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Design and evaluation of a mobile application for educational purposes and facilitating scientific literature search for students and researchers

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Abstract

Background One of the needs of students and researchers is access to databases and up-to-date knowledge. Given the lack of knowledge of students in using databases and various limitations (lack of access, economic, sanctions, internet, etc.), and the spread of mobile phone use, this study aimed to design and evaluate a mobile application for offline searching of articles and journals in the field of medical sciences.

Methods In this study, First, a checklist of important items was prepared using a review of the literature and was given to 24 experts (Medical library and information sciences, Health information management) and 16 students for validation. Based on this, scientific articles from the universities of medical sciences in Isfahan, Kashan, Shahrekord, and Yazd were collected from Web of Science, Scopus, and PubMed databases, and the application was designed. Finally, the usability of the application was evaluated using the QUIS questionnaire.

Results According to the participants, a total of 14 items for articles (Article Title, Author Full Name, Abstract, Keywords, Publication Date, Volume, Issue, Start Page, End Page, Type, Journal Name, etc.), 16 items for journals (Journal Title, ISSN, Subject Categories, Publisher/Holder, etc.), and 10 items for technical capabilities (search of Title, abstract, keyword, etc.) were considered necessary. The overall results of the usability evaluation were reported as "good" in all groups of faculty (7.57), students (6.94) and librarians (6.8). Only librarians at Tehran University of Medical Sciences rated the application as "average" in the "Terminology and System Information" Sect. (6 ± 1.77).

Conclusions The mobile application improves the education and access of researchers to articles and journals. Given the advantages of the application, its use leads to greater satisfaction among users.

Keywords Mobile applications, Program evaluation, Education, User-Centered design

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Introduction

Given the unprecedented growth of scientific literature, the need for students and faculty to conduct comprehensive and efficient searches while saving time and money is of paramount importance. The use of computers, electronic publishing, and information and communication technology (ICT) has led to the development of digital libraries due to advantages such as the speed of information transfer, cost-effectiveness of electronic access methods, search accuracy, ease of use, and user-friendliness [1].

With the increasing use of new technologies, smartphones are being used by a variety of users (faculty, students, healthcare professionals, and librarians) in a wide range of healthcare fields [2–4]. Therefore, academic institutions are trying to better support user needs by providing access to library resources and services [5, 6]. Although a lack of awareness and access barriers may hinder their ability to meet these needs effectively, many libraries and academic institutions have developed mobile applications to provide better services to their users, taking advantage of the features of mobile phones such as portability, easy access, and reduced costs, as a means to help develop and enhance education [7–9].

The increase in databases and journals has made it difficult for students and researchers to find relevant information. Many tools are designed on the basis of computer systems that have their own limitations (such as accessibility, cost, ease of use, etc.) for which mobile phones can be a solution. Using mobile phones, in addition to facilitating the search process, can provide educational resources tailored to the needs of students with greater ease. It can also expand learning and better manage users' access to scientific materials at any time and place.

In Boruff and Storie's study [10] the respondents used mobile applications for searching articles (46.5%) and reading articles (50.2%). The results of Boller [11] and Hinze et al.'s [12] study showed that the use of mobile applications can encourage users to read and access safe and educational resources. Also, due to its ease of access, low cost and the possibility of its development is being developed to provide better services to customers.

The results of Jari et al.'s [13] study showed that targeted training, providing simple and practical educational content, and encouraging users to use it effectively even in environments with limited technology, can lead to increased work performance, reduced errors, and reduced information confusion. The results of the study Zolfaqari et al. [14] showed that individual, technical, and legal-ethical factors were identified as key determinants of mHealth adoption, and the use of the application can be effective as an educational tool aimed at increasing access to scientific information, especially for students

and researchers in underserved areas. Zhao et al.'s [15] study demonstrated that the continuous use of mobile library applications (m-library) is depends on factors such as perceived usefulness and user satisfaction. Moreover, three components: information quality, system quality, and service quality significantly influence user satisfaction. Torres-Pérez et al. [16] conducted a study to assess the adoption level and quality of services (14 indicators) of mobile access to libraries in the world's top universities. Results showed a very high level of accessibility through web or mobile applications. However, the use of mobile applications was quite low (17%), and only half of the applications met at least 7 of the indicators. In contrast, the web mobile accessibility showed a significant improvement (74.3%).

According to the results of the studies, the use of mobile phones in various research fields (reading and searching for articles, etc.) is increasing, and mobile phones have even encouraged more users to do this. This study was conducted to provide convenience to users and increase access to articles for users in Iran. On the other hand, in other studies, the use of mobile phone applications is lower compared to other methods of accessing articles. This rate depends on various factors such as the quality of services and information, satisfaction, etc. In this regard, this study, by assessing the needs of various stakeholders, has tried to examine the usability and satisfaction of the application in addition to designing the application based on the needs of users.

Today, the production and use of new technology is increasing. On the one hand, with the expansion of science and information, a large amount of knowledge is being published annually in many articles in various journals. Unfortunately, faculty and researchers in Iran have limited access to online databases. Given Iran's economic conditions and financial and economic sanctions, there is no sustainable source of funding for researchers, especially students, to cover costs, including the possibility of purchasing database subscriptions and applications. On the other hand, with the emergence and spread of the COVID-19 virus, University activities were held virtually. Due to the lack of proper infrastructure and financial problems, the quality of education for students and researchers decreased significantly. Therefore, universities tried to provide some of their services to users in the form of mobile applications. Given the growth in the use of mobile applications, several universities of medical sciences in Iran tried to provide researchers with training in efficient and effective search for articles and journals, and access to reliable and reliable articles and information in the context of a native mobile application on a shared basis. The use of online databases and the use of modern search engines with artificial intelligence-based tools has led to very high effectiveness and efficiency.

However, these artificial intelligence tools require a lot of access to data and a lot of server-side processing, which conflicts with the limitations of developing countries like Iran, which aim to access information offline at the lowest cost. Therefore, This application also facilitates the research process and the presentation of information in scientific articles and journals.

The primary educational objective of the application is to enhance information literacy among students and novice researchers—specifically their ability to search, identify, and retrieve relevant scientific literature from reputable medical databases. The application serves as a self-directed learning tool, aiming to improve users' competence in key areas such as using Boolean operators, interpreting bibliographic data, evaluating journal impact metrics, and differentiating article types. This educational focus responds directly to the findings of our initial needs assessment, which revealed a lack of formal training in literature searching and database use among students in Iranian medical universities.

Method

This cross-sectional study was conducted in 2024. This research includes needs assessment, information gathering, design, implementation, and evaluation of the application that involves three main phases:

Phase 1: identifying and validating information elements

To determine the content, features, and functionalities of the application, we reviewed specialized medical databases and library guidelines. The findings were analyzed with research Consultant, considering the needs of Iranian medical university users. A checklist was developed based on this analysis, divided into three sections: article search fields (40 items), journal search fields (23 items), and technical capabilities (16 items)(Supplementary 1). Experts in health information management, medical informatics, and librarianship assessed the checklist's content and face validity. Its reliability was confirmed using Cronbach's alpha, which was calculated at 0.89 based on the ratings of experts.

To determine the necessity of the items obtained, the checklist was provided to 40 participants, including 24 specialists (Medical Library and information sciences, Health Information Management with at least 3 years of work experience) and 16 students. Sampling in each group was done randomly. The Participants rated each item on a 5-point Likert scale (very little=1, little=2, moderate=3, high=4 and very high=5). The acceptance or rejection of the proposed items was such that the minimum average score for accepting each component was 3.75 points and components with an average score of less than 2.5 were also removed from the application program. Elements whose average score was between 2.5

and 3.75 were reviewed by the research team and a decision was made(consensus and work experience among the research team, the relationship to the objectives,).

Phase 2: data collection and preparation

The population of this stage includes all research articles in 3 databases (Scopus, Web of Science, and PubMed). Iran is divided into 10 educational regions, of which Region 7 was randomly selected, which includes four universities of medical sciences: Isfahan, Kashan, Shahrekord, and Yazd. All articles from these universities were included in the selected database. In this stage, according to the confirmed cases from the previous stage, information on scientific articles from four universities was collected as a pilot. To ensure maximum information and reduce errors, we searched for articles using the "Affiliation" section in Scopus, Web of Science, and PubMed databases. Then we prepared a list of medical articles and journals based on the findings of the previous stage. In this study, due to problems of financial sanctions, lack of financial support, infrastructure limitations and internet speed, it was not possible to use API. Therefore, We had to manually download the files from the database and used similarity techniques and Excel software to remove duplicate entries. The number of articles obtained for University: Isfahan (31550), Kashan(12940), Yazd(8699) and Shahrekord (6557). then finally, a bibliographic database of information sources was created based on the identified list of articles and journals. Which was added to the application database.

It should be noted that all types of articles (original, review, clinical, etc.) available in the application are from 4 selected universities in three databases: Scopus, Web of Science, and PubMed, and only bibliographic information of the articles was collected. The full text content is not available in the offline database, but it allows users to access it using DOI while online. This approach supports the ability to search for articles offline without violating the publisher's copyright usage and database usage policies.

Phase 3: application design and evaluation

An offline search-enabled Android application was developed in this phase. Given Android's utilization in more Iranian smartphones, we selected the Basic4Android environment and Visual Basic programming language for development.

During development, one of the main challenges was optimizing offline search in the database. Given the significant number of articles and journals collected in the previous stage, an efficient database management system was needed. SQLite was chosen due to its speed and suitability. Also, to avoid slow search, an advanced search was tried to be used that loads fewer fields at runtime.

Another challenge was the issue of compatibility or different versions of Android, which was enabled by testing on different versions of Android by solving the issue of user interface inconsistencies on Android version 9 and above. Another problem was the issue of hardware and processor power of different devices, which caused problems in displaying search results, especially when there were many results, which was also solved by managing the information display and dividing the display of results (50 or 100 results) on each page.

The user interface (UI) of the app, including the logo, icons, menus, and overall layout, was designed based on feedback from health information management and medical informatics experts. A prototype was developed and evaluated by the research team. Issues related to search accuracy and navigation, and the user interface (UI) were resolved in consultation with the research team and search filters were refined. Any issues related to installation, performance, and other aspects were reviewed. The final version was then produced. After obtaining informed consent, the application was installed on participants' smartphones, and they received training on how to use it. Once participants were confident in their abilities, were asked to use the application for two weeks and then participate in a usability evaluation. In this

study, two sampling stages were used. First, two universities were randomly selected from all universities in Iran. Then, to increase and improve the quality of the results, a stratified sampling method was used in the selected university. The strata in each university included faculty, students, and librarians. The sample size was calculated based on the Cochran formula (Formula 1) for each class, and based on that, samples were randomly selected. where Z is the Z-value (1.96 for 95% confidence), p is the estimated proportion (0.5), and e is the margin of error (0.05).

The Questionnaire for User Interface Satisfaction (QUIS) version 5.5 was used to assess usability [17, 18]. The questionnaire consists of sections on "Overall Reactions To The Software, Screen, Terminology, And System Information, Learning, System Capabilities". Questions were answered on a 10-point Likert scale (0(low)–9(high)). Results were categorized into three levels based on the mean score: 0–3 (poor), 3.1–6 (average), and 6.1–9 (good). Data analysis was conducted using SPSS version 19, with descriptive statistics (mean and standard deviation).

$$n = \frac{\left(Z \frac{\alpha}{2} \times S^2 \right)}{d^2}$$

Formula 1: Cochran's Sample Size Formula.

Table 1 Suggested information items for the application in phase 1

domains	items
Journals	First author, Article title, Author full name, Abstract, Article's keywords, article type, Author(s) ID, Author(s) Email, authors' affiliation, journal name, journal Index, Researcher IDs, ORCIDs, Funding Orgs, Funding Name, Preferred, Funding Text, Cited References, Cited Reference Count, Times Cited, WoS Core, Times Cited All Databases, Publisher, Publisher City, Publisher City, Publisher Address, Create Date, eISSN, Journal Abbreviation, Publication Date, Publication Year, Article Number, Volume, Issue, Start Page, End Page, DOI, DOI Link, Supplement, Publication.
Articles	Journal Title, Type, ISSN/ISBN, Indexed, Subject Categories, access status, Publisher/Holder, IF, IF (5 Year), Eigen Factor, JCI, Best Quartile (JCR), Immediacy, Cited Half-life, JCR (ISI) Rankings, Scopus Rankings, Eigen Factor, Cite Score, Best Quartile(Scopus), H-Index, SJR, SNIP, Primary URL.
Technical Capabilities	Title search, abstract search, keyword search, article search by (year, city, and university), author search by (name, year, and city), journal search (by name and ISSN), clear the content of the search page, personalize, change color, Change font size, categorize the results, Support contact, program usage guide, online search capability, Quick access menus, Suggestions of users.

ID identification ORCID Open Researcher and Contributor ID, WoS Web of Science, eISSN electronic International Standard Serial Number, DOI Digital Object Identifier, ISBN International Standard Book Number, IF impact factor, JCR Journal Citation Reports, SJR SCImago Journal Rank, SNIP Source Normalized Impact per Paper, URL Uniform Resource Locator

Results

In the initial phase, the content acquired from specialized databases and guidelines comprised 79 primary items that were categorized into three main domains: journals, articles, and technical capabilities of the application (Table 1).

The checklist was randomly distributed to 40 participants, including 24 experts and 16 students (Table 2). Among the experts, males constituted the majority (over 62%), with the largest age group being 48–57 years old (33%). Most experts held a degree in Health Information Management (62.5%) and had work experience ranging from 5 to 14 years (41.7%). In the student group, females were the majority of participants gender (62.5%). Additionally, most student participants were aged 30–35 (37.5%) and were pursuing a Master's degree (50%).

Based on the participant's viewpoint, These items were acceptable:

Articles(14 items): Article Title, Author's Full Name, Abstract, Article's Keywords, Publication Date, Volume, Issue, Start Page, End Page, Article Type, Journal Name, Journal Index, Authors' Affiliation, and DOI. Journals (16 items): Journal Title, ISSN, Subject Categories, Publisher/Holder, Indexed, access status, IE, IF (5 Year), Best Quartile (JCR), Cite Score, Best Quartile(Scopus), Eigen

Table 2 Demographic characteristics of participants for validation the information items in phase 1

participants	Variable	Category	N (%)
Students	Gender	Female	10 (62.5)
		Male	6 (37.5)
	Age	18-23 years	4(25%)
		24-29 years	5(31.25)
		30-35 years	6(37.5)
		Above 35 years	1(6.25)
	Education level	Bachelor's degree	2(12.5)
		Master's degree	8(50)
		Clinical sciences (medicine, pharmacy, dentistry)	3(18.75)
		Specialized doctorate and above	3(18.75)
Experts	Gender	Male	15(62.5)
		Female	9(37.5)
	Age	28-37	5(20.8)
		38-47	7(29.1)
		48-57	8(33.4)
		Above 57 years	4(16.7)
		Specialty	Medical Library and Information Sciences
		Information Management	15(62.5)
	Work Experience	Less than 5 years	3(12.5)
		5-14 years	10(41.7)
		15-24 years	6(25)
		More than 24 years	5(20.8)
	Scientific Rank	Coach	4(16.8)
		Assistant Professor	7(29.1)
		Associate Professor	6(25)
Professor		7(29.1)	

Factor, H-Index, SJR, SNIP, and Primary URL. Technical Capabilities: All items were finalized and approved.

Subsequently, data from all four universities was collected, focusing on Articles and journals indexed in Scopus, PubMed, and Web of Science. After cleaning and removing duplicates, the data was stored in an SQLite database for use in the application. The mobile application was developed using Java programming language in the Basic4Android environment, based on the Android operating system. The application included several training sections for users. It offered search capabilities for article titles and abstracts, allowing users to combine keywords using Boolean operators(AND, OR, NOT). Advanced search and customization options were also provided, enabling users to combine search terms with publication year and university. Additionally, the application allowed searching for authors by name, year, and city, as well as searching for journals by name. Different parts of the application are displayed in Fig. 1.

After final approval of the application by the research team, participants provided informed consent and the

application was installed on their mobile devices. The study population for the evaluation was initially randomly selected from Tehran University of Medical Sciences (One of the best universities) and Iran University of Medical Sciences (one of Iran's largest medical universities) was added to the study population, and participants were categorized into three Stratified: Faculty, Librarians, and Students. Stratified sampling was employed to select a representative sample.Iran University of Medical Sciences had approximately 1114 faculty, 9950 students, and 42 librarians, while Tehran University had 1984 faculty, 17,926 students, and 58 librarians.

Using the Cochran formula, the number of samples in each Stratified was calculated separately for each university. Thus, in the faculty Stratified, 286 and 322 were obtained and in the students Stratified, 370 and 376 were obtained at Iran and Tehran Universities, respectively.

To ensure reliability, an additional 17 and 18 participants were added to the faculty and student groups, respectively. Participants were selected randomly within each stratum. Given the small number and specialized skills of librarians, a census was conducted for this group (Tables 3 and 4, and 5). It is worth noting that due to incomplete questionnaires and the inability to replace participants, the participation rates for librarians at Iran and Tehran Universities of Medical Sciences were 66.7% (28 out of 42) and 68.9% (40 out of 58), respectively.

After users had used the application for two weeks, they were asked to participate in a usability evaluation using a questionnaire. The results of this evaluation are presented in Table 6.

The results showed that the mean usability scores based on the questionnaire were 7.57 for faculty, 6.94 for students, and 6.8 for librarians, indicating a “good” level of usability. However, librarians from Tehran University of Medical Sciences rated the “Terminology and System Information” section as “average,” while all other participants rated all sections as “good.” Across both universities, faculty and librarians gave the highest mean scores to the “Screen” section, whereas students rated the “Overall Reactions To The Software” highest. Conversely, both faculty and students gave the lowest mean scores to the “Overall reaction to the software”section, while librarians rated the “Terminology And System Information” section the lowest.

The qualitative feedback from the study participants includes the following: Users appreciated the training on how to search the database, but suggested using more video tutorials and visual resourcesand making the learning resources more diverse, understandable, and simple. Students were satisfied with offline access to articles and the speed of searching, but some of them wanted more functionality and customization. Librarians found the search to be accurate, but the “System Terms and

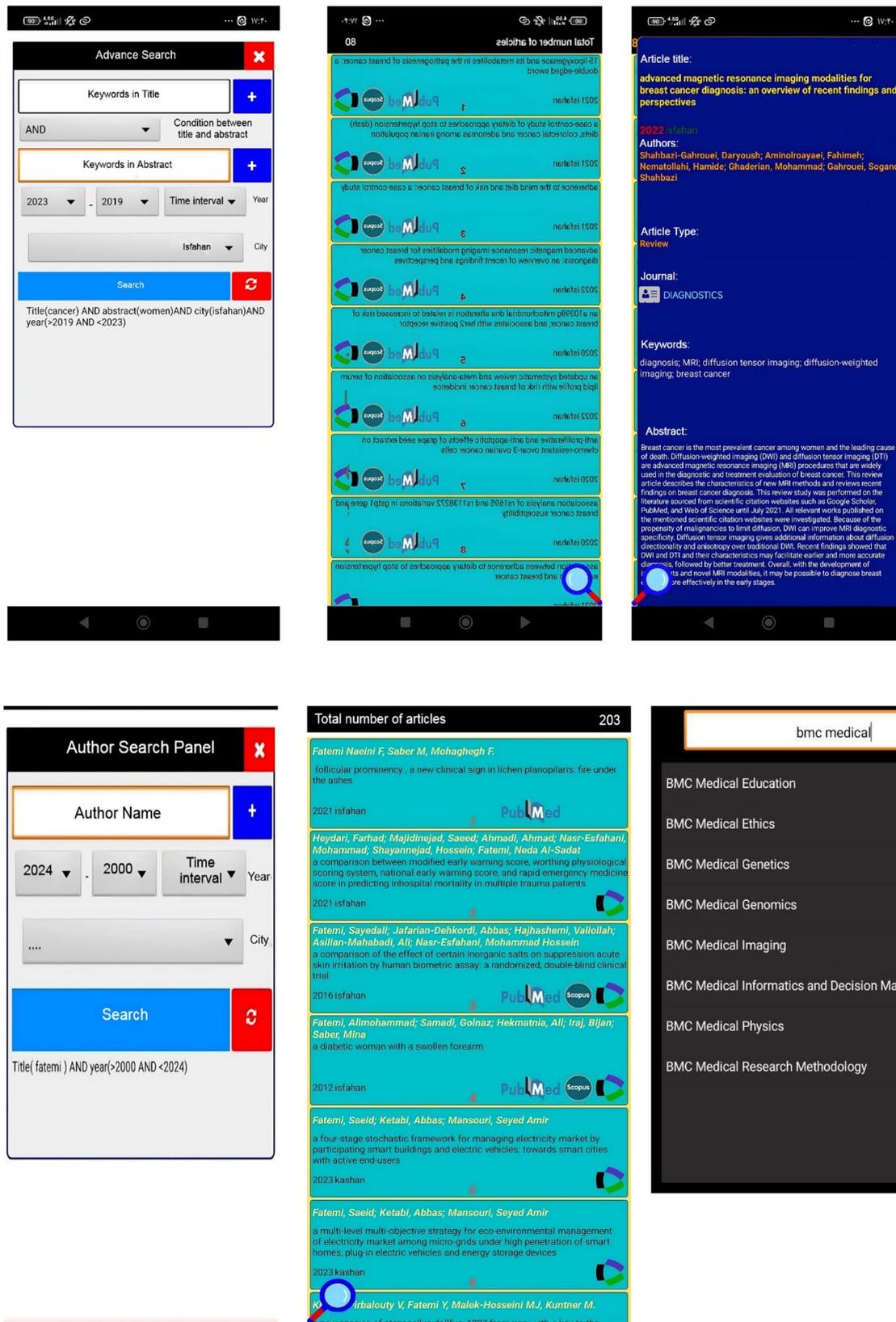


Fig. 1 Multiple screenshots of the application interface

Table 3 Demographic characteristics of faculty participants in the evaluation (Phase 3)

Variable			Iran University of Medical Sciences (N= 303)	Tehran University of Medical Sciences (N= 339)
			N (%)	N (%)
Faculty	Age	28–37	67(22.1)	48(14.2)
		38–47	146(48.2)	171(50.4)
		48–57	58(19.1)	66(19.5)
		More than 57 years	32(10.6)	54(15.9)
	Gender	Male	166(55)	186(54.9)
		Female	137(45)	153(45.1)
	Work Experience	Less than 5 years	75(24.8)	75(22.1)
		5–14	131(43.2)	107(31.6)
		15–24	68(22.4)	84(24.8)
		More than 24 years	29(9.6)	73(21.5)
	Scientific Rank	Coach	5(1.6)	11(3.2)
		Assistant Professor	142(46.9)	136(40.1)
		Associate Professor	105(34.7)	84(24.8)
		Professor	51(16.8)	108(31.9)

Table 4 Demographic characteristics of librarians participants in evaluation (Phase 3)

Variable			Iran University of Medical Sciences N= 28	Tehran University of Medical Sciences N= 40
			N (%)	N (%)
Librarian	Age	Less than 30 years	5(17.9)	6(15)
		30–39	13(46.4)	16(40)
		40–49	6(21.4)	11(27.5)
		More than 49 years	4(14.3)	7(17.5)
	Gender	Male	9(32.1)	16(40)
		Female	19(67.9)	24(60)
	Work Experience	Less than 5 years	3(10.7)	5(12.5)
		5–14	11(39.3)	12(30)
		15–24	10(35.7)	14(35)
		More than 24 years	4(14.3)	9(22.5)
	Degree	Diploma and below	2(7.1)	1(2.5)
		post graduate	2(7.1)	5(12.5)
Bachelor's degree		7(25)	12(30)	
Masters and above		17(60.8)	22(55)	

Information” section believed that standard library and librarianship terms were less respected, and their satisfaction with this section was lower than with other sections. Various users also suggested adding features and functions such as periodic updates, search history, and the ability to request advice, which would be very useful in creating future versions.

Discussion

This study designed and evaluated a mobile application for offline access to medical science articles and journals for Iranian researchers and students.

In this study, A notable discrepancy was found among the three groups regarding the lowest-rated features, which can be justified according to the type of function and different needs of each group. Faculty members assigned the lowest average rating to the “learning”

Given their teaching roles and students’ learning needs, faculty members expressed a desire for the application to facilitate effective student learning. However, the application’s main focus is on providing accurate and easy article search capabilities. Students, on the other hand, gave the lowest rating to the “Screen,” which is understandable given their extensive use of various applications and their tendency to make comparisons and better visuals and customization. Since most users of this application are students and researchers, future versions should prioritize these areas to enhance user satisfaction. Librarians, conversely, awarded the lowest rating to the “Terminology and System Information “. This can be attributed to their specialized knowledge and experience with other professional library systems, which may set higher expectations for precise language and system feedback.

Table 5 Demographic characteristics of students participants in evaluation (Phase 3)

VARIABLE		Iran University of Medical Sciences N= 388 N (%)	Tehran University of Medical Sciences N= 394 N (%)
Student	Age	18–23	214(55.1)
		24–29	101(26.1)
		30–35	45(11.6)
		More than 35 years	28(7.2)
	Gender	Male	151(38.9)
		Female	237(61.1)
	Degree currently studying	Bachelor's degree	152(39.2)
		Master's degree	61(15.7)
		Clinical sciences (medicine, pharmacy, dentistry)	156(40.2)
		Specialized doctorate and above	19(4.9)
		192(48.7)	
		144(36.6)	
		33(8.4)	
		25(6.3)	
		175(44.4)	
		219(55.6)	
		177(44.9)	
		52(13.2)	
		148(37.6)	
		17(4.3)	

Offline access was a prominent strength as students emphasized the value of accessing journal metadata without the Internet, especially in Iran given the sanctions and cost constraints. A review of the literature by the research team revealed an absence of similar applications in Iran and more studies [19–22]. have investigated systems, digital libraries, and their challenges.

This study aimed to address these challenges by developing a mobile application focused on education, accessing articles and journals, and overcoming infrastructure and financial constraints, that have also been highlighted in previous research. The findings of Hajiahmadi and Norouzi [23] indicated that digital libraries in Iran are not in good condition in technology. Therefore, it is necessary to identify and address weaknesses by considering existing criteria and components and their relative

importance. This would improve the design and development of systems and their services. The results of Malekmohammadi Zeinolabedini's research [24] showed that designers of library software need to reconsider their designs based on the needs of librarians. Overall, studies have indicated that digital libraries in Iran face numerous challenges related to education, technology, needs assessment, and design.

Our findings are consistent with and support recent studies that highlight the usefulness of new educational tools—particularly virtual training—when facing infrastructure-related barriers. The results of the study by Fathi et al. [25] and the study by Khosravi et al. [26] showed that holding virtual workshops and classes leads to improved performance and increased academic levels of students. Participants also stated that these trainings changed their attitude and better understanding, ease, and usefulness of the materials and were generally satisfied with the workshops and training. The results of the study by Roozbehani et al. [27] and Karimi Rouzbahani et al. [28] showed that health education via SMS, as a simple, low-cost and accessible method, had a significant effectiveness in improving adherence to treatment and metabolic control in diabetic patients. Attention has also been paid to the importance of providing structured content and personalized training through mobile technologies. Although these two studies focus on the field of diabetes, the educational principles (behavioral reinforcement, microlearning and asynchronous communication) can be used in other health-care fields (generalizable). In the present study, the application was designed with the aim of promoting information literacy and empowering researchers in scientific search of articles and journals.

In Iran, users generally have limited knowledge about reliable and accessible information sources. Also, users face several problems such as the high cost of personal internet, low internet bandwidth, and various problems of accessing databases. To address these issues, a mobile phone-based application was designed to function offline and help achieve educational and research goals. By using this application, users can more easily access reliable

Table 6 Usability of the application(Phase 3)

Variable	Faculty			Student			Librarian		
	M/Sd		Total Average	M/Sd		Total Average	M/Sd		Total Average
Overall Reactions To The Software	U1	U2		U1	U2		U1	U2	
Screen	7.3±1.1	6.9±0.97	7.1±1.03	6.8±1.31	6.7±1.17	6.75±1.24	6.7±1.7	7.2±0.97	6.95±1.33
Terminology And System Information	7.9±0.43	8.1±0.75	8±0.59	6.7±1.72	7.1±1.82	6.9±1.77	6.9±0.78	7.3±0.93	7.1±0.85
Learning	7.2±0.73	8.1±0.62	7.65±0.67	7.1±0.83	6.7±0.54	6.9±0.68	6.2±1.45	5.8±2.1	6±1.77
System Capabilities	8.1±0.38	7.7±1.15	7.9±0.76	6.7±1.74	7.5±0.98	7.1±1.36	7.1±0.67	6.9±1.27	7±0.97
The Result Of Usability Evaluation	7.4±0.65	7±1.4	7.2±1.02	6.9±1.38	7.2±1.21	7.05±1.29	6.8±1.4	7.1±1.84	6.95±1.62
	-	-	7.57±0.81	-	-	6.94±1.26	-	-	6.8±1.30

U1 Iran University of Medical Sciences, U2 Tehran University of Medical Sciences, M/Sd Mean/Standard Deviation

and available information sources, thereby improving their knowledge and skills in searching for articles and journals.

Omeluzor et al. [29], focused on four areas of ICT tools in libraries: identification of administrative and electrical equipment, types of information resources, and the challenges of creating an electronic library in Nigeria. The results of a researcher-developed questionnaire indicated that most participants agreed on the use of electronic books and journals for library development. They identified “training” as a significant challenge for developing online libraries and considered inadequate training as a negative impact on the efficiency and skills of users (librarians and researchers). Ankamah et al. [30], investigated the usage and acceptance of electronic resources (Wikipedia, ScienceDirect, and PubMed) among library users at the College of Health Sciences, University of Ghana. The results indicated that most respondents were aware of and used various electronic resources.

Overall, this study aimed to incorporate as many features and findings from previous research as possible, given the constraints of infrastructure, technology, and budget. However, in light of the increasing use of mobile phones, a particular focus was placed on developing an offline mobile application. This approach was deemed most suitable for the Iranian context based on user needs and expert recommendations. Moreover, in addition to providing search functionality, the application was designed to offer educational resources for novice researchers. Kato’s study [31] identified key factors influencing information discovery, including searching across various sources and databases, designing a user-friendly interface, implementing both simple and advanced search engines, and ranking results effectively. De Leon et al. [32], found that to improve stakeholder satisfaction and usability at the Santo Tomas University (UST) library, aspects such as simple and advanced search and navigation functions, organization, and accuracy of resources needed improvement. Khan and Shahzad [33] identified key features of a Digital Library Management System (DLMS) such as advanced search, Boolean operators, electronic book sharing, full-text search, reliability and security, access control, customization, and a user-friendly interface. Fitriana et al. [34], identified key challenges and requirements from stakeholders to improve library services, stating that a new system should simplify processes, enhance user experience, and improve efficiency and access to resources. Xiaocui et al. [35] study showed that the adoption of mHealth applications is influenced by key factors such as ease of use, perceived usefulness, and user needs, which led to the application being not only technically efficient, but also motivationally and educationally effective.

In the present research, after a needs assessment and design of a mobile application, in addition to educational features, the ability to search for articles and journals were also provided to users. Then, to assess the level of user satisfaction, an evaluation of the usability of the application was conducted. In this evaluation, for a more comprehensive review, the views of 3 groups of key stakeholders in different areas of usability were examined across different usability dimensions, and the average score was reported as good. In the study of Astiti et al. [36], conducted a study to design a prototype of a web-based digital library was designed to serve as a resource for elementary schools. In studies [37, 38], improvements in the effectiveness of structured behavioral models such as health action process approach (HAPA) model in measuring health behavioral intentions and actions are demonstrated. Given that the mobile application of the present study includes an educational and behavioral intervention platform in addition to a search tool. Using similar assessment strategies in the mobile application leads to personalized features and allows users to receive content and articles that are contextually aligned with their motivational or cognitive readiness in addition to searching for text. The needs assessment for this library was conducted through observation and interviews. After the design, the study was evaluated by 5 experts in 7 areas using the DigiQUAL tool and achieved an average score of 4.4 (excellent category). Mohideen et al. [39], conducted an evaluation using user acceptance tests (UAT) and system acceptance tests (SAT), which showed that library staff found the system to be engaging, accessible, and useful. Fang and Chiu Wu’s study [40] found that a mobile library application for children, motivated reading and served as a self-learning tool for children. Soltaninejad et al. [41] emphasizes that the design of the educational environment plays a key role in improving learning performance and reducing stress. On the other hand, the lack of attention to visual comfort, ease of use, and physical interactions of users and ergonomics with digital devices can lead to reduced concentration and physical problems, just like physical environments. Therefore, there is a need to extend the principles of ergonomics from physical space to software design. Based on these results, in the present study, an attempt was made to pay attention to these principles in the design of the application, and a usability evaluation was also conducted based on this issue to assess the level of user satisfaction.

This study examined the role of mobile phones in addressing students’ demands for academic education and research and addressing various types of constraints. Although the study was conducted in Iran, but this offline and customizable application can be used in digitally constrained areas or other developing countries with similar infrastructure and constraints, according to the needs

of researchers and different languages, so that everyone can benefit from the opportunity for educational and research equity. Today, the use of artificial intelligence in various fields is expanding and has increased efficiency and improved work efficiency. Similarly, the results show that the widespread use of mobile-based applications can significantly improve access to education and research resources, so integrating artificial intelligence in improving strategies and recommendations for intelligent search and automatic categorization can improve efficiency.

Limitations and future work

In this study, there are financial and infrastructure limitations, so the information of articles from a limited number of universities in Iran was included in the application, which is suggested to include information from all universities in Iran, considering the satisfaction of users. Also, due to financial limitations and sanctions conditions, the application was designed only in the Android version. It is better to design its IOS version as well. On the other hand, due to the lack of speed and appropriate geographical coverage of the Internet, this application is designed offline, so the application needs to update articles and journals in a specific period. This study was conducted in Iran due to educational infrastructure and limitations, so generalizability is reduced. It is suggested that future research should examine universities, countries with different languages, and focus on its greater generalizability.

This study also has external influences on user engagement. Although this application is designed function offline, factors such as internet access, academic resources, and user familiarity still affect the interaction and efficiency of the application. For example, the need for an internet connection is necessary if articles and journals are updated or new training or features are added. It is also possible that the level of user satisfaction is affected by the limited comprehensiveness of the articles (due to economic sanctions and access to the database). The level of digital literacy of different users also affects their ability to use the advanced features of the mobile-based application. To address these challenges, it is recommended to use an integrated online module, pre-loaded training, and the use of the university's internal network in the future. These measures would help users access all features more easily and ensure that the information remains up-to-date.

Conclusion

Given the lack of education, limited student access to resources and databases, and various other constraints, this study was conducted as a needs assessment, followed by the design, implementation, and evaluation of an offline mobile application for educational purposes

and to facilitate scientific literature searches in Iran. Due to the application's user satisfaction, good usability, and practicality, it has the potential to be expanded at the national level by enhancing its technical features, addressing the needs of diverse users, and incorporating periodic data updates and multilingual support.

Furthermore, it can be adapted for use in other countries with limited infrastructure, poor internet connectivity, restricted access to databases, and similar economic conditions.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12909-025-07897-y>.

Supplementary Material 1.

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Authors' contributions

Jalal Nikukaran : Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing. Alireza Fallahzadeh: Methodology, Formal analysis, Supervision, Validation, Data Curation, Writing - Original Draft. Shadi Hazhir: Software, Investigation, Visualization, Writing - Original Draft. Amir Hami: Validation, Resources, Writing - Original Draft. Seyed Ali Fatemi Aghda: Conceptualization, Methodology, Supervision, Project administration, Writing - Original Draft, Writing - Review & Editing. The authors read and approved the final version of the manuscript.

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Data availability.

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the review board and the ethics committee of Shahid Sadoughi University of Medical Sciences (IR.SSU.SPH.REC.1402.078). all participants provided written informed consent after they were completely informed of the study's purpose and procedures. All methods were carried out in accordance with relevant guidelines and regulations. This study adhered to the ethical principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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