International Journal of Digital Content Management
Allameh Tabataba'i University
Vol. 2, No. 3, Summer & Autumn 2021

Research paper

Evaluation of Persian Coronavirus Apps Using MARS

Mohammadreza Hasanpour*

Date Received: 2021/06/17 Date Accepted: 2022/08/18

Abstract
Background: The rapid growth of COVID-19 disease in recent days has led to the rapid development of mobile health applications.
Objective: This study aims to evaluate the quality of applications which provide information related to Coronavirus in Iran.
Method: A systematic search has been conducted in Cafebazaar (Iranian app store) between May-October 2020. The Mobile Application Ranking Scale (MARS) is used to evaluate mobile applications and includes 23 items.
Result: After limiting Apps to the criteria specified in the systematic search, 13 mobile applications were downloaded from Bazaar Cafe, which have been evaluated in terms of functionality, engagement, aesthetics, information, and subjectivity. In general, the Apps analyzed in this article are in poor condition in terms of quality. The highest rated app is *Mask* (2.69) and the lowest score is for *Corona* (Statistics, video, map) (1.47).
Conclusion: The findings of this study showed that coronavirus applications designed in Iran are not in a favorable position in terms of MARS indicators. The lowest average was related to the information indicator. This shows that there is no professionalism in designing applications and it is necessary to pay special attention to evidence-based information in designing self-care and prevention programs of COVID-19.

Key words: Coronavirus Apps, Mobile applications, COVID-19, MARS

---

* Master of Business Administration, Khorasan Razavi University, Research Sciences Branch, School of Management. Hasanpour14mr@gmail.com

Introduction:

More than 200 countries have been struck by the coronavirus disease-2019 (COVID-19) pandemic [37]. due to the absence of a particular medicine, the promotion of respiratory and hand hygiene, social distancing , quarantines for the suspected cases, isolation and contact tracing of the infected individuals, and widespread travel bans have been implemented [6].

To cope with these issues, digital content in different applications have appeared with different initiatives, which are currently driven by organizations and governments worldwide. The main purpose is to efficiently teach people, who have been in close contact with infected individuals , how to behave and prevent being infected, treatment, instructions, etc. their effort is keeping people up-to-date with the latest information about COVID-19 and help them to control this situation individually.

There is an increasing number of health, well-being and medical applications for mobile phones on the market [17]. Mobile Apps have been developed and studied in different fields related to the health before [3][5][7][12][13][18][22][25][31][35]. For instance, Apps privacy [8][10], reliability and effectiveness[9], learning about COVID-19[16], COVID-19 Apps' frameworks[21]. With the advent of technology and the rise of digital innovation, people's access to health information has been increased. Especially in epidemic [34][26] or pandemic conditions, the use of mobile applications has enhanced the level of public awareness and support of the healthcare workers[1][11][27].With the outbreak of the coronavirus epidemic, various Apps have been developed in regard to this aim; such as contact tracing and information dissemination[2][38], lockdown enforcement, generating awareness and monitoring of quarantined individuals[20], national and international media reports[19][28][33]. The app functions have been classified according to the clients as health workers, health system managers and data services by the WHO [36]. There are several tools used effectively to study Apps in health scope [14]. MARS, created in the health environment, is used to evaluate the quality of mobile apps [17].

A unique opportunity has been provided by mobile applications due to their quality enabling distant connectivity with the flexibility of function, design, and accessibility [23]. Current estimates suggest that the global usage of smartphones stands at 3.5 billion as of June 2020

that provides a large user base to help coordinate and implement mobile interventions to disseminate information and help with pandemic response [15][32]. Therefore, the purpose of this study is to analyze and evaluate the contents as well as features of COVID-19 mobile apps in Iran in Persian Language.

Methodology:

A systematic search was conducted in Cafebazaar (Iranian app store)sometime between May-October 2020. We used the terms 'COVID-19', 'coronavirus', 'pandemic', and 'epidemic. We found 61 apps. Criteria for inclusion of programs in the research community were: Persian language, coronavirus training programs, and free download.

For eligible apps, data was extracted by app name, developer, disability, target, cost, app functionalities, average user rating, the number of user ratings, and downloads. After that, for the screening of the apps, we used the app titles and full description. We excluded the games, and apps with not enough information and no longer available or working

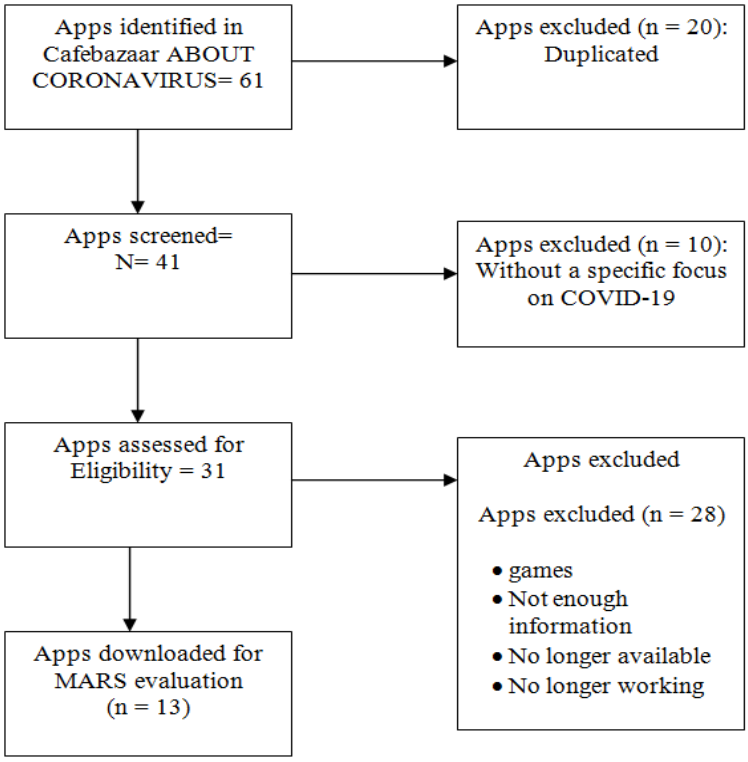

Fig1. Systematic search of Coronavirus apps.

The only specific and reliable quality assessment tool for mobile health applications that offers multidimensional measurement is the Mobile Application Ranking Scale (MARS) [29] which was used to evaluate mobile applications and it includes 23 items grouped by five subscales: engagement (5 items), functionality (4 items), aesthetics (3 items), information (7 items), And subjective quality or subjectivity (4 items) which are presented in the following table.

Table 1. MARS subscales

Scales	Subscales
Engagement	1. Entertainment 2. Interest 3. Customization 4. Interactivity 5. Target group
Functionality	6. Performance 7. Ease of use 8. Navigation 9. Gestural design
Aesthetics	10. Layout 11. Graphics 12. Visual appeal
Information	13. Accuracy of app description 14. Goals 15. Quality of information 16. Quantity of information 17. Visual information

Scales	Subscales
	18. Credibility 19. Evidence base
Subjective	20. Would you recommend this app? 21. How many times do you think you would use this app? 22. Would you pay for this app? 23. What is your overall star rating of the app?

The average of the first four subscales determines the program quality score. MARS items use the Likert scale: 1-inappropriate, 2-poor, 3-acceptable, 4-good, 5-excellent

One team of 20 evaluators (specialists in the field of medical informatics) performed the evaluation. Each evaluator was assigned at least two evaluation programs. Training sessions were held for experimenters on the process of evaluating programs using templates and they were provided with detailed information on how to evaluate.

The results provide a list of special quality rating programs for coronavirus prevention to recommend its use to individuals. All the apps selected were free to download, with no in-app purchase options/requirements.

Result:

The results provide a list of coronavirus education and prevention programs with their quality ratings. A total of 61 Apps were identified. After the eligibility phase, 13 apps were obtained.

Table 2. Average score of quality of coronavirus applications

N	App name	Average quality
1	Mask	2.69
2	Corona virus program of Qom University of Medical Sciences	2.64
3	Health Ambassadors	2.62
4	Taak (Nutrition, safety and corona)	2.50
5	Corona moment statistics	2.57
6	Corona counter system	2.33
7	Corona / Online Diagnosis, News, Education, Statistics	2.27
8	Ned	2.45
9	Corona comprehensive	2.56
10	Pezeshket	2.11
11	Corona virus (preventive ways)	1.89
12	Corona (statistics, video, map)	1.47
13	Corona and Iran	1.90

In this study, 61 mobile applications were downloaded from Bazaar Cafe, and after limiting them to the criteria specified in the systematic search, 13 of them were evaluated in terms of Functionality, Engagement, Aesthetics, Information sharing, and Subjective. In general, the programs analyzed in this article are in poor condition in terms of quality.

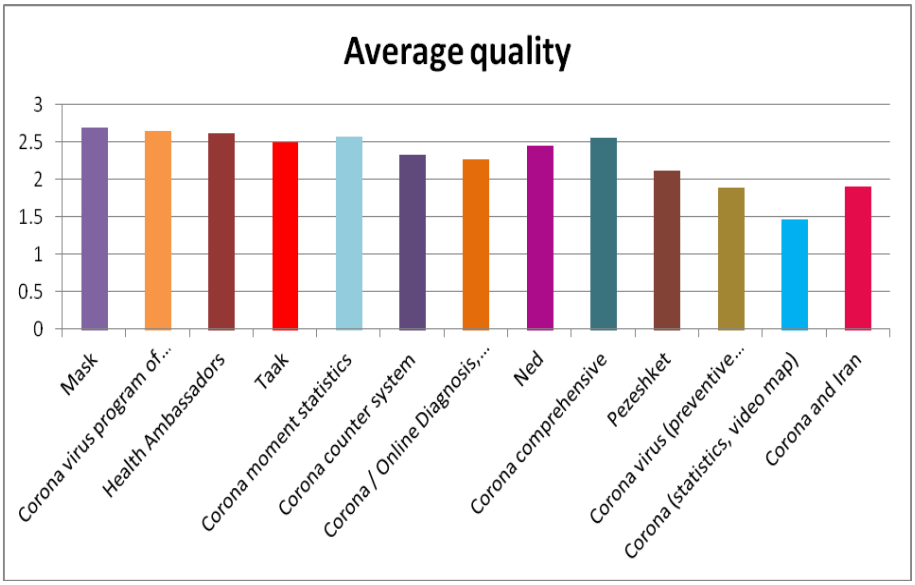

Fig 2. The average scores of the quality of indicators in *13 Apps* according to MARS subscales

As it is apparent in Fig 2, the highest rated app is *Mask* (2.69) and the lowest score is for *Corona* (Statistics, video, map) (1.47).

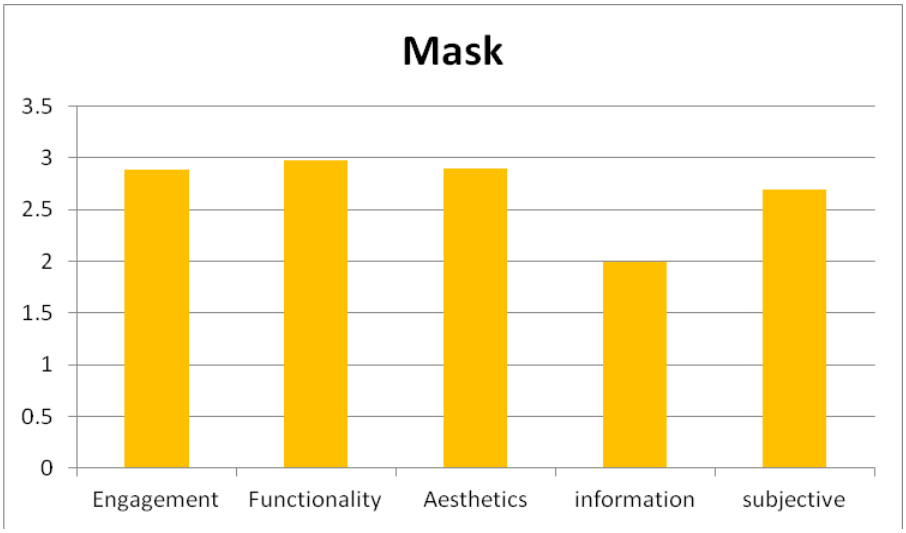

Fig 3. The evaluation of indicators in *Mask* according to MARS subscales

Fig 3 shows the average score of each indicator in *Mask* app. Functionality is ranked at the top (2.98), and the lowest score belongs to information (1.99). Therefore, Aesthetics (2.90), Engagement (2.89), Subjective (2.70) are ranked respectively among the highest and lowest indicators.

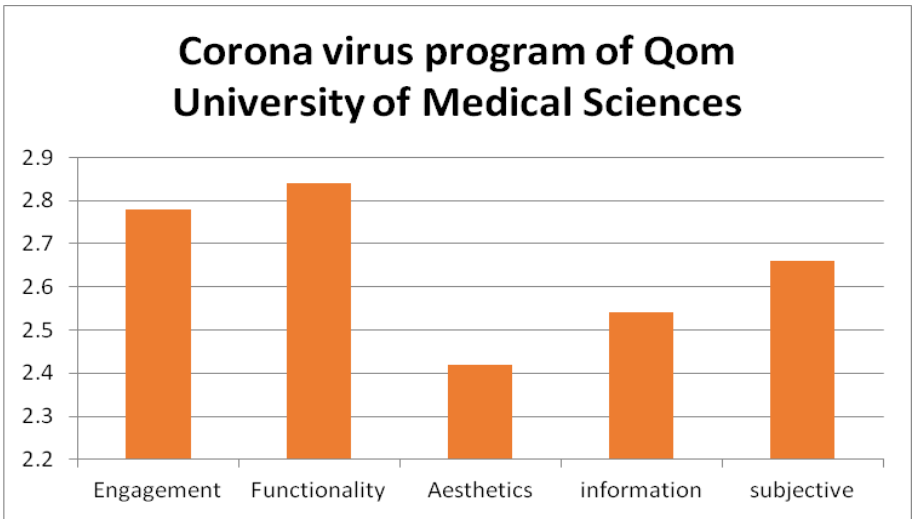

Fig 4. The evaluation of indicators in Coronavirus Program of Qom University of Medical Sciences according to MARS subscales

Fig 4 demonstrates the average score of each indicator in *Coronavirus Program of Qom University of Medical Sciences* app. Functionality is ranked at the top (2.84) and the lowest score belongs to Aesthetics (2.42). Therefore, Engagement (2.78), Subjectivity (2.66), information (2.54) are ranked respectively among the highest and lowest indicator.

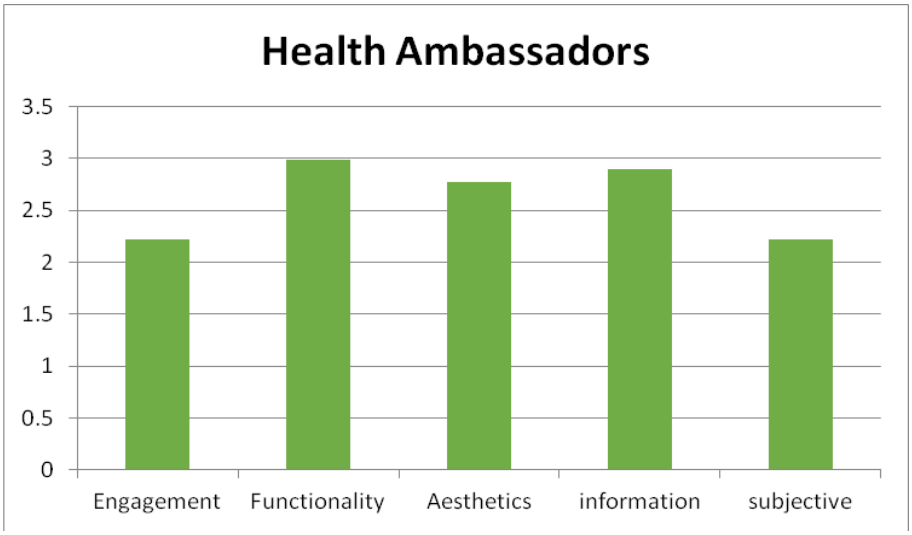

Fig 5. The evaluation of indicators in Health Ambassadors according to MARS subscales

Fig 5 illustrates that the average score of each indicator in *Health Ambassadors* app. Functionality is ranked at the top (2.99) and the lowest score equally belongs to Engagement and Subjective (2.22) indicators. Information (2.90) and Aesthetics (2.77) are ranked as the second and third places respectively.

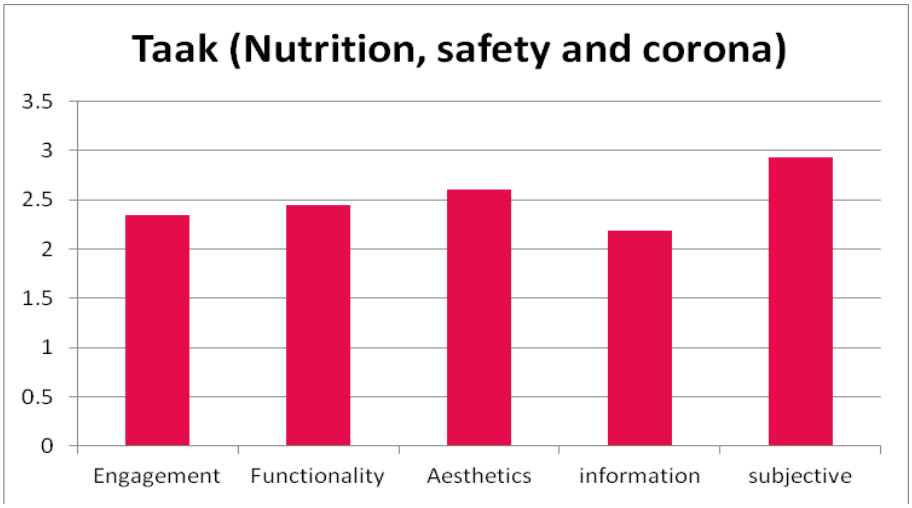

Fig 6. The evaluation of indicators in Taak (Nutrition, safety and corona) according to MARS subscales

As It can be seen in Fig 6, the average score of each indicator in Taak app is evaluated. Subjective is ranked at the top (2.93) with the highest score, followed by Aesthetics (2.60), Functionality (2.45), Engagement (2.34), and Information (2.19) are ranked as the second to fifth places, respectively.

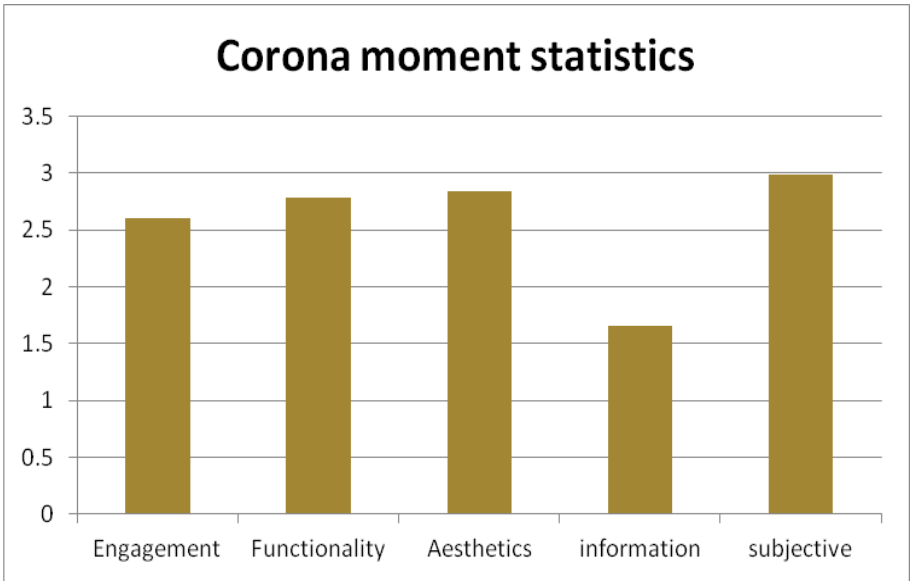

Fig 7. The evaluation of indicators in Corona moment statistics according to MARS subscales

The results of evaluating the MARS subscales in *Corona moment statistics app* are presented in Fig 7. Subjectivity is ranked with the highest score (2.99) , followed by Aesthetics (2.84). Functionality (2.78), Information (2.66), and Engagement (2.60) are ranked as the second to fifth places, respectively.

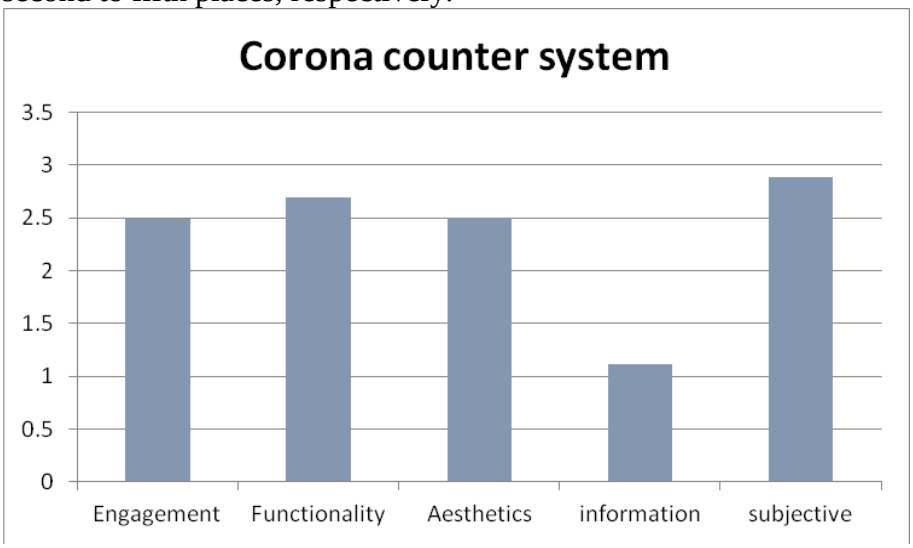

Fig 8. The evaluation of indicators in *Corona counter system* according to MARS subscales

Evaluating the MARS subscales in *Corona counter system* is shown in Fig 8. Subjectivity is ranked with the highest score (2.89) . Functionality (2.69), Aesthetics (2.50), Engagement (2.49), and Information (1.11) are ranked as the second to fifth places, respectively.

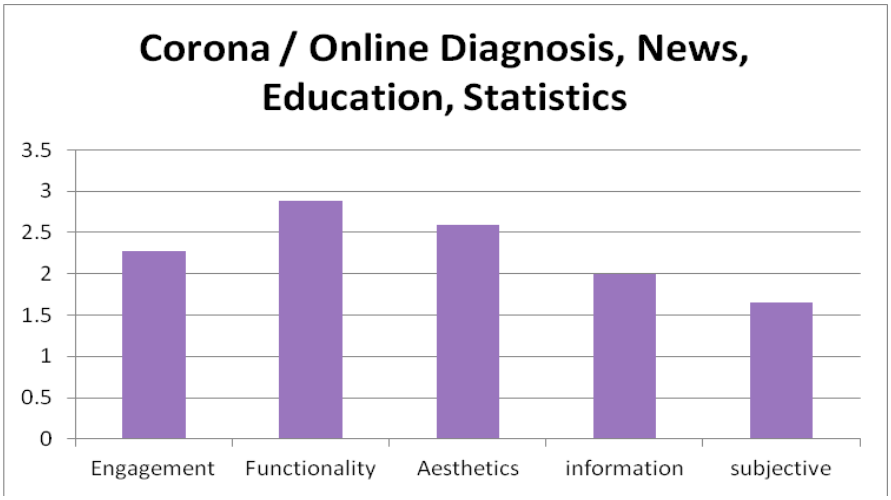

Fig 9. The evaluation of indicators in Corona / Online Diagnosis, News, Education, Statistics according to MARS subscales

It is apparent from Fig 9 that Functionality (2.88) is ranked at the top among the indicators of *Corona / Online Diagnosis, News, Education, Statistics.* The second to fifth places belong to Aesthetics (2.59), Engagement (2.28), Information (1.99), and Subjectivity(1.65), respectively.

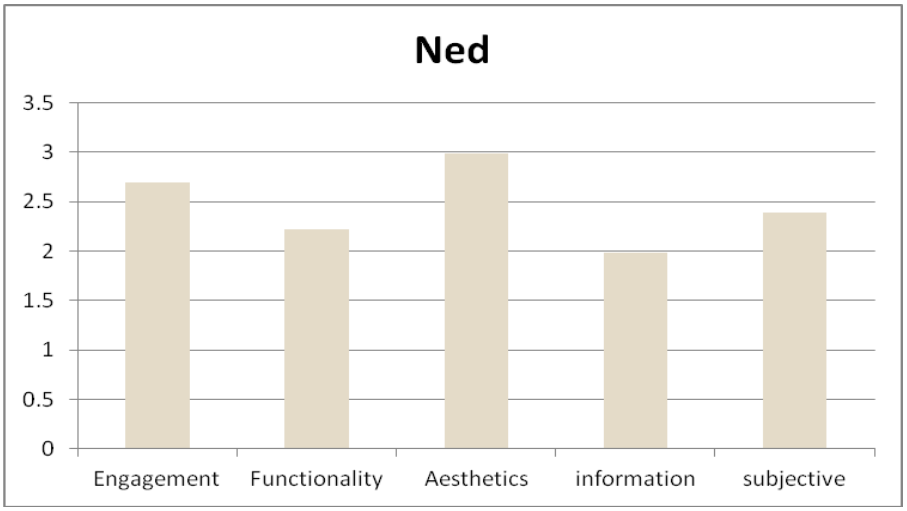

Fig 10. The evaluation of indicators in *Ned* according to MARS subscales

Fig 10. highlights that Aesthetics (2.99) has the highest score in the evaluation of indicators in *Ned*. Engagement (2.70), Subjectivity (2.39), Functionality (2.22), and Information (1.98) are ranked as the second to fifth places, respectively.

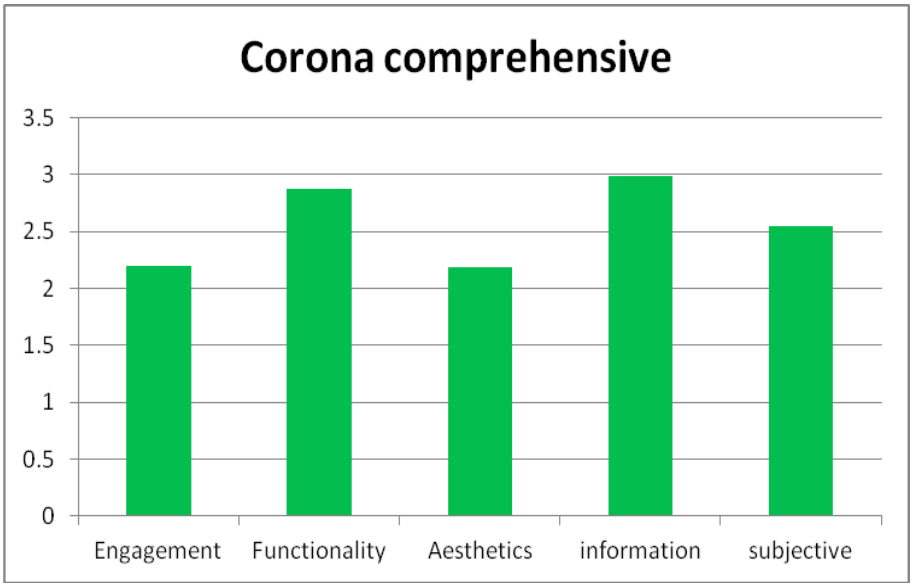

Fig 11. The evaluation of indicators in *Corona comprehensive* according to MARS subscales

As It can be seen in Fig 11, the average score of each indicator in *Corona comprehensive* app is evaluated. Information (2.99) is ranked at with the highest score(2.5). Functionality (2.88), Subjectivity (2.55), Engagement (2.20), and Aesthetics (2.19) are ranked as the second to fifth places, respectively.

Fig 12. The evaluation of indicators in *Pezeshket* according to MARS subscales

The results of evaluating the MARS subscales in *Pezeshket* App are presented in Fig 12. Information (2.55) is ranked at the top with the highest score .Functionality (2.44), Engagement (2.27), Aesthetics (2.11), and Subjectivity (1.19) are ranked as the second to fifth places, respectively.

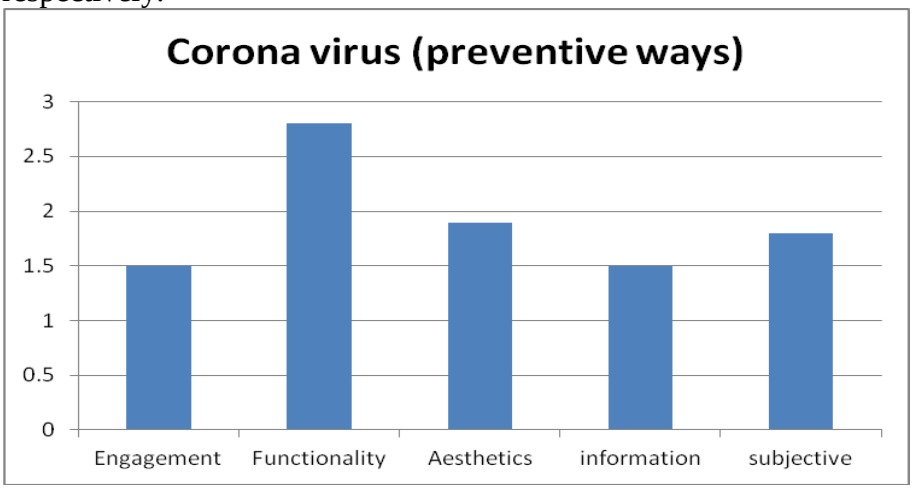

Fig13. The evaluation of indicators in *Corona virus (preventive ways)* according to MARS subscales

It is apparent from Fig 13 that Functionality (2.80) is ranked at the top among the indicators of *Corona virus (preventive ways).* The second and third places belong to Aesthetics (1.89), and Subjectivity (1.80). The fourth place equally belongs to Engagement, and Information (1.50).

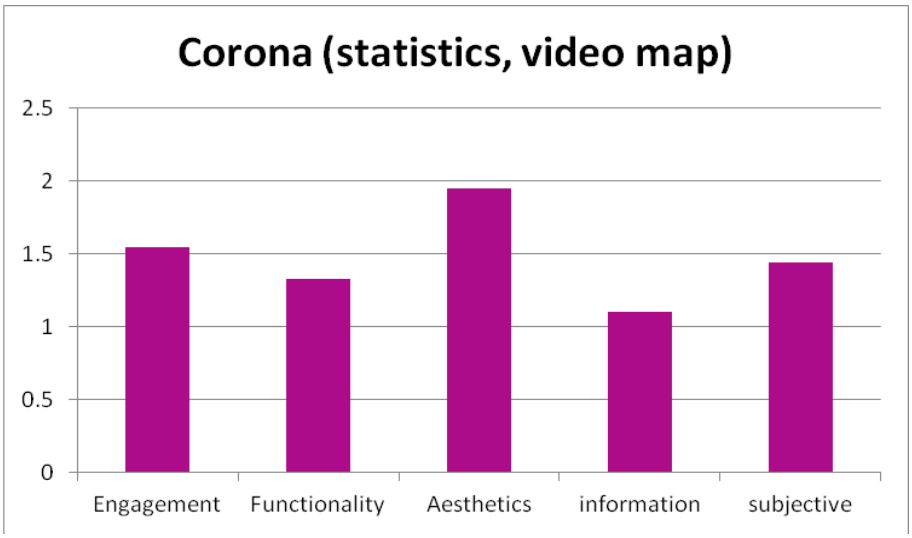

Fig14. The evaluation of indicators in *Corona (statistics, video map)* according to MARS subscales

Fig 14. shows the average score of each indicator in *Corona (statistics, video map)* App. Aesthetics is ranked at the top (1.95) and the lowest score belongs to information (1.10). Therefore, Engagement (1.55), Subjectivity (1.44), and Functionality (1.33), are ranked respectively among the highest and lowest indicators.

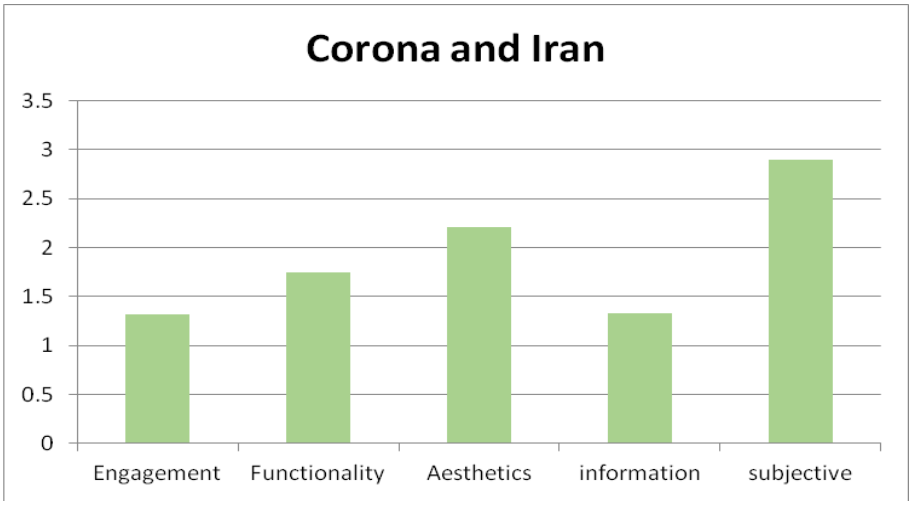

Fig15. The evaluation of indicators in *Corona and Iran* according to MARS subscales

Fig 15. demonstrates the average score of each indicator in *Corona and Iran* App. Subjectivity is ranked at the top (2.90) and the lowest score belongs to Engagement (1.32). Therefore, Aesthetics (2.21), Functionality (1.75), and information (1.33) are ranked respectively between the highest and lowest indicators.

Discussion:

However, It should be admitted that little research has been done into smartphone applications for Covid-19. Despite a large number of programs in Bazaar Cafe, no study has been conducted to evaluate their quality. The authors of the paper believe that the present study is one of the first studies to conduct a comprehensive evaluation of the mobile applications used during the COVID-19 epidemic. The psychometric properties of the MARS scale are reliable and valid, so the use of this tool provides a solid ground for our study [30]. Smartphone applications have great potential for controlling the dissemination of misinformation related to the COVID epidemic, raising public awareness, tracking patients, and ultimately helping to improve preventive and clinical patient care. One effective way to deal with an epidemic is to use health communication information technologies, such as Mobile Health (mHealth).

To tackle and control COVID-19 as an emerging disease, we must use mHealth capabilities and programs. Therefore, mHealth can be used as a supportive approach to public health programs in an epidemic/pandemic [4].

The developers of the App believe that the "Mask App" was created to prevent people from being infected by Corona. People can see the map of high-risk areas and enter their health status on a daily basis and assess the possibility of themselves and their families being infected by Corona. "The production of the Mask was voluntary and without commercial motives. The purpose of the Mask is to help Iranian citizens and the health system to control the spread of Coronavirus. It also tends to reduce victims by increasing awareness, and it provides a map of the disease in Iran" [40]. However, evaluation of the quality of this application according to the MARS tool shows that this program is weak in the information sector (1.99) and it is in an unfavorable situation regarding other components such as entertainment (2.89), performance (2.98), aesthetics (2.9), and goal (2.7). According to the average of each section, it can be concluded that this program is more of an entertainment aspect and lacks specialized information that can be effective in reducing the occurrence of the disease. After the Mask, the highest average is related to the *Corona virus program of Qom University of Medical Sciences*. The expert evaluation showed that the overall average score of MARS in this application is weak (2.64) and it is in an unfavorable situation. The average score included entertainment (2.78), performance (2.84), beauty (2.42), information (2.54), and goal (2.66). Coronavirus application is provided by the Vice-Chancellor for Research and Technology of Qom University of Medical Sciences [41]. According to the designers of this application, this program is the first university application for corona prevention [39]. However, according to the findings of this research, this application needs to be seriously re-examined and modified. Among the 13 applications reviewed, 10 applications were Pezeshket (2.11), Corona Comprehensive (2.56), Ned (2.45), Corona / Online Diagnosis, News, Education, Statistics (2.27), Corona Counter System (2.33), Corona Moment Statistics (2.57), Mask (2.69), Taak (2.50), Health Ambassadors (2.62), Corona virus program of Qom University of Medical Sciences (2.64) are on an almost equal average, approximately 2 and 3, applications Corona and Iran (1.90), Coronas

(statistics, video, maps (1.47), coronavirus (ways of prevention) (1.89) are in comparison above 1.4 and below 2. In general, the indicators of entertainment, performance, aesthetics, Information, and purpose do not have a satisfactory average. None of the reviewed applications has a satisfactory average in the entertainment indicator. In the entertainment indicator, the score of entertainment, interest, customization of interaction, and the target group is not in good condition. In the performance indicator, there is poor leadership. In the aesthetic indicator, the visual and graphic aspects are undesirable, in the information indicator, which has the lowest average, there is a lack of quality and valid information, and in the subject indicator, the results were not satisfactory.

According to these findings, the applications downloaded from Bazaar Cafe during COVID-19 lack the necessary quality in the field of coronavirus awareness and prevention. Research shows that mHealth is an effective way to implement training programs during an epidemic/pandemic [24]. However, one of the limitations of this research is the lack of attention to the users' own evaluation of the applications, which we did not consider in this article, and the quality indicators were pre-made according to the tools and evaluated by experts. For more detailed studies, it is recommended to perform qualitative or mixed studies using Netnography or anthropological methods. Also, due to the lack of monitoring of applications produced by people, there is a need for proper management of designed applications and their regular evaluation. Therefore, the authors of this article propose to develop a native protocol derived from health application evaluation tools to evaluate coronavirus applications designed by the public and private sectors (or volunteers).

Conclusion and Future Work:

The findings of this study showed that coronavirus applications designed in Iran are not in a favorable position in terms of MARS indicators. The lowest average was related to the information indicator. This shows that there is no professionalism in designing applications and it is necessary to pay special attention to evidence-based information in designing self-care and prevention programs of COVID-19. Changing the view from commercial to scientific is necessary to implement this approach. It is necessary to include information in the design of mobile applications of health related to

COVID-19 according to the taste of the audience and according to their information needs in applications. Of course, people have different information needs. Paying attention to the level of education, level of knowledge, and knowledge of people on COVID-19 is an essential indicator in the information sector. In translating information messages of age groups, it is necessary to target the level of education and information needs of individuals. Transmitting information messages requires knowing the audience. Also, attention to documented, tested and valid information should be given priority in the information section of self-care programs. The recommendation for future work is to design knowledge-based applications, evidence-based information, quality information, that is suitable for ages based on information need.

Recommended Citation

Moghadami, M., Mantegh , H., Malekolkalami, M., (2021). Challenges of Creating and Operating Digital Libraries in the Digital Age in Iran. *International Journal of Digital Content Mangement,* 2 (3), 115-164.

Reference:

Ahmadi S, Bempong NE, De Santis O, Sheath D, Flahault A. The role of digital technologies in tackling the Zika outbreak: A scoping review. *J Public Health Emerg* 2018; *2:* 1-20.

Ananth V. *Beyond contact-tracing, Aarogya Setu may find use in policy inputs*. The Economic Times; 2020. Available from: *https://economictimes.indiatimes.com/news/economy/policy/ beyond-contact-tracing-aarogya-setu-may-find-use-in-policyinputs/ articleshow/75078678.cms*, accessed on October 17, 2020.

Apidi NA, Murugiah MK, Muthuveloo R, Soh YC, Caruso V, Patel R, et al. Mobile medical applications for dosage recommendation, drug adverse reaction, and drug interaction: review and comparison. Ther Innov Regul Sci 2017 Jul;51(4):480-485. [doi: 10.1177/2168479017696266] [Medline: 30227053]

Aslani N, Lazem M, Mahdavi S, Garavand A. A Review of Mobile Health Applications in Epidemic and Pandemic Outbreaks: Lessons Learned for COVID-19, Arch Clin Infect Dis. Online ahead of Print ; In Press(In Press):e103649. doi: 10.5812/archcid.103649.

Badawy SM, Barrera L, Sinno MG, Kaviany S, O'Dwyer LC, Kuhns LM. Text messaging and mobile phone apps as interventions to improve adherence in adolescents with chronic health conditions: a systematic review. JMIR Mhealth Uhealth 2017 May 15;5(5):e66 [FREE Full text] [doi: 10.2196/mhealth.7798] [Medline: 28506955]

Bassi, Abhinav & Arfin, Sumaiya & John, Oommen & Jha, Vivekanand. (2020). An overview of mobile applications (apps) to support the coronavirus disease-2019 response in India. Indian Journal of Medical Research. 151. 10.4103/ijmr.IJMR_1200_20.

Becker S, Miron-Shatz T, Schumacher N, Krocza J, Diamantidis C, Albrecht U. mHealth 2.0: experiences, possibilities, and perspectives. JMIR Mhealth Uhealth 2014 May 16;2(2):e24 [FREE Full text] [doi: 10.2196/mhealth.3328] [Medline: 25099752]

Boujraf, Abdelkrim. (2020). COVID-19 mobile apps that preserve privacy. 10.13140/RG.2.2.29344.53763.

Chaturvedi, Ankita & Kalyani, Sushil & Jain, Gyanesh. (2020). RELIABILITY AND EFFECTIVENESS OF INDIAN COVID-19 MOBILE APPS. 10.13140/RG.2.2.20319.89761.

Cho, Hyunghoon & Ippolito, Daphne & Yu, Yun. (2020). Contact Tracing Mobile Apps for COVID-19: Privacy Considerations and Related Trade-offs.

Danquah LO, Hasham N, MacFarlane M, Conteh FE, Momoh F, Tedesco AA, *et al.* Use of a mobile application for Ebola contact tracing and

monitoring in Northern Sierra Leone: A proof-of-concept study. *BMC Infect Dis* 2019; *19*; doi:10.1186/s12879-019-4354-z.

Device software functions including mobile medical applications. US Food and Drug Administration. 2019. URL: https://www.fda.gov/medical-devices/digital-health/device-software-functions-including-mobile-medical-applications [accessed 2020-010-20]

Hilty D, Chan S, Torous J, Luo J, Boland R. A framework for competencies for the use of mobile technologies in psychiatry and medicine: scoping review. JMIR Mhealth Uhealth 2020 Feb 21;8(2):e12229 [FREE Full text] [doi: 10.2196/12229][Medline: 32130153]

Hutton, Brian & Catalá-López, Ferrán & Moher, David. (2016). La extensión de la declaración PRISMA para revisiones sistemáticas que incorporan metaanálisis en red: PRISMA-NMA. Medicina Clínica. 147. 10.1016/j.medcli.2016.02.025.

Infectious disease experts provide evidence for a coronavirus mobile app for instant contact tracing | University of Oxford. Accessed May 28, 2020. http://www.ox.ac.uk/news/2020-03-17-infectious-disease433 experts-provide-evidence-coronavirus-mobile-app-instant-contact

Krauskopf, Patricia. (2020). WHO Academy: COVID-19 Learning and WHO Info Mobile Apps. The Journal for Nurse Practitioners. 10.1016/j.nurpra.2020.07.002.

Larco, Andrés & Enríquez, Freddy & Luján-Mora, Sergio. (2018). Review and Evaluation of Special Education iOS Apps Using MARS. 1-6. 10.1109/EDUNINE.2018.8450977.

Lee S, Lee Y, Lee S, Islam SMS, Kim S. Toward developing a standardized core set of outcome measures in mobile health interventions for tuberculosis management: systematic review. JMIR Mhealth Uhealth 2019 Feb 19;7(2):e12385 [FREE Full text] [doi: 10.2196/12385] [Medline: 30777847]

Linder C. *This MIT App Tracks the Spread of Coronavirus While Protecting Your Privacy*. Popular Mechanics; 2020. Available from: *https://www.popularmechanics.com/ technology/apps/a31742763/covid-19-app-private-kit-safepaths/*, accessed on October 17, 2020.

Maharashtra govt launches online self-assessment tool to better identify, assist Covid-19 patients. India Today; 2020. Available from: *https://www.indiatoday.in/india/story/ maharashtra-govt-launches-online-self-assessment-tool-tobetter- identify-assist-covid-19-patients-1662766-2020-04-03*, accessed on October 17, 2020.

Martin, Tania & Karopoulos, Georgios & Hernández-Ramos, José & Kambourakis, Georgios & Nai Fovino, Igor. (2020). Demystifying

COVID-19 digital contact tracing: A survey on frameworks and mobile apps.

Ming, L C & Untong, Noorazrina & Aliudin, Nur & Osili, Norliza & Kifli, Nurolaini & Siang, Tan & Goh, Khang Wen & Ng, Pit & Al-Worafi, Yaser & Lee, Kah & Goh, Hui. (2020). Mobile Health Apps on COVID-19 Launched in the Early Days of the Pandemic: Content Analysis and Review. JMIR mhealth and uhealth. 10.2196/19796.

Nayak S, Blumenfeld NR, Laksanasopin T, Sia SK. Point-of-Care Diagnostics: Recent Developments in a Connected Age. *Anal Chem*. 2017;89(1):102-123. doi:10.1021/acs.analchem.6b04630

Otu A, Ebenso B, Okuzu O, Osifo-Dawodu E. Using a mHealth tutorial application to change knowledge and attitude of frontline health workers to Ebola virus disease in Nigeria: a before-and-after study. *Human Resources for Health*. 2016;**14**(1):5. doi: 10.1186/s12960-016-0100-4.

Plate, Albert-Jan & Kubben, Pieter. (2020). Mobile apps for neuroscience. 10.1049/PBHE019E_ch8.

Reeves JJ, Hollandsworth HM, Torriani FJ, Taplitz R, Abeles S, Tai-Seale M, *et al.* Rapid response to COVID-19: Health informatics support for outbreak management in an academic health system. *J Am Med Inform Assoc* 2020. pii: ocaa037.

Reyes, Andrew. (2020). A Mindfulness Mobile App for Traumatized COVID-19 Healthcare Workers and Recovered Patients: A Response to "The Use of Digital Applications and COVID-19". Community Mental Health Journal. 10.1007/s10597-020-00690-9.

Roundup: Tech's role in tracking, testing, treating COVID-19. Available from: *https://www.mobihealthnews.com/news/ roundup-techs-role-tracking-testing-treating-covid-19*, accessed on October 17, 2020.

Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, *3*(1), e3422.

Tabi K, Randhawa AS, Choi F, Mithani Z, Albers F, Schnieder M, et al. Mobile apps for medication management: review and analysis. JMIR Mhealth Uhealth 2019 Sep 11;7(9):e13608 [FREE Full text] [doi: 10.2196/13608] [Medline: 31512580]

Udugama, Buddhisha & Kadhiresan, Pranav & Kozlowski, Hannah & Malekjahani, Ayden & Osborne, Matthew & Li, Vanessa & Chen, Hongmin & Mubareka, Samira & Gubbay, Jonathan & Chan, Warren. (2020). Diagnosing COVID-19: The Disease and Tools for Detection. ACS Nano. XXXX. 10.1021/acsnano.0c02624.

Wakefield J. *Coronavirus: Tracking app aims for one million downloads*. Available from: *https://www.bbc.com/news/ technology-52033210*, accessed on October 17, 2020.

Wood CS, Thomas MR, Budd J, Mashamba-Thompson TP, Herbst K, Pillay D, *et al*. Taking connected mobile-health diagnostics of infectious diseases to the field. *Nature* 2019; *566* : 467-74.

Johnson, Anne & McKendry, Rachel & Stevens, Molly. (2019). Taking connected mobile-health diagnostics of infectious diseases to the field. Nature. 566. 467-474. 10.1038/s41586-019-0956-2.

World Health Organization. *WHO guideline: Recommendations on digital interventions for health system strengthening*. Geneva: WHO; 2019.

World Health Organization. *Coronavirus disease 2019 (COVID-19): Situation report-78*. Geneva: WHO; 2020.

Zhou, Xiaoyun & Snoswell, Centaine & Harding, Louise & Bambling, Matthew & Edirippulige, Sisira & Bai, Xuejun & Smith, Anthony. (2020). The Role of Telehealth in Reducing the Mental Health Burden from COVID-19. Telemedicine and e-Health. 26. 10.1089/tmj.2020.0068.

Corona virus program of Qom University of Medical Sciences https://qom.shafaqna.com/FA/195804. Accessed on October 17, 2020.

Mask Application. https://www.mask.ir/about_us.html, accessed on October 17, 2020.

https://hrlib.muq.ac.ir/index.aspx?fkeyid=&siteid=206&pageid=24974&newsview=35811. Accessed on October 17, 2020.