BookSense an Application for Mental Disorders Diagnosis: A Case Study for User Evaluation and Redesign

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Abstract. Booksense, a mobile application that allows to identify mental disorders such as depression, work stress and postraumatism [1], through a series of questions based on a mental health assessment that allows you to find out if you have a mental illness, the app can detect if the user shows signs of a mental disorder, being the most important to detect the problem from its stages initials, plus it also has a database of institutions in the country where you can receive care. The World Health Organization (WHO) estimates that there are currently 300 million people on the planet who suffer from depression. This is why it is important to have assisted diagnostic tools that help prevent this type of affectations in the population, as well as keep informed. the people about help centers. All this would not be possible if you do not count an application that has three important aspects that are: Efficiency, **effectiveness** and satisfaction aspects that are not present in this diagnostic tool is why the importance of the use of usability evaluations. This research aims to generate a redesign of this application based on it and the Nielsen heuristic's that fill the gaps and usability problems, using a user-centered design methodology and concluding that applying the proposed methodology in a mobile context it was possible to increase the levels of efficiency, effectiveness and satisfaction in a way considerable.

Keywords: Depression· Heuristic · Usability evaluation · User centered design · Mobile apps.

1 Introduction

Booksense is a software for mobile devices with information on mental disorders and tests capable of giving an approximate diagnosis about whether a person

suffers from a mental disorder [1], because this is important to perform evaluations that allow a greater experience of usability in the systems, specifically for this type of mobile applications, which today prove to be a very useful tool for the prevention of mental disorders such as depression and that due to the delicacy with which these conditions are treated it is essential to know how to offer a usability experience in mobile systems for patients with this type of conditions. It is necessary to establish the end user as the center of the entire product development process. Within this context, a close relationship is established with common users in order to evaluate the usability of a proposed redesign based on Nielsen's heuristics of this mobile application that diagnoses and displays information about mental disorder problems. There are different research projects that have the user as their main point since a new trend in software development has emerged, moving from desktop applications to those of web and mobile environment, getting people with different physical and cognitive conditions to enter and access to them, therefore, the level of quality of these programs must be excellent, since there is a varied number of users with complex needs, abilities and skills [2]. Jacob Nielsen considered the father of web usability defines the term in consideration of information on the Internet as "the quality attribute that measures the ease of web interfaces" with this means that design is not important or how great it looks your website, if it is complicated to use [3].This research paper mainly addresses the 10 Nielsen heuristics or collections of patterns that contemplate similar characteristics in mobile devices [4] applied to the redesign of the Booksense.

It is important to consider the following three aspects of usability for all types of software: More efficient to use: takes less time to complete a particular task, Easier to learn: operations can be learned by observing the object, More user satisfaction: meets user expectations.

ISO 9241 defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use"[5] Abran et al. [6] consolidate the ISO 9241 [5], IOS 9126 [7], ISO 13407 [8]. This model defines usability as a combination of effectiveness, efficiency, satisfaction, learnability, and security, along with a recommended set of related measures. Every usability evaluation method has its advantages and disadvantages. Some are difficult to apply, and others are dependent on the measure's opinions or instruments. In addition to these challenges, mobile devices and applications change very quickly, and updated methods of usability evaluation and measurement are required on an ongoing basis [9].

For this, it is necessary apply a series of metrics that allow to redesign the different elements within the application, in this case the 10 Usability Heuristics for User Interface Design of Nielsen 1. Visibility of system status 2. Match between system and the real world 3. User control and freedom 4. Consistency and standards 5. Error prevention 6. Recognition rather than recall, 7. Flexibility and efficiency of use 8. Aesthetic and minimalist design 9. Help users recognize, diagnose, and recover from errors 10. Help and documentation. For later make a usability evaluations where the main objective is validating the prototype gen-

erated from of redefinition of the Nielsen heuristics in a mobile context where each aspect was implemented of these metrics, in order to know level of usability compared to the study application (Booksense) and to conclude that there is a considerable or not improvement.

2 Theoretical Fundament

Many studies have been involved in the area of health, proposing new ways to improve people's quality of life or expedite repetitive processes by proposing automated systems such as Doctor's innovative clinic: An application of Artificial Intelligence and Physiological Sensors which allows measuring five main physiological parameters when entering a medical clinic, these physiological parameters are weight, height, body temperature, pressure and heart rate, this allowed medical staff to create a rapid diagnostic report and automate the administrative process of the clinics also offering the patient greater comfort as it is a very little invasive system [10]. Within the biomedical area there is also research that focuses on improving the quality of life of people with disabilities as shown in the article A Novel EOG/EEG Hybrid Human-Machine Interface Adopting Eye Movements and ERPs: Application to Robot Control which offers people with disabilities to perform housework through a humanoid robot with the sole act of performing some kind of gesture with their eyes [11].

Having a good design is important for the development of a computer or technological system as presented in the article Integration of User Centered Design in The Development of Health Monitoring System for Elderly focuses on how to develop a simple system to use for the elderly and can monitor their health, the health monitoring system is designed on three levels: personal medical device layer, mobile application layer and remote central service layer. An apparatus based on a chair for the acquisition of physiological signals was built and a mobile application for data delivery and health management was developed [12].

On the other hand, there are also systems that help keep track of a disease such as diabetes is the case of mHealth Diabetes Self-Management which allows the most independent management of patient health care [13]. mHealth is, according to the WHO definition, the practice of medicine and public health supported by devices such as telephones, patient monitoring devices, digital assistants and other wireless devices [14].

To measure usability in mobile applications and obtain real results, it is necessary to consider the context as an integral part of the application for this it was necessary to perform the evaluations in a real environment with common users regardless of their experience with the use of mobile applications since it also there is a heuristic evaluation that is a widely accepted method to diagnose usability problems in the user interface [15]. It can be done with a small group of evaluators (3 to 5) and allows judging the degree of compliance with specific usability principles [16][17].

It is clear that there are many systems that are in charge of health care and that in a way for its use there is always the predisposition of the user, but

that is not the case for people with a mental health problem for this exist some applications that monitor physical and emotional well-being such as: Moodpath, Youper, Wysa, etc. but that the lack of user-centered designs poses a great challenge for this area due to the complexity of treating people with a mental disorder.

3 Materials and Methods

The Booksense mobile application shown in Fig. 1 is an application developed by Mexican students of the Center for Technological Scientific Studies (CECyT) of the National Polytechnic Institute with information on mental disorders and tests capable of giving an approximate diagnosis to know if you suffer any mental disorder[1].

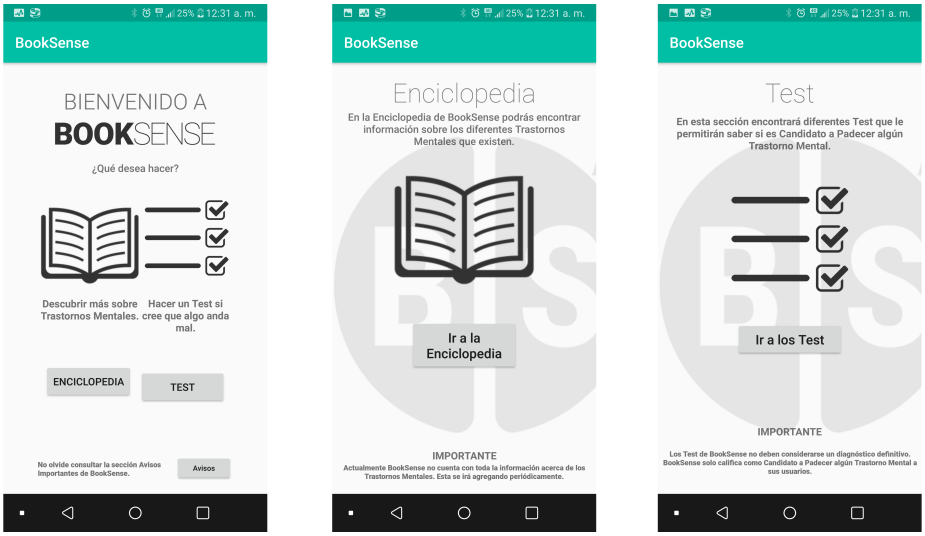

Fig. 1. Screenshots of the Mobile BookSense application for the diagnosis of mental disorders

This application to be redesigned is in beta, so the contributions of this research could help improve this system through a focus on UCD (User Centered Design) that is defined as the active involvement of users for a clear understanding of user and task requirements, iterative design and evaluation, and a multidisciplinary approach Fig. 2 shows the diagram used to represent UCD processes [18]. and tools such as heuristics, taking into account the following methodology: 1) Evaluate the application testing different components that make it up to finally answer a series of questions that allowed know about its usability 2) Create

a prototype based on the study application and the implementing Nielsen guidelines 3) Evaluate the proposed prototype 4) present the results obtained from the two evaluations. The users performed a series of tasks within the application and the proposed prototype and then answered a questionnaire that, based on the results, allows the creation of a comparative and justify a redesign.

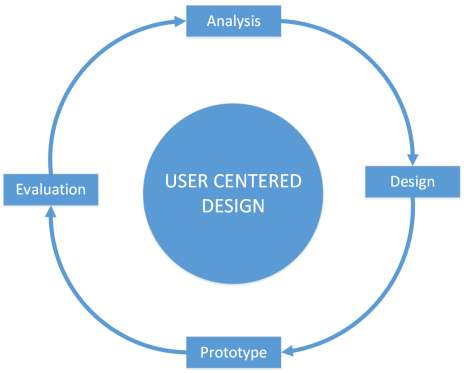

Fig. 2. Diagram representing each of the parts that make up the user-centered design scheme

3.1 Participants

The population of interest for this study were students and full-time office workers with different characteristics as shown in Table 1 that presented useful answers for usability evaluate, which in addition to not being familiar with the application carried out the tasks assigned and considered the questions easy to answer.

Table 1. 10 participants with different occupations performed usability tests. Sex categories: female (F) and male (M).

Participant	Age	Sex	Occupation
1	20	F	Student of biology
2	29	M	Engineer
3	30	F	Accountant
4	20	M	Psychology student
5	21	M	Psychology student
6	20	F	Psychology student
7	21	F	Psychology student
8	38	M	Accountant
9	37	F	Accountant
10	29	F	Accountant

3.2 Procedure

The tasks established here are those performed by participants for this research work and are shown in Fig. 3 and are explained below: 1) Enter to the different sections of the ENCYCLOPEDIA 2) Enter to the TEST section 3) Perform a test of each of the disorders **The information presented in the application** 4) Enter the instructions of each of the tests provided by the application 5) Enter the test results 6) Obtain test results 7) Exit the application. A mobile device was provided with the Booksense application installed to perform the established tasks, subsequently the proposed prototype was presented to the user to perform the same established tasks and answer the assigned questionnaire.

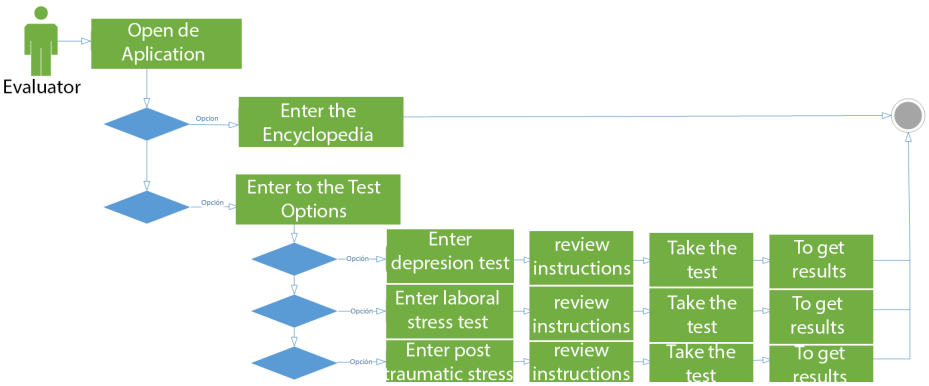

Fig. 3. Flujograma of the tasks to be performed for the evaluation.

To measure the usability of the application and the prototype, a research paper called Measuring Usability was used through questionnaires (Measuring Usability with the USE Questionnaire) where USE means Usefulness, Satisfaction y Ease of use It states that usability seems to consist of utility and ease, and utility and ease of use are correlated. Each factor in turn drives user satisfaction and frequency of use [19].

A brief questionnaire allow for significant comparisons between two products and perhaps under different circumstances such as this research. The Questionnaires were constructed as Likert rating scales that are a format in which the answers are scored in a range of 5-point values that users were asked to, ranging from completely disagree to totally agree, dividing the questions in sets that allow to determine the dimension of three main usability factors to be measured which are: utility, ease of use, ease of learning and satisfaction, as shown in Table 2.

Table 2. Questionnaire **submitted** to the user for the evaluation of the application and the proposed prototype on a Likert scale from 1 to 5.

Utility	**No.**	**Type of Response**
Save time when I use it	1	Likert (1 = Disagree; 5 = Agree)
Satisfy my needs	2	Likert (1 = Disagree; 5 = Agree)
He does everything he expects me to do	3	Likert (1 = Disagree; 5 = Agree)
Easy to use	**No.**	**Type of Response**
I found it easy to use	4	Likert (1 = Disagree; 5 = Agree)
It requires the least steps	5	Likert (1 = Disagree; 5 = Agree)
It can be used without written instructions	6	Likert (1 = Disagree; 5 = Agree)
Learning facility	**No.**	**Type of Response**
I learned to use them quickly	7	Likert (1 = Disagree; 5 = Agree)
I easily remember how to use it	8	Likert (1 = Disagree; 5 = Agree)
I can quickly become skilled at using it	9	Likert (1 = Disagree; 5 = Agree)
Satisfaction	**No.**	**Type of Response**
I'm satisfied with that	10	Likert (1 = Disagree; 5 = Agree)
I would recommend it to a friend	11	Likert (1 = Disagree; 5 = Agree)
It works like I want it to work	12	Likert (1 = Disagree; 5 = Agree)

4 Results and Discussion

The context for performing the usability tests of this research it is important to clarify that the application does not require a connection width of band, nor is it focused on professionals who treat mental disorders, the context is simple, the person who performs the evaluations is a common user who can be highly experienced in the use of mobile technologies or not, mobility is not a factor that already influences that the application does not use the internet to work and finally users do not have previously diagnosed psychological status. **Additionally, objective evaluation metrics are not taken, such as: time required, number of errors, time needed to learn, number of errors, etc. If not rather subjective metrics that help give a more subjective assessment of the usability of the Booksense application.**

The surveys carried out presented the results obtained in the evaluation of the application and the proposed prototype based on the Nielsen applied heuristics. Fig. 4 shows the comparative graph of the score obtained, as you can see the degree of usability of the prototype has a high index compared to the Booksense application.

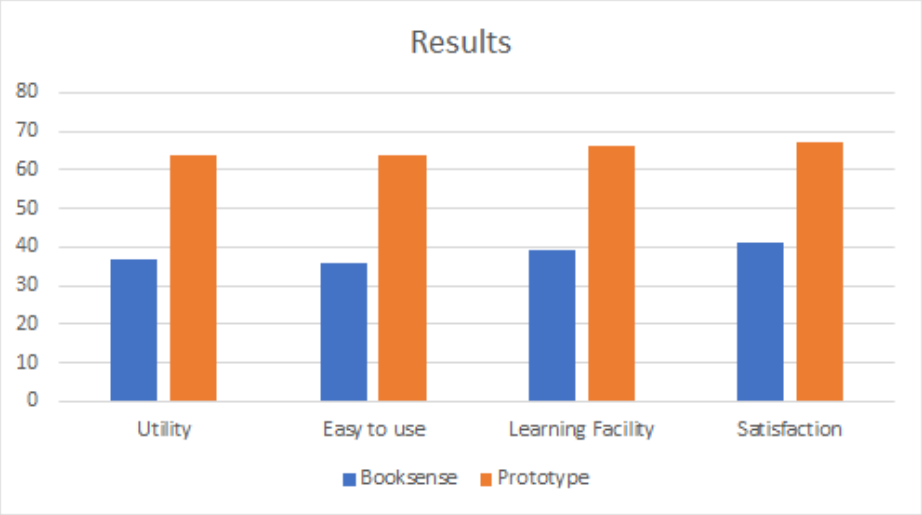

Fig. 4. Graph of result comparison obtained in usability evaluations carried out by common users.

It is evident that applying Nielsen's heuristics it was possible to make a prototype that was able to verify the need to apply a redesign of this application since usability in this type of projects is very important so that it has the impact that the creator expects to have your product and thus benefit the end user.

To have a clearer picture of the prototype made based on Nielsen's heuristics, it is important to specify where they were applied and how they differ from the original application as shown in the Fig. 5 First a loading symbol was added for each of the sections that kept the user informed about what happened in the application between the change from one section to another, the following is to show understandable information avoiding medical language that can confuse the user, another added as part of the applied heuristics was to allow a complete navigation from any part of the system providing freedom to move from the beginning of a mental disorder test to the encyclopedia, on the other hand the standardization of elements such as the buttons with which it will count, in the fifth place, the application has the option of preventing the user from finishing a test in case of wrongly answering a question by displaying a message ensuring that the action to be carried out is actually intended to be completed, another important element that offers added value to the usability of the application was the implementation of an instruction in each of the sections that allowed the user to remember what had to be done and how, the flexibility and efficiency that was proposed to apply was to offer the possibility of choosing a configuration for different types of users for example people with some mental disorder, people with acquaintances who have some mental disorder, etc. It is a fact that all the aforementioned elements are presented in a simple way, the heuristic nine is

applied in the questions section which facilitates returning to the beginning, to a previous question recovering from errors and finally the necessary documentation to know the details with which the application has.

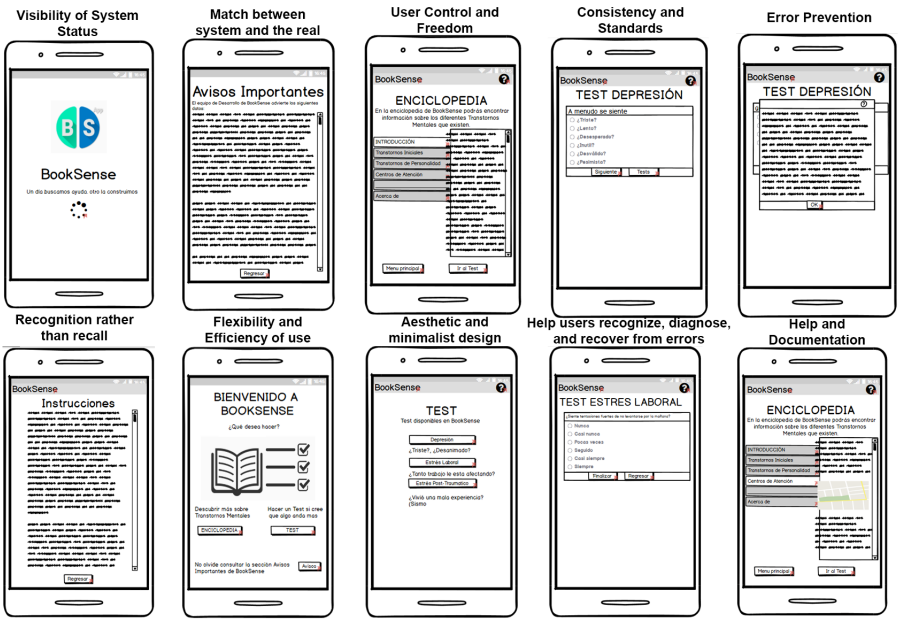

Fig. 5. Captures of the proposed prototype based on Nielsen's heuristics and study application.

5 Conclusions

Many of the existing applications lack a methodology to analyze usability and are released to the market or distribution platforms for free, which implies that end users are not satisfied with the result, thus having very low satisfaction, which, even if it complies with other important aspects such as efficiency and effectiveness will reach the point of not being considered by the user to cover any need or activity required. For this reason, we can conclude that using a well-organized methodology that has as its central theme the involvement of the user, turns out to be very effective when creating more friendly interfaces, increasing certain aspects of usability, not to mention that applying certain metrics such as heuristics of Nielsen that although they are based on a web context, they can be migrated to a mobile one, offering considerable improvements such as those showed by the results presented.

We very clear that there are other types of evaluations that can identify other types of usability deficiencies and that thanks to these you can create mobile software products that meet certain standards.

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