Original Article

Design of an APPS Prototype Oriented to Mental Health in University Students

Laberiano Andrade-Arenas[1], Elizabeth Liñan-Espinoza[2]

[1,2]Faculty of Sciences and Engineering, Universidad de Ciencias y Humanidades, Lima, Perú.

[1]Corresponding Author : landrade@uch.edu.pe

Abstract - Mental health among college students has grown exponentially since the pandemic. This was manifested through fatigue, depression, stress, anxiety, and others. The methodology applied in the research is design thinking, which has five phases. In addition, the objective of the research is to make a design through app prototypes that allow for a support system for university students, showing different scenarios of alternatives that minimize students' mental health problems. An interview was conducted using the Atlas TI.22 software with university students, and a survey was sent to experts for validation of the instrument. In this way, the data was triangulated using the networks in the software. As a result, the student's satisfaction with the design of the mobile application was obtained, as was the validation of the mobile application by expert judgment, taking into account the approval of criteria such as usability, quality, integration, and interface. The beneficiaries of the research were university students, teachers, and parents.

Keywords - Mental health, Stress, App prototype, Anxiety, Depression.

1. Introduction

Mental health is becoming a major societal concern, especially among young college students. Academic stress, lack of sleep, social pressure, and uncertainty about the future are just some of the reasons why college students suffer from mental health problems. In addition, the confinement of SARS-cov2, better known as COVID-19, in 2020 has affected people's mental state, with a particular focus on vulnerable groups such as young people between the ages of 15 and 29 [1]. Recent studies have confirmed that these generations are having difficulty coping with the effects of the current pandemic. Thus, the pandemic's impact on mental health does not vary by country or age.

Knowledge about mental health is important to develop a strategic health plan based on disease prevention and to strengthen the well-being and health of the population [2]. In addition, psychological, environmental, and behavioral factors influence various aspects of health. Since mental disorders among college students are an issue of great importance due to the academic and social pressures they are exposed to, there are currently several digital tools that can help improve mental disorders among young people, such as mobile applications (apps).

In the context of the country of Mexico, most students use at least one smartphone, which is part of their lifestyle. Because it is considered a practical and accessible tool for communication, entertainment, information, and learning [3]. In addition, with the rise of technology in everyday life, applications have emerged as a useful tool for treating mental health problems. Therefore, developing an application model for college students that focuses on improving their psychological well-being is an important and valuable approach.

In the country, the government has faced challenges and has had to look for solutions and strategies to meet the population's needs. Since then, due to the interruption of the working day, universities have closed their physical facilities and implemented online education [4]. This has disadvantaged many students who live in extreme poverty and do not have the necessary equipment to attend online or Internet classes. This has often led to emotional problems in students, such as depression, obesity, and low self-esteem, which have had a negative impact on their normative performance and personal development.

The Peruvian government implemented lengthy quarantine protocols to control the spread of COVID-19 among humans. This strategy was applied in all countries of the world with the same purpose of protecting people and preventing further infection. It consisted of the reduction and social isolation that families had to carry out [5]. This situation modified some significant changes in the people's way of life, such as the work environment, education, social

relations, and health, among others, to which they were not used. However, despite the efforts made to prevent the spread of COVID-19, it should be noted that the pandemic also affected the mental health of several people nationally and internationally.

Therefore, the most effective way to address modern problems is through application development. Specifically, the aim is to develop a prototype application to help college students improve their mental health. Given the critical nature of mental health, we are dedicated to creating a comprehensive solution. The study aims to improve college students' mental and psychological well-being by providing them with application-based information and resources to identify and manage stressful situations and anxiety. The research will begin with a review of the literature on mental health problems prevalent among college students, followed by identifying user needs and requirements and creating a prototype application based on the information collected. This study aims to produce a prototype application that improves students' mental health and provides a basis for developing more robust and efficient tools in the future.

2. Literature Review

Developing an app for mental health among university students is a relevant and current topic that is the subject of research in various fields, including psychology, computer science, and education. Therefore, the present research paper proceeds to conduct a review of the topic, which will allow a summary of the main findings and concepts of previous research. First of all, it is important to emphasize the relevance of mental health in university society due to the presence of stress, anxiety, depression, and other common psychological disorders among students. Previous research has shown that university students suffer from mental health problems more frequently than the general population, which implies the need to implement strategies to deal with these problems.

During the pandemic, an economic, health, and social crisis occurred, resulting in an increase in physical, psychological, and mental health problems [6]. In addition, the university population is particularly prone to depression, anxiety, and stress, and a decrease in sleep quality has been noted. A study conducted in Changzhi among 7143 medical students found that 24.9% suffered from anxiety, of which 0.9% had severe anxiety and 21.3% had mild anxiety. It was also found that sleep quality was affected during the period of home confinement.

Previous studies have also shown that college students experienced significant mental health problems during the spread of the global COVID-19 pandemic [7]. However, few analyses have examined changes from pre-pandemic levels in different populations. Therefore, this study aimed to compare changes in mental health and associated stressors during the pandemic in international and local university students studying in Australia.

At the same time, the strategy of information sharing as a means of campus suicide prevention is an often debated and divisive topic. This study focused on determining which students are more and less likely to opt for university permission to notify an emergency contact in the event of serious concerns about their mental health [8]. Therefore, routine cross-sectional data were used from 29,799 students in 2020 and 31,998 students in 2021 at a UK university. The proportion of students opting into the consent-to-contact policy was summarized descriptively across years. Multiple logistic regression models were used to analyze the probability of participation based on student characteristics, including likely clinical depression, age, gender identity, sexuality, ethnicity, home or international student status, disability, study mode, and study level. Most students chose to participate in both years (91.2% in 2020 and 90.4% in 2021). However, probable clinical depression and gender identity other than sex had the strongest associations with non-acceptance in 2020. These findings were replicated in the 2021 dataset. It is concluded that some of the most vulnerable students appear to be less likely to participate, and more research is needed to understand why these groups are less likely to participate and what additional support universities may need to prevent serious injury or loss of life.

The effects of COVID-19 in India were profound, resulting not only in human fatalities but also in the long-term mental well-being of the population [9]. This section aims to scrutinize the psychological impact of the pandemic on college students in India. Furthermore, this study analyzes the factors that influence this situation after the second wave of the COVID-19 outbreak.

During the COVID-19 pandemic, medical school curricula underwent extensive changes globally, such as implementing online learning [10]. However, this study aims to comprehend the impact of the pandemic on the mental health of medical students at Rocky Vista University College of Osteopathic Medicine in Parker, Colorado, USA. The study aimed to analyze the impact of the pandemic on anxiety and depression levels among medical students, as well as the influence of various factors on their mental health during this period. Additionally, it aimed to investigate how different subgroups within the study population were affected.

Anxiety is prevalent but frequently underestimated among the general population and medical students [11]. Consequently, we performed a review to analyze the predisposing factors and overall prevalence of anxiety in medical students. Examined 69 cross-sectional studies in February 2019 and examined data from 40,348 medical

students. The prevalence of anxiety among medical students was 33.8%, with Middle Eastern and Asian students having a higher prevalence. No significant differences were found in anxiety prevalence when comparing subgroups by gender and year of study. Approximately one in three medical students worldwide experience anxiety, significantly higher than the general population.

The decline in young adults' mental health after the COVID-19 pandemic is undergoing more scrutiny. Since it is evident that the psychological impact of the pandemic will persist for many years, particularly in younger students who lacked the chance to develop efficient coping mechanisms before the COVID-19 outbreak [12], the purpose of this study is to examine mental health issues among university students in Poland two years after the pandemic. Additionally, the study analyzed the coping mechanisms implemented by participants in the face of stress to identify those that could benefit the mental health of young individuals.

As the spread of SARS and COVID-19 viruses impacted university students' mental health worldwide, it has become a public health concern. A study in Indonesia analyzed the correlation between social media addiction and mental health among university students. The data were collected from 709 students studying in universities throughout the country between June 3 and June 20, 2020. A validated 10-item scale developed by the Epidemiological Center-Depression (CES-D) was utilized to evaluate the participants' mental health [13]. The findings suggest that pupils with elevated social network addiction levels are prone to mild depression. Additionally, research has shown that college students who maintain positive relationships with their parents and have a stronger religious affiliation experience improved mental health outcomes when compared to those who have a strained relationship with their parents and have a weaker religious affiliation. These findings underline the importance of implementing interventions aimed at reducing reliance on social networks and promoting family connections and religious practices during the pandemic as a means of mitigating associated risks and fostering better mental health outcomes among college students.

In addition, the COVID-19 pandemic has highlighted the importance of social media platforms to access health information. However, a considerable amount of misleading information has emerged, complicating the ability to differentiate between authentic and non-authentic information, particularly about the origin, transmission, prevention, cure and mortality rate of COVID-19. The impact of this inaccurate information on mental health and its influence on decision-making, especially with regard to vaccines, remains uncertain [14]. Since the objective of a cross-cutting study was to investigate the opinions of Lebanese university students on the importance of social media during the COVID-19 pandemic and to assess the impact of disinformation on respondents' mental health and vaccination decisions, the data obtained revealed that mental health disorders in Lebanese college students were low and were linked to frequent social media exposure during the epidemic.

In recent decades, Haiti has experienced man-made natural disasters that have left its citizens vulnerable. Due to a weak state that cannot protect its people, Haitians face higher levels of poverty and violence compared to other countries in the Western Hemisphere. Recently, Haitians have encountered two crises: the political instability and violence known as "peyi lk" and the global COVID-19 pandemic [15]. Thus, this study examines the impact of two crises on the psychological well-being and mental health of 38 Haitian university students in an under-researched region in the north of the country. The study demonstrates that both crises have resulted in similar psychological effects on youths, including traumatic experiences linked to threats or violence, mandatory confinement, and a pervasive rise in insecurity among the population. Similarly, the extreme violence in "peyi lk" and the unpredictable nature of COVID-19 resulted in elevated stress and anxiety levels. This research underscores the impact of "complex emergencies" that impact entire populations, increasing trauma and endangering people's mental health.

Moreover, the pandemic has caused major hindrances at both the state and interstate levels and in various industries, commerce, and individuals' lives, resulting in a significant global surge in mental disorders. To explore these disorders among university students and their correlation with different lifestyles, a cross-sectional study was carried out at the University of Ni (Serbia) from December 2021 to February 2022. The study comprised 1400 students selected at random, with 692 females and 708 males, who were evaluated using apt questionnaires. Statistical analysis has revealed that a substantial proportion of students (16.6%) reported experiencing extremely severe symptoms of depression, while 480 students (34.3%) reported severe or extremely severe symptoms of anxiety [16]. The findings indicate that the COVID-19 outbreak had a major influence on the psychological well-being of university students and that receiving social support is a crucial approach to managing these mental health challenges during crises.

During the COVID-19 pandemic, young adults, particularly college students, were more susceptible to mental health issues, including anxiety and depression. This study aims to investigate and compare the factors contributing to mental health disorders among college students during and after the COVID-19 lockdown. In conducting research, a cross-sectional observational study was performed on 417 students from Universiti Tunku

Abdul Rahman. These individuals filled out an online survey, which measured their physical activity levels using the International Physical Activity Questionnaire: Short Form (IPAQ-SF) as well as their anxiety and depression symptoms using the General Anxiety Disorder: 7 (GAD-7) and the Patient Health Questionnaire: 9 (PHQ-9) [17], respectively. The study findings indicate that COVID-19 lockdowns have negatively affected the mental health of college students. Additionally, the study identified several factors that increase the risk of exacerbating mental illness. Specifically, individuals with low-income families, those who lack physical activity, and females are at higher risk of developing anxiety and depression.

In summary, the literature review supports the idea of designing a prototype app on mental health for college students to prevent stress, anxiety, depression, and others. These apps provide us with an accessible, efficient, and complete platform to improve mental health among college students. The app differs from other research in its help section for finding your health specialist online. In this way, the student who feels anxiety, stress, or depression can be attended to either by video call with the doctor or through chats.

3. Materials and Methods
This section has described how to create initial models and preliminary versions and implement methodologies with technological tools for developing mobile application prototypes. Additionally, utilized the technological tool Figma to create designs for the prototypes, which significantly facilitated the design process.

3.1. Methodology Design Thinking
This methodology focuses on design and innovation and is widely recommended by companies dedicated to developing innovative products to satisfy their customers. Its main focus is identifying key user problems and proposing solutions through a collaborative design process. Therefore, the activities are carried out as a team, facilitating decision-making and constantly updating the project [18]. The Design Thinking methodology consists of 5 phases, and the first of them, the Design Thinking methodology consisting of 5 phases, was carried out (see Figure 1).
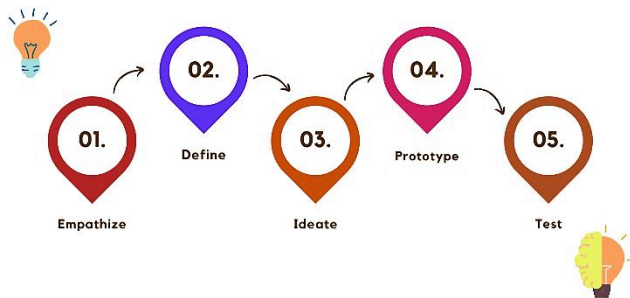

Fig. 1 Phases of the design thinking methodology

3.1.1 Empathize
This part collects information through an interview with the direct stakeholders.

- What are the main health-related challenges you face as a university student, and how do you think a mobile application could help you overcome them?
- What features or functionalities would you consider important in a mobile application designed to improve your health as a university student? Why do you think these features would be beneficial?
- What is your level of interest and willingness to use a mobile application designed to improve your health as a college student? What factors might motivate you to use it on a regular and consistent basis?

3.1.2. Define
By asking questions from the previous stage where the current and future situation emerges by going through a transformation (see Table 1).

Table 1. Future situation

Current Status	Future Situation
Students face challenges such as a lack of time for exercise, unhealthy eating habits, and high-stress levels.	Students adopt quick and effective exercise routines, improve their eating habits and learn stress management techniques.
Lack of access to specific resources and support makes it difficult for students to adopt a healthy lifestyle during their college years.	Students have access to a mobile application that provides them with practical tools and solutions to improve their health and well-being.
College students need practical tools and solutions that meet their needs and demands to improve their health.	The mobile application is designed to meet university students' specific needs and demands, offering personalized functionalities tailored to their lifestyles.
There is a need to promote awareness of the importance of healthy living among college students.	Students gain a greater awareness of the importance of health and take a proactive approach to improving their physical and mental well-being.

3.1.3. Ideate
The activities to be carried out are placed in the form of a brainstorming profluvium of ideas of how to make the mobile prototype app to improve mental health; for this, the team eliminates the activities that do not add value.

- Identify the most important features that would address the mental health issues of college students.
- Prototype the app's user interface, starting with the app's front end.
- Implement the key functionalities of the application that have been defined; perform continuous improvement.

3.1.4. Prototyping

Prototypes are made, considering the previous step's activities. Figma was used as a cloud-based design tool, i.e., an online tool; it is used to design or create user interfaces collaboratively in real-time. According to the authors [19], the complementary application Figma Mirror for Android and iOS allows real-time visualization of prototypes on mobile devices. At the same time, it is a vector graphics editor and a real-time prototyping tool for mobile devices.

In turn, it is a vector graphics editor and a web-based prototyping tool. So, the author [20] manifests that Figma is a tool for prototyping web pages or mobile applications that stands out for its intuitive functionality and ability to allow teamwork in real-time. In addition, it is hosted in the cloud and has add-ons that improve the visualization of the design. It can be used from the browser or downloaded to the computer. In short, it is a complete and versatile solution for online prototyping.

3.1.5. Testing

This is done by expert judgment, considering the mobile application's criteria.

3.2. Prototype Development

In this section, the prototypes were developed to detect app design errors. The design development process was carried out using the Figma tool, which has several prototypes so the user can access them and be attended to by a health specialist.

Also, as prototype development (see Figure 2), where the start of the application is observed, which has buttons to start and thus gives the next screen where you can connect with specialists in health from the comfort of your home via video call or direct chat, in which observe the start of the application with an encouraging slogan.

In this way, if the student or user feels that something is damaging their mental health, they can log in and seek help. In addition, it can be seen in Figure 3 that the "university student" user has the option to choose the physician according to the specifications shown. Also, to begin with, the user has the option to register if he or she does not have a previous account so that he or she can access all the benefits provided by the application. Likewise, when registering, the university student must correctly enter his or her data.
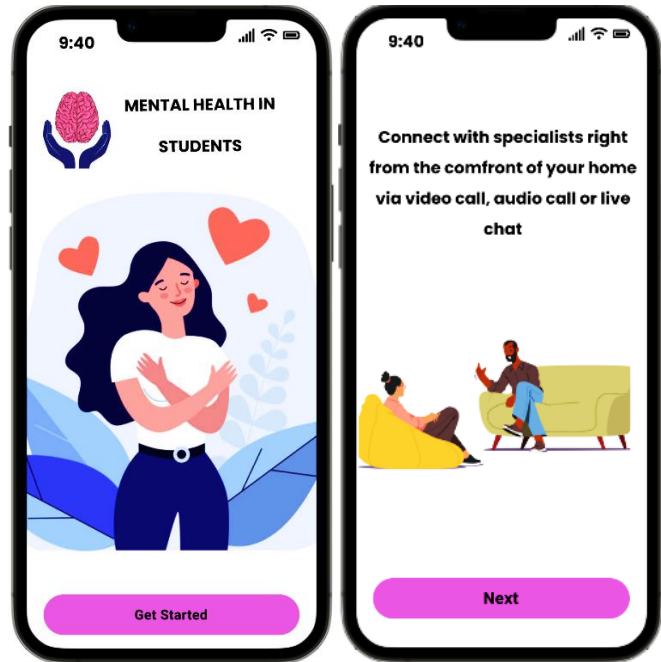

Fig. 2 Application startup

Fig. 3 Account login and registration

In developing the prototypes shown in Figure 4, the users or university students are required to log in to the application. They have two options for accessing the mobile app: logging in with their Gmail email or Facebook account. Additionally, there is an "I forgot my password" option for users to recover their password by entering and resetting their registered email address.

In Figure 5, the development of the prototypes can be observed on the welcome screen of the account, where all the available health specialists are shown.
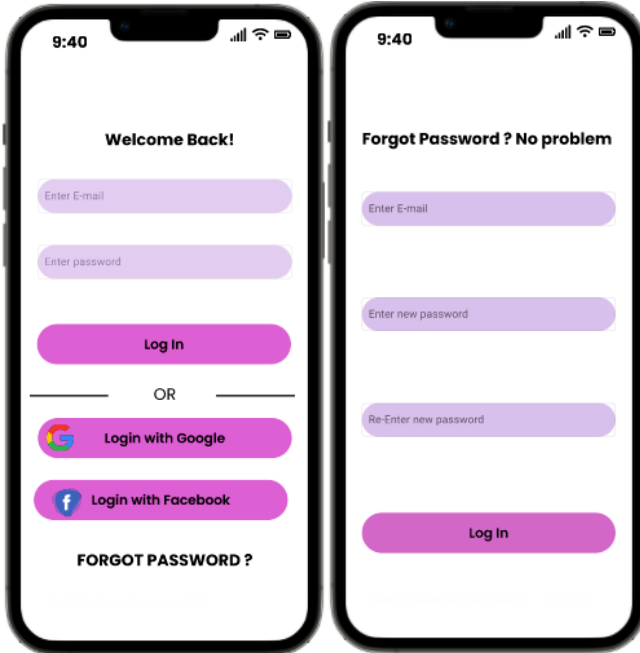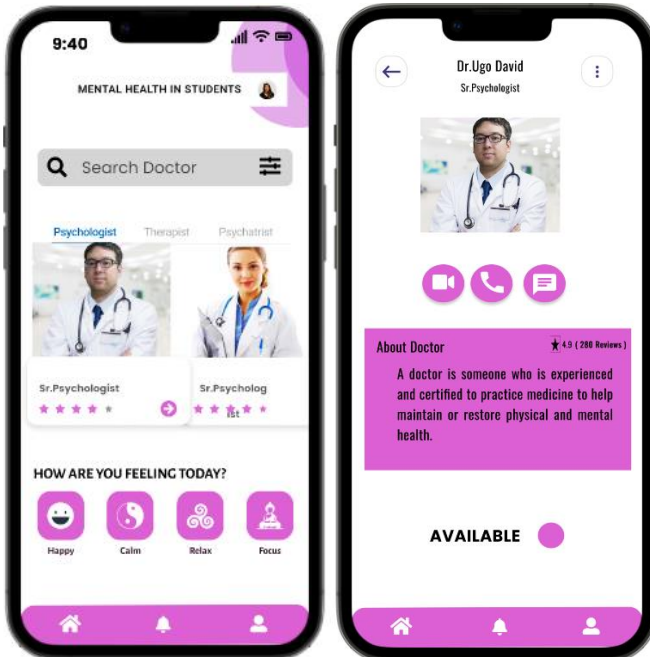
Fig. 4 Login and password forgotten

Fig. 5 Welcome screen with medical profile

Thus, several health specialists, such as therapists, psychologists, etc., are observed. In addition, when selecting a doctor or specialist, his profile is shown, along with a brief description of whether he is available or busy. Finally, in the development of the prototypes in Figure 6, it can be seen that the user "university student" has selected his specialist and is on a video call to receive medical attention. Likewise, after the video call, they continue communicating through a direct chat to follow the instructions provided by the health specialist. Therefore, the student will receive immediate help to prevent various diseases that damage mental health.

Fig. 6 Start of video call plus chat medical

4. Results and Discussion
4.1. About the Interview

As a result of the Atlas.ti analysis identified that students should exercise properly and take care of their health by having proper study time management. This indicates that there is an awareness of the importance of maintaining a healthy and balanced lifestyle for the overall well-being of college students.

E1 (...) Generally, I don't exercise as well as I don't have a diet, and I don't visit the doctor (...)

E2 (...) I exercise by playing soccer games, or sometimes I go for a walk on weekends (...)

The idea of exercising appropriately implies that students recognize the importance of being physically active but also understand that they must do so in a way that is safe and tailored to their abilities and schedules. This may include performing short, efficient exercise routines that can be easily integrated into their daily routine.

E3: (...) The time I spend exercising is null since I work in the mornings and study in the evenings (...).

E4: (...) health is good for not having stress, we students get stressed because we have several courses and we work (...)
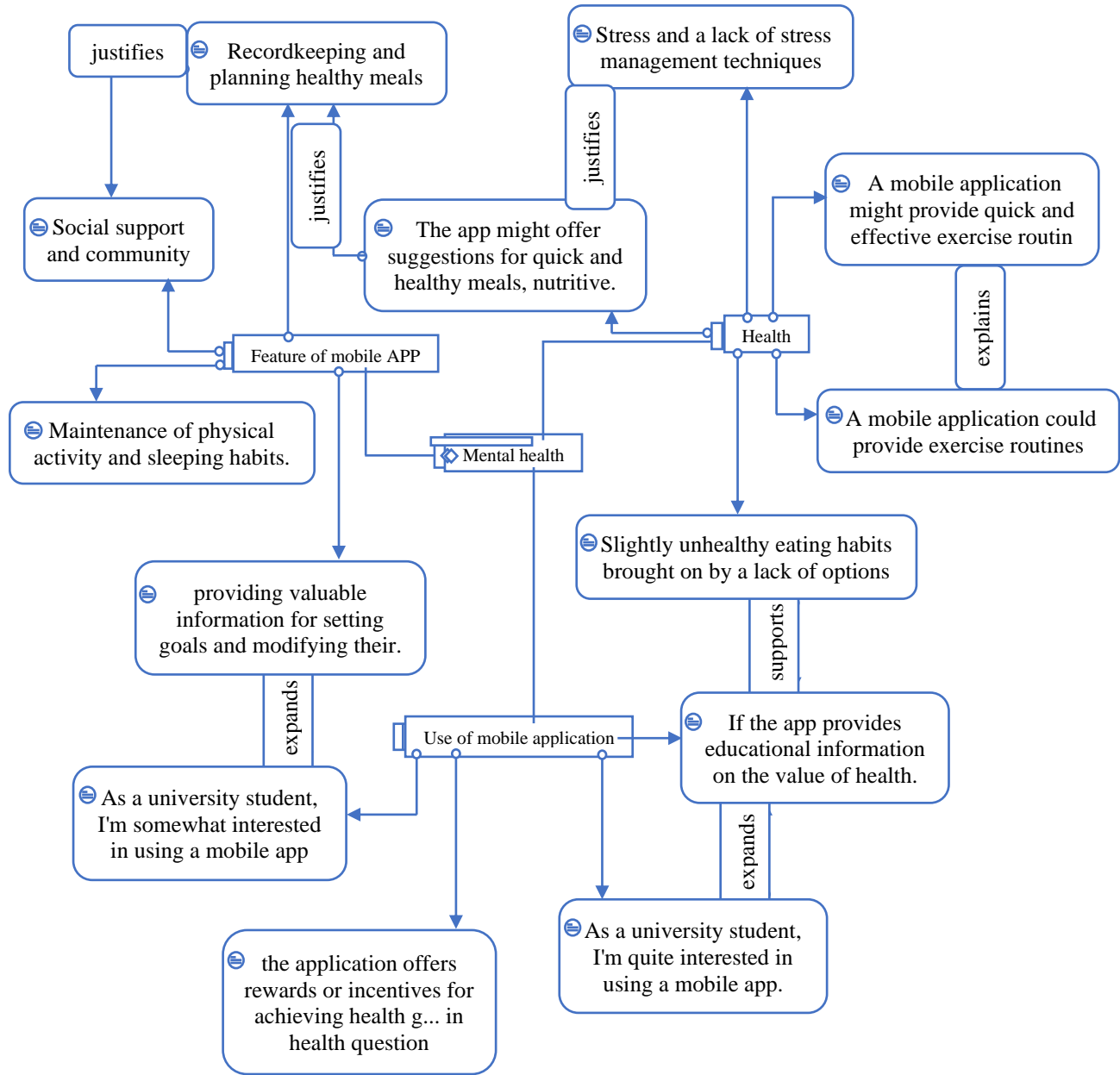
Fig. 7 Analysis of student interviews through the network

Likewise, through proper study time management, health care points to the importance of balancing time dedicated to study with moments of rest and self-care. Students recognize that they cannot neglect their health while focusing on their academic performance and understand the need to set limits and prioritize their well-being.

E5: (...) It would be good to have technological tools that help us plan and guide our mental health support (...).

E6: (...) It would be good to have a technological tool that is user-friendly and that we could take advantage of (...)

In addition, it is mentioned that the mobile application can help improve health as long as it complies with the aspects mentioned above. This indicates that students see the potential of mobile technology as a tool to support their well-being, but they also have clear expectations about the features and functionalities the app should provide. This may include the ability to provide appropriate exercise routines, reminders to manage study time and promote a balanced approach, as well as intuitive and user-friendly functionalities.

In summary, using the mobile application allows university students to have an option as a technological tool

to appropriately deal with problems such as stress. In addition, as students mostly work and study, they have problems sleeping easily when they accumulate their tasks and exams at the university. In that sense, they should perform activities such as exercise walking, among others. Also, the intervention of a specialist in the medical part since the mobile applications are only tools of help (see Figure 7).

4.2. About the Expert Validation

For the expert validation, some criteria such as Usability (U), Quality (C) and Integration (I) were taken into account. According to the results provided by the experts in evaluating the mobile application prototype to improve the mental health of university students, the following scores were obtained for each of the evaluated criteria: usability, quality, integration and interface (see Table 2).

In terms of usability, the prototype obtained an average score of 81.42%. This indicates that the experts considered the application quite usable, with an overall positive rating. However, some improvements might be needed to achieve a higher score (see Figure 8).

In terms of quality, the prototype obtained an average score of 82.85%. This score indicates that the experts considered the quality of the prototype to be quite good. However, there are still areas for improvement that could raise the score on this criterion (see Figure 9).

In terms of integration, the prototype obtained an average score of 84.28%. This indicates that the experts felt that the integration of the prototype with other systems or components was adequate overall. However, there may be specific aspects of the integration that need improvement to achieve an even higher score (see Figure 10).

In relation to the interface, the prototype obtained an average score of 82.85%. This suggests that the experts considered the prototype interface to be effective and attractive in general. However, some specific interface aspects could be improved to raise the score on this criterion (see Figure 11).
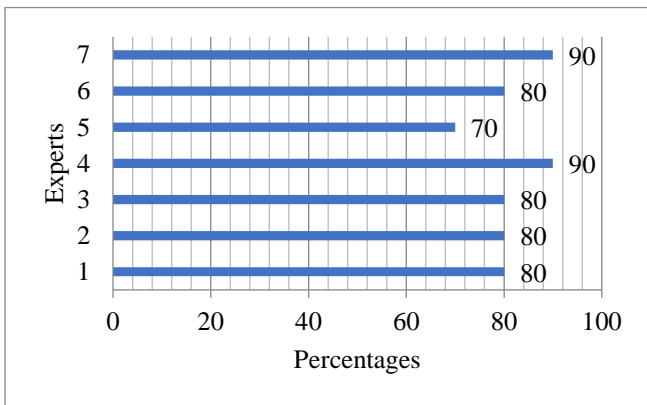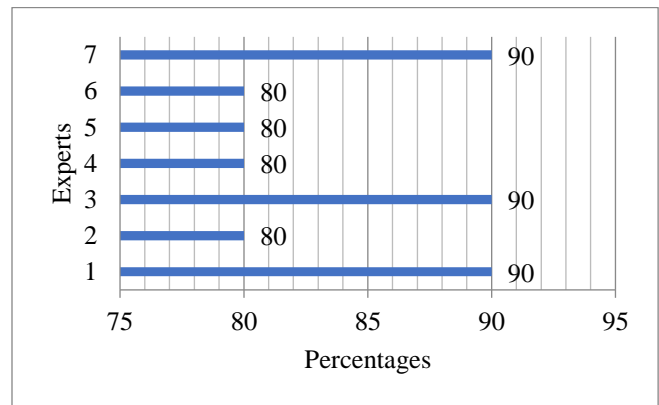
Table 2. Expert evaluation

Criteria	E1	E2	E3	E4	E5	E6	E7	Mean
Usability	80	80	80	90	70	80	90	81,42%
Quality	70	80	90	90	90	80	80	82,85%
Integration	90	80	90	80	80	80	90	84,28%
Interface	80	80	80	90	90	80	80	82,85%

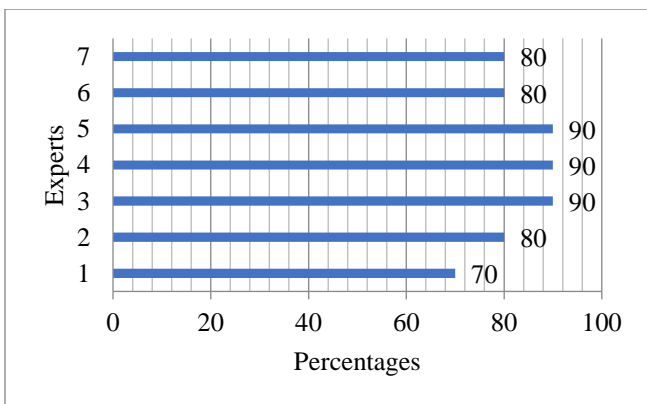**Fig. 8 Usability**

Fig. 10 Integration
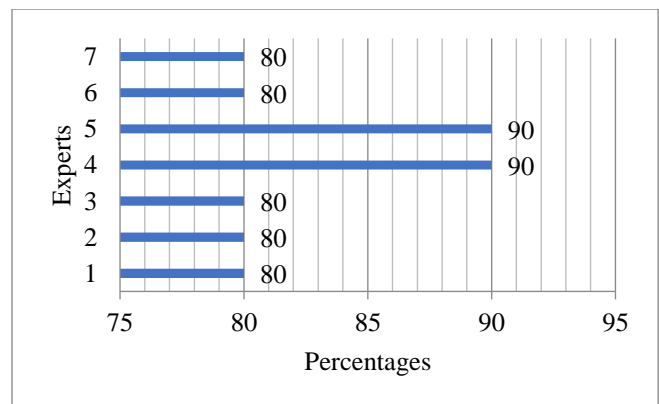

Fig. 9 Quality

Fig. 11 Interface

Therefore, the results of the expert evaluation indicate that the prototype of the mobile application to improve the mental health of university students has good usability, quality, integration and interface in general. However, there are still areas for improvement identified by the experts that could increase the score on each of these criteria. These improvements could include usability tweaks, quality refinements, optimizing integration with other systems, and improving specific interface aspects.

5. Conclusion

In conclusion, developing a mobile app to improve the mental health of college students has proven to be a promising proposal. Through Atlas.ti's analysis, it was identified that students recognize the importance of exercising properly and taking care of their health by managing their study time in a balanced way. Furthermore, it was stressed that student satisfaction with the design of the mobile application prototype is crucial for its effectiveness and adoption. The use of design thinking methodology allowed a systematic and orderly approach to developing the mobile application prototype. This methodology facilitated the understanding of students' needs and preferences, ensuring that the features and functionalities of the application were tailored to their requirements. It is important to note that one limitation of the research was conducting interviews virtually rather than face-to-face. This limitation was due to the current circumstances in which many students work and study, making it difficult to coordinate physical encounters. Despite this limitation, measures have been taken to ensure the quality and collection of relevant data during virtual interviews. As a suggestion for future research on this subject, it is recommended to conduct a multidisciplinary study involving professionals from different fields, such as psychologists, doctors, and engineers. This multidisciplinary collaboration could enrich mobile app development by integrating different perspectives and specialist knowledge to effectively address the mental health of college students.

Acknowledgment

References

[1] Leidy Janeth Jaramillo Salinas, and Britanny Michelle Herrera Caizatoa, "Deterioration of Mental Health due to the Impact of the Covid-19 Pandemic: Development of a Computer Application for its Measurement and Control," *Digital Repository of the Catholic University of Cuenca*, 2023. [Google Scholar] [Publisher Link]

[2] Rodrigo Moreta-Herrera et al., "Satisfaction with Life, Psychological and Social Well-being as Predictors of Mental Health in Ecuadorians," *Actualidades en Psicología*, vol. 32, no. 124, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[3] Pedro Sánchez Escobedo, and Gloria Yaneth Calderón Loeza, "Differences in the Use of Mobile Devices between Junior High and College Students in Mexico," *RIDE Revista Iberoamericana Para la Investigación y el Desarrollo Educativo,* vol. 11, no. 22, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[4] Ericka Julissa Suysuy Chambergo, and Patricia Del Rocío Chávarry Ysla, "Mental Health during Confinement due to SARS-COV-2 in Peruvian University Students," *Horizonte Empresarial*, vol. 8, no. 1, pp. 376–381, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[5] Antenor Vásquez Muñoz, Humberto Ivan Morales Huaman, and José Alberto Silva Siesquén, "Influence of Mental Health on the Academic Performance of University Students due to Covid 19," *Hacedor - AIAPÆC*, vol. 5, no. 2, pp. 119–129, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[6] Gema Sanchis-Soler et al., "Actions for a Healthy University: Impact on Mental and Physical Health in Young People," *Health, Physical Activity, and Sports Technology,* vol. 44, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[7] Melissa A. Russell et al., "Changes in Mental Health across the COVID-19 Pandemic for Local and International University Students in Australia: A Cohort Study," *BMC Psychology*, vol. 11, no. 55, pp. 1-12, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[8] Myles-Jay Linton et al., "Notifying University Students' Emergency Contacts in Mental Health Emergencies: Multi-Year Analysis of Student Consent Policy Preferences," *Preventive Medicine*, vol. 169, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[9] Priya Bhakat, and Kakoli Das, "Status of Mental Health among College and University Students during First and Second Wave of COVID-19 Outbreak in India: A Cross-Sectional Study," *Journal of Affective Disorders Reports*, vol. 12, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[10] Dean C. Paz et al., "Impact of COVID-19 on Rocky Vista University Medical Students' Mental Health: A Cross-Sectional Survey," *Frontiers in Psychology*, vol. 14, pp. 1-9, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[11] Travis Tian-Ci Quek et al., "The Global Prevalence of Anxiety among Medical Students: A Meta-Analysis," *International Journal of Environmental Research and Public Health*, vol. 16, no. 15, pp. 1-18, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[12] Monika Talarowska et al., "Mental Health of Students at Polish Universities after Two Years of the Outbreak of COVID-19," *International Journal of Environmental Research and Public Health*, vol. 20, no. 3, pp. 1-12, 2023, [CrossRef] [Google Scholar] [Publisher Link]

[13] Sujarwoto, Rindi Ardika Melsalasa Saputri, and Tri Yumarni, "Social Media Addiction and Mental Health among University Students during the COVID-19 Pandemic in Indonesia," *International Journal of Mental Health and Addiction*, vol. 21, pp. 96-110, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[14] Diana Jabbour et al., "Social Media Medical Misinformation: Impact on Mental Health and Vaccination Decision among University Students," *Irish Journal of Medical Science (1971 -),* vol. 192, pp. 291-301, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[15] Michael Galvin et al., "Exploring the Impact of Crisis and Trauma on the Mental Health and Psychological Well-Being of University Students in Northern Haiti," *International Journal of Mental Health Promotion*, vol. 25, no. 2, pp. 173–191, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[16] Tamara Jovanović, and Aleksandar Višnjić, "Coping with Symptoms of Mental Health Disorders among University Students during the COVID-19 Pandemic in Relation to Their Lifestyle Habits," *Medicina,* vol. 59, no. 1, pp. 1-12, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[17] Imtiyaz Ali Mir et al., "Determinants and Predictors of Mental Health during and after COVID-19 Lockdown among University Students in Malaysia," *PLoS One*, vol. 18, no. 1, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[18] Balagopal Ramdurai, "A Study on Mobile Apps in the Healthcare Industry," *SSRG International Journal of Mobile Computing and Application,* vol. 8, no. 1, pp. 17-21, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[19] Hadi Asnal et al., "UI/UX Design and Prototyping Workshop with Figma at Taruna Masmur Vocational School Pekanbaru," *J-PEMAS - Jurnal Pengabdian Masyarakat*, vol. 3, no. 1, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[20] Valerie Manna et al., "A Design Thinking Approach to Teaching Sustainability," *Journal of Marketing Education,* vol. 44, no. 3, 2022. [CrossRef] [Google Scholar] [Publisher Link]