Development of mobile application in dermatological and aesthetic dysfunction

Desenvolvimento do aplicativo móvel em disfunções dermatológicas e estéticas

Desarrollo de aplicación móvil en disfunción dermatológica y estética

Wellington Pinto[1]
Pedro Henrique de Oliveira Cardoso[2]
Ludovico Migliolo[3]

---

[1] Master's degree in Biotechnology from Dom Bosco Catholic University (UCDB). S-Inova Biotech, Postgraduate Program in Biotechnology, UCDB. **E-mail:** dr.wellcoelho@gmail.com, **Orcid:** https://orcid.org/0000-0002-1777-7583

[2] Master's degree in Biotechnology from Dom Bosco Catholic University (UCDB). S-Inova Biotech, Biotechnology Postgraduate Program, UCDB. E-**mail:** cardosoliveira20@gmail.com, **Orcid:** https://orcid.org/0000-0002-2872-3767

[3] Doctor in Genomic Sciences and Biotechnology from the Catholic University of Brasília. Postgraduate Program in Biotechnology, Dom Bosco Catholic University. **E-mail:** ludovico@ucdb.br, **Orcid:** https://orcid.org/0000-0002-6606-2189

Wellington PINTO; Pedro Henrique de Oliveira CARDOSO; Ludovico MIGLIOLO

Abstract: The mostly Brazilian population present common disorders among young and adults peoples denominated aesthetic diseases, for example acne, melasma, psoriasis and nettle rash. Given this scenario, the development of a mobile application has become feasible, with technology growing exponentially, and, at the same time, there is also an increased interest for developing new ways of disseminating content in a practical way. In this study, the aim was to help nonprofessional, academics and health and aesthetic professionals. A large percentage were young people (74.7%), aged between 18 and 29 years old, but the target of the application is not exclusive to this profile. Our research resulted in good metrics, among them, the public studied is interested in paying to have the application on their smartphone. Thus, the virtual atlas of aesthetic dysfunctions demonstrated to be a tool for nonprofessional and professionals helping in the acquisition of information.

Keywords: aesthetic health; application; innovation; technology; mobile learning.

Resumo: A população, em sua maioria brasileira, apresenta distúrbios comuns entre os jovens e adultos denominados doenças estéticas, como, por exemplo, acne, melasma, psoríase e erupção cutânea. Diante desse cenário, o desenvolvimento de um aplicativo móvel tornou-se viável, pois a tecnologia cresce exponencialmente e, ao mesmo tempo, há também um maior interesse em desenvolver novas formas de disseminar o conteúdo de maneira prática. Neste estudo, o objetivo era ajudar não profissionais, acadêmicos e profissionais de saúde e estética. Uma grande porcentagem era de jovens (74,7%), com idade entre 18 e 29 anos, mas o alvo do aplicativo não é exclusivo desse perfil. Nossa pesquisa resultou em boas métricas, entre elas, o público estudado tem interesse em pagar para ter o aplicativo em seu smartphone. Assim, o atlas virtual das disfunções estéticas demonstrou ser uma ferramenta para não profissionais e profissionais auxiliando na aquisição de informações.

Palavras-chave: saúde estética; aplicativo; inovação; tecnologia; aprendizagem móvel.

Resumen: La población mayoritariamente brasileña presenta trastornos comunes entre jóvenes y adultos denominados enfermedades estéticas, por ejemplo, acné, melasma, psoriasis y erupción cutánea. Ante este escenario, el desarrollo de una aplicación móvil se ha vuelto factible, con la tecnología creciendo exponencialmente, y, al mismo tiempo, también hay un creciente interés por el desarrollo de nuevas formas de difusión de contenidos de una manera práctica. En este estudio, el objetivo era ayudar a personas no profesionales, académicos y profesionales de la salud y la estética. Un gran porcentaje eran jóvenes (74,7%), con edades comprendidas entre los 18 y los 29 años, pero el objetivo de la aplicación no es exclusivo de este perfil. Entre ellos, el público estudiado está interesado en pagar por tener la aplicación en su smartphone. Así, el atlas virtual de disfunciones estéticas demostró ser una herramienta para no profesionales y profesionales ayudando en la adquisición de información.

Palabras clave: salud estética; aplicación; innovación; tecnología; aprendizaje móvil.

1 INTRODUCTION

In the area of aesthetic dysfunctions, there was a high number of demands in non-surgical procedures and interventions to treat these dysfunctions. Thus, the goal within this perspective is to apply and analyze the use of technology for identification and dissemination of health knowledge through mobile devices such as smartphones.

Currently, there is no official list of the most prevalent cosmetic diseases in the country. However, we have the main diseases that lead people to seek treatment, especially when associated with pathologies, we have social discomfort and impairment in people's routine. Among these diseases we have acne (*Propionibacterium acnes*), which consists of inflammation of the sebaceous glands and hair follicles, leading to the formation of pimples and blackheads, although it is a pathology that affects the majority of the population, there are many controversies regarding its prophylaxis.

Not only acne, the same occurs with melasma, psoriasis, dermatitis, urticaria, abscess, keratosis, scar, cyst, chloasma, dermatosi, dyschromia, eczema, ephelides, erythema, excoriation, folliculiti, herpes, hirsutism, lupus, milium, and many others. One way to promote this knowledge is through the development of systems or applications, it is notorious the increase in the use of mobile devices, with internet access via wireless network. Mobile devices with higher computing power, however, each time with new attractions, generating new models, increasing the processing capacity, besides the infinity of new applications added.

Being an exponentially growing market, in the same way, the motivation to develop innovations for these devices increases. The compatibility and acceptance of the JavaScript programming language (JS) on these devices, allows for the creation of applications. Mobile learning is being explored in several areas, making its support and dissemination more flexible. Many applications and educational systems are being created, to increasingly assist people in the various areas of knowledge.

The application is considered an atlas, which shows the esthetic dysfunctions that most affect the population. Following the mobile learning methodology, which aims to use mobile devices as tools for learning. In

addition, this method is used mainly in distance learning, but it can also be a tool to help in classrooms.

Mobile learning is a concept that emerged in the mid-1970s, when computer scientist Alan Kay described the concept of the Dynabook, which at the time was a personal computer used as a portable book to facilitate learning. The consequence of this would be teaching with more agility and convenience. Later, in the 2000s, the expansion of Distance Education and Home Office, which had a strong impact on the lives of the population with the SARS-CoV-2 pandemic, marked its presence in the lives of many.

Being something immeasurable in terms of benefits, this modality has brought significant changes to society, following this technological line, several other things have been improved, such as wireless networks and greater fluidity in the exchange of information. Appropriate to education, this agility is necessary for the new generation. It is worth pointing out that there are other methods available that should not be confused, an example would be e-learning with mobile learning.

E-learning is a process where the consumption of content from the devices has the function of distance learning. When we talk about mobile learning, besides using mobile devices, it does not present a linear content, so the individual can determine the best way to consume the content and the speed.

Within the perspective presented, we have the proposal for the development of a Mobile Application as a safe source of information regarding dermatological diseases. The development of the application in question comes to help both academics and professionals in the area and lay people, with prophylaxis information, causes, treatments and guidelines, without annulling the search for a specialist in the area or confirmation of diagnoses.

2 METHODOLOGY

The study was conducted from 2022B to 2023A, during the months of December 2022 and January 2023, virtually through the Google Forms platform. In this survey, 150 (one hundred and fifty) participants were used, with the public being aesthetic professionals, health academics, lay people

in the subject of aesthetic dysfunctions, and professionals from other areas. Those who agreed to participate had to agree to the Informed Consent Form and answer a brief form about the application. In addition, duplicate information was not accepted, where each participant could only answer the questionnaire once. Those who did not agree with the Informed Consent Form were not part of the data presented.

To carry out this research, we did not use a physical place for collection, because the Informed Consent Form- ICF and questionnaire were sent virtually through the Google Forms platform.

2.1 App development

The application was developed in JavaScript, using the framework known as React Native, a component library developed by Facebook for the creation of native applications on Android and IOS. JavaScript is mainly used for creating World Wide Web sites, the WWW of our research, being one of the three main technologies of Web development.

Thanks to the dynamics of including JavaScript in the various libraries of the Node Package Manager, it was the language of choice for creating the application. However, since the language is not directed to the creation of mobile applications, it will be used with the React Native library, whose tools are directed to this type of development, being easier to apply and can be rendered for both mobile platforms, Android and IOS, something impossible to accomplish in the Java or Kotlin language, for example, without recreating the application from scratch.

2.2 People approach and testability of the app

The public studied was 150 (one hundred and fifty) aesthetic professionals, health academics, lay people on the subject of aesthetic dysfunctions, and professionals from other areas, all over 18 years old, who mainly use one of the two most popular operating systems, IOS and Android. They received an invitation to participate in the research online, where there was the possibility of agreeing to the Free and Informed Consent Form - ICF, testing the application, and filling out the questionnaire evaluating the

satisfaction and experience of people about it. Authorization was requested and, after analysis, approval was obtained from the Ethics Committee from Dom Bosco University Catholic, CEP/UCDB number: 65615022.2.0000.5162.

2.3 Analysis of results

The data were presented descriptively, with categorical variables presented as absolute (n) and relative (%) frequency and continuous numerical variables as mean ± standard deviation. The results will be arranged in figures and tables.

3 RESULTS AND DISCUSSION

3.1 Phase 1 - Application structuring

The application was structured based on its predecessor, "Beauty and Health Guide" in the first version was observed improvements that could be made and then applied them. Changes in color, font and distribution were put into practice. The whole approach to the application followed the data presented in phase 2 and, as it was divided into levels, it was carried out as follows.

3.1.1 Levels

The levels were restricted to 3 (three), being named according to the general framework of the dysfunction. The levels are Level 01- Capillaries; Level 02- Facials and Level 03- Body.

3.1.2 Menus and submenus

The esthetic dysfunction was divided in menus, and its characteristics in submenus, which present definition, how the dysfunction appears, treatment and prevention. As described in this text, the application displays the contained information as demonstrated in figure 1.

Figure 1 - General organization for mobile app tab navigation, demonstrating the menu and sub-menus of all esthetic dysfunction addressed inside the app

Level 01 – Capillaries

Menu 01- 11 – Local of dysfunction.

Sub-menu 1.1 – Definition.

Sub-menu 1.2 – How it is presented.

Sub-menu 1.3 – Treatment.

Sub-menu 1.4 – Prevention.

Level 02 – Facial

Menu 01- 31 – Local of dysfunction.

Sub-menu 1.1 – Definition.

Sub-menu 1.2 – How it manifests itself.

Sub-menu 1.3 – Treatment.

Sub-menu 1.4 –Prevention.

Level 03 – Corporal

Menu 01 – Skin cancer.

Sub-menu 1.1 – Definition.

Sub-menu 1.2 – Clinical Manifestation.

Sub-menu 1.3 – Treatment.

Sub-menu 1.4 – Prevention.

Source: Elaborated by the authors.

3.2 Phase 2 - Application

In recent years, countless people have developed tools that have improved the quality of life in their communities, and with the advent of the technological revolution in the 21st century, more people and health professionals have acquired and own digital devices, leading to the deve-lopment of new apps and intuitive tools that can organize tasks, finances,

and provide valuable health information to users (Boudreaux *et al.*, 2014; Milne-Ives *et al.*, 2020).

Since then, the world of our lives and the way we interact everywhere, the use of mobile devices and apps and their correlations in people's daily lives are more obvious than ever. A developed application allows your audience to access your business anytime and anywhere. The improvement, availability, and the possibility to insert new features help increase its use, preventing the app from being forgotten or even deleted (Boudreaux *et al.*, 2014).

Apps are one of many tools that bring the possibility to connect your business and consumers. This means of communication allows customers to understand your products, services, and even history. The advantage is that these are all very simple ways: through mobile devices. This will make more and more people aware of your work and increase sales, but to achieve this goal, your app is essential.

Thus, as part of this movement, a beta version of an application was tested on a sample of 150 individuals, with results organized by age groups represented by the colors: blue (18 to 23 years), orange (24 to 29 years), yellow (30 to 35 years), green (36 to 41 years) and purple (>41 years), where the usability of the app was successfully evaluated. The age of the study participants, people of different ages were addressed intentionally, but without escaping the main audience of the research, where it can be seen that the biggest advantage is the young population, from 24 to 29 years old (Figure 2).

Figure 2 - The result regarding the age range evaluated an audience over 18 years old. It obtained a larger audience of young people, 50% (75) of the answers from people between 24 and 29 years old, followed by 24.7% (37) of the audience between 18 and 23 years old. Color legend: Blue (18 to 23 years), red (24 to 29 years), orange (30 to 35 years), green (36 to 41 years) and purple (>41 years)
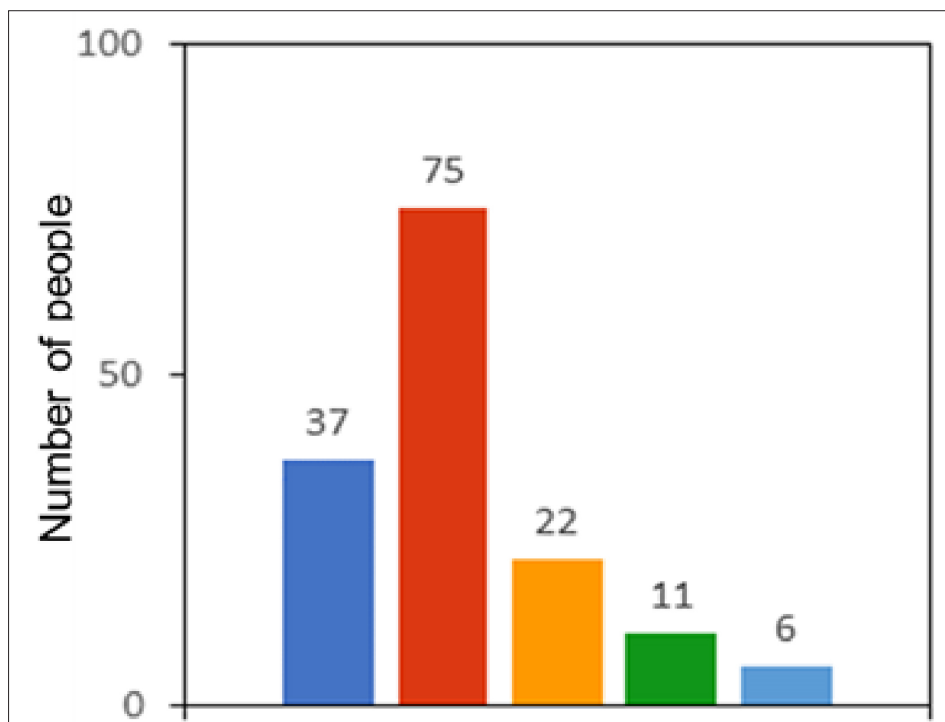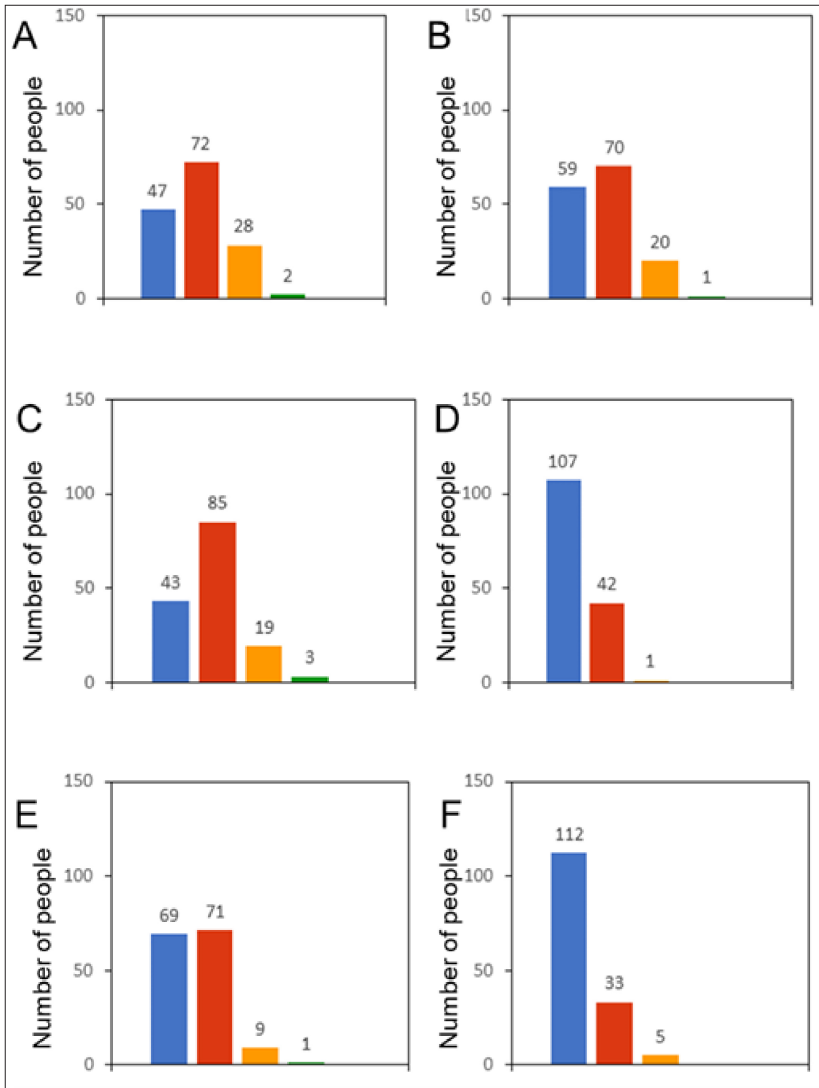

Source: Data obtained from authors questionnaire about the application.

According to Ditzz and Gomes (2017), the use of technology related to teaching practice, focused on young audiences, has produced relevant results for both students and teachers. In addition, the authors report that teachers, using the technology they are used to using in their daily lives, like the new assessment model, now digital, because it can be used as a tool to improve the teaching practice itself, improve the teaching process, and improve student attention and interest in the content (Ditzz; Gomes, 2017).

From this, the comparison of the results of the learning process culminates in a two-way street and a questionnaire (Figure 3), characterizing the perceived relevance of the application. As part of this, the academic results showed 112 responses, or 74.7%. And it can also be highlighted all the benefits that online tools offer to this audience, such as broader learning, expanded communication for information exchange, flexibility, autonomy, and content available 24 hours a day (Xhaferi; Xhaferi, 2020).

Figure 3 - Evaluation of relevance and its impact. (A) are the answers referring to the discoverable treatments. In (B), we have the results that say about the discovery of new dysfunctions. (C), relevance to aesthetic professionals. (D) against the impact for the lay public. (E) for people who study aesthetic health. (F) for academics. Color legend: Blue (very relevant), red (relevant), orange (neutral), green (not very relevant) and purple (not at all relevant)

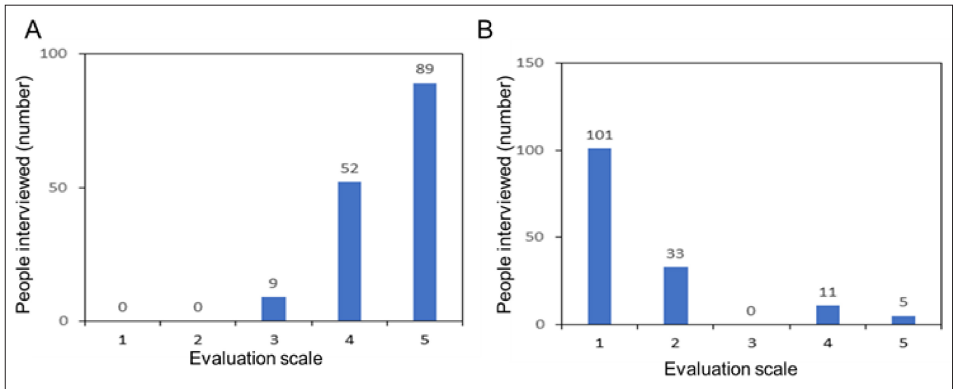Source: Data obtained from authors questionnaire about the application.

When used for this specific purpose, the versatility brought by digital devices can provide benefits in disease control and screening. With a focus on aesthetic well-being, Brazil is one of the fastest growing market in the beaty industry (Łopaciuk; Łoboda, 2013). According to CEO Eduardo Kanashiro (2021), many patients report doubts about aesthetic procedures, their differences and the best time to use them. Thus, those who have access to the application learn about the dysfunction, how to treat it, and look for a professional. However, we aim to facilitate the distribution of this information in a way that makes it easier to use the application.

To this end, two questions were raised. The first is the user's ability to use a cell phone, which, according to the data analyzed, may be something very satisfactory for most young people. It also evaluates the difficulty to enter and test the application, the time to learn how it works, and whether all the content can be easily accessed to meet both professional and non-specialized audiences.

An evaluation scale based on the General Motors concept (Bayou; Korvin, 2008) was used, where a 1 means the participant does not know how to use a cell phone and a level 5 means he has a lot of skills, the results in this question were satisfactory, with 94% of the participants having a lot of skill when using the smartphone, perhaps this skill is reflected in the age question asked.

A large portion of interviewed answered that it takes no effort to use the app and a small portion answered that it takes effort. From this result, we suspect that the difference in smartphone experience results is due to the application improvement suggestions provided in Figure 4B.

Figure 4 **-** The results represent, (A) experience using smartphones in different degrees, being 1 very difficult and level 5, extreme ease, considering level 4 and 5 of experience, we get a result of 94% (89). (B) Level of effort to understand how to use the application following the General Motors model. The number 01 indicates no effort, with 67.3% (101) of the responses. 05 indicates extreme effort, with only 3.3% (5) of the responses

Source: Data obtained from authors questionnaire about the application.

Interviews with several professionals specializing in the study of the nervous system suggest that cell phones end up being the external hard drives (HD) of our brain. It is well known that our brain has the ability to store information in memory subsets, both short- and long-term, and with the advancement of technology, many features of logical reasoning have come to be accounted for by digital devices, leaving aside the functions we are required to remember (Wilmer; Sherman; Chein, 2017).

While the schema does not specify exactly where the technique is applicable, it does emphasize that the ability to handle something or something falls under implicit memory, which is part of a larger group of long-term memories. A tutorial on how to use the app would fit this profile. Teach people the ability to access applications quickly and nimbly using prior knowledge gained from previous instruction. This hypothesis was indirectly implied by 127 (84.66%) participants who marked the tutorial option.

In the application we bring several aesthetic disorders that affect people, many people suffer with one disease or another, they do not know

what to do to treat it, which is the best specialist for that. In addition, some pathologies lead to social exclusion or judgments that put people in a bad light, so this application was developed to be easily accessible.

The application contains all the scientifically researched information that can help with prevention and help people find the right professionals. Although a large number of participants came from the health field, representing 54% (Figure 5), other fields also showed interest. In addition, all the knowledge generated by the University will be taken to the community in an uncomplicated way, helping the work of professionals who are already inserted in the market and of those who will be incorporated in the future.

Figure 5 - Important approaches to consider, as it dictates totally different directions from the evaluation of other questions. With 54% (81) of the answers being from the health area, the other questions are taken to the perception of the critical sense of individuals who may have positive thinking in the realm of health promotion and prevention. Color legend: Blue (Exact and earth sciences), red (Biological science), orange (Engineering), green (Health science), light blue (Agricultural sciences), dark orange (Linguistics, letters and arts), purple (Social and applied sciences), brown (Human sciences), gray (High school completed), light brown (Incomplete high school), yellow (Others: Self-employed) and dark green (Other: high school)
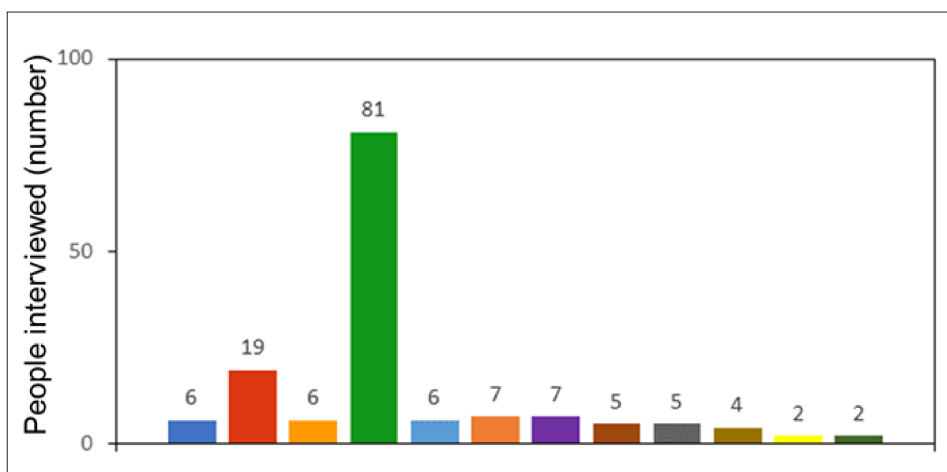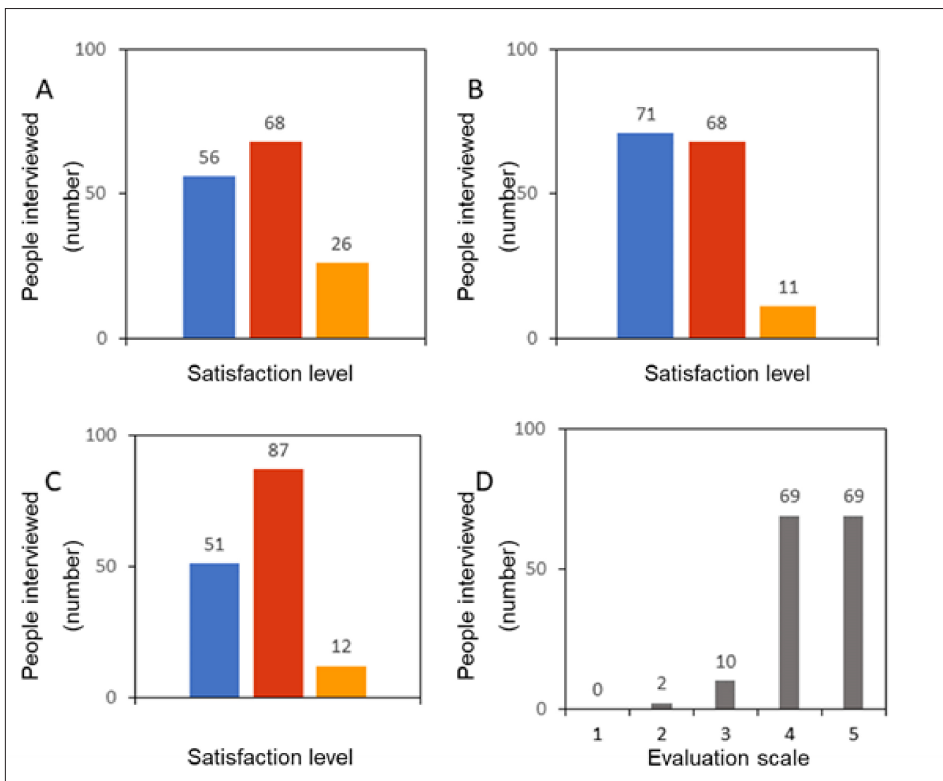

Source: Data obtained from authors questionnaire about the application.

From the next data, it was evaluated how the structuring of the application agrees with the opinion of users, we follow the basic rules of conditional logic, where clicking on one of the menus, will lead to another and so on. The conditional logic says that a starting point "P" will lead consequently to the ending point "Q", and this is independent of the order in which both appear, the logic will be the same to go back and follow with another topic (Gouveia *et al.*, 2002).

The data presented in Figure 6 shows satisfaction results regarding (A) the distribution and arrangement of information, the first menu (B) got 71 (47.3%) responses as "very good" and in the second menu (C) this number fell to 51 (34%) responses. Perhaps it could be related to the dysfunction presented in this second menu that concerns "body dysfunctions". (D) demonstrate the satisfaction in relation to the disposition of the information. As for the audience, dysfunctions affecting the face are more in demand. A survey showed that the most popular topics in the area of basic care, and among them are cleansers, facial moisturizers and exfoliators. Products that are routinely indispensable in the Skin Care routine (Korrapati *et al.*, 2021).

Figure 6- Distribution and disposition of information in the application. (A) indicates the esthetic dysfunction menu, how the text is elaborated and how comfortable it is to read. (B) brings us the options marked before the first menu, where there are three options: facial, body and hair. (C) concerns the second menu, this one responsible for the dysfunctions, as an example, acne and alopecia. For (D) the disposition of the information was analyzed, obtaining a result of 46% (69) in grade 5 that says it is very well disposed. Color legend: Blue (Very good), red (Good), orange (Neutral), green (Bad), purple (Very bad)

Source: Data obtained from authors questionnaire about the application.

Color is an integral part of our lives, saturating our shopping centers with vivid hues, while neutral tones discreetly infuse an air of understated elegance. For fast food chains, intense colors attract customers, boosting profits. Color psychology plays a crucial role in brand loyalty and the success

of an app, with studies indicating that color choice strongly influences product access rates, user experience, and emotions. A carefully selected color palette can enhance functionality, as evidenced by the positive results (data not shown). Notably, the color of the application icon (A) was approved by 81 respondents (54%) as "good," while 74 (49.3%) admired the color of the first menu (B). The design was excellent, but the choice of color made all the difference.

Shifting the focus to the typographic elements within the application, the data examines the fonts used in various menus and their respective sizes, including headings, subheadings, descriptions, and references. In accordance with guidelines set forth by Microsoft, Apple, Google and Sony font selection and size were carefully calibrated for maximum readability. The result is a clean, organized aesthetic that complements the overall spirit of the design (Dyer, 2014).

The principles of visual hierarchy are essential to creating a user-friendly web page that provides clear direction to the visitor. A scaling strategy is used to guide the user on their journey through the site. The data collected with this approach yielded excellent results (data not shown), especially for font used in (A) menus, (B) references and (E) descriptions, with 86, 62 and 69 responses rating it as "Very good", respectively. In addition, descriptions of font size in (C) headings and subheadings, (D) description of aesthetic dysfunctions, and (F) references were answered 69 times (about 46% of the total sample size).

The figure 7 show a general usability evaluation of the application. In figure 7A it shows if the user rates the app usage experience has great, good or regular. In figure 7B demonstrate if this application is recommendable to other people by the user. In addition, it was also investigated how much each participant would pay to have this application on their cell phone and what cell phone operating system they were using at the time of filling out the form.

Figure 7 - (A) shows the results obtained as to the experience of using the application by users, 46.7% (70) of the answers were great, 52% (78) as a good experience, and 1,3% (1) rate as a regular experience. In (B) it is depicted whether the app is recommendable for other people to use, just like previous graphs it is rated in degrees, with 64.7% (97) of responses for maximum recommendation. Color legend: Blue (Very good), red (Good), orange (Neutral), green (Bad), purple (Very bad)
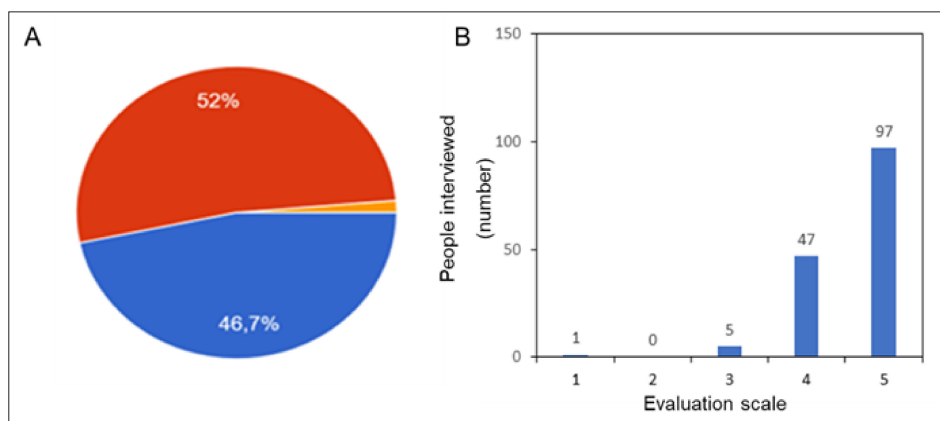
Source: Data obtained from authors questionnaire about the application.

Although the application still has a version available only for IOS and Android operating systems, and due to these precautions, we obtained results that people would pay to have the application in their smartphones, as shown in Figure 8, only 28.7% (43) of volunteers would not pay to have the application in their cell phones, against the other 73.3% (107) who would not mind this question and would invest an amount.

Figure 8 - Analysis of how much people would pay to have the application installed on their cell phone. The charge would be made only at the time of obtaining the application and not monthly as other apps do. The highest number of answers was that some amount would be paid, and only 28.7% (43) would not pay. Color legend: Blue (less than 2 US dollars), red (between 2 and 50 US dollars), orange (more than 50 US dollars), green (wouldn't pay)
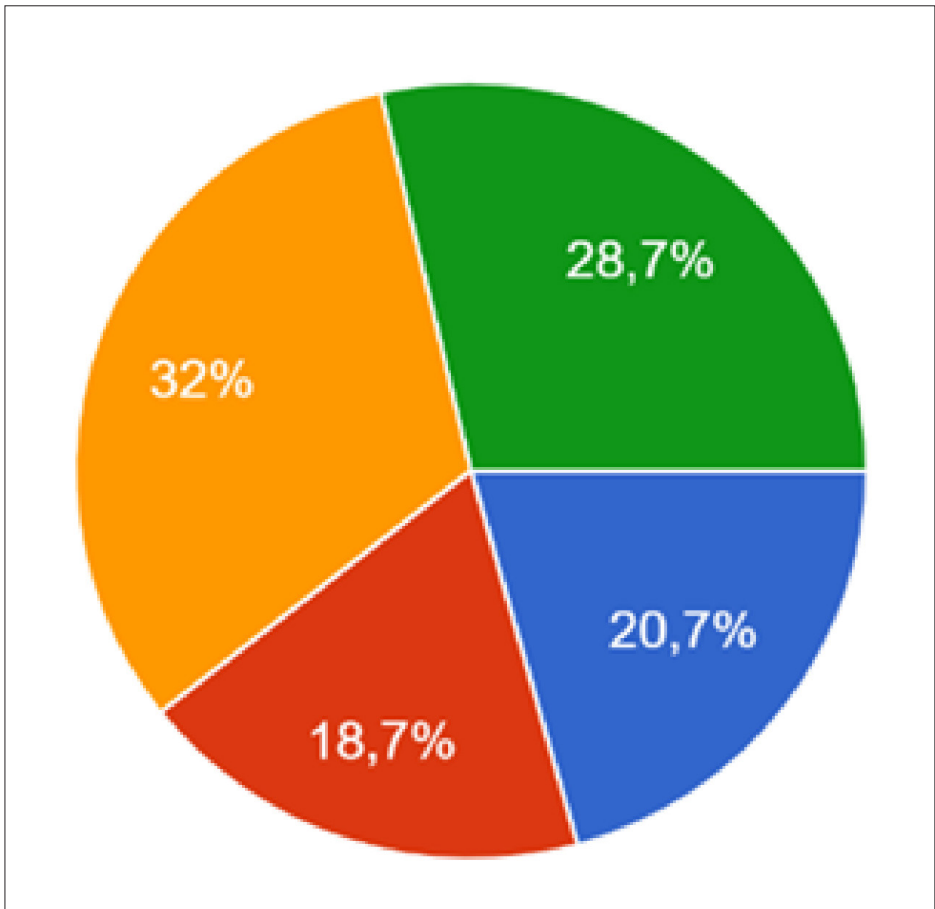
Source: Data obtained from authors questionnaire about the application.

According to a survey conducted by StockAPPs, the majority of users who use the form and test the application use IOS operating systems. This is reinforced by the decline of Android and increase of IOS users in recent

study (Garg; Baliyan, 2021), and the same was observed in our questionnaire (data not shown).

The spread of wireless internet and the use of mobile devices have facilitated access to information anywhere and at any time, in order to simplify tasks and offer subsidies for decision making, through mobile applications. This field of possibilities follows the technological innovations, and the different mobile applications aimed at the health area have emerged, with the perspective of providing autonomy in care, especially those related to their continuity in extra-hospital and outpatient environments (Milne-Ives *et al.*, 2020).

The use of health-oriented mobile applications (APPs) can act as a tool for disease self-management and client involvement in the self-care process, whether in medication adherence, non-pharmacological therapies, or task accomplishment, which facilitates the achievement of clinical outcomes in the conduct of treatments, a promising proposal regarding motivating patients for self-care at home (Milne-Ives *et al.*, 2020; Pecorelli *et al.*, 2018).

Scientific evidence points to the importance of this technological tool as a facilitator in home care, as found in a study that identified the importance of a mobile app used by a group of patients undergoing bowel surgery. The application was used as a tool to support surgical recovery and as a record of patient adherence to an enhanced recovery program, which identified that 89% of participants reported that the app was helpful in achieving recovery goals, and 76% further added that the app was an incentive for post-surgical recovery (Pecorelli *et al.*, 2018).

Patients, institutions, and healthcare professionals already use mobile apps, as a way to interconnect contexts, users, and knowledge, as well as broaden strategies, in which caring and educating move forward together (Boudreaux *et al.*, 2014; Ventola, 2014). However, the development of mobile applications and their distribution on digital platforms, with different purposes and varied functionalities, are not enough to guarantee effectiveness, efficiency, and validity in the use of the resources offered by technology. Thus, when proposing an application that has the proposal to improve health care, the unfolding of compacted methodological steps that promote the construction of these applications and that attest to the func-

tionalities of the technology employed are essential and, within this process, is the evaluation of usability (Boudreaux *et al.*, 2014; Pecorelli *et al.*, 2018).

The usability of mobile applications comprises the way to evaluate the ease of use, the way individuals interact with the system, measured through validated instruments, and the ability of a program/application to be understood, comprehended and operationalized by an individual, achieving its specific purpose (Boudreaux *et al.*, 2014; Pecorelli *et al.*, 2018).

4 CONCLUSION

The process of evaluating the usability of mobile applications provides more security to the technology, proves its efficiency, validity and effectiveness, fundamental requirements when it comes to resources that involve human health. From the data analyzed we found a wide distribution of publications that address the usability of mobile apps in health, with the use of different evaluation scales, with emphasis on the Brazilian National Health System (SUS, *Sistema Único de Saúde*), concluding that this can be a scale safely used by researchers who aim to validate the usability of health application. After analyzing the data collected, we found that the target audience for the application is between 24 and 29 years old. Most respondents found the implementation of the app relevant and easy to use, with most of them delving into the app's functionality by following the tutorial. Interestingly, health science students were the most helpful in our survey. The information distribution and layout of the app received a lot of praise, with the graphic design and text composition also receiving positive feedback. Most users liked the experience of the app, 71.4 % would be willing to pay to access the tools that the app offers on iOS devices.

REFERENCES

BAYOU, M. E.; KORVIN, A. Measuring the leanness of manufacturing systems—a case study of Ford Motor Company and General Motors. *Journal of Engineering and Technology Management*, [*s.l.*], v. 25, n. 4, p. 287–304, 2008.

BOUDREAUX, E. D.; WARING, M. E.; HAYES, R. B.; SADASIVAM, R. S.; MULLEN, S.; PAGOTO, S. Evaluating and selecting mobile health apps: strategies for healthcare

providers and healthcare organizations. *Translational behavioral medicine*, [*s.l.*], v. 4, n. 4, p. 363-71, dez. 2014.

DITZZ, Á. J. M.; GOMES, G. R. R. A utilização do aplicativo plickers no apoio à avaliação formativa. *Revista Tecnologias na Educação*, [*s.l.*], ano 9, v. 19, p. 1-13, jul. 2017.

DYER, I. C. An examination of typographic standards and their relevance to contemporary user-centred web and application design. *In*: RAU, P. L. P. (Ed.). *Cross-Cultural Design*: 6th International Conference, CCD 2014 held as part of HCI International 2014. Heraklion: Springer International Publishing, 2014.

GARG, S.; BALIYAN, N. Comparative analysis of Android and iOS from security viewpoint. *Computer Science Review*, [*s.l.*], v. 40, n. 2, 2021.

GOUVEIA, E. L.; ROAZZI, A.; MOUTINHO, K.; DIAS, M. G. B. B. Raciocínio condicional: influências pragmáticas. *Estudos de Psicologia*, Natal, v. 7, p. 217-25, 2002.

KORRAPATI, N. H.; PERERA, M. H.; SWAMY, P. K.; RANGANATH, P. A.; ANKIREDDY, K.; THOMAS, S. A.; BATHALA, R. P. Skincare Routine During The COVID-19 Pandemic: An Online Survey. *International Journal of Progressive Sciences and Technologies*, [*s.l.*], v. 5, n. 2, 2021.

ŁOPACIUK, A.; ŁOBODA, M. Global beauty industry trends in the 21st century. *In*: MANAGEMENT, KNOWLEDGE AND LEARNING INTERNATIONAL CONFERENCE, 2013, Zadar. *Anais* [...]. Zadar: Make Learn, 2013.

MILNE-IVES, M.; LAM, C.; COCK, C.; VELTHOVEN, M. H. V.; MEINERT, E. Mobile apps for health behavior change in physical activity, diet, drug and alcohol use, and mental health: systematic review. *JMIR mHealth and uHealth*, [*s.l.*], v. 8, n. 3, mar. 2020.

PECORELLI, N. *et al*. An app for patient education and self-audit within an enhanced recovery program for bowel surgery: a pilot study assessing validity and usability. *Surgical Endoscopy*, [*s.l.*], v. 32, n. 5, p. 2263-273, 2018.

VENTOLA, C. L. Mobile devices and apps for health care professionals: uses and benefits. *Pharmacy and Therapeutics P & T*, [*s.l.*], v. 39, n. 5, p. 356-64, maio 2014.

XHAFERI, B.; XHAFERI, G. Online learning benefits and challenges during the COVID 19- pandemic-students' perspective from SEEU. *SEEU Review*, [*s.l.*], v. 15, n. 1, p. 86-103, 2020.

WILMER, H. H.; SHERMAN, L. E.; CHEIN, J. M. Smartphones and cognition: a review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in psychology*, [*s.l.*], v. 8, p. 605, 2017.