

Construction and validation of a mobile application for health education about COVID-19

Construção e validação de aplicativo móvel para educação em saúde acerca da COVID-19

Construcción y validación de una aplicación móvil para educación en salud sobre COVID-19

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ABSTRACT

Objective: To construct and validate a mobile application for health education about COVID-19.

Method: Methodological study, developed in six stages, in the state of Rio de Janeiro, between June 2020 and August 2021, with 20 health professionals, using an electronic form. Validation took place through the Content Validity Index, whose indexes should be greater than or equal to 80%.

Results: The application called ROBOVID was constructed and validated by expert judges on the subject, with a Content Validity Index of 100% for the domains of content and cultural adequacy, and with a variation of 90 to 100% for the domains of language, illustration, and presentation, achieving 97% on the Overall Validity Index and 98% on the “ten golden rules” for use in health education.

Conclusion: The ROBOVID application proved to be a valid technological tool for health education about COVID-19 among the Brazilian population

Keywords: Health education. Computers, handheld. Pandemics.

RESUMO

Objetivo: Construir e validar um aplicativo móvel para educação em saúde acerca da COVID-19.

Método: Estudo metodológico, desenvolvido em seis etapas, no estado do Rio de Janeiro, entre junho de 2020 a agosto de 2021, com 20 profissionais de saúde, utilizando um formulário eletrônico. A validação ocorreu através do Índice de Validade de Conteúdo, cujos índices deveriam ser maiores ou iguais a 80%.

Resultados: O aplicativo denominado ROBOVID foi construído e validado por profissionais juízes especialistas na temática, com Índice de Validade de Conteúdo de 100% para os domínios de conteúdo e adequação cultural, e com variação de 90 a 100% para os domínios de linguagem, ilustração e apresentação, alcançando 97% de Índice de Validade Global e 98% nas “dez regras de ouro” para uso em educação em saúde.

Conclusão: O aplicativo ROBOVID demonstrou ser uma ferramenta tecnológica válida para educação em saúde acerca da COVID-19 entre a população brasileira.

Palavras-chave: Educação em saúde. Computadores de mão. Pandemias.

RESUMEN

Objetivo: Construir y validar una aplicación móvil de educación sanitaria sobre COVID 19.

Método: Estudio metodológico, desarrollado en seis etapas, realizado desde junio de 2020 hasta agosto de 2021 mediante formulario electrónico. La validación se realizó a través del Índice de Validez de Contenido, donde los índices deben ser mayores o iguales al 80%.

Resultados: La aplicación denominada ROBOVID fue construida y validada por 20 profesionales de la salud expertos en el tema, con un Índice de Validez de Contenido del 100% para los dominios contenido y adecuación cultural, y con validación del 90 al 100% para los dominios lenguaje, ilustración. Y presentación, logrando el 97% de Índice de Validez Global, y el 98% frente las diez reglas de oro para uso en educación para la salud.

Conclusión: La aplicación ROBOVID demostró ser una herramienta tecnológica válida para la educación en salud sobre COVID-19 entre la población brasileña.

Palabras clave: Educación en salud. Computadoras de mano. Pandemias.

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■ INTRODUCTION

According to the World Health Organization (WHO) report, in August 2021, Brazil ranked second place regarding the number of deaths and third in the number of cases caused by coronavirus disease 2019 (COVID-19), behind only of the United States of America (USA) that led the ranking on the world stage⁽¹⁾.

Despite almost two years after the current pandemic, many uncertainties and questions remain, not only due to the speed of propagation of this infectious, acute, and emerging disease, but, above all, due to the lack of complete information about the natural history of this condition. Moreover, there is still no complete information on effective and unquestionable measures for the clinical management of cases of human infection with the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)⁽²⁾. Therefore, it is essential the development of health education strategies with the population to clarify doubts about the prevention and control of the disease.

In view of the exponential increase in the use of audiovisual resources aimed at guiding the population to cope with COVID-19, the creation of a mobile application on the subject enables to monitor information, encouraging people's self-care, in addition to configuring a technological innovation in Health area. These systems corroborate the improvement of the quality of communication, emerging as a strategy in health education, considering that access to the internet through mobile devices, such as smartphones, has been predominant as means of searching and obtaining information⁽³⁾.

The idealization of an Educational Technology (ET) that provides health education in the pandemic context constitutes a facilitating tool for autonomous decision-making by the Brazilian population in coping with this problem. Thus, the expansion of knowledge will be sought in a practical and accessible way, through colloquial language to enable the adoption of safe behaviors in the individual and collective scope, aiming, especially, to minimize the transmission of SARS-CoV-2.

Thus, with the health education as its goal, the question was: is a mobile application for guidance on the prevention and control of COVID-19 valid for use among the Brazilian population? Thus, the objective was: to construct and validate a mobile application for health education about COVID-19.

■ METHOD

Methodological study developed in six stages⁽⁴⁾: 1) survey of doubts from the population about COVID-19; 2) literature review; 3) construction of the mobile application;

4) application validation by expert judges, 5) application adequacy; and 6) indexing the application at the Play Store for Android and Apple Store for IOS.

The first stage occurred in July 2020, through the application of an electronic semi-structured form through the Google Forms Virtual Platform. This stage included Brazilian individuals, aged 18 years or older, of both sexes and residents in the state of Rio de Janeiro. Those who did not submit the form duly filled in within the prescribed period were excluded.

For this phase, an invitation letter was sent via social media (WhatsApp and Facebook), with the objectives of the research, in addition to the access link to the electronic form. Convenience sampling was adopted to capture the participants, using the snowball technique, which consists of a form of non-probabilistic sampling, through reference chains of possible participants, who were initially invited by the researchers and, later, from the indication of the individuals themselves⁽⁵⁾. Data collection was ended by theoretical saturation, when the statements provided the data for the conclusion of this stage of the study⁽⁶⁾.

The instrument for data collection with the population consisted of two parts, the first for the characterization of the participants and the second with open questions about COVID-19: 1) Do you have doubts about COVID-19? If yes, could you describe what they are? 2) What information do you think is important to have in the mobile app about COVID-19? 3) How can a mobile app help in understanding and preventing COVID-19?

The answers obtained in this stage constituted the textual corpus processed in the software *Interface de R pour Analyses Multidimensionnelles de Textes Et de Questionnaires* (IRAMUTEQ), using the methods Word Cloud and Descending Hierarchical Classification (DHC)⁽⁷⁾. The interpretation of the data occurred according to the assumptions of Thematic Analysis, which aims to find the meaning nuclei that compose a communication, which leads to the understanding of the analytical object⁽⁸⁾.

In the second stage, an integrative literature review was performed, aiming to seek updated information about COVID-19, to identify, analyze and synthesize reliable and current data on the subject, in order to guide the theoretical content of the application. The search was guided by the research question: what does the scientific literature address on prevention and control measures of COVID-19? Data collection took place using the advanced search form of the informational resources: Latin American and Caribbean Literature on Health Sciences (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE) and US National Library of Medicine National Institutes of Health (PUBMED).

The standardized controlled terms of the Health Sciences Descriptors (DeCS) and the Medical Subject Heading (MESH) in Portuguese, English and Spanish were used, associated in pairs and in trios using the Boolean operator "AND", and the quotation marks ("") to limit and establish the order of compound terms. Thus, the search strategy was: (tw: ("Infecção por coronavírus")) AND (tw: ("Síndrome respiratória aguda grave")) AND (tw: ("Medidas de segurança")) AND (tw: ("Educação em saúde")) AND (tw: ("Doença pelo novo coronavírus")) AND (tw: ("Pandemia")). (tw: ("Infección por coronavirus")) AND (tw: ("Severe Acute Respiratory Syndrome")) AND (tw: ("Security Measures")) AND (tw: ("Health Education")) AND (tw: ("COVID 19")) AND (tw: ("Pandemic")).

Original articles were included; available in full and that answered the research question. The following were excluded: studies that portrayed only questions regarding the analysis of genomic sequences and/or clinical aspects of the new coronavirus, as well as duplicate articles. No publication period was defined. The search and selection phase of publications was carried out in September 2020, by two authors, independently.

However, the two reviewers collected data on the same day and used the same search strategies, thus reading and evaluating the titles and abstracts of the selected articles in the informational resources, in accordance with the defined inclusion/exclusion criteria. There was no deviation between the reviewers, both agreed on which studies met the necessary elements to answer the research question.

For data collection of the selected articles, an instrument developed by the authors was used, aiming to characterize each production by addressing the items: code, title, informational resource, journal, year, authors, study design and objective. The data were organized in a database in the Microsoft Excel 2007 software.

Besides the scientific evidence found in the review, protocols, recommendations, guidelines and technical standards published by the World Health Organization (WHO)⁽⁹⁾ Ministry of Health⁽¹⁰⁾ Pan American Health Organization⁽¹¹⁾ e Center of Disease Control and Prevention (CDC)⁽¹²⁾ among others were followed, as a way of increasing the theoretical content of the application in line with responsible health bodies and authorities, with emphasis on the Brazilian context.

The third stage consisted of meeting the research team with the application developer to present the creation proposal. Several meetings were held to decide important issues, such as: definition and approval of items related to the application's interface, selection of videos and pictures on the topic, visual identity, application's name, attractiveness, animation, and design of theoretical content in the form of

"themes", aiming to present information about COVID-19 in the most organized possible mode.

The fourth stage involved validation by a committee of expert judges, based on Fehring's⁽¹³⁾ adapted criteria: PhD title = 04 points; Master's Title = 03 points; Research (with publication) in the study's area of interest = 02 points; Article published in the study's area of interest = 02 points; Clinical practice lasting at least one year in the study's area of interest = 01 point; Certificate of specialization in the technical education area = 02 points. A minimum score of five points was established for participation. Moreover, the following inclusion criteria are considered: health professionals with professional and/or academic experience in the subject of COVID-19. Those who did not submit the instrument duly completed within the prescribed period were excluded.

The committee of judges was invited by an invitation letter, sent by email, detailing the objectives of the study, as well as guidelines for downloading and accessing the application for both iOS and Android devices. In addition, a link was made available to the electronic form with three parts: 1) questions about the expert's sociodemographic profile; 2) questions about the content and design of the application; 3) a questionnaire based on "ten golden rules" that sought to evaluate the application's potential for use as a tool in the teaching-learning process in health. For this, a questionnaire composed of ten items was applied, which seek to evaluate whether a software is suitable for use in health education. This instrument was previously applied in Brazil, as part of a software quality assessment model for use in medical education⁽¹⁴⁾. In addition, there was a field for participants to write suggestions/comments to improve the application. A period of seven days was stipulated for returning the form by Google Forms.

To capture the judges, convenience sampling was adopted, using the snowball technique⁽⁵⁾. Thus, the experts were invited by indication of the research team itself, and later by indications made by the participants, respecting the aforementioned inclusion criteria. However, when an expert was indicated, a search was carried out on the Lattes Platform, to assess compliance with the pre-established criteria, aiming at a subsequent invitation to the study. At this stage, the limit of 20 participants was defined in line with the scientific evidence that suggests six to twenty participants for each group of evaluators in studies of this nature⁽¹⁵⁾.

For the evaluation by the expert judges regarding the content and design of the application and the "ten golden rules", a Likert-type scale was used with four answer options ranging from 1 to 4, as follows: 1 - I strongly disagree, 2- I somewhat disagree, 3- I somewhat agree, and 4- I strongly

agree. In this analysis, to estimate the degree of agreement between the judges, the Content Validity Index (CVI) was calculated through the sum of the answers I somewhat agree (3) and I strongly agree (4), divided by the total number of judges. According to the literature, the items evaluated must have a CVI greater than or equal to 0.8 (80%), therefore, the items with a CVI below this limit must be readjusted according to the suggestions⁽¹⁶⁾.

The fifth stage was aimed at the adequacy of the application upon the suggestion of the judges. It is noteworthy that the judges' suggestions were evaluated and accepted, when possible, both for items that reached the determined agreement index and for those that did not. The sixth stage focused on making the application available free of charge for download in the APP Store and Google Play Store.

The study complied with Resolution No. 466 of 2012 of the National Health Council, with opinion approved under No.4,132,385 and Certificate of Presentation for Ethical Assessment (CAAE) No.34338120,6,0000,8160. It is worth mention that all participants signed the Free and Informed Consent Form (FICF), which was accepted online.

■ RESULTS

The smartphone mobile application developed in this study was called ROBOVID, by a combination of the word robot that refers to technology, with the term COVID, the disease of the pandemic context. Therefore, the results will be presented according to the stages used for its construction and validation.

Survey of doubts from the population about COVID-19

A total of 228 adults aged between 18 and 73 years old, with an average of 32 years old, participated in this stage, with the majority being 179 (78.5%), female, and 130 (57.0%) single. Regarding the level of education, 107 (49.1%) reported incomplete higher education, followed by complete higher education, 89 (39.0%). As for the profession, the highest percentage was the nursing professionals with 60 (26.3%). In view of the processing of the corpus by the IRAMUTEQ software, through the methods described above, it was possible to reach the core of understanding of the text segments, which through the interpretive analysis in line with the best evidence related to the theme, it was possible to identify theoretical contents about COVID-19 that would compose the application.

Literature review

By surveying doubts presented by the population about COVID-19, an integrative literature review was carried out to support the creation of the application. The search resulted in the following distribution among the publications found in each informational resource: LILACS (n=02); MEDLINE (n=02); PubMed (n=16), totaling 20 publications. Next, the publications found were analyzed, then the duplicated manuscripts by title and abstract (n=9) were excluded. Afterwards, studies were excluded by reading each title, abstract and using the inclusion criteria. Thus, after reading and final evaluation, eight studies were included in the review.

Thus, with the intention of better ratify the findings and discuss them in a reasoned manner, through the convergence of subjects, the results were categorized into two units of analysis, namely: 1- Characteristics of the new coronavirus; 2- Promotion of acceptability, adherence, compliance with measures to prevention and control of COVID-19 in the population. In view of this, the information that made up the application was organized into topics that included guidelines on COVID-19, including: characteristics of the new coronavirus; transmission; diagnosis; prevention/protection; signs and symptoms; social isolation; use of mask; hands hygiene, products and surfaces; Groups of risk; medication use; and, vaccines.

It should be noted that the information was treated respecting the profile of the target audience (civil society), with language adaptation (colloquial). This treatment sought to select information aimed at health education, in order to facilitate the elucidation of doubts presented by the user in the face of COVID-19.

Construction of the mobile application

The mobile application was created through the Design Sprint methodology, designed by Google to establish methods and tools for the quick development of digital solutions that could generate a positive impact on users. The methodology was chosen because it is an agile and cheaper way to answer critical design questions, perform prototyping and test ideas. In this directive, a research was carried out on references, users and context that guided the development of ideas for the application's interface, which was designed through flowcharts and wireframes, which are prototypes used to test navigation, functionality, and usability.

With the wireframes approved, the development was started using the JavaScript language, through the multi-platform application development framework React Native, developed by Facebook. Thus, it was sought to develop applications for iOS and Android systems with a single code base, reducing cost, with a total of eight test versions of the application before sending the code for publication.

For data integration and data management, direct calls were used between the application and a spreadsheet hosted on Google Drive service, which can be filled and updated in real time with the application, for this, the Tabletop.js library was used, which allows this integration in a stable, agile, and free form.

The application was built with a simple, but attractive, and easy-to-use interface, with open user control functionality, which allows all civil society, interested in the subject, to have individualized access and quickly and securely obtain information about COVID-19. Thus, the application was called ROBOVID for mobile devices (smartphones), for online use, on IOS and Android platforms.

The application's home screen presents the information available in the form of "themes" on the bottom bar, which when clicking on the topic of interest, the user will be taken to the selected one, which presents the information in the form of questions, in addition to videos and pictures. The application also allows information and/or media (picture and video) of interest to be saved on the smartphone, and later shared.

In addition, ROBOVID contains a side menu to guide the use of the application through the browser with a description of how to use it, information about the project, the privacy policy, the term of use, contact us, in addition to the item "evaluate ROBOVID", space intended for evaluating the usability of the application through a form based on the System Usability Scale⁽¹⁰⁾ which includes items on ease and trust in the use of users, in addition to identifying inconsistencies, but that was not the object of analysis in this article.

Application validation by expert judges

The validation stage had the participation of 20 health professionals: 19 nurses (95.0%) and one physician (4.7%). From these, 12 (57.1%) worked as professors of higher education, 10 (43.4%) performed care activities and three (13.0%) worked as managers or supervisors, of which nine (39.1%) had more than ten years of experience. As for the complementary training, 14 (60.9%) were masters, six (26.0%) were doctors, all in the nursing area. Regarding the time of experience in the subject of COVID-19, it ranged from one year to one and a half years, with the highest index being the time of 16 months (30.4%).

Chart 1 presents the judges' answers regarding the content and appearance of the application and the CVI for the items according to domains. The overall CVI obtained for the five domains evaluated by the expert judges was 0.97% and the CVI of each item individually ranged between 0.90% and 1.00% for all domains, indicating relevance and pertinence of the educational material.

Domains	Strongly Disagree/ Somewhat Disagree	Somewhat agree/ Strongly agree	CVI
As for content			
The mobile application is easy to understand about the clarification of doubts about transmissibility, protective measures, clinical manifestations, social isolation and vaccines about COVID-19.	0	20	1.00
It is addressed information that may promote acceptability, adherence and compliance with COVID-19 prevention and control measures.	0	20	1.00

Chart 1 – Validation of the application by experts regarding domains, content, language, illustrations, presentation, and cultural adequacy. Rio das Ostras, Rio de Janeiro, Brazil, 2021

Domains	Strongly Disagree/ Somewhat Disagree	Somewhat agree/ Strongly agree	CVI
The application is clear regarding the specificities of COVID-19 regarding transmission, pre-existing health condition, transmission, severe acute respiratory syndrome, risk groups, lethality, among others.	0	20	1.00
The information contained in the application is scientifically accurate.	0	20	1.00
As for language			
Reading is appropriate to the reader's understanding.	0	20	1.00
The information is presented clearly.	0	20	1.00
Common vocabulary words or meaning for technical terms are used.	0	20	1.00
Learning is facilitated through thematic axes.	02	18	0.90
As for the illustrations			
The layout used in the application attracts the reader's attention and is in line with the COVID-19 theme.	02	18	0.90
Learning is facilitated through self-explanatory videos.	0	20	1.00
The videos are relevant to the understanding about COVID-19 by the target audience.	0	20	1.00
The videos are in adequate quantity.	01	19	0.95
As for presentation			
The distribution of information in the mobile application follows an order suitable for understanding on COVID-19.	0	20	1.00
The font size and type make the content in the mobile app easy to read.	02	18	0.90

Chart 1 – Cont.

Domains	Strongly Disagree/ Somewhat Disagree	Somewhat agree/ Strongly agree	CVI
The application is attractive to the general population	0	20	1.00
The application interface is attractive	01	19	0.95
The interface used in the application encourages reading and enables learning	01	19	0.95
As for cultural adequacy			
The application is culturally appropriate to the language and experience of the target audience	0	20	1.00
The mobile application presents culturally appropriate media to the target audience	0	20	1.00
Overall CVI	0.97		

Chart 1 – Cont.
Source: Research data, 2021.

It is noteworthy that although the CVI achieved was greater than 80%, the judges' suggestions were evaluated and accepted, when possible, as described in the next stage.

According to the analysis of the questionnaire based on the "ten golden rules" for use in health education, the application achieved a CVI of 100% in almost all items, except for

only items 3, 5 and 6 with a CVI of 95%, reaching an overall CVI of 98%. Thus, the experts considered the application to be easy to use, conducive to use, suitable for educational purposes and with evidence-based content. In addition, they considered that the use of multimedia was adequate, as shown in Chart 2.

Rules	Strongly disagree/ Somewhat disagree	Somewhat agree/ Strongly agree	CVI
1- Is the application content suitable for the educational purpose?	0	20	1.00
2- Is the application content based on evidence and not on opinions?	0	20	1.00
3- Does the application allow the use of hypermedia and hypertext to promote knowledge?	1	19	0.95
4- Does the application allow the use of hypermedia and hypertext to promote knowledge?	0	20	1.00

Chart 2 – Evaluation of the "ROBOVID" application regarding its adequacy for use in health education by expert judges on the COVID-19 theme. Rio das Ostras, Rio de Janeiro, Brazil, 2021

Rules	Strongly disagree/ Somewhat disagree	Somewhat agree/ Strongly agree	CVI
5- Is the use of multimedia in the application appropriate?	0	19	0.95
6- Does the application allow the reader to explore and interactively experience the clarification of doubts?	0	19	0.95
7- Does the application present the content aiming to stimulate the use of skills to resolve doubts?	0	20	1.00
8- Is the application easy to use, is its navigation appropriate?	0	20	1.00
9- Can the application be defined as a suitable tool for use due to the benefits provided?	0	20	1.00
10- Can the application be defined as a tool with low maintenance costs, allowing quick content updating?	0	20	1.00
Overall CVI	0.98		

Chart 2 – Cont.

Source: Research data, 2021.

Application adequacy after evaluation by the expert judges

After the evaluation among the judges, it was made a synthesis of the qualitative analysis of the recommendations made by the judges, as well as the due justification when a suggestion/recommendation cannot be accepted (Chart 3).

Indexing the application at the Play Store for Android and Apple Store for IOS.

Finally, in the sixth stage, after evaluating and responding to the judges’ suggestions, the “ROBOVID” application (Figure 1) for mobile devices was registered with the National Institute of Industrial Property (*Instituto Nacional de Propriedade Industrial - INPI*), under the number BR 512021001882-6 and made available free of charge for consultation accessing the

link for Android: https://drive.google.com/file/d/1_NhKOaX-Nn55RP7d1V9P60h6Klpbp21XC/view?usp=sharing and scanning the QR Code (Figure 2) for iOS devices.



Figure 2 – QR Code of the ROBOVID app for iOS devices.
Rio das Ostras, Rio de Janeiro, Brazil, 2021
Source: Research data, 2021.

Judges' suggestions accepted	
In the topic signs and symptoms - include post-covid symptoms, "Post-Covid Syndrome" and thrombotic syndrome	
In the topic "hand and surface hygiene" it should come just below prevention against coronavirus.	
In the topic masks, include information on the types of mask and their percentage of protection and a photo of surgical, homemade and N95 masks	
Include the topic on the different types of tests for the diagnosis of COVID 19	
Review the writing style, providing a colloquial language	
In the thematic axis "use of masks" I suggest to put one	
In the thematic axis vaccines include information on the immunization of newborns breastfed by mothers who have been vaccinated	
I suggest that more videos be inserted, helping with understanding	
Judges' suggestions accepted	Justification
Use of color between one topic and another.	When new categories were added, the entire application would have to be updated to define new colors and this would add cost.
The application interface could be more attractive and illustrative	The typography and the overall style of the application were studied, respecting interaction with the user.
The application interface could already have some information about COVID-19.	The App's interface invites you to explore it, for this reason you don't put all the information on a single screen, especially on the home screen.
I believe that reading would be more pleasant if the font size were a little larger	The font size respected the system standard, as defined by the good interaction practices of both Google and Apple. Twitter, Facebook, among others that use the same font size.
Promote interactivity with the illiterate and digitally illiterate public, where "ROBOVID" could answer questions	Excellent resource to improve the accessibility of the application, however this issue requires high financial resource.
Remove information about chloroquine and other medicines.	It was maintained given the possibility of harm to the population, due to the use of contraindicated medication in the treatment of COVID-19.

Chart 3 – Synthesis of the qualitative analysis of the changes suggested by the judges. Rio das Ostras, Rio de Janeiro, Brazil, 2021
 Source: Research data, 2021.

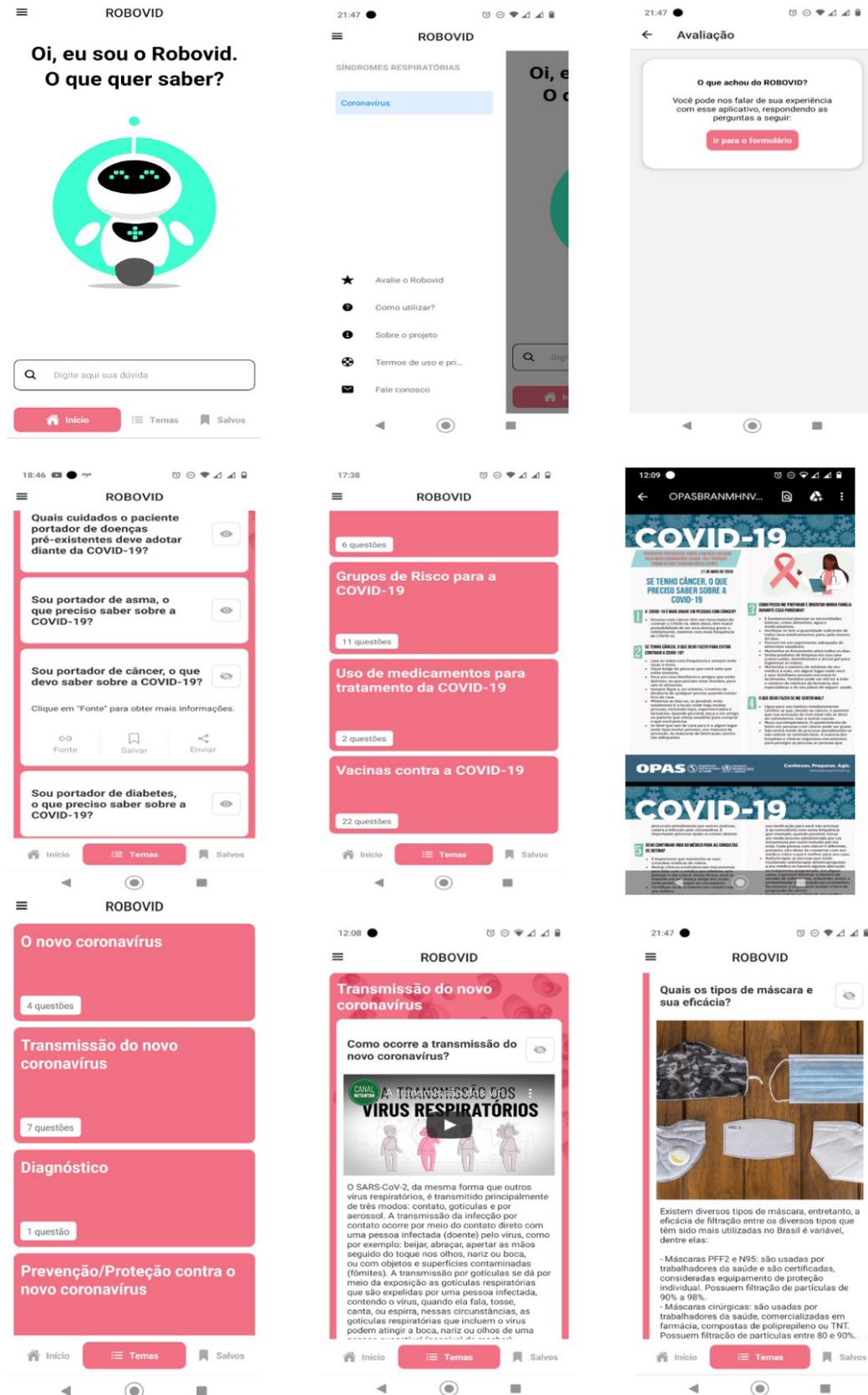


Figure 1 – Images from the ROBOVID application. Rio das Ostras, Rio de Janeiro, Brazil, 2021
Source: Research data, 2021.

■ DISCUSSION

The evaluation of the experts considered the application valid for the practice of health education to the population about COVID-19, therefore, with satisfactory levels in relation to the established domains regarding content, language, illustrations, presentation and cultural adequacy, as well as, compared to the “ten golden rules”, reaching individual and overall values (CVI) above the established criteria for the items, as recommended in the literature, demonstrating consistency in the responses and agreement between the evaluators⁽¹⁶⁾.

The innovation of the present study consisted of, besides developing an educational technology from the perspective of health professionals, mostly nurses, evaluating its adequacy in the teaching-learning process in health, using the “ten rules of another”⁽¹⁴⁾. In view of this, it is understood that the evaluation of information systems is a necessity for the developer, as a way of improving the quality of the information broadcasted, using more dynamic and consistent metrics for its evaluation. Thus, it is possible to measure their potential and deficiencies in the health education process⁽¹⁷⁾.

However, it is noteworthy that in the analysis by items of the instrument based on the “ten rules of another”, it was verified that three items concerning the use of multimedia obtained 95% CVI among the experts, and that despite having reached a value higher than that recommended by the literature, instigates, as a future perspective, updates in the application that allow improvements in functionality, such as the addition of new content/media.

However, it is worth emphasizing that this study brings the first description of an application for Brazilian mobile devices, developed by health professionals, for teaching-learning about COVID-19, evaluated in terms of face and content and use in health education, by a significant number of specialists in the area.

Thus, the construction and validation process was in line with the literature when it recommends that the elaboration of educational materials in health should use instruments that can respond to the construction of technologies that cover specific content, coherent structure and appropriate language in order to permeate learning⁽¹⁸⁾. In this current, ET means the set of technological resources developed from a scientific method, with the purpose of facilitating the daily lives of people in several fields of knowledge, considered relevant in terms of expanding the individual's knowledge, making them co-author of their own care process⁽¹⁹⁾.

To this end, it is necessary to ensure greater accuracy in content validation faced the proposed technologies, paying attention, among other aspects, to the selection of judges with professional and/or academic expertise regarding the

investigated object. Other aspects that must be considered when preparing a digital type ET, the organization and design, in addition to the amount of information contained in each screen, font size and type, and when applicable, pay attention to the choice of colors and contrasts between them, aiming at the achievement of learning by users⁽²⁰⁾. Items on which the ROBOVID application reached values above those recommended by the literature in the face of experts' evaluation.

Furthermore, mobile applications used in the health area are attractive, dynamic, easy to access and low cost, stimulating use and facilitating learning because it is a mobile platform in health educational support for civil society, being accessed from anywhere, anytime, this ET assumes significant relevance in terms of health education⁽³⁾, as it provides quick access to protocols, guidelines and recommendations from competent health bodies, aiming to contribute with information about symptoms, prevention, transmission, and the adoption of protective measures against COVID-19, which makes it relevant for nursing clinical practice, as it can enhance the reduction of demands on health services provided to the general population.

Understanding, therefore, that information technology is more than a facilitator for nurses, it presents itself as a critical component to transform nursing practice and education⁽²¹⁾, at the same time as it allows greater visibility of nursing professionals, autonomy and being protagonist in educational activities, anchored in a device at no cost to the user, with easy installation and portability.

In view of this, it is understood that mobile applications are configured as innovative digital technologies, as in addition to offering convenience and benefit to the population, and managers in access to knowledge, they become an attractive alternative for the continuing training of health professionals, by visual, tactile and hearing stimulation⁽³⁾. Especially in the face of the current pandemic moment, caused by a virus with great potential for propagation and complications to the health of individuals.

Thus, developing computational solutions in the form of mobile applications represents an effective means of making the tool available and reaching the desired target audience. However, in this respect, a study⁽³⁾ developed points out to a limited number of applications on COVID-19 from the perspective of health professionals, which confirms the relevance of the development of this ET and corroborates the WHO recommendation, when it states that initiatives aimed at educating the population constitute an important strategy for protection against COVID-19⁽²²⁾.

On this aspect, this research points out that digital information technologies in cyberspace have surpassed mass

communication broadcast on television and the press⁽⁴⁾. This fact can be observed in another research that found in cyberspace, in Brazil between 2013 and 2019, that the consultation of information through online media remained stable between 90% and 87%, but through social media it showed a large growth from 47% to 64%, and on the other hand, television had a decline from 75% to 73%, while the print media reduced its consumption by 50%. Thus, social media, online media and television are the most responsible for the consumption of news/information in Brazil⁽²³⁾.

In the meantime, research reports that in Brazil, coping with COVID-19 has been turbulent between political and health authorities, with constant divergences of official information, evidencing and even conditioning the population to resort to mass and digital media in the process of understanding, control and monitoring of events related to the pandemic⁽²⁴⁾, which reinforces the importance of ROBOVID.

In view of this, it is understood that the development of validation studies of ET, such as mobile applications for smartphones to control COVID-19, such as the present study, presents itself as an educational tool in health, as it enables the general population, to recognize early symptoms, reducing the occupation in health services by patients with mild symptoms, as well as guides on the recognition of complications of the disease, in addition to favor the adoption of preventive measures, corroborating the clinical practice of nursing with regard to control of this disease and its aggravations.

■ CONCLUSION

The construction of the ROBOVID application was based on the identification of the real doubts of the population about COVID-19, making it possible to consolidate it as a tool for the teaching-learning of individuals. The availability of these contents in a mobile application is configured as a facilitator of care and a transforming component for health education, regarding guidelines aimed at reducing transmission rates, complications, hospitalizations, and deaths from this condition.

Therefore, ROBOVID provides the expansion of knowledge in a simple way, with real-time access to reliable and updated information about COVID-19, in a safe and qualified way, besides being a voluntary and interactive activity, emerging as a differentiated proposal of access to knowledge in a digital and autonomous way.

As a limitation, it is understood that the construction of this ET does not have resources for use by people with disabilities and/or illiteracy, a fact that makes it impossible

for this segment to have access to information. Another limitation refers to the non-validation of this technology by the target audience, with a view to being quickly validated by this segment, which is configured as a proposal of continuity of the study. In the same side, the largest percentage of the population that participated in the stage of raising doubts about COVID-19 was composed mostly of health professionals, who have scientific knowledge and may have contributed to raise specific questions. Despite this selection bias, it was observed that even this group of the population had doubts about COVID-19, which were essential to point out the thematic contents to be addressed by the developed application.

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