A Codesign Approach for Conversational User Interfaces to Support College Students with Depression

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Abstract. Introduction*: The university context has demands that can increase the risk of depression and other mental disorders in students. Conversational User Interfaces (CUI) have been explored to support the prevention, diagnosis and therapy of people with depression. However, the design of these CUI, focused on college students, has not been deeply investigated.* ***Objective:*** *Based on this context, the objective of this paper is to propose a codesign approach for CUI to support college students with depression.* ***Methodology****: The Design Science Research method was used to propose, instantiate, and evaluate the design generated using the proposed approach.* ***Results:*** *The results suggest that the approach led to enjoyable CUI in this domain. Finally, some lessons learned are discussed.*
Keywords *Chatbot design, Design approach, Design Science Research, Student well-being, Mental health*

1. Introduction

The university context involves a series of changes that have the potential to influence students' mental health. It is estimated that between 15% and 25% of university students will experience some mental disorder during their academic period [Arino e Bardagi 2018]. A study by the World Health Organization (WHO) with university students from 19 colleges spread across 8 countries (Australia, Belgium, Germany, Mexico, Northern Ireland, South Africa, Spain, and the United States) found that Major Depressive Disorder (MDD) was the most common mental health disorder among university students, with 18.5% of students in the first 12 months of college being affected by MDD [Auerbach et al. 2018].

Estimates worsened during the pandemic caused by COVID-19. Post-COVID-19 research indicates a general prevalence of mental disorders of 72.9% among undergraduate students [Silva 2021]. Among the causes of damage to the mental health of university students, adaptations related to the transition from high school to higher education, moving to another city, and distancing from family and friends stand out,

as well as pressure regarding academic obligations [Cardoso 2022]. Another important related cause is the fact that during university life, around 80% of students experience daily stress. High levels of stress are associated with the development of depression and other mental disorders [Fragelli e Fragelli 2021].

Depression is considered one of the main causes of disability in the world. Depression is characterized by depressed mood (prostration, irritability, feelings of emptiness) and/or loss of energy and pleasure or interest in day-to-day activities. These symptoms should predominate on most days for at least two weeks. Several related symptoms may be present, such as poor concentration, feelings of low self-esteem, guilt, hopeless thoughts about the future, ideas of death, and disturbances in the biological rhythms of sleep, appetite and libido. It is quite understandable that these symptoms imply difficulties in interpersonal relationships and socializing, as well as in work relationships [Souza et al. 2022b].

In addition to conventional treatments, other approaches can also be used to prevent and/or reduce the damage caused by depression [Whitaker 2017]. Computational solutions have been developed to support the prevention [Li e Luo 2021] , diagnosis [Gupta e Sharma 2021] and therapy [Serrano-Ripoll et al. 2022] of people with depression. Conversational User Interfaces (CUI) (e.g. chatbots) are among computational solutions developed [Souza et al. 2022b]. The term "chatbot" stems from the words "chat", which is related to the conversation, and "bot", which is short for robot. Chatbots are automated programs that execute instructions based on specific rules to simulate conversations with humans, in general, using natural language structures [Galvão et al. 2019, Kumar 2021].

Although there are studies in the literature involving chatbots to support people with MDD (see Section 2), in general, the studies do not detail how the design decisions were made. The design of CUI aimed at college students with MDD has also not been deeply investigated.

In this context, this paper describes a codesign approach for CUI to support college students with depression. The term codesign has been used as a way of designing a solution for a community with that community being engaged in the design process, emphasizing the aspects of Human-Computer Interaction (HCI) [Baranauskas et al. 2013]. We built the proposed approach, instantiated it in a real context and evaluated it with college students with depression.

Our approach addresses a technology considered emerging, as CUIs are relatively new technologies that have grown rapidly in recent years. We seek a solution for the integration between technology, end users and a specific context, that of university students. Therefore, this paper is inserted in the context of one of the Grand Challenges for HCI Research in Brazil (2025-2035): Interaction with Emerging Technologies: An Ecosystem Integrating Humans, Technologies, and Contexts [Zaina et al. 2024].

The research method used was Design Science Research (DSR) [Dresch et al. 2015] (see Section 3). The results of this research point to the following contributions: i) a codesign approach for CUI for specific domains in mental health (see Section 4); ii) an example of the instantiation of the approach in the context of developing a chatbot to support college students with depression (see Section 5); and iii) a discussion

of the lessons learned by the authors during the process of building and instantiating the approach (see Section 6).

2. Related works

In this section, 9 related works are presented. To select these works, 17 papers were analyzed. Out of the total studies, 10 were selected from a systematic review the authors are conducting on chatbots for mental health. Additionally, 5 were chosen on an ad-hoc basis, and 2 were included because they were conducted by the research group in the same domain. After reading and analyzing the 17 works, 8 were excluded due to the following criteria: i) the artifact addressed was not a conversational interface; ii) the work was not related to the target audience; iii) the work was not related to mental disorders; and iv) it was not possible to access the work to read the full text. Below is a summary of the 9 selected works, ordered by year of publication and author's name.

[Fitzpatrick et al. 2017] determined the feasibility, acceptability, and preliminary efficacy of a fully automated conversational agent (Woebot) to deliver a self-help program to college students who identify as having symptoms of anxiety and depression. The authors did not report how the chatbot was developed, whether they used any existing design approaches, and they also did not report the profile of the project team. The authors conducted a 2-group randomized clinical trial with 70 college students. The intervention group interacted with the chatbot and the control group received an e-book on depression. According to the authors, the results suggest that the group that used Woebot showed a significant reduction in symptoms of depression and anxiety, as measured by the Patient Health Questionnaire (PHQ-9) (F=6.47; *P*=.01) and General Anxiety Disorder-7 (GAD-7) ($F_{1,54}$= 9.24; *P*=.004), compared to the control group. Although both groups showed a decrease in anxiety symptoms, there was no statistically significant difference between them. The group that interacted with the chatbot also showed a high level of engagement with the tool.

[Gabrielli et al. 2021] conducted a proof-of-concept evaluation to measure the engagement and effectiveness of the psychoeducational chatbot Atena, which supports healthy coping with stress and anxiety. The target audience consisted of university students. The authors did not report how the chatbot was developed. The authors indicated that psychologists and User Experience (UX) specialists were part of the project team. A proof-of-concept evaluation was conducted with a sample of 71 volunteer university students recruited by convenience. The evaluation was performed using the 10-item Perceived Stress Scale (PSS-10), GAD-7, and Five-Facet Mindfulness Questionnaire (FFMQ) questionnaires and free-text responses about the user experience with the chatbot. The volunteers were also asked to complete a short online survey to report what they liked and disliked most about their experience with the chatbot. The authors used statistical analyses to evaluate the effectiveness of the chatbot intervention. Participants' responses to the open-ended questions in the online final survey were analyzed using thematic analysis. The main results suggest that chatbot use is associated with a significant reduction in anxiety and stress symptoms among participants.

[He et al. 2022] tested the clinical efficacy and nonclinical performance of a mental health chatbot (XiaoE) based on Cognitive Behavioral Therapy (CBT) for young adults with depressive symptoms. The authors did not report how the chatbot was

developed, whether they used any existing design approaches, and they also did not report the profile of the project team. The authors conducted a randomized clinical trial with university students to evaluate the effectiveness of the mental health chatbot compared to an e-book intervention and a general chatbot. They used the PHQ-9, Working Alliance Questionnaire (WAQ), Usability Metric for User Experience-LITE (UMUX-LITE) and the Acceptability Scale (AS) as evaluation metrics. The results indicate that participants who used the mental health chatbot showed a significant reduction in depressive symptoms compared to the control groups. Adherence to the intervention was higher in the chatbot group compared to the control groups. They also reported high satisfaction with the use of the mental health chatbot, highlighting the ease of use and the usefulness of the interactions. The majority of users indicated that they would recommend the chatbot to other young people experiencing similar symptoms. The chatbot intervention group showed high engagement rates, with many participants using the tool regularly throughout the study period.

[Koulouri et al. 2022] explored whether chatbots can be an acceptable solution in mental health for young adults. The paper presents a high-fidelity prototype of a conversational agent for screening and intervening in mental health of young adults in a university context. The authors point out that they used a user-centered design approach. The authors also report that they involved the target audience only in the data collection phase. An evaluation with the target audience of university students was not carried out. The evaluation described in the paper was carried out with 3 mental health specialists. Semi-structured interviews and a demonstration of the functional prototype were carried out for the evaluation. The results indicate that the specialists considered the chatbot a tool that can help students identify mental health problems and seek help. The authors also point out as a benefit the possibility of 24/7 access, unlike traditional care that has restricted hours. As limitations, the authors highlighted concerns about confidentiality and security; limitations in expressing empathy, especially in serious cases. The chatbot was highlighted as a complement and not a substitute for human professionals.

[Kuhlmeier et al. 2022] proposed a theory-based design for personalized conversational agents to treat depression in youth and young adults. They proposed two principles to guide the design. The authors report the participation of young people with depression in the problem identification phase and a multidisciplinary team throughout the project. They built prototypes and for evaluation, interviews were conducted with five healthcare specialists and potential nondiagnosed users.

[Souza et al. 2022b] formalized design recommendations for chatbots to support students with depression. They proposed a set of 24 design recommendations. The authors reported that mental health professionals and HCI specialists worked on this proposal. The paper has much to contribute to the design process in this context, but it does not present an approach with steps and activities to be carried out. The proposed recommendations were also not used to create a chatbot, and an evaluation with the target audience was not carried out.

[Tagarot 2022] presents a chatbot designed to help college students facing depression. The author does not describe in the paper which approach was used to design the chatbot or the profile of the team that participated in the project. The author reported an evaluation with the target audience, in which five volunteers interacted with the chatbot

and answered a feedback questionnaire. The results indicate that the volunteers felt better after using the chatbot.

[Mustafa et al. 2024] developed a chatbot prototype to detect and treat anxiety in university students. The aim of the paper was to present the evaluation of the level of acceptance of the prototype. The authors do not report in the article which approach was used for the design of the chatbot. The authors also do not report the profile of the team that participated in the project. For the evaluation, semi-structured interviews were conducted with the target audience.

[Oghenekaro e Okoro 2024] implemented an AI-based chatbot to provide personalized and accessible mental health support to college students. The authors point out the use of a user-centered design approach, but do not describe the profile of the team that developed the chatbot. The authors report that the evaluation of the chatbot was conducted using a mixed-methods approach (engagement metrics, PHQ-9 and GAD-7). Although it is reported in the paper that the evaluation was conducted and that these metrics collectively assessed the effectiveness of the chatbot in promoting mental well-being, the authors do not describe the evaluation process and do not present the results.

Table 1 presents a summary of related work and compares them with the proposal of this paper. Where N/A appears in the table, it reads "Not applicable" and where N/R appears in the table, it reads "Not reported". The works presented indicate that chatbots tend to be a good tool to provide mental health interventions. Chatbots have the potential to be accessed more actively and frequently, unlike traditional care. Chatbots also enhance the engagement of university students. However, little has been reported on design approaches for CUI in this context. The studies also say little about the participation of multidisciplinary teams and end users in the construction of chatbots. Little is also said about how dialogues should be created to ensure the safety of the target audience. Therefore, this paper seeks to minimize this gap in the literature.

3. Methodological path

The research method used in this study was DSR. The DSR grew out of efforts to formalize Design Science in Information Systems research. The method provides researchers with a framework to produce and present high-quality, rigorous, and publishable research in research outlets [Peffers et al. 2007, Dresch et al. 2015]. The DSR method was used to propose, instantiate in a real context and evaluate the design generated using the proposed approach. Grounding our research in DSR provided a validated research framework. We adhered to DSR best practices to ensure that our approach was developed systematically and with scientific rigor.

The DSR process [Dresch et al. 2015] includes 11 steps (Figure 1), being them: 1) Problem identification; 2) Problem awareness; 3) Artifact identification and problem class configuration; 4) Proposal of artifacts to solve the specific problem; 5) Project of the selected artifact; 6) Artifact development; 7) Artifact evaluation; 8) Explanation of learning; 9) Conclusions; 10) Generalization to a class of problems; and 11) Communication of results. Sections 1, 2 and 4 contains results from steps 1, 2 and 3 of the DSR. Section 4 contain results from steps 4, 5 and 6 of the DSR. Section 5 contain results from step 7 of the DSR. Sections 6 and 7 contains results from steps 8, 9, 10 and 11 of the DSR.

Table 1. Comparison table of related works.

ID	Proposed an approach to design?	If yes, was it implemented?	If no, did they use any existing design approaches? Which?	Developed a conversational interface?	What mental disorder is covered?	What target audience?	Was there an evaluation with the target audience?
1	No	N/A	N/R	Yes	Depression and Anxiety	College students	Yes
2	No	N/A	N/A	No	Stress and Anxiety	College students	Yes
3	No	N/A	N/A	No	Depression	College students	Yes
4	No	N/A	User-Centered Design	Yes	Mental health	Young adults and counselors in a university context	No
5	Yes	Yes	N/A	Yes	Depression	Youth and young adults	Yes
6	Yes	No	N/A	No	Depression	People with depression	No
7	No	N/A	N/R	Yes	Depression	College students	Yes
8	No	N/A	N/R	Yes	Anxiety	College students	Yes
9	No	N/A	User-Centered Design	Yes	Mental health	College students	No
This paper	Yes	Yes	N/A	Yes	Depression	College students	Yes

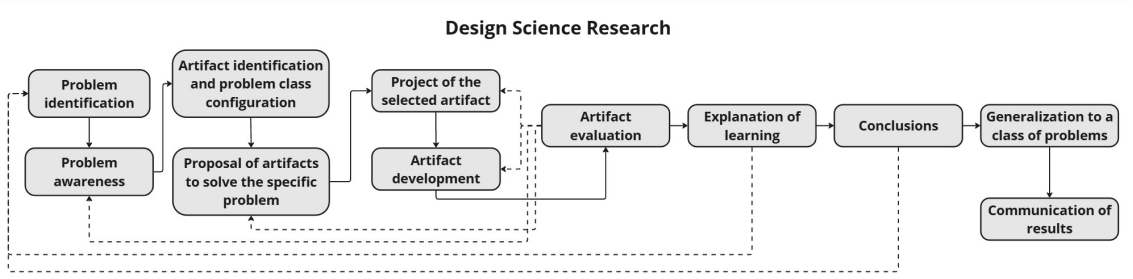

Figure 1. Design Science Research. Adapted from [Dresch et al. 2015].

4. Approach proposal

This paper is inserted in the context of the project AMIVE[1], that intends to build a computational infrastructure for identification and intervention autonomous of real-time of users with a MDD. In this context, we sought to insert a CUI into this infrastructure that would deliver the intervention through specialized dialogue with users.

To support this project, initial research [Souza et al. 2022b] was conducted to substantiate the problem and the motivation for building the proposed approach. As reported in Sections 1 and 2, there is a lack of approaches in the literature to support the codesign of CUI in the context of college students with depression.

After identifying the problem and motivation, we defined the objectives and artifacts to solve the specific problem. A multidisciplinary work team has been formed. This work team included computer researchers, designers, psychologists, professionals who work with the target audience and representatives from the target audience (graduate students in computing and health). We drew from our previous experience with therapeutic solutions and incorporated relevant literature on computing and health to support our process. The specialists discussed the initial steps, necessary artifacts, and information required to develop the CUI, taking into account the specific demands of the project. The work team defined that the main objective of the proposed approach would be to show the path taken to build the CUI, filling the gap observed in the literature.

The proposed approach (Figure 2) is composed of the three main stages of a design process, namely: 1) Clarification; 2) Design; and 3) Evaluation. What differentiates the approach from other design processes is that it indicates activities, techniques, directives, actors, among other specific elements for the codesign domain of CUI to support college students with depression.

Before the Clarification stage of Figure 2, it is necessary to define the work team (actors). [Souza et al. 2019] highlight the importance of a multidisciplinary team in healthcare software projects. Considering the mental health domain, the approach points out the need for a work team composed of Healthcare specialists, Computer specialists, and Representatives of the target audience. The work team must work collaboratively in all stages and activities proposed in the approach.

Once the work team has been defined, the first stage to be taken is Clarification. The first activity in this stage consists of conducting studies in the literature about the

[1]https://www.amive.ufscar.br/

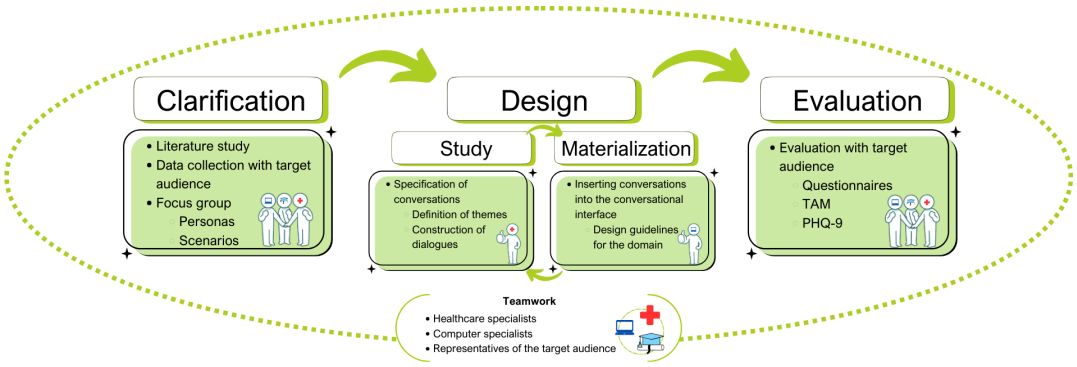

Figure 2. Proposed approach.

domain in which the chatbot will be inserted. This study can be carried out ad-hoc or based on methods such as systematic review, benchmark, among others.

The second activity of the clarification stage requires collecting data from the target audience. This data can be gathered by means of, for instance, literature research on the target audience profile, interviews, and questionnaires. Before collecting sensitive data from the target audience, the approval from a research ethics committee is strongly recommended.

The third activity of the clarification stage suggests holding a focus group with the work team with the intention of defining Personas and Scenarios. Considering the mental health domain, it is recommended that the Personas Enrichment Method be used [Rodrigues et al. 2014, Souza et al. 2022a]. The method aims to add specific information to personas within the scope of therapeutic applications and supports the active participation of health professionals.

The Design stage includes two substages: Study and Materialization. In the Study stage, the healthcare specialist in the team must specify the conversations, define the themes, and construct the dialogues that will be delivered to the students through the CUI. To do this, the healthcare specialist must consider the results of the clarification stage, their domain knowledge and can also consult other sources in the healthcare literature. It is recommended that these conversations be written in natural, non-technical language. In other words, the healthcare specialist does not need to know a technical computer language, thus facilitating collaboration within the work team. The approach proposes that the content of the dialogues be specialized and defined by a health specialist due to the sensitive context, thus avoiding inappropriate responses from the chatbot to the students. This strategy can be used for ruled-based chatbots, but also for those based on machine learning, or even based on large language models. Actual research on large models for mental health points to the use of fine-tunning and/or other steps that need the specialists' involvement.

In the Materialization substage, the approach points to the insertion of dialogues into a CUI. To do this, it is necessary to define or build the interface that will be used by the team. It is recommended that this substage be carried out by a computer specialist.

The computer specialist will be able to develop the CUI to be used or or

choose from one that already exists. The computer specialist also has specialized knowledge to transform the dialogues built by the healthcare specialist in natural language into a computational language. The approach also suggests that the computer specialist apply design directives for the domain (for example, the directives discussed in [Souza et al. 2022b]).

Finally, the last stage of the approach consists of evaluating the CUI by the target audience. For this evaluation, the approach suggests the use of questionnaires designed to assess the experience with dialogues, the Technology Acceptance Model (TAM) [Davis 1989] and the PHQ-9 [Santos et al. 2013].

5. Approach instance

This section presents the instantiation of the proposed approach for the design of a chatbot to support college students with depression. Firstly, to initiate the implementation of the approach, the work team was defined. The work team was composed of 3 Computer specialists, 2 Healthcare specialists and 4 Representatives of the target audience (university students). The results of the clarification, design and evaluation stages are described in the Subsections 5.1, 5.2 and 5.3.

5.1. Approach instance - Clarification

Starting the Clarification stage, the literature study activity was carried out. The work team applied the benchmark method to evaluate the scenario of offering chatbots to people with depression. Seven chatbots were evaluated, and none of the chatbots found were focused on college students. Among some of the benchmark findings, we highlight the need to be careful with the responses that the chatbot delivers to users, since, considering the sensitive context, the chatbot cannot generate a response that stimulates risky thoughts [Souza et al. 2022b].

To collect data about the target audience profile, the work team consulted a survey about the socioeconomic and cultural profile of undergraduates at federal universities in the country [Andifes 2019]. The work team also consulted a survey about the perceptions of college students about ethics in computer-based data collection and interventions for mental health [Menegasso 2021].

With the results of the literature study and the collection of target audience profiles, the work team carried out a focus group. The objective of the focus group was to use qualitative data to discuss the presentation of the solution to the end user, content parameters and frequency of interventions, and chatbot behavior strategies. All 9 team members participated in the focus group. The focus group conducted a total of eight meetings to define the chatbot's scope, requirements, personas, and scenarios. These meetings were recorded, and various artifacts were produced by participants as a result. Among the results obtained, the definition of the stages of interaction between the chatbot and the user, the proposition of the chatbot's communication flow with the user, and a set of 6 personas was defined.

Through the focus group, it was defined that the chatbot's interactions with the user would follow the following steps: 1) Greeting: in order to hail the user and begin to understand the context and problem; 2) Analysis: with the aim of understanding the user's demand at the moment and seeking the next most appropriate courses of action; 3)

Intervention: to reaffirm the user's welcome, guide and offer intervention for the current demand; 4) Feedback: with the aim of understanding the effectiveness of the previous stage through user feedback; and 5) Conclusion: with the aim of farewell.

After defining the interaction steps between the chatbot and the user, the communication flow between them was defined (Figure 3). The proposed interaction flow begins with an initial greeting, during which the chatbot welcomes the user, explains the triggering factor that initiated the conversation, and inquires about the user's immediate state. Following this, the chatbot conducts a preliminary exploration of the user's context to establish a foundational understanding. Subsequently, the interaction progresses to a more detailed contextual specification, wherein the chatbot deepens its inquiries to gain a comprehensive understanding of the user's situation. Upon reaching this stage, the chatbot delivers an intervention, directing the user toward an appropriate course of action for care. To assess the efficacy of the intervention, the chatbot then solicits user feedback. Throughout the process, the chatbot also functions as a data collector, leveraging both initial and prior user inputs to identify previously attempted protective measures. The interaction concludes with an appropriate closing message, ensuring a structured and coherent conversational experience.

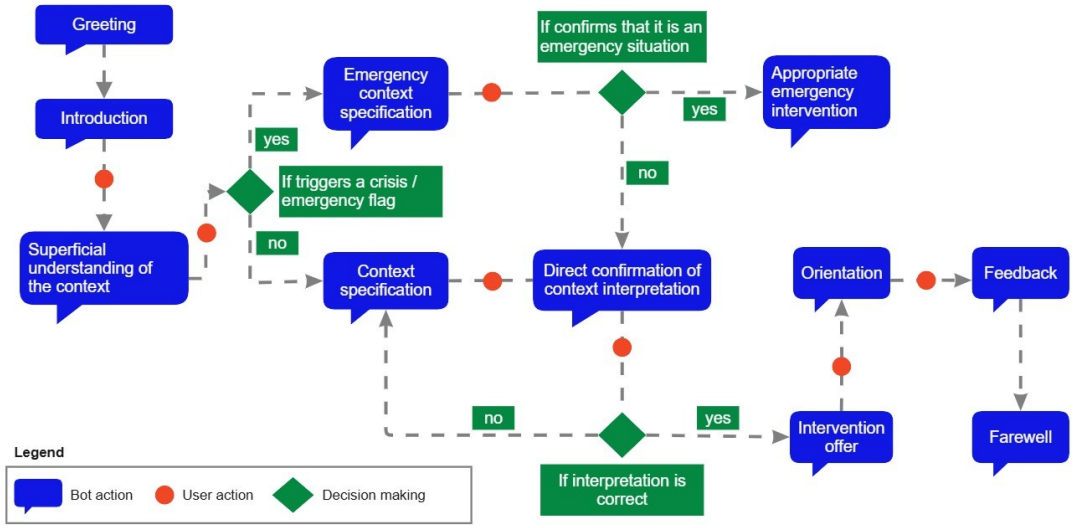

Figure 3. Communication flow between the chatbot and the user.

Considering data from the literature, the target audience profiles and the specialized knowledge of the participants, 6 personas were created. The approach points to the use of the Personas Enrichment Method [Rodrigues et al. 2014, Souza et al. 2022a], which was very significant in the context. The Personas Enrichment Method led participants to think about their pain, clinical condition of the target audience, and forms of therapy. Such characteristics were fundamental for specifying the themes of the chatbot's conversations. Figure 4 shows one of the personas developed.

5.2. Approach instance - Design

After completing the clarification stage proposed by the approach, the working group began the design stage. This design stage is divided into two sub-stages, namely: Study and Materialization.

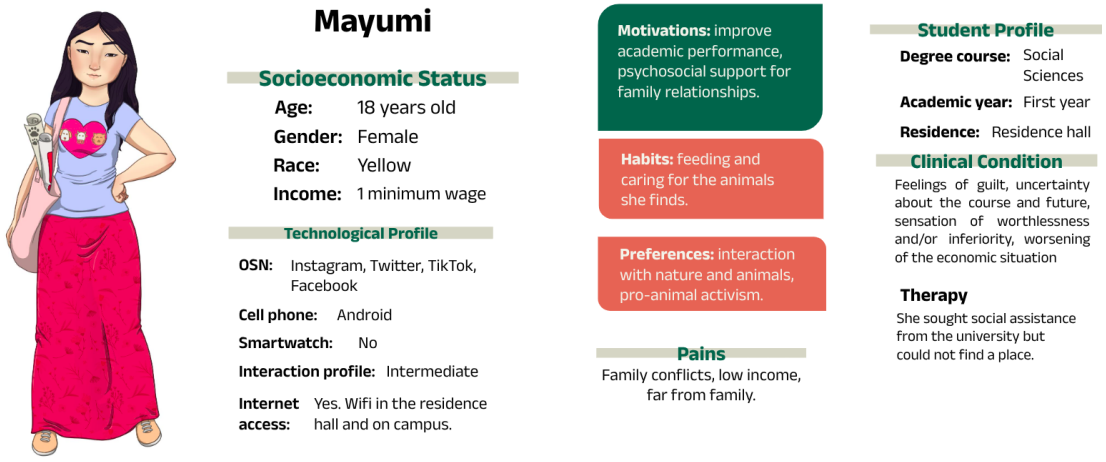

Figure 4. Example of one of the personas created.

5.2.1. Study

A design decision made by the work team was that the chatbot would not create dialogues autonomously. This decision was made because of the sensitive context in which the chatbot is inserted. Therefore, the team decided that the chatbot would have personalized content developed by the team's healthcare specialists.

The text of the dialogues could be written in non-technical language, facilitating collaboration with healthcare specialists. Later, in the materialization stage, the computer specialists were tasked with transcribing the dialogues into JSON files to be interpreted by the chatbot.

Given the sensitive nature of mental health, all decisions regarding themes, dialogues, presentation methods, and response options were made by psychologists and psychology professionals who work with the target audience. They defined the themes and constructed the conversations considering the defined communication flow and the profiles of the personas created. When writing the content of the dialogues, the specialists based themselves on their experiences and scientific literature on depression and mental health.

In total, 13 themes were defined, namely: Autonomy, Depression in university students, Distance from origin city, First use, First year at University, Gender, Income, Initial dialogue, Insomnia, Poor academic performance, Risk of death, Sleeping deprivation and Support network. Based on these themes, 21 dialogues were written.

Figure 5 shows an excerpt from a dialogue on the topic of "support network". In the dialogue, the health expert indicated a symptom to which the question is linked (e.g. does not find a support network, impaired spiritual support) and the classification of the answers according to severity (light, medium or severe). The user will only see the questions and answer options; the data on symptoms and severity are for internal use by the team to suggest intervention.

Are you able to find support from friends, family or spirituality when you are going through difficulties in your daily life? Because emotional bonds, friends and family are of great help in being able to talk, exchange ideas, let off steam and find support to face stages in life. (does not find a support network, impaired spiritual support)

- ☐ I understand that yes, somehow I can always count on them. (light)
- ☐ I understand that yes, but it hasn't been enough. (medium)
- ☐ No, I haven't been able to find support from anyone. (severe)

Figure 5. Example of an excerpt from a dialogue.

5.2.2. Materialization

The AMIVE project includes an application developed to track depressive profiles in college students. This application has several features, among them there is a module in which users can interact with a chatbot. The application also has the internal functionality to edit the chatbot's dialogues. Therefore, this application was chosen to be used as a CUI in this materialization stage.

The dialogues created in the Design/Study stage were inserted into the application through the chatbot dialogue editing functionality. Figure 6a shows a screenshot of the application's home screen, where the development team (system administrator) can enter the dialog editor. When entering the dialog editor, the system administrator is redirected to the second screen (Figure 6b), where he can import a dialog already created in a file in JSON format, or create a new dialog directly in the application. When clicking on "create new" the system administrator is redirected to the screen shown in Figure 6c. The system administrator can then enter data about a specific dialog and link that dialog with symptoms identified in the user's interactions with the application. This linking of the dialog to the symptoms (Figure 6d) is used to suggest personalized dialog themes to users based on their interactions with the application.

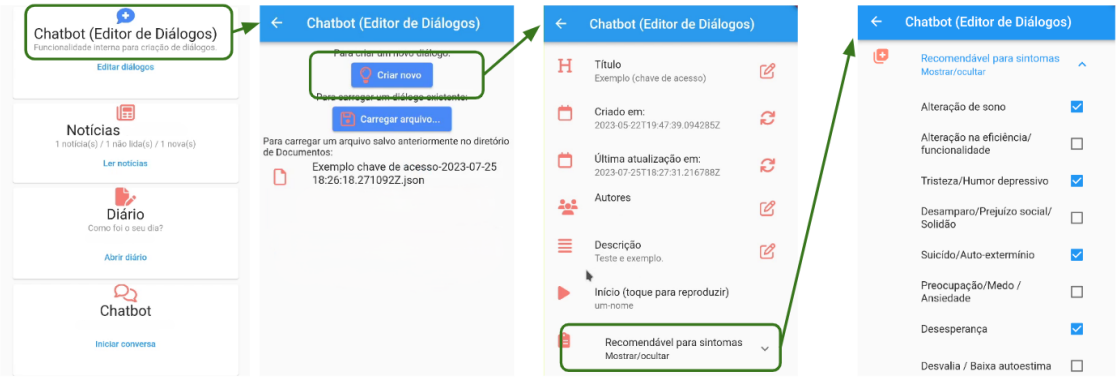

Fig. a Fig. b Fig. c Fig. d

Figure 6. Screenshots of the flow for editing chatbot dialogues in the AMIVE application.

Considering the proposed approach, before inserting the dialogues into the application's chatbot, one of the computer specialists used design guidelines for Chatbots to Support People with Depression [Souza et al. 2022b] and a manual on writing,

behavior and communication journeys for chatbots. The manual was developed within the context of the AMIVE project, with the purpose of recording the modeling process of the project's conversational agent, validating and recording the design choices made, and guiding further research on iterations of chatbot development projects.

The manual developed for the project is composed of three parts that help in creating the chatbot: (1) writing manual, section 1 of the manual; (2) behavior manual, section 2; and (3) communication journey manual, section 3. The writing manual aims to be a guide for creating and formatting content for the conversational agent. It deals especially with the language used to create the bot's content, proposes a definition of symbology, including graphic elements that the bot can use during dialogues, and proposes the construction of a glossary with flag words and other important terms that can trigger the bot. The behavior manual aims to describe guidelines and recommendations on how the created content can meet the user in a way that is appropriate to the project's values. Among these behaviors, we can mention the bot's encouragement of the user for self-care and the individual care and attention that the bot should have with each user. This section also includes a catalog of interventions from the bot to the user. The purpose of the communication journey manual is to describe the path that the chatbot should take during the bot-user and user-bot interaction, seeking a comfortable dialogue flow. The journey proposed by the project is composed of four phases, from the initial greeting to the end of the dialogue.

The guidelines, guidance, and suggestions available in the manual were used to create the content available in the project's chatbot. Figure 7 shows an example of how the manual was applied in a dialogue inserted in the chatbot. The bot starts the dialogue session in phase 01 of the communication journey described in section 3 of the manual, subsection 3.1 (first and second lines of the table in Figure 7). This phase is characterized by having little friction and a definition of the user's current situation. In the fifth and sixth lines of the table, the bot moves on to phase 02 of subsection 3.1 of the manual, this phase is characterized by there being a more in-depth analysis of the user's current situation by the bot. The next lines of the table show the transition from phase 02 to phase 03 of subsection 3.1 of the manual. Phase 03 describes the need for the bot to welcome the user, along with the provision of cautionary signs.

Throughout the conversation presented in Figure 7, it is possible to note the presence of personalization, non-textual elements, and empathy of the bot with the end user, following the guidelines present in section 1 of the manual. The personalization subsection of the manual (subsection 1.1 - personalization) recommends using the user's name or nickname and writing the dialogue directed at the user, for example, in the sentence "Good Morning, User!", in this case, "User" is a fictitious name of a user, indicating the personalization of the content. Subsection 1.3 of the manual (reducing context ambiguity) describes how to write the content to reduce the context ambiguity of the dialogue, creating more specific content; In the image excerpt, the text content converges on problems that may be causing insomnia and what actions can help in the treatment. Regarding non-textual elements, subsection 1.4 (non-textual elements) describes the importance of inserting emojis and emoticons to bring the bot closer to the user; emojis are present throughout the excerpt, such as the sleeping emoji in the bot's first message. Also in section 1 of the manual, guidelines are given for the content to be

written to demonstrate the bot's empathy with the user (subsection 1.6 - empathy). This characteristic is also present in the bot's first message, specifically in the excerpt "College life can be quite challenging at times, right? There are so many things to do, and so many demands to meet.".

Also present in the excerpt of the dialogue presented is the application of the guidelines on the bot's behavior, present in section 2 of the manual. The guidelines applied in this section are individual care and attention (subsection 2.3) and mapping of determinants of suffering (subsection 2.5). Subsection 2.3 describes the care that the bot must have with the user, trying to clearly understand the situation of the individual and the environment in which he or she is inserted. Subsection 2.5 guides the survey of determinants of suffering so that they can be used in the provision of care actions that the bot offers to the user. In Figure 7, the white lines refer to the bot's messages, while the gray lines refer to the options available to the user. The choice made by the user is marked in bold and underlined.

After applying the manual, directives, and guidelines, the computer specialists transformed each of the dialogues written in non-technical language by the project's researchers into the JSON file format and they added the dialogues to the application's chatbot. To make the chatbot available for the evaluation described in Subsection 5.3, a total of 10 dialogues were created, each covering a different topic about the mental health of university students, including dialogues about insomnia, income, and poor academic performance.

5.3. Approach instance - Evaluation

Instantiating the last stage of the proposed approach, an evaluation was carried out with university students with a depressive profile. This subsection will present the protocol for recruiting students for the clinical study to evaluate the chatbot, the profile of the students participating in the study and the results obtained from the evaluation. This study was approved by the Research Ethics Committee of the Federal University of São Carlos (SP-BR).

5.3.1. Recruitment protocol

The invitation to participate in the clinical study was sent to student email lists and was published on all official channels of the Federal University of São Carlos (SP-BR). A total of 222 students expressed interest in the study and responded to a sociodemographic survey. Students interested in the study also answered the PHQ-9 questionnaire [Santos et al. 2013].

Students with moderately severe symptoms (PHQ-9 score between 15 and 19), severe symptoms (PHQ-9 score between 20 and 27) or active suicidal ideation (response greater than 0 on item 9 of the PHQ-9) were not recruited for the second phase of the study. These students were offered support and listening by a health professional, with the intention of psychoeducation and referral to a health service. Students who presented symptoms compatible with mild depression (PHQ-9 score between 5 and 9) or moderate depression (PHQ-9 score between 10 and 14) were invited to participate in the second phase of the study. In total, of the 222 interested students, 44 were identified as having

	Dialogue Session	Manual Application
BOT:	Good Morning, User! I'm here to help you! 🤗 College life can be quite challenging at times, right? There are so many things to do, and so many demands to meet. 😔 At times we may feel distressed or lost with so many responsibilities, after all, balancing several activities can be tiring and stressful. When we enter college, we may end up facing some concerns, including financial, permanence, and survival. 😔 In this back and forth of college life we may also eventually start to have problems with sleep. 😴 Did you know that you may be unwell and therefore have insomnia or have insomnia and therefore be unwell? Both possibilities are true. 🤔 I'm here to talk whenever you want. If at any time you no longer want to talk, just close the conversation. 🤗 Knowing this, what would you like to talk about insomnia? 🧐	The bot starts the session with low friction, as indicated in phase 01 of 3.1, in addition to applying guidelines 1.1 (personalization) and 1.4 (non-textual elements). In this section, the bot also applies guidelines 1.6 (empathy), and 2.3 (care and individualized attention).
USER:	• I'm feeling unwell, and that's why I have insomnia. I want to know what it can cause me. • I have insomnia, and that's why I'm feeling unwell. I want to know what it can cause me. • **I have insomnia and I want to know what it can cause me.**	
BOT:	Do you want to know what sleep deprivation can cause in our lives? 🧐	In this section, the bot prepares to transact between phase 01 and phase 02 of 3.1. It also applies guidelines 1.3 (reducing context ambiguity), and 1.4.
USER:	• Yes, I want to understand a little more. • **I don't want to understand this right now.**	
BOT:	To properly address sleep problems, let's first try to understand why you're suffering from insomnia. Could it be? 😁	The bot continues the session by understanding the user's context, as indicated in phase 02 of 3.1, in addition to applying guidelines 1.3, 1.4, and 2.5 (mapping of determinants of suffering).
USER:	• No, I know why I have insomnia. • I don't want to understand that now. • **Yeah, let's go.**	
BOT:	Do you know what is depriving you of sleep? 🤔	The bot prepares to transact between phases 02 and 03 of 3.1. Guidelines 1.3, 1.4, 2.3, and 2.5 still apply here.
USER:	• I am overwhelmed with work. • **I need to meet deadlines.** • I need to study for tests. • None of these.	

Figure 7. Example of dialog session and application of manual items.

mild or moderate depression and were invited to participate in the second phase of the study.

The second phase of the study evaluated different functionalities of the AMIVE application. Study participants received a link to download and install the AMIVE application on their personal mobile devices. Of the 44 students who were invited to participate in the second phase of the study, 22 interacted with the chatbot and, consequently, had access to the dialogues.

5.3.2. Students profile

The profile of the 22 students participating in the study was identified considering the applied sociodemographic research. The research data indicate that the students participating in the study, for the most part, are in undergraduate studies (81.8%), do

not have a partner (54.5%), do not have children (81.8%), use or have used psychiatric medication (54.6%) and are being monitored by a mental health professional (54.5%). 36,4% of students are from the Exact and Tecnology area, 36,4% are from the Humanities and Management area and 27,2% are from the Biological and Health area. The majority of students (54.6%) reported being in the initial years of their degree, with less than 50% of the course completed.

In relation to the distance from their hometown and, consequently, from their family, only 0.3% of students study in their hometown. 10.6% study between 100km and 200km away from their hometown. 55.9% study between 200km and 300km away from their hometown. And 33.2% study more than 300km away from their hometown. In relation to monthly family income, 45.5% of students are part of a family with a monthly income of up to one minimum wage per person. 9.1% are part of a family with a monthly income of between 1 and 2 minimum wages per person. 36.4% are part of a family with a monthly income of between 2 and 3 minimum wages per person. And 9.1% are part of a family with a monthly income of between 3 and 4 minimum wages per person.

5.3.3. Evaluation results

The chatbot was made available to volunteer students and data was collected over a period of four weeks. Figure 8 shows the graph with the number of accesses by dialogue theme. As can be seen in the graph, the most accessed dialogues were about the themes “Depression in university students” and “Support Network”. Of the available dialogues, the only one that was not accessed once was about the theme “First year at University”.

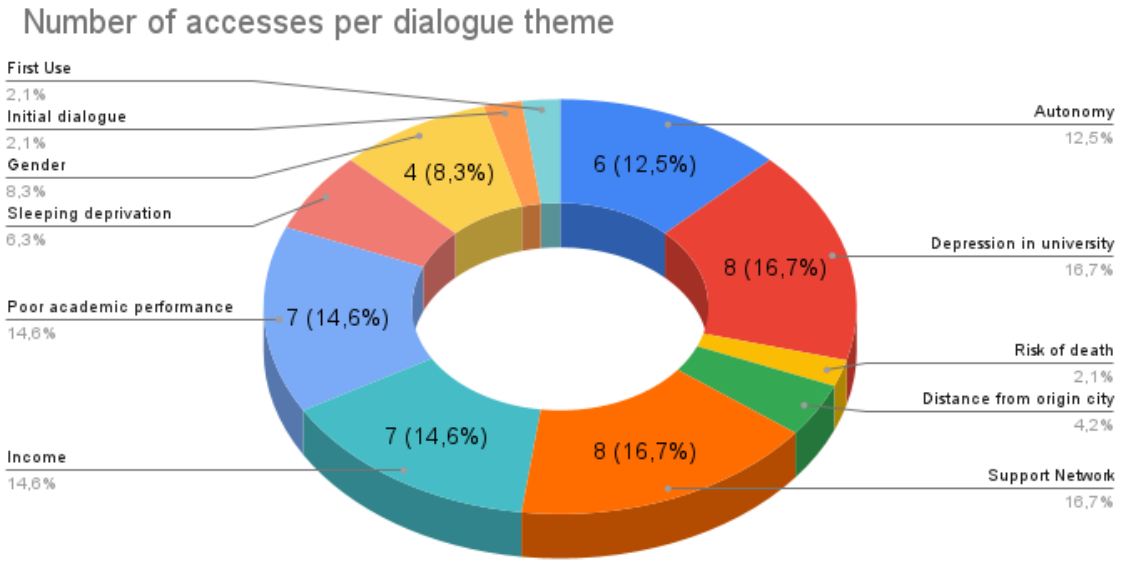

Figure 8. Graph with the number of accesses to the dialogue for each theme.

At the end of each dialogue, students were invited to answer two questions to evaluate that specific dialogue. The questions asked and the possible answers were:

1. How do you evaluate the experience of chatting with chatbot? Possible answers: i) I didn’t like talking to chatbot; ii) I’m neutral; and iii) I enjoyed talking to chatbot.

2. How do you evaluate the impact of conversation? Possible answers: i) It didn't help me; ii) I'm neutral; and iii) It helped me.

Figure 9 shows the graph with the results of the responses to the first question for each theme. Of the 22 participants, one did not answer the question. The theme "first year at University", "initial dialogue" and "First use" are not included in the graph because these themes did not receive any evaluation from the students. As can be seen in the graph, the most accessed themes ("Depression in university students" and "Support Network") were also the ones that received the best evaluation for this question. Only the topic "Poor academic performance" received a negative evaluation. The results of the responses to this question suggest that the dialogues and themes presented generated a good experience for the students who chatted with the chatbot.

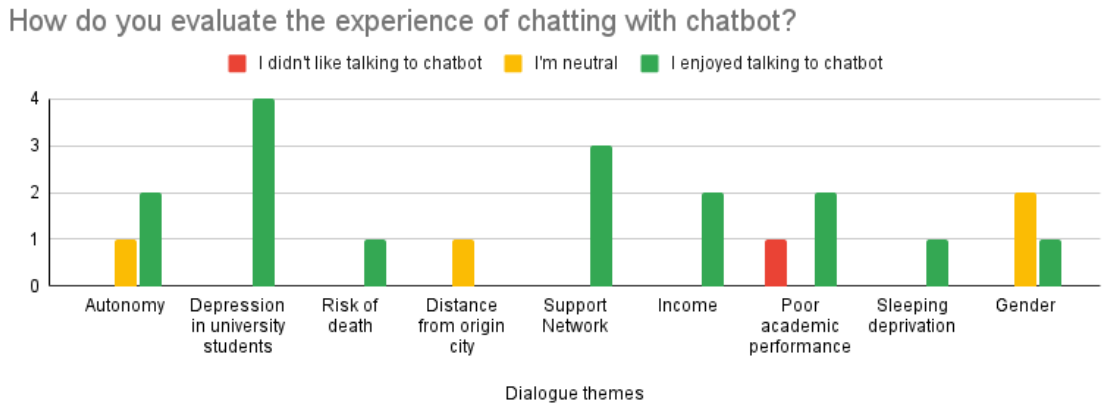

Figure 9. Graph with the results of the answers to the first evaluation question.

Figure 10 shows the graph with the results of the responses to the second question for each theme. Of the 22 participants, one did not answer the question. The results of the responses to this question suggest that the dialogues and themes presented had an impact on the students who spoke with the chatbot.

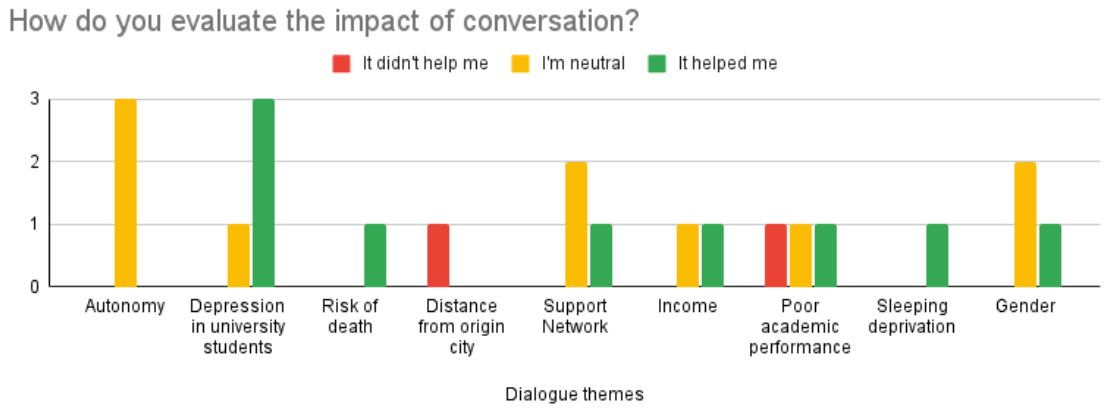

Figure 10. Graph with the results of the answers to the second evaluation question.

6. Lessons learned

This research work defined a collaborative approach to the design of CUI for a specific audience and domain. In addition, the approach was used and a CUI were designed and used. Some lessons learned from this research include:

The need for stakeholders from different areas and expertise. CUI for mental health require designers and healthcare professionals on the team. Collecting data for design, applying techniques and methods that inform design decisions, interaction design, and designing user interfaces, among others, requires specialized design knowledge. Furthermore, it is extremely important that health experts take responsibility for the content of conversations, which aim to improve the health situation. Finally, the students, as final users, may have a voice and be as involved as possible.

The need to apply specialized knowledge to design and evaluate. Specialized knowledge was used at different moments in the process and by different actors. Designers used design guidelines that supported the decision-making and interface design. Health professionals used specific databases about the target audience to select conversational topics and provide scientific highlights in the texts. Evaluations may use specialized instruments depending on which aspect will be considered (e.g. TAM or PHQ-9).

Be guided and collaborate. The collaborative approach employed in the design process of the AMIVE application integrated qualitative data analysis, development requirements, and the conceptualization of tools and artifacts. This methodology facilitated a cyclical process of production and research, wherein the outcomes of each phase were systematically assessed and validated in subsequent stages. Consequently, an iterative progression was established throughout the project's development. While the primary focus of the team was to delineate the chatbot's development scope, additional factors—such as the communication framework and user interaction strategies—were also systematically examined. Moreover, previously established design elements were refined through engagement with specialized professionals who contributed to discussion groups. The inclusion of diverse perspectives during these collaborative stages fostered a multidisciplinary validation process, ensuring the rigorous evaluation of key design components. Thus, the project's multidisciplinary and cooperative nature played a pivotal role in consolidating and validating its outcomes. The resulting discussions reinforced the chatbot's design elements, ultimately ensuring a coherent and effective development process tailored to the needs of the target audience.

Choose tools wisely. Different technologies can be applied in the design process as well as in implementing the desired design solution. In this research, a conversation editor was created to support multidisciplinary work, since specific programming languages were not common to all. Also, conversational agent technology can influence many design decisions (e.g. ruled-based bots vs large language models). The technologies that will be applied must be discussed as soon as possible in the project.

Evaluate not only with specialists but with students. Students should be involved at various stages of the design process, as they experience unique mental health situations and may have particular interaction demands. Furthermore, the evaluation of the CUI is a fundamental aspect of the approach and must involve the target audience.

Longitudinal studies are best suited for MDD, given that symptoms are observed over time and provision of interventions must be continuous.

7. Conclusion

The motivation for this research came from observations at the Federal University of São Carlos (SP-BR) regarding a rise in mental health issues among students. Universities often struggle to provide adequate support for these students, and technology could play a significant role in addressing this challenge.

While this audience typically engages with technology systems, the significance of this paper lies in proposing a design approach that supports addressing their specific interaction demands related to mental health that have not been adequately explored in existing literature. For instance, aspects such as trustworthiness, empathy and specific conversation topics (e.g. academic performance, distance from family) emerged with the approach proposed.

This paper presented an approach to codesigning CUI for colege students with depression. While the literature emphasizes a participatory and multidisciplinary approach, one of the key differences highlighted in this paper is our focus on specific methods to foster collaboration and participation from both the target audience and specialists. While user-centered design acknowledges the importance of this collaboration, this paper provides practical strategies for implementing it within this unique and relatively unexplored context. For example, a design specialist applied guidelines for CUI on dialogues created by health specialists, a collaboration not seen in other work in the context. The primary contribution of the paper is to present the approach utilized in the research, detailing its application and the results that demonstrate its effectiveness. This approach serves as a reusable resource that other researchers or developers can adopt for similar projects.

The suggested steps, methods, techniques, and artifacts were reported. The interfaces created through the instantiation of this approach were evaluated by students, in a longitudinal clinical study and in their daily lives. The results suggest that the approach led to enjoyable user interfaces as desired.

One limitation of this research is the report of instantiation in only one project. Another limitation is the sample size, with 22 students participating in the evaluation. However, there are significant challenges in recruiting participants for mental health research. Due to the stigma associated with participating in such studies, obtaining large sample sizes is often difficult.

Future works include investigating this approach in other cultural contexts and universities and also for other mental health diseases. We also highlight as future work the investigation of how Artificial Intelligence can be further explored and used to improve dialogues within the AMIVE application, without compromising the security and reliability of the application in a context as sensitive as mental health.

8. Ethical Issues

To ensure ethical standards during the study, a psychologist was made available to support the research participants at any time. The study, conducted with university students,

received approval from the Research Ethics Committee of the Federal University of São Carlos (SP-BR) under opinion number 67249823.5.0000.5504. Participants signed an informed consent form, which outlined the risks and benefits of the research. They were informed that their participation was voluntary, that they could withdraw their consent and discontinue their participation at any time without any negative consequences, and that the data collected would be anonymized. Furthermore, the data was anonymized even among team members, meaning that not all team members had access to all participants' data. The focus group was carried out with members of the research project.

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