Non-Programming Development of a Therapy Chatbot for University Students: Utilizing Computational Thinking and Rapid Prototyping

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Abstract. The increasing prevalence of mental health challenges among university students has highlighted the need for scalable and accessible support mechanisms. Therapy chatbots have emerged as a promising solution, offering immediate and personalized assistance to those in need. However, the development of these tools traditionally requires advanced programming skills, limiting their accessibility to a broader range of stakeholders. This paper presents the development of HopeU, a therapy chatbot designed for university students, which was created without traditional programming. The development process utilized the ChatGPT module within the computational thinking framework and employed rapid prototyping as the methodology. The chatbot leverages the principles of **Cognitive Behavioral Therapy (CBT),** which emphasizes the connection between thoughts, emotions, and behaviors, by guiding users through structured conversations that prompt reflection on their emotional states. This approach allowed for the creation of a functional and effective therapy chatbot that could be developed and maintained by individuals without formal programming expertise. The paper discusses the design and development process, highlighting the benefits of computational thinking in breaking down complex tasks into manageable components, and the effectiveness of rapid prototyping in iteratively refining the chatbot based on user feedback. HopeU offers a solution to the current gaps in university mental health services, offering personalized support at scale. This approach opens possibilities for non-technical developers to create effective digital mental health tools, with implications for broader applications in the field of mental health support and education.

Keywords: HopeU, Therapy Chatbot, Non-programming, Computational Thinking, Rapid Prototyping.

1 Introduction

The mental health crisis among university students is a growing concern worldwide, with increasing numbers of students reporting symptoms of anxiety, depression, and stress [1]. Traditional counselling services, though effective, are often overwhelmed by

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demand, leading to long wait times and limited access [2]. Digital interventions, such as therapy chatbots, offer a promising alternative by providing immediate, scalable, and accessible support [2]. The development of these chatbots, however, typically requires significant technical expertise, which can be a barrier for many educational institutions, particularly those with limited resources.

This paper presents the development of a therapy chatbot named HopeU, designed specifically for university students. What sets HopeU apart is that its development did not involve traditional programming techniques. Instead, the project utilized the ChatGPT module within a computational thinking framework, with rapid prototyping as the chosen methodology. The chatbot applies the principles of Cognitive Behavioral Therapy (CBT), which highlights the interplay between thoughts, emotions, and behaviors, by leading users through structured dialogues that encourage them to reflect on their emotional experiences. This approach not only simplified the development process but also made it accessible to individuals without formal programming skills, potentially broadening the range of stakeholders who can contribute to the creation of digital mental health tools.

2 Background Statement

The need for innovative mental health interventions has never been more critical, particularly in the context of higher education. According to a survey by the American College Health Association [3], over 60% of college students reported feeling overwhelming anxiety, and more than 40% reported feelings of depression severe enough to impact their functioning. The traditional model of campus counselling centres, while invaluable, is increasingly unable to meet the demand for services, leading to an exploration of alternative support mechanisms [2].

Therapy chatbots have emerged as one such mechanism, leveraging advancements in artificial intelligence (AI) to provide users with a conversational interface that can offer cognitive behavioral therapy (CBT), mindfulness exercises, and other therapeutic interventions [4]. Recent studies further underline the growing role of AI in mental health interventions. For example, Haque and Rubya discuss the increasing popularity of chatbot-based mental health apps and how they are becoming more widely adopted due to ease of access and constant availability [2]. Furthermore, Rathnayaka et al. have demonstrated that chatbots with cognitive skills can provide personalized mental health interventions remotely, offering promising avenues for reaching underserved populations [4]. These AI-driven tools have shown significant potential in supporting mental health, particularly by addressing anxiety and depression symptoms. A similar approach to embedding CBT into therapeutic digital interventions can be seen in the work by Yusof et al., where they explored a therapeutic game design model for managing depression. Their model demonstrated the effectiveness of incorporating structured CBT techniques into digital platforms to provide targeted mental health support [5]. Studies have shown that these tools can be effective in reducing symptoms of anxiety and depression, particularly in populations that may be reluctant to seek face-to-face therapy [6][7].

Despite the potential benefits of therapy chatbots, their development remains a complex task, typically requiring extensive programming knowledge, limiting their creation to those with specialized technical skills and significant resources. This presents a barrier to widespread adoption, particularly in educational settings where there may be interest in developing customized tools to meet specific student needs, but where technical expertise is limited. The problem addressed in this paper is how to create a functional, effective therapy chatbot without relying on traditional programming methods. The solution proposed involves the use of computational thinking—a problem-solving process that can be applied to both digital and non-digital contexts—and rapid prototyping, which allows for quick iterations based on user feedback. The goal was to create a chatbot that could provide meaningful mental health support to university students while being accessible to developers with limited programming knowledge.

HopeU was developed in response to this challenge. By using ChatGPT—a powerful AI language model—the development team was able to bypass the need for traditional coding. Instead, the focus was on applying computational thinking principles and rapid prototyping techniques to iteratively design, test, and refine the chatbot. This approach not only expedited the development process but also ensured that the final product was both effective and user-friendly.

3 Design and Development of HopeU

The design and development of HopeU followed a structured approach that combined computational thinking and rapid prototyping methodologies. The goal was to create a functional therapy chatbot capable of providing mental health support to university students without requiring extensive programming knowledge. The process began with an overarching design phase where key components were identified and conceptualized, followed by a development phase that translated these concepts into a working prototype. The final stage involved iterative testing and refinement, ensuring that the chatbot met user needs and functioned effectively. Figure 1 illustrates the development framework for HopeU therapy chatbot application.

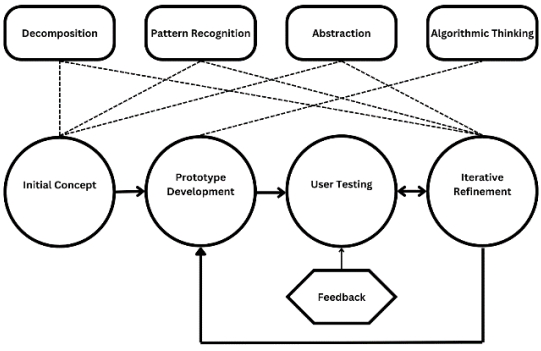

Fig. 1. Development Framework for HopeU Therapy.

The entire design and development process highlight the effectiveness of combining computational thinking with rapid prototyping in creating a functional therapy chatbot without traditional programming. By breaking down the development process into manageable components and iteratively refining the prototype based on user feedback, the team was able to produce a chatbot that meets the needs of university students, providing them with accessible mental health support. This approach not only simplifies the development process but also opens up new possibilities for non-programmers to contribute to the creation of digital mental health tools.

The development of HopeU utilized the MIT App Inventor, a user-friendly platform that enables individuals without extensive programming experience to create fully functional mobile applications. MIT App Inventor was particularly advantageous because it allowed the team to focus on the design and functionality of the chatbot without getting bogged down in writing code from scratch [8]. The platform's intuitive drag-and-drop interface enabled the developers to quickly prototype and test different features, such as the chatbot's natural language processing capabilities and multimedia elements like text, images, animations, and audio. By using this platform, the development team could efficiently iterate on the design, implement user feedback, and refine the chatbot's functionalities, all within a non-programming environment. This approach aligned perfectly with the rapid prototyping methodology, enabling quick adjustments and enhancements throughout the development process.

The development of HopeU is underpinned by two key theoretical frameworks: Cognitive Behavioral Theory (CBT) and Computational Thinking**.** CBT, a widely recognized psychological theory, emphasizes the relationship between thoughts, feelings, and behaviors, which aligns with the chatbot's goal of helping students identify and manage stressors through guided reflection and feedback. HopeU's design leverages CBT principles by prompting users to track their emotions and recognize patterns that may contribute to anxiety or depression.

3.1 Cognitive Behavioral Theory (CBT)

Cognitive Behavioral Therapy (CBT) is a widely-used, evidence-based treatment for managing various mental health issues such as anxiety, depression, and stress. According to Yusof et al., CBT is centered on the principle that negative thought patterns influence emotions and behaviors, and by altering these thoughts, individuals can improve their mental well-being [5]. CBT often involves structured interventions that help individuals recognize distorted thinking, challenge unhelpful beliefs, and develop healthier behavioral patterns.

In more recent studies, CBT continues to be a foundational method in digital mental health interventions, such as therapy chatbots. New research has demonstrated the adaptability of CBT in AI-powered applications, where structured techniques like cognitive restructuring and mindfulness exercises can be integrated into automated platforms [9]. These tools can deliver CBT principles through conversational interfaces, enabling users to manage their mental health independently while maintaining the core elements of human-led CBT practices.

3.2 Computational Thinking

Computational thinking is a problem-solving process that breaks down complex problems into smaller components, identifies patterns, abstracts general principles, and develops step-by-step solutions [10]. This approach is valuable for designing digital tools like therapy chatbots, allowing developers to focus on conceptual rather than technical details. The four key processes involved are decomposition, pattern recognition, abstraction, and algorithmic thinking [10].

Decomposition involves breaking down the chatbot development into manageable parts, such as understanding user input, providing empathetic responses, and offering resources. For instance, the task of interpreting user input was further divided into recognizing distress expressions, identifying conversational context, and selecting appropriate response types.

Pattern recognition entails identifying similarities across different cases to create efficient solutions. For HopeU, this meant analyzing common themes in user language, like anxiety or sadness, and programming the chatbot to consistently recognize and respond to these patterns.

Abstraction focuses on generalizing responses to handle various user interactions without needing specific replies for every scenario. Instead of scripting responses for every possible input, HopeU's responses were categorized by broader emotional expressions, allowing the chatbot to respond appropriately to different user statements indicating sadness or distress.

Algorithmic thinking involves creating clear rules for solving problems. For HopeU, this meant designing decision-making processes to guide the chatbot's responses. Leveraging ChatGPT allowed the team to focus on higher-level decision rules, like acknowledging anxiety with empathy and suggesting coping strategies.

3.3 Rapid Prototyping Process

The development of HopeU followed the principles of rapid prototyping, a methodology characterized by the quick creation of functional prototypes, iterative testing, and continuous refinement based on user feedback [11]. This approach was particularly well-suited to a non-programming context, as it allowed the development team to experiment with different designs and functionalities without the need for extensive coding. The phases included initial conceptualization, which involves defining key functionalities and outlining the overall design, setting the foundation for the first prototype. This was followed by prototype development, which entailed creating the initial working model of HopeU and incorporating core functionalities for testing. Next, user testing was conducted by engaging a group of users to interact with the prototype and collecting their feedback to identify areas for improvement. Finally, the iterative refinement phase allowed developers to continuously revise the prototype based on user feedback, enhancing functionality and user experience through successive iterations.

The first phase of rapid prototyping involved the initial conceptualization of HopeU. Here, the team focused on defining the key functionalities the chatbot would need and

outlining the overall design. This phase was heavily informed by computational thinking, with decomposition used to identify the core tasks and abstraction applied to generalize potential solutions. The goal was to create a blueprint that could guide the development of the first prototype.

With a clear conceptual framework in place, the team moved to the second phase, where the initial prototype of HopeU was developed. This prototype incorporated the core functionalities identified during the conceptualization phase, including basic natural language processing capabilities and a limited set of responses designed to address common mental health concerns among students. The focus during this phase was on creating a working model that could be tested and refined, rather than on perfecting every aspect of the chatbot.

Once the initial prototype was developed, the third phase involved testing it with a small group of university students. The data collection involved gathering feedback from 50 university students who interacted with HopeU over a two-week period. This group was selected based on their willingness to participate and their current enrollment in university courses, ensuring they fit the target demographic of HopeU users. The data for this study was collected using the Lund USE Questionnaire [12], a tool designed to measure how users interact with digital interventions, particularly focusing on usability, engagement, and perceived effectiveness. The feedback was assessed using a Likert scale, allowing the researcher to evaluate user satisfaction across different categories of chatbot interaction. The analysis provided a comprehensive understanding of user needs and how well HopeU addressed them. This phase was critical for identifying any issues with the chatbot's understanding of user inputs, its ability to provide appropriate responses, and its overall usability. The feedback from this phase was invaluable in refining the chatbot. For instance, if users reported that the chatbot's responses felt too generic or unhelpful, the team could revisit the pattern recognition and abstraction processes to improve the chatbot's ability to generate more personalized and contextually relevant responses.

The final phase of rapid prototyping involved iterative refinement based on the user feedback received during testing. This phase was characterized by continuous cycles of development, testing, and revision, with each iteration bringing the chatbot closer to the final product. The rapid prototyping approach allowed the team to make incremental improvements without the need for extensive reprogramming, ensuring that the final version of HopeU was both effective and user-friendly. For example, adjustments could be made to the chatbot's decision-making processes based on new patterns observed in user interactions, or additional resources could be added in response to user requests for more specific types of support. Each iteration of the prototype was tested again with users, and the feedback was used to guide further refinements until the team was satisfied with the chatbot's performance.

4 HopeU: A Theraphy Chatbot for University Students

HopeU is an AI-powered personal therapy chatbot specifically designed and developed as a stress management companion for University students. Tailored to address the

unique challenges faced by these students, particularly those grappling with academic pressures and other life stressors, HopeU provides a safe and confidential space for users to express their concerns and seek guidance. The application allows the students to engage in open conversations with the chatbot without the fear of their personal stories being exposed to others. Through this interaction, students can receive personalized support and coping strategies, making HopeU an invaluable tool for mental well-being on campus.

HopeU is delivered via an Android application, incorporating various multimedia elements such as text, images, animations, and audio to create an engaging and user-friendly experience. Unlike many other mental health apps that often lack certain features or come with additional costs, HopeU is accessible by everyone ensuring that all students can benefit from its full range of services without financial barriers. It includes a mood tracker feature that helps users identify patterns, triggers, and trends in their mood, offering deeper insights into their mental health. The subsequent figures showcase the interfaces of the HopeU mobile application, illustrating its design and functionality.

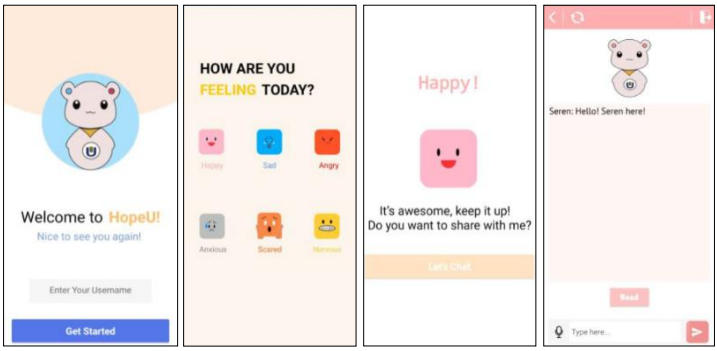

Fig. 2. Interfaces of HopeU Theraphy Chatbot.

5 Discussion

The development of HopeU highlights several key insights into the process of creating digital mental health tools without traditional programming. The use of computational thinking provided a structured framework that allowed the development team to focus on the conceptual aspects of the chatbot, such as user interaction and content delivery, rather than the technical details of coding. This approach not only simplified the development process but also made it accessible to individuals without formal programming training.

The success of HopeU as a digital mental health tool is closely tied to the principles of Cognitive Behavioral Therapy (CBT)**,** which underpin its design. CBT emphasizes the connection between thoughts, emotions, and behaviors, and the chatbot leverages this by guiding users through structured conversations that prompt reflection on their emotional states.

In addition, the use of ChatGPT as the underlying technology enabled the chatbot to perform complex language processing tasks without the need for custom coding. This

was particularly important in the context of mental health support, where the ability to understand and respond empathetically to user input is crucial. By leveraging ChatGPT's pre-trained language capabilities, the development team was able to create a chatbot that could engage in meaningful, supportive conversations with users.

The rapid prototyping methodology proved to be an effective way to develop a therapy chatbot in a non-programming environment. The iterative nature of rapid prototyping allowed the development team to quickly test and refine the chatbot, ensuring that the final product was both functional and user-friendly. This approach also facilitated collaboration between technical and non-technical stakeholders, as changes could be made and tested in real-time, without the need for extensive coding or reprogramming.

The novelty of HopeU lies not only in its role as a therapy chatbot but in its development process, which sidesteps traditional programming requirements. This approach democratizes the creation of digital mental health tools, enabling non-technical stakeholders such as educators, healthcare providers, and mental health advocates to develop and customize interventions. The broader implications of this model extend beyond educational institutions; by simplifying the development process, it holds potential for widespread adoption in resource-limited settings, such as rural mental health programs or global health initiatives. Future research could explore scaling this approach to other areas of healthcare or personalized support systems, offering an accessible solution for other therapeutic contexts, such as substance abuse or trauma recovery.

6 Conclusion

The development of HopeU represents a successful case study in the non-programming development of a therapy chatbot. By applying the principles of computational thinking and using rapid prototyping, the development team was able to create a functional, effective chatbot without the need for traditional programming skills. This approach not only simplified the development process but also made it accessible to a broader range of stakeholders, potentially expanding the use of digital mental health tools in educational settings.

Looking ahead, the HopeU project offers valuable insights for future developments in digital mental health tools. The use of computational thinking and rapid prototyping could be applied to other areas of mental health support, as well as to the development of other types of chatbots or AI-driven tools. Further research and development could explore ways to enhance the chatbot's capabilities, such as integrating additional AI technologies or expanding its range of therapeutic interventions. Additionally, ongoing user testing and feedback will be essential in ensuring that HopeU continues to meet the evolving needs of university students and other users.

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