Designing and Evaluating Malaria Educational Software for Vector Biology and Disease Control Students at Kerman University of Medical Sciences, Utilizing Smartphone Technology

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Abstract

Background: Malaria is among the most important parasitic diseases transmitted by mosquitoes. It is an important health problem in many countries, especially tropical and subtropical countries. This study aimed to design an educational software for malaria and evaluate the satisfaction level of the software application among students of Vector Biology and Control of Disease in Kerman University of Medical Sciences.

Methods: This descriptive cross-sectional study was conducted through the following two stages: 1. design and creation of educational software for Malaria and 2. Assessment of the level of satisfaction in the use of an electronic questionnaire among 75 students. Finally, the data were analyzed using SPSS software version 24.

Results: In the present study, educational software for malaria was designed and created. The results of the study showed that 53 (70.7%) of the participants were females and 22 (29.3%) of them were males. According to the results, 100% of users considered the software installation, size, and working speed easy and appropriate. 93.3% of students stated that images in the software could convey the necessary content. Also, 100% of users found it easy to use the software and communicate with the software developers. According to the results, more than 80% of students in this study preferred using this educational software to reading texts.

Conclusion: This educational software is recommended for use by the target community, experts in the healthcare sector, and students in medical universities, especially students of Vector Biology and Control of Diseases.

Introduction

Malaria is among the most important parasitic diseases that are transmitted by mosquitoes. It is one of the most important health problems in many countries, especially tropical and subtropical countries.[1] The World Health Organization (2021) reported 47,000 deaths related to malaria globally. Iran, one of the malaria-foci countries in the world, is currently implementing a malaria eradication program. However, malaria cases have also

been reported from local centers in Hormozgan, and Sistan and Baluchestan provinces.[2]

In recent years, the mass media and distance education, including mobile phones, have become educational tools that are often used to increase people's knowledge and awareness of malaria.[3] Today, mobile phones are among the most widely used and popular means of communication. The most important reasons for the popularity of mobile phones are the easy accessibility, the possibility of installing a variety of educational software and e-books, and easy transportation, among others.[4]

Mobile health, which is rapidly expanding in the field of e-health, means the use of mobile phones to compute and communicate technologies in healthcare and public health. Mobile health has enormous potential and beneficial effects on health and health services. Mobile health is designed to improve health care and services for health care providers.[5] Although there are very few studies in the field of mobile health in Iran, the use of mobile education in the field of infectious diseases has been observed.[6-8] The results of many studies have shown that the use of mobile education helps to manage diseases such as AIDS, tuberculosis, diabetes, and cerebral palsy.[9-12] In recent years, mobile technology has also been used to monitor malaria treatment.[13, 14] The aims of this study were to design an educational software for malaria and evaluate the satisfaction level of the software application among students of Vector Biology and Disease Control in Kerman University of Medical Sciences.

Methods

Study Design

This study was conducted in two stages. The first stage involved the design and creation of a malaria software, based on Android database. The second stage was a descriptive, cross-sectional study that was conducted from January to March 2020. This stage involved the use of a questionnaire to evaluate the satisfaction level of the educational software among students of Vector Biology and Disease Control in Kerman University of Medical Sciences, Iran.

Study Site

The study location was Kerman City, the capital of Kerman province, which can be found in the southeastern part of Iran (30.2839° N, 57.0834° E). The province is one of the malaria-endemic areas in the southeastern part of Iran (Figure 1).

First Stage

Raw design of mobile application: The Raw mobile application was first coded by programming experts. The required parts of this program were selected and approved by the project executors. In the mobile application, the sources of information were extracted from the latest guidelines of the W.H.O. and related articles. Information on the mobile application included the epidemiology of malaria, its vectors and behavior of different mosquito species, methods of diagnosis, and treatment. The information collected was entered into a raw format of the program, in batches which were separated from each other. Finally, the ultimate mobile app was created in the form of an installable Android application that could be used on mobile phones. The raw software was coded by an Android programmer. Android internal database was used for programming. The general view of the software was in XML language and the main language of the software was Java. This educational software was written with Android Studio software version 3.6. The Random Access Memory for this application was 4 and the storage space was 2 megabytes.

Second Stage

We conducted a descriptive, cross-sectional study to evaluate the satisfaction level of the educational software among students from the Vector Biology and
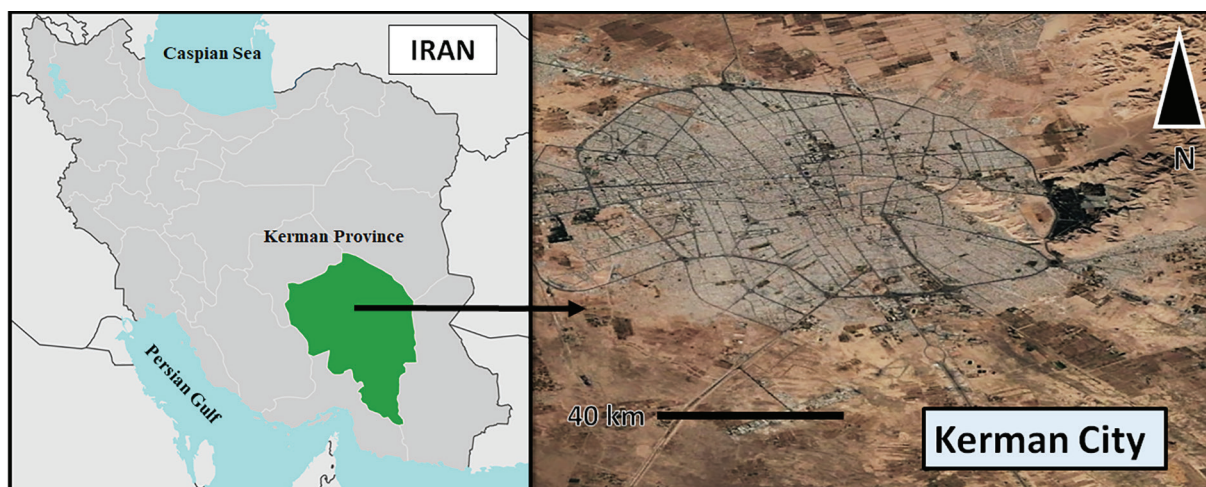

Figure 1: Location of the study areas in Kerman city, Southeast of Iran. (Images were provided through Google Earth Professional (https://www.google.com/earth/versions/#download-pro).

Disease Control Department of Kerman University of Medical Sciences in Iran. 87 students were studying in the Department of Vector Biology and Disease Control. All selected students had passed their malaria courses. Finally, 75 students were eligible for participation in the current study. All students who agreed to participate in this study and had already completed the questionnaire were enrolled in this survey, one week after installing the software application. 75 participants did not have similar experiences of using the newly developed mobile application. The data were collected using an electronic questionnaire. The questionnaire consisted of two sections. The first section contained questions for collecting the demographic data of participants. The second section had questions for assessing the satisfaction level of participants concerning the use of the educational software. The questionnaire by Alizadeh *et al.* (2021) was used with some modifications [7]. The validity of the questionnaire was confirmed by experts, and its reliability was confirmed by conducting a preliminary study with a Cronbach's alpha index of 0.8. All participants who agreed to take part as respondents in the study were informed about the need to sign written informed consents.

Statistical Analysis

Data analysis was performed through SPSS version 24, using descriptive statistics. The graph was made using the GraphPad Prism version 8.

Results

In the present study, software for the diagnosis, prevention, and treatment of malaria was developed on the mobile phone. The application was made for Android systems and could be installed on mobile phones. Figure 2 shows the final images displayed on the various software pages. A first click on the program icon displayed Kerman University of Medical Sciences as the first page at the upper part, alongside the name of the software "Diagnosis, prevention and treatment of malaria". After a few seconds, the second page (main menu) opened; it included the following five sections: table of contents, about us, contact us, signs, abbreviations, and references (Figure 2). By clicking on the "Precautions" section, one of the five major sections of the program, the important tips for accessing compounds, medicines and precautionary tips during spraying were provided. Finally, in this program, a section called "Contact us" was provided for receiving any criticisms or suggestions. The section connected users to various programs, so they could talk to the creators of the program.

While working with the software, a click on the "table of contents" opened the third page of the software. As shown in Figure 2, this page has different options. It was possible to click any option, and a page would be opened with written information and images about malaria vectors and malaria control methods in Iran and the rest of the world, agents, reservoirs, and methods for diagnosing malaria and resistance of vectors (Figure 3).

The results of this study showed that 53 (70.7%) student participants were females and 22 (29.3%) were males. The number of users (in percentages) who answered various questions in the questionnaire about the mobile educational software are presented in Table 1. According to the results, 100% of users said the software was easy to install. Also, the size and speed of working with the software were appropriate.
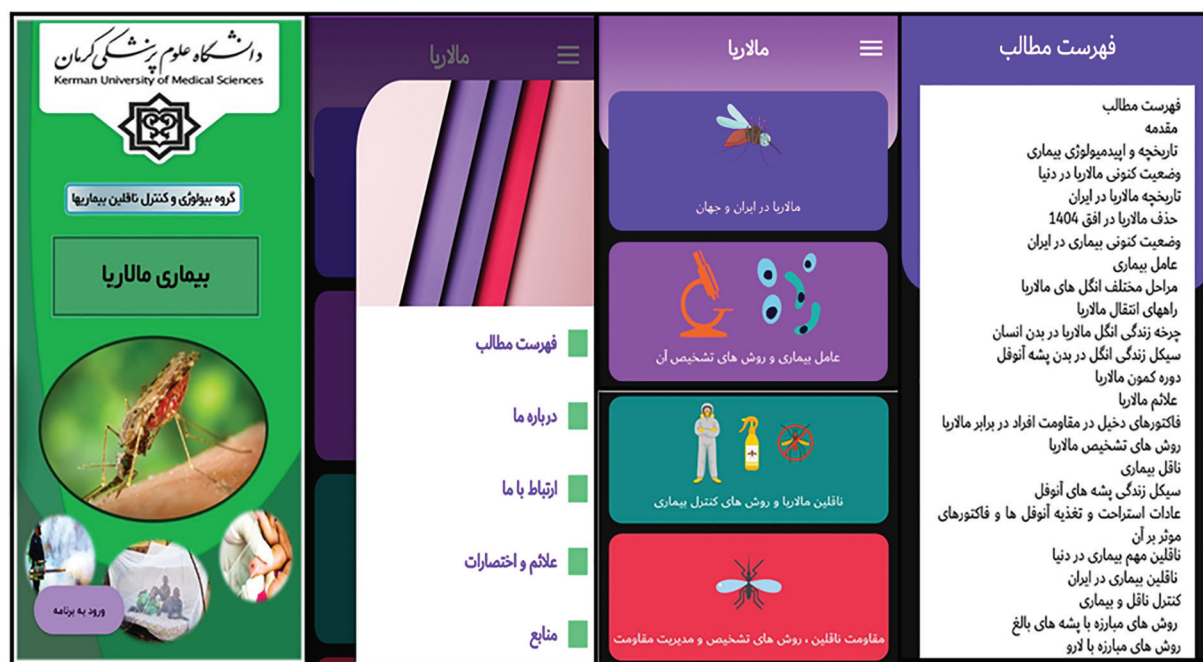

Figure 2: View of the main pages in the software (The figure is original).

Figure 3: View of secondary pages of the software (The figure is original).

Table 1: Answers given by users of the studied software about their levels of satisfaction

Questions	Yes Number (%)	No Number (%)	Somewhat Number (%)
1. Was the software installation on the mobile easy?	75 (100)	-	-
2. Was the software size appropriate?	75 (100)	-	-
3. Did the software images convey the necessary content to you?	70 (93.3)	-	5 (6.7)
4. Were the brightness, color, size and font of the content in the software appropriate?	63 (84)	-	12 (16)
5. Was it easy to understand the scientific content of the software?	75 (100)	-	-
6. Was it easy to use the software?	75 (100)	-	-
7. When opening the next pages or returning to the previous ones, was the speed of working with the software appropriate?	75 (100)	-	-
8. Was the information provided in the software up to date?	75 (100)	-	-
9. Was it easy to communicate with software developers?	75 (100)	-	-

Generally, 93.3% of students stated that images in the software were appropriate to convey the necessary content. Also, 100% of users found it easy to use the software in different ways, including contacting its developers for any feedback. Users suggested adding videos on malaria and designing software that could be installed on iOS. Also, the software was not installed on the mobile phones of fewer than 4 users because the Android versions of their phones did not support the installation of the software.

Figure 4 shows the percentages of user responses to the question of this study, "How much do you prefer using this educational software to reading texts?" Based on the results, more than 80% of students in this study preferred using this educational software to reading texts.

Discussion

In this study, educational software for malaria diagnosis, prevention, and treatment was designed and assessed.
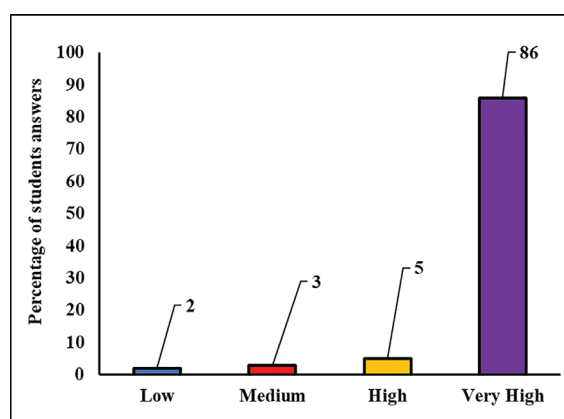

Figure 4: Percentage of students' answers about their preferences for using the software or reading texts

The study was conducted on undergraduate students of Vector Biology major because of the importance of malaria in that field of study. The results of this study showed that users were satisfied with the use of the educational software. The results showed that 100% of the students found the software installation easy, and

the size and speed of working with it were appropriate; 93.3% of them stated that the images in the software could convey the necessary content.

Till now, several educational software in the field of infectious diseases, non-infectious diseases and health pests, AIDS,[11] diabetes,[9] Tuberculosis,[12] cerebral palsy,[10] familiarity with pests of medical importance,[8] identification and control of bed bugs,[6] identification and treatment of head lice[7] have been developed in Iran. The results of the present study show a very high level of user satisfaction with mobile software. The results of a study by Alizadeh *et al.* in 2019 showed that the level of user satisfaction with the software, based on bed bug mobile phone, was more than 80%.[6] Also, the results of another study by Alizadeh *et al.* in 2020 showed that users reported more than 78% of the effect of software educational information on the prevention and control of lice infection.[7] Therefore, these results are consistent with those of the present study. In one study, the results of evaluation of the satisfaction level of the users of the educational software "identification and control of health pests" among students of Vector Biology and Control as the target group showed that students who participated in the evaluation of graphic capabilities (81.52%) and educational capabilities (81.48%) were satisfied. Also, more than 60% of the students preferred having the information on health pests in software to books.[8] According to the results of the present study, more than 80% of students preferred having information on this educational software to reading texts.

The results of a study by Safdari *et al.* in 1397 showed that users were satisfied with their designed software for Tuberculosis,[12] which is consistent with the results of the present study. Also, a study by Ghazi Saeedi *et al.* in 2015 showed that over 82% of caregivers of children with cerebral palsy were satisfied with the use of the software for their studies and mentioned that it had met their information needs.[10] These results are in line with those of the present study. The results of Nasiri *et al.* in 2014 showed that education through mobile phones promoted learning and remembering among medical students, and the effect was more on remembering.[15] Our study results show that students preferred text-based learning to texts.

One of the limitations of this study is that, apart from mobile phones with Android operating systems, those with iOS operating systems were unable to download the software. Therefore, it is suggested that in future studies, other researchers in this field could design educational software in such a way that it can be run on all operating systems. Additionally, the software application cannot be supported by mobile phones with Android versions that are less than 4. Also, the present content is in the Persian language. Therefore, only people who are proficient in the Persian language may be able to use it easily.

Conclusion

This mobile application allows users to have information such as identification of malaria parasites and vectors, ways of prevention and control of malaria in a completely professional and specialized way, without using the Internet. The use of this mobile application could help students gain full knowledge of the epidemiology of malaria, its agents, behavior of various vector species, methods of diagnosis and treatment, as well as the most up-to-date methods of controlling malaria vectors. This will bring more Biology and Vector Control students in line with the national malaria eradication programs. The use of this software can be a step towards raising the level of awareness of users in the direction of the malaria elimination program in Iran. Therefore, designing and using educational software may be a new step for improving the quality and speed of education. Hence, the software is recommended for use by the target community and students of medical universities in Iran.

Ethical Consideration

The current study received ethical approval from the Ethics Committee of the National Center for Strategic Research in Medical Education (NASR). All participants consented to be respondents in the study. Results of this study were presented to both NASR and the Department of Vector Biology and Control, in the School of Public Health, Kerman University of Medical Sciences.

Acknowledgment

Authors' Contribution

IA and SY drafted the manuscript with oversight from MAG. GNG analyzed data. MAG, LSH, FS, and AAA provided critical intellectual feedback and assisted in revising the manuscript. All authors read and approved the final manuscript.

Funding

Conflict of Interest: None declared.

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