, articles or professional contacts.

Table of Relationships:

	Relationship:	Explanation:
1	User interacts with AIRecommendationEngine	The user provides mood data, and the engine generates personalised recommendations based on that data.
2	AIRecommendationEngine analyses data from MoodTracker	Mood data logged by the user is analysed by the recommendation engine to provide relevant suggestions.
3	User uses Journal	The journal allows users to record and retrieve their entries for personal reflection and emotional tracking.
4	User receives notifications from NotificationService	The notification service sends updates, reminders, or tips to keep the user engaged.
5	User accesses resources via ExternalSupportService	The app connects users to external support services, helping them find additional mental health support.
6	ExternalSupportService provides data to MentalHealthResources	The external service fetches detailed resources based on location, making them accessible to the user.

Purpose of the Class Diagram:

The mental health app's modular structure is shown in this class diagram. It demonstrates how many elements (such as journaling, mood tracking, and notifications) work together to create a customised system of support for mental health. The functioning of the app is improved by using outside support services, which guarantee users have access to expert assistance and other resources. The app's core component is an AI-driven recommendation engine that uses user data to provide insightful and useful recommendations.

2.2. Technology Review

The Technology Review evaluates the tools and frameworks selected for the development of the MindBalance app.

2.2.1 Flutter

Flutter is chosen for its ability to deliver cross-platform compatibility using a single codebase. Supported by Google, Flutter allows developers to build mobile applications for both iOS and Android simultaneously, reducing development time and costs [8]. The hot reload feature accelerates testing cycles by enabling real-time updates, making the development process more efficient.

While native development tools like Swift for iOS and Kotlin for Android offer superior performance for computationally intensive tasks, they require separate codebases, leading to higher costs and longer development timelines. Given the project's need for scalability and speed of deployment, Flutter strikes a balance between performance and practicality.

2.2.1.1 Real-World Success of Flutter

Flutter has demonstrated its real-world success through applications built for diverse industries, showcasing its reliability, scalability, and cost-efficiency. Popular apps like Google Ads, Reflectly, and Alibaba highlight Flutter’s ability to deliver fast, visually appealing, and high-performance mobile applications. For example, Reflectly, a mental health and journaling app, leverages Flutter’s flexibility to provide a clean and intuitive user experience, aligning closely with the goals of MindBalance. Similarly, Alibaba, a global e-commerce platform, uses Flutter to maintain performance across millions of users while managing a single codebase for iOS and Android [12].

These examples validate Flutter’s suitability for MindBalance by demonstrating its ability to support complex, scalable, and user-centric applications effectively. Its adoption by major brands underscores Flutter’s reliability and makes it an ideal choice for delivering a responsive, cross-platform mental health app.

2.2.1.2 Why have I chosen Flutter?

Flutter stands out for its unique ability to combine cost efficiency with robust functionality. Native tools like Swift for iOS and Kotlin for Android offer better performance for highly computational

tasks but require separate codebases, resulting in higher development costs and longer timelines. For a project like MindBalance, which prioritizes scalability and speed of deployment, Flutter's cross-platform capabilities strike an optimal balance between performance and practicality.

Compared to other cross-platform frameworks like React Native, Flutter provides a more seamless development experience due to its native rendering engine and comprehensive widget library. While React Native relies on a bridge to interact with native components, potentially leading to performance bottlenecks, Flutter's architecture eliminates this dependency, ensuring smoother performance and a more consistent user experience.

Additionally, Flutter's extensive community support and continuous updates from Google provide a reliable foundation for long-term app maintenance and enhancements. This ensures that the MindBalance app can evolve alongside user needs and technological advancements.

2.2.2. TensorFlow Lite

TensorFlow Lite is used to integrate on-device machine learning into the MindBalance app. It offers a lightweight solution for running AI models on mobile devices, optimising both latency and power consumption. This ensures that the app provides real-time, personalised mental health recommendations without requiring continuous internet connectivity [9].

Compared to PyTorch Mobile, which demands greater technical expertise for implementation, TensorFlow Lite is better suited for performance-critical, production-level applications. The ability to convert pre-trained models to TensorFlow Lite further simplifies deployment, ensuring an efficient and seamless user experience.

2.2.3 Firebase

Firebase is selected as the backend solution due to its comprehensive set of tools, including real-time databases, authentication, and cloud storage. Firebase integrates seamlessly with Flutter and TensorFlow Lite, simplifying backend management while ensuring robust data security [10].

Firebase's compliance with GDPR standards ensures that sensitive user data, such as mental health inputs, is securely encrypted and stored. Its built-in authentication system enables users to register securely while protecting privacy. Compared to AWS, which provides more advanced features and greater customisation, Firebase is more suitable for rapid development and cost-effective scalability.

2.2.4. Data Security Measures

Given the sensitive nature of mental health data, data security is a core consideration. Firebase's end-to-end encryption ensures that all data transmitted between the app and the server remains secure. Additionally, anonymisation techniques will be applied to protect user identities, ensuring compliance with GDPR regulations [11].

Users will provide explicit consent during registration, ensuring transparency about data usage and storage. This approach guarantees that all legal, ethical, and professional standards are met while safeguarding user confidentiality.

2.3. Summary of Outcomes of Literature and Technology Review

Table 1. Literature Review Outcomes

Source	Main Findings	Limitations
Stallman [1]	Students face high stress levels.	Limited focus on intervention strategies.
Evans et al. [2]	Financial stress exacerbates mental health issues.	No focus on technological solutions.
D'Alfonso et al. [3]	AI tools provide scalable support.	Lack of personalisation in existing tools.
Torous et al. [4]	Cultural sensitivity is lacking in many tools.	Focused on clinical rather than non-medical.
Kleinman [5]	Integration of professional services is essential.	Limited studies on digital tool effectiveness.

Table 2. Technology Review Outcomes

Technology	Benefits	Limitations
Flutter	Cross-platform, cost-effective, scalable.	Marginally slower than native solutions.
TensorFlow Lite	Optimised for on-device AI performance.	Requires machine learning expertise.
Firebase	Simplified backend management.	Limited advanced customisations.
AWS	Highly scalable with advanced features.	Complex setup and maintenance.
PyTorch Mobile	Powerful and flexible AI integration.	Higher technical complexity.

The outcomes of the literature and technology reviews indicate that MindBalance will combine proven AI-driven techniques and non-medical interventions with robust, scalable technologies like Flutter, TensorFlow Lite, and Firebase. These choices ensure the app is cost-effective, efficient, and capable of providing personalised support to university students in need.

3. Methodology

GUIDANCE: Up to 1000 words

The Methodology outlines how the MindBalance app will be developed, tested, and managed. This section details the tools, design approaches, algorithms, and processes used, along with the rationale for selecting these methods.

3.1. Design

The design phase will focus on creating an intuitive and user-friendly application tailored to university students. The following design methods will be used:

- Wireframing and Prototyping: Wireframing and Prototyping: Tools like Figma will be employed extensively to craft the app's user interface (UI). Wireframes will serve as

blueprints to map out the app's layout and functionalities, ensuring that all navigation flows are logical and user-centric. This process will involve multiple iterations to refine usability based on visual and interactive feedback. Figma's collaborative features will also enable real-time adjustments during team discussions, ensuring alignment with project objectives and user preferences.

- User-Centric Design: A key pillar of the design phase will involve engaging university students directly through surveys, interviews, and focus group discussions. These activities will provide critical insights into user preferences, behaviors, and challenges. By incorporating this feedback, the app's features and layout will be tailored to address specific needs, such as accessibility, ease of use, and relevance to mental health concerns. This approach ensures that the final design resonates with the target audience and fosters high user engagement.
- AI Model Integration: TensorFlow Lite will underpin the AI recommendation engine, which forms a core component of the app. The integration process will focus on embedding machine learning models that can analyse inputted stressors and mental health habits to deliver tailored suggestions. This includes features like mood tracking, journaling analysis, and predictive analytics to anticipate heightened stress periods. The lightweight nature of TensorFlow Lite ensures that these capabilities can run efficiently on users' mobile devices without compromising performance or requiring constant internet connectivity.

The design choices are guided by findings in the literature review, where intuitive designs and non-clinical interventions (e.g., journaling and guided breathing) were shown to improve accessibility and user engagement [5,7].

3.2. Testing and Evaluation

The MindBalance app will be tested in two stages to make sure it satisfies the necessary performance, usability, and functionality requirements. Prior to release, these stages are intended to thoroughly evaluate the app's capabilities and fix any possible problems.

Functional testing, the initial stage, aims to validate every functionality of the application. As part of this, the AI recommendation engine is assessed to make sure it provides accurate and timely recommendations depending on user input. Furthermore, to ensure smooth functioning, data input processing, module navigation, and other crucial features will be examined. Using automated testing technologies like Selenium and Appium, which are very effective at covering a variety of test cases, functional testing will be used. By taking a methodical approach, any mistakes or inconsistencies will be identified and corrected swiftly.

By integrating the target audience, university students, the second phase, usability testing, places an emphasis on the user experience. During this stage, the app's UI will be tested for usability, responsiveness, and clarity. Students will contribute both qualitative and quantitative feedback through focus groups, surveys, and structured interviews. To obtain thorough insights, real-life situations will be replicated, including documenting stressors, obtaining tailored recommendations, and utilising borough-level services. Iterative improvements will be driven by these findings, guaranteeing that the app fulfils user expectations and provides a positive experience.

3.2.1Evaluation Metrics:

In-depth metrics will be used in the evaluation process to fully evaluate the app's performance. Among these metrics are:

1. **Performance Metrics:**
   - **Load Times: The app's main screens are expected to load within 5 seconds to ensure quick access and prevent user frustration.**
   - **Frame Rate: A consistent frame rate of 60 FPS will be maintained to provide smooth animations and transitions, contributing to a polished user experience.**
   - **Stability: The app's crash rate should remain below 1% during testing. Automated tools will monitor crash reports, ensuring swift resolution of vulnerabilities and overall reliability.**

2. **User Satisfaction: To assess factors including perceived usefulness, visual appeal, and simplicity of usage, surveys will be administered using a Likert scale. A satisfaction rating of four or more will be regarded as a sign of success. Feedback regarding the emotional impact of the app will also strive for at least 80% of users to indicate that it has a good impact on their mental health.**

3. **Accuracy of AI Recommendations: A group of experts in mental health will examine the AI engine's suggestions. These suggestions must have a minimum accuracy rate of 90% and be in line with best practices and evidence-based tactics. To ensure relevance and dependability, the AI models will be continuously improved based on input from experts and users.**

3.2.2 Why these metrics?

Functionality, usability, and user trust are the app's primary goals, and these metrics give them top priority. Post-launch evaluations will address advanced engagement statistics, including daily active users or session durations, which are valuable. The immediate goal is to provide a reliable and easy-to-use program that addresses students' mental health requirements.

With a staged testing and assessment process and well-defined KPIs, the MindBalance app is guaranteed to be useful and effective. By attending to fundamental needs and integrating expert and user input, the app will be in a good position to offer its intended audience significant assistance.

3.3. Project Management

The project will adopt the Agile methodology due to its iterative and flexible nature. Agile ensures that development is structured around continuous improvement and responsiveness to user feedback. By breaking the project into smaller, manageable increments known as sprints, Agile allows for the regular delivery of functional prototypes. This iterative approach facilitates ongoing refinement of app features based on stakeholder and user feedback, ultimately ensuring the final product aligns closely with end-user needs.

3.3.1. Sprint Planning and Execution:

Each sprint will be planned for a duration of two weeks, during which specific tasks and milestones will be outlined and assigned. At the end of each sprint, progress will be reviewed in dedicated sprint review meetings. These reviews will focus on assessing completed tasks, identifying bottlenecks, and planning for the subsequent sprint. Sprint retrospectives will further provide the team with an opportunity to evaluate the processes used, promoting continuous improvement in workflow and team collaboration.

3.3.2. Collaboration and Communication:

Effective communication is critical in Agile project management. Weekly stand-up meetings will be held to facilitate quick updates on progress, discuss challenges, and ensure alignment among team members. Additionally, dedicated communication channels will be established using tools such as Slack or Microsoft Teams to allow for real-time updates and discussions.

3.3.3 Tools and Resources:

- Trello: This tool will be used to manage tasks visually through Kanban boards, enabling the team to track the status of each task and ensure clarity in task assignments. Trello's intuitive interface supports the Agile framework, making it easier to plan, prioritise, and monitor tasks across sprints.
- GitHub: Version control will be managed using GitHub, ensuring that all code changes are tracked and documented effectively. GitHub's collaborative features, such as pull requests and issue tracking, will streamline code reviews and facilitate collaboration among developers.
- Risk Management: Proactive risk management strategies will be incorporated throughout the project lifecycle. Potential risks, such as delays in development or integration challenges, will be identified early and mitigated through contingency planning and regular risk assessments during sprint reviews. Clear communication and a focus on adaptability will help the team address any unexpected challenges effectively.
- Stakeholder Involvement: Regular stakeholder meetings will be scheduled to provide updates on project progress and gather feedback. Stakeholders will have access to prototypes and progress reports, allowing them to offer input and ensure the project remains aligned with their expectations.

By leveraging Agile methodologies and utilising tools like Trello and GitHub, the MindBalance project will ensure a transparent, collaborative, and adaptive development process. This approach not only enhances efficiency but also guarantees that the final application is well-suited to meet the needs of its users.

3.3.4 Technologies and Processes

The MindBalance app was developed using a carefully chosen set of technologies and procedures to guarantee strong data protection, high performance, and smooth integration. Given their capacity to meet the project's particular requirements—such as cross-platform compatibility, real-time functionality, and user-centric design—these technologies were selected. An extensive summary of the project's key technologies and their functions may be found below:

3.3.4.1 Flutter

Flutter is used given its cross-platform development features, which enable the iOS and Android platforms to be supported by a single codebase. As a result, development time and expenses are greatly decreased, and device performance is maintained. Creating a highly customisable and aesthetically pleasing user interface is essential for capturing users' attention, and Flutter's vast widget library offers the freedom to do so. As it allows for real-time modifications while testing and debugging, its "hot reload" function speeds up the development cycle. The application provides fluid animations and transitions by utilising Flutter's native rendering engine, guaranteeing a well-designed user experience. Due to this, Flutter is the best option for developing MindBalance-style applications that are scalable, responsive, and economical [8].

3.3.4.2 TensorFlow Lite

The software incorporates on-device machine learning capabilities using TensorFlow Lite. Without requiring constant internet connectivity, this small infrastructure guarantees real-time, tailored mental health suggestions. By facilitating the deployment of pre-trained AI models, TensorFlow Lite streamlines the integration process and improves the application's capacity to efficiently analyse user input. Even on low-end hardware, the responsive experience is guaranteed by the framework's mobile device optimisations, which reduce latency and power consumption. TensorFlow Lite is especially well-suited for production-level apps that need on-device AI due to its ease of use and performance when compared to alternatives such as PyTorch Mobile [9].

3.3.4.3 Firebase

The backend solution for the application is Firebase, which offers a strong infrastructure for user authentication, data storage, and real-time data management. Its Flutter integration guarantees smooth front-end and back-end communication. The effective management of user inputs and app-generated data is made possible by Firebase's real-time database, which guarantees immediate updates and device synchronisation. The platform's adherence to GDPR regulations ensures that private mental health information is safely maintained and protected. The integrated authentication features of Firebase further improve user security and privacy by establishing a reliable setting for handling private data. Firebase provides a more affordable and developer-friendly solution than competitors like AWS, which fits the project's requirements for scalability and quick development [10].

3.3.4.4 Figma

The app's user interface (UI) and user experience (UX) are designed and prototyped using Figma. Real-time feedback and modifications are made possible by its collaborative features, which guarantee that the design satisfies project objectives and user expectations. Before development starts, the team may visualise and refine the app's functionality and layout using Figma's wireframing and prototyping tools. The finished product will be easy to use, accessible, and aesthetically pleasing because of our user-centric approach.

A unified and effective development process is ensured by the combination of various technologies. Each of Flutter, TensorFlow Lite, Firebase, and Figma is essential to producing a top-notch application that satisfies user requirements and industry standards. A dependable and responsive application is produced by the smooth connection between the frontend, backend, and AI components made possible by the integration of these tools. MindBalance establishes a solid basis for its success by utilising the advantages of each technology to strike a balance between innovation, usability, and security [8, 9].

4. Implementation

GUIDANCE: Up to 3000 words

Finally, you can tell us WHAT you did, i.e. How did you apply the methodologies you have described in the section above to your actual problem.

This part can be very descriptive but please avoid excessive detail.

Some strategies that can help you write this part:

- Choose a writing style (e.g., first, second, or third-person perspective).
- Start this section with any design work you might have done e.g., System design/architecture, UX design artefacts etc.
- If you divided your work into sprints, that can be a good structure for this section.
- Only include code snippets for particularly challenging parts of your implementation.
- Pick out a few difficult problems you had to solve and tell us in detail how you solved them. This brings your experience to life.

Refer to the Project Report Builder on Moodle for content that you should include in this section.

5. Evaluation and Results

GUIDANCE: Up to 2000 words

This is an important section where you weigh up the strengths and weaknesses of your artefact.

Guidance: If your project has a user-facing element, we expect to see some kind of evaluation of this with representative intended users, for example a 'think aloud' usability test.

You can also apply standard metrics for the domain you are working in and see how you have done against them. **Your project does not have to be perfect -- indeed the outcomes might have been bad.** The point is you must evaluate the outcome and discuss its strengths and weaknesses.

This section should include the following subheadings:

- Related Work

Refer to the Project Report Builder on Moodle for content that you should include in this section.

6. Conclusion

GUIDANCE: Up to 1500 words

The conclusion summarises the project. Start by summarising the overall outcome of your project and to what extent the aims and objectives have been met. You need to highlight your key outputs and/or discoveries.

The following subsections that must appear in your conclusion.

Future Work

Answer the question -- **What next?**

You've completed a significant piece of work -- perhaps the largest piece of work you have ever done. But no project is ever 100% complete, and you will have found new ideas along the way. If someone were to pick up your project, what avenues should be explored next?

This is an important section, and it helps us understand what you have learned by doing the project and allows you to show you understand what a more ideal solution might look like, outside the constraints of the MSc Project timeframe.

Reflection

You must critically reflect on the entire project process and how well you have worked on the project. What particular things have you learned during the project? Why were you able and unable to meet project goals? What would have you done differently in hindsight?

Refer to the Project Report Builder on Moodle for content that you should include in this section.

7. References

In this section, you **must** reference any sources used in your work. Typically, these sources will have come up during the investigation and related work sections. Your referencing must use the IEEE referencing style IEEE Citation Guidelines2.doc (ieee-dataport.org) .

It is **highly** recommended that you use reference management software such as RefWorks that is provided by the university. Your project should have as many references as is required. However, having few references indicates that no thorough investigation has occurred.

It is your responsibility to ensure that you have actually read all the material you reference, and that the references provided in your report are legitimate and **NOT AI generated**.

[1] H. Stallman, “Psychological distress in university students,” Aust. Psychol., vol. 45, no. 4, pp. 249-257, 2010.

[2] T. Evans et al., “Evidence for a mental health crisis in graduate education,” Nat. Biotechnol., vol. 36, no. 3, pp. 282-284, 2018.

[3] S. D’Alfonso et al., “Artificial intelligence-assisted online social therapy for youth mental health,” Front. Psychol., vol. 8, p. 796, 2017.

[4] J. Torous and L. Roberts, “The ethical use of mobile health technology in clinical psychiatry,” J. Psychiatr. Pract., vol. 23, no. 4, pp. 253-259, 2017.

[5] A. Kleinman, “Culture and depression,” N. Engl. J. Med., vol. 351, no. 10, pp. 951-953, 2004.

[6] NHS England, “Improving Access to Psychological Therapies (IAPT),” NHS Services, [Online]. Available: https://www.england.nhs.uk/mental-health/adults/iapt/.

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[8] Google Developers, “Flutter: Beautiful native apps in record time,” [Online]. Available: https://flutter.dev/.

[9] TensorFlow, “TensorFlow Lite: Machine learning for mobile devices,” [Online]. Available: https://www.tensorflow.org/lite/.

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[11] European Union, “General Data Protection Regulation,” Official Journal of the European Union, 2016.

[12] Google Developers, "Showcase: Apps built with Flutter," Flutter.dev, [Online]. Available: https://flutter.dev/showcase.

[13] G. Booch, J. Rumbaugh, and I. Jacobson, The Unified Modeling Language User Guide, 2nd ed. Addison-Wesley, 2005.

[14] R. France and B. Rumpe, "Model-driven Development of Complex Software: A Research Roadmap," Future of Software Engineering (FOSE '07), 2007, pp. 37-54.

[15] Object Management Group (OMG), "Unified Modeling Language (UML) Specification," [Online].

[16] A. S. Gokhale, Introduction to UML, Morgan Kaufmann, 2008.

[17] I. Sommerville, Software Engineering, 10th ed., Pearson, 2015.

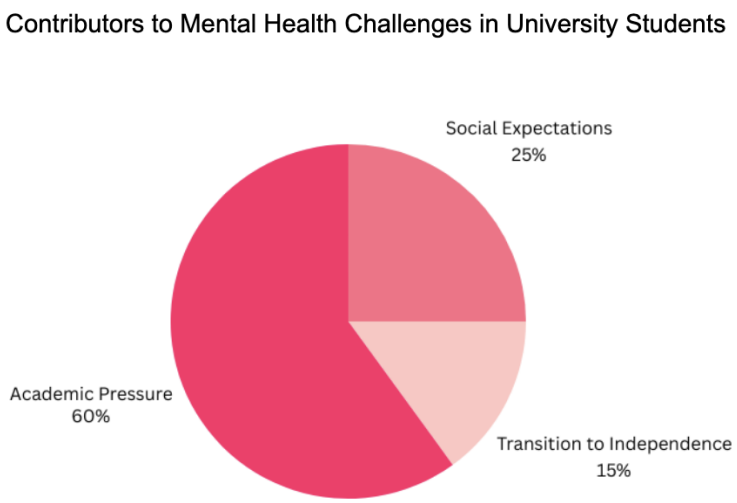
8. Appendices

Appendices appear after references. Your appendices depend on the nature of your project. **Do not assume people will read your appendices.** Even if you direct them to do so in your main text, appendices are considered additional information and should not be relied upon to understand your main body of work. Refer readers to an appendix using a phrase such as *see Appendix A for further details*.

The following documents **must** be included as references:

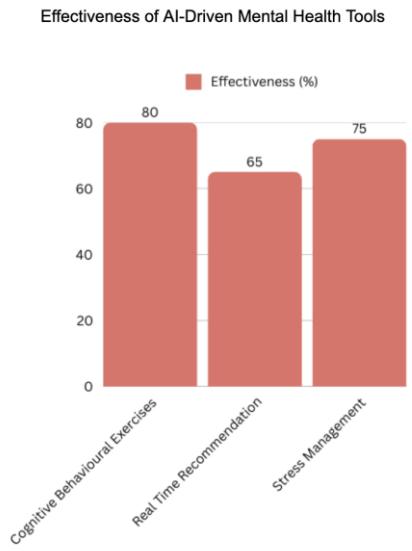
- Your Project Proposal.
- Evidence of your use of a project management tool.
- A description of how to access any technical output. **It is strongly recommended you use GitHub or something similar to do this.**

Any important communications between you and external stakeholders -- **please ensure private data is removed and communications anonymised.**



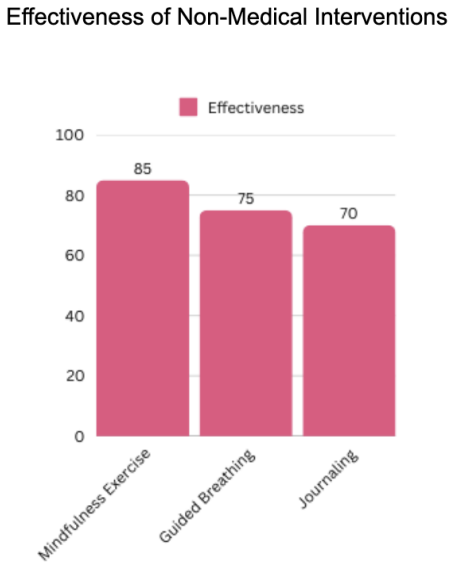
Pie Chart - Figure 1. Contributors to Mental Health Challenges in University Students

The Mental Health Crisis in Students: The following pie chart (Figure 1) illustrates the primary contributors to mental health challenges among university students, including academic pressure, social expectations, and the transition to independence. These factors significantly impact students' psychological well-being, as discussed by Stallman [1] and Evans et al. [2].



Bar Chart - Figure 2. Effectiveness of AI-Driven Mental Health Tools

AI-Powered Mental Health Tools: The bar chart below (Figure 2) demonstrates the effectiveness of various AI-driven mental health tools, such as cognitive behavioral exercises, real-time recommendations, and stress management strategies. These features, as highlighted by D'Alfonso et al. [3], showcase the potential of AI in delivering tailored mental health support.



Bar Chart - Figure 3. Effectiveness of Non-Medical Intervention

Non-Medical Interventions: Figure 3 depicts the effectiveness rates of non-medical interventions, including mindfulness exercises, guided breathing, and journaling. Research by Firth et al. [7] emphasises the importance of these practices in reducing stress and anxiety, supporting their inclusion in the MindBalance app.