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ORIGINAL: Virtual Education Infrastructures in Mazandaran University of Medical Sciences during COVID-19 Pandemic

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ABSTRACT

Introduction: Due to the importance of e-learning in universities, this study was conducted to assess the readiness of faculties, to evaluate each of the e-learning infrastructures, and to assess the needs of virtual education development in Mazandaran University of Medical Sciences (MAZUMS) in 2020-21.

Material and Methods: This cross-sectional descriptive study was conducted among 124 professors from 9 faculties of MAZUMS. The data collection tool in this study included 3 questionnaires which were filled by the participants. Data collection was done by the help of employees in each faculty. Collected data were entered into SPSS20 software for statistical analysis.

Results: The readiness assessment score in the field of e-learning development was almost appropriate based on the participants' views. Among the studied areas, the highest and lowest scores were related to the areas of faculty members' readiness and financial readiness, respectively. The highest and lowest number of faculty members, equipment and physical resources were in the Sari Medical School and Behshahr Nursing and Midwifery School, respectively.

Conclusion: The deputies and officials of the education development offices of each faculty had a good attitude towards the development of virtual education. In order to develop virtual education in each faculty, short-term and long-term planning based on the faculty's capacities, allocating the required resources, and empowering more students in the field of virtual education seems necessary.

Introduction

The emergence and development of new technologies led to important changes in education. The use of technology in education transformed the learning environment from traditional to virtual, owing to its flexibility, attractiveness, accessibility, and the lack of requirement for physical presence (1, 2). Medical education has also undergone fundamental changes as a result of extensive advances in information

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and communication technology and foundation of virtual universities. Medical schools around the world, especially in developed countries, have invested heavily in new technologies to provide high-quality education and health services (3-5).

In general, the benefits of e-learning outweigh its limitations. Therefore, it has become an attractive choice in terms of upgrading competencies and updating knowledge and skills in medical education, facilitating the education at higher levels and promoting the culture of lifelong learning among faculty and students. However, designing and launching successful and highly effective e-learning systems and courses in medical universities requires organizational, technical and pedagogical amendments (6, 7). One of the issues in this field is the unfamiliarity of students and professors with software and teaching methods (8). In addition, the existence of appropriate infrastructures and the ability to use them are of the necessities of e-learning systems (9).

Generally, the first step in planning an educational system is to determine the related needs (10). Needs assessment is the basis of work and is a regular process in collecting and analyzing information that the target group needs to learn (11). The main purpose is to generate information about users. In this way, it is possible to attract responsible participation in the design and deployment of systems; because purchasing and setting up e-learning software and providing desired courses and compiling time-consuming and expensive content alone do not create a successful system and require specific preparations in advance (12).

Considering the importance of e-learning, especially during the COVID-19 epidemic (5), the purpose of this study was to evaluate the level of faculties' readiness in order to examine each of the infrastructures of virtual education, under the title of assessing the need for the development of virtual education in Mazandaran University of Medical Sciences (MAZUMS).

Methods

This cross-sectional descriptive study was performed among the faculty members of MAZUMS in 2020-21. The sample size of 124 people was measured according to the results of the study by Najimi et al. in Isfahan in 2017 (13). Sampling method was one-stage stratified random. The Research Ethics Committee of the MAZUMS approved the study protocol (code: IR.MAZUMS.REC. 1398.1408).

Among the 124 participants in the study, 70 were from Sari Medical School and 6 from each of Sari Dental School, Sari Pharmacy School, Sari Nursing and Midwifery School, Sari Health School, Sari Paramedical School, Amol Paramedical and Nursing School, Ramsar Medicine and Pharmacy School, and Behshahr Nursing and Midwifery School. The dean, vice chancellor and directors of the education development offices of each faculty with at least one year position were the main participants in the study. Other participants were randomly selected from the list of faculty members, using a table of random numbers. Of the nine deans of faculties, only one participated in the study. In order to replace the remaining eight people, eight faculty members were selected.

Three questionnaires were used to collect data, which were used in the study of Najimi et al. and their validity and reliability were confirmed (13). The first questionnaire (no. I) had 18 questions in 4 areas. Four questions were related to the evaluation of the faculty infrastructure, 2 questions to the evaluation to the faculty resources, 5 questions to the students' readiness, 6 questions to the faculty members' readiness, and 1 question to their attitude towards virtual education. Respondents chose a number between 1 and 10 based on a range from completely inappropriate to perfectly appropriate. Regarding the different number of questions in each area, the average score in each area as well as the average total score was calculated and reported. All averages based on statistical norm were categorized in 6 categories of completely inappropriate (mean scores of 1 to 2.5),

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inappropriate (mean scores of 2.5 to 4), almost inappropriate (mean scores of 4 to 5.5), almost appropriate (mean scores of 5.5 to 7), appropriate (mean scores of 7 to 8.5), and completely appropriate (mean scores of 8.5 to 10). The second questionnaire (no. II) consisted of 3 descriptive questions about the views of faculty members regarding the needs related to the facilities and infrastructure, establishment and development of virtual courses, and upgrading the professors' abilities in the virtual education program. The faculty members responded to these questions based on their priorities. The third questionnaire (no. III) was related to the number of faculty members, equipment and physical resources of each faculty, which was completed by 9 information technology (IT) experts from each faculty.

Data were collected and analyzed using SPSS-20 software and indices of mean, standard deviation and frequency distribution were used to report descriptive data. First, the data normality was assessed using Kolmogorov-Smirnov test. In case of normality of the components, statistical tests of analysis of variance, independent t, or Mann-Whitney along with appropriate post-test were used. If the components were not normal, Kruskal-Wallis nonparametric test and Pearson correlation test were used. Significance level was considered $P<0.05$.

Results

In this study, 124 participants (57 male and 67 female) with mean age of 44.45±8.97 years and work experience of 10.61±7.28 years were included. Other demographic characteristics of the participants are shown in ***Table 1***.

Table 1. Demographic characteristics of the participants

Demographic characteristics		N (%)
Faculty	Sari Medicine	70 (56.5)
	Sari Dentistry	6 (4.8)
	Sari Pharmacy	6 (4.8)
	Sari Nursing and Midwifery	6 (4.8)
	Sari Health	6 (4.8)
	Sari Paramedicine	6 (4.8)
	Amol Paramedicine and Nursing	12 (9.7)
	Ramsar Medicine and Pharmacy	6 (4.8)
	Behshahr Nursing and Midwifery	6 (4.8)
Executive position	Faculty member	101 (81.5)
	Faculty educational development office	8 (6.5)
	Dean	1 (0.8)
	Deputy of education	4 (3.2)
	Deputy of financial and administration	5 (4)
	Deputy of research and technology	4 (3.2)
	Deputy of research centers	1 (0.8)
Academic degree	Instructor	12 (9.7)
	Assistant professor	55 (44.4)
	Associate professor	39 (31.5)
	Professor	18 (14.5)

Evaluation of readiness and attitude towards e-learning development

E-learning development questionnaire (no. I) was used to assess the total score of readiness. According to the participants, the average score of the total readiness towards e-learning development was at "almost appropriate" level. Among the areas studied, faculty members' readiness, students' readiness, infrastructure readiness, and

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financial readiness received the highest to lowest scores, respectively. All areas except financial readiness were at "almost appropriate" level. The participants' attitude regarding the development of virtual education in the faculty was "almost appropriate". Investigations based on six levels showed that a total of 104 people (83.8%) had positive and 20 (16.2%) had negative attitudes towards the development of e-learning.

The relationship between e-learning development readiness areas and demographic characteristics of faculty members

Table 2 shows the relationship between e-learning development readiness areas and demographic characteristics of faculty members of MAZUMS. The results showed that there was no statistically significant relationship between the variables of gender, executive position, and age with the total readiness score and any of the areas (P>0.05);

Table 2. The relationship between e-learning development readiness areas and demographic characteristics of faculty members

Demographic characteristics of faculty members		Readiness scores in different areas; Mean (SD)				Total readiness score; Mean (SD)
		Infrastructure	Financial	Students'	Faculty members'	
Sex	Female	5.64 (1.22)	5.36 (1.30)	5.95 (1.14)	6.38 (1.46)	5.83 (1.12)
	Male	5.80 (1.23)	5.38 (1.34)	5.89 (1.20)	6.21 (1.27)	5.82 (1.15)
	P-value [a]	0.496	0.959	0.805	0.480	0.948
Faculty	Sari Medicine	5.29 (1.09)	5.01 (1.21)	5.60 (1.02)	5.83 (1.35)	5.43 (1.01)
	Sari Dentistry	6.08 (0.97)	6.25 (1.54)	6.30 (1.30)	6.75 (1.73)	6.34 (1.23)
	Sari Pharmacy	6.12 (0.6)	6.01 (0.63)	5.63 (0.46)	6.41 (0.65)	6.04 (0.52)
	Sari Nursing and Midwifery	7.37 (0.20)	6.91 (1.06)	7.80 (0.35)	8.11 (0.49)	7.55 (0.39)
	Sari Health	6.29 (1.05)	5.75 (0.52)	5.36 (1.39)	6.77 (0.77)	6.04 (0.87)
	Sari Paramedicine	6.91 (1.32)	6.91 (1.28)	7.40 (0.65)	7.72 (0.68)	7.23 (0.81)
	Amol Paramedicine and Nursing	6.83 (0.72)	6.01 (0.85)	6.76 (0.73)	7.13 (0.69)	6.68 (0.59)
	Ramsar Medicine and Pharmacy	4.12 (0.72)	3.75 (0.88)	4.63 (0.70)	4.97 (0.38)	4.37 (0.62)
	Behshahr Nursing and Midwifery	6.16 (0.25)	5.08 (0.97)	6.36 (0.42)	6.97 (0.32)	6.14 (0.41)
	P-value [b]	<0.001	<0.001	<0.001	<0.001	<0.001
Executive position	Faculty member	5.76 (1.17)	5.40 (1.28)	5.96 (1.05)	6.29 (1.26)	5.85 (1.06)
	Others	5.61 (1.45)	5.23 (1.49)	5.73 (1.58)	6.28 (1.75)	5.72 (1.42)
	P-value [a]	0.616	0.586	0.407	0.972	0.606
Academic degree	Instructor	6.81 (0.54)	6.04 (1.22)	6.91 (0.76)	7.41 (0.65)	6.79 (0.68)
	Assistant professor	5.74 (1.09)	5.51 (1.17)	6.01 (1.15)	6.49 (1.37)	5.94 (1.01)
	Associate professor	5.53 (1.46)	5.08 (1.51)	5.61 (1.24)	5.84 (1.41)	5.51 (1.32)
	Professor	5.43 (1.04)	5.11 (1.21)	5.67 (0.88)	5.89 (1.02)	5.52 (0.92)
	P-value [b]	0.008	0.099	0.005	<0.001	0.003
Age	**P-value [c]**	0.195	0.949	0.543	0.840	0.560
Work experience	**P-value [c]**	<0.001	0.021	0.075	0.070	0.010

[a] Independent t-test, [b] Variance analysis test, [c] Pearson correlation coefficient

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But there was a significant relationship between type of faculty with the total readiness score and its areas (P<0.05). Among the faculties, Sari Nursing and Midwifery School and Sari Paramedical School had the highest and Ramsar Medicine and Pharmacy School had the lowest level of readiness towards e-learning development. The results showed that there was a significant relationship between academic degree with the total readiness score and the areas of infrastructure readiness, students' readiness and faculty members' readiness (P<0.05); So that the level of readiness towards e-learning development was higher in the faculty members with the academic degrees of instructor and assistant professor compared to the associate professor and professor. There was also a positive and significant relationship between the work experience and the total readiness score and the infrastructure readiness (P<0.05); So that the level of readiness towards e-learning development was higher in faculty members with more years of experience.

The needs related to facilities and infrastructure, establishment and development of virtual courses, and instructing professors towards virtual education development

The data collected from questionnaire no. II identified the maximum and minimum needs related to facilities and infrastructure, establishment and development of virtual courses, and instructing professors towards virtual education development in MAZUMS (***Table 3***).

Table 3. Needs assessment regarding facilitating the faculties in the field of virtual education

Components	Facilities and infrastructure		Establishment and development of virtual courses		Instructing professors	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Providing good internet connection for faculty members and students	85 (68.5)	39 (31.5)	75 (60.5)	49 (39.5)	11 (8.9)	113 (91.1)
Providing proper hardware and software for faculty members and students	28 (22.6)	96 (77.4)	27 (21.8)	97 (78.2)	20 (16.1)	104 (83.9)
Online presentation of lessons	22 (17.7)	102 (90.3)	26 (21)	98 (79)	21 (16.9)	103 (83.1)
Holding educational workshops	17 (13.7)	107 (86.3)	10 (8.1)	114 (91.9)	64 (51.6)	60 (48.4)
Providing proper physical space	16 (12.9)	108 (87.1)	21 (16.9)	103 (83.1)	4 (3.2)	120 (69.8)
Providing adequate computers for faculty members and students	12 (9.7)	112 (90.3)	10 (8.1)	114 (91.9)	7 (5.6)	117 (94.4)
Evaluating the financial credit of the faculty and the readiness for investment	11 (8.9)	113 (91.1)	10 (8.1)	114 (91.9)	3 (2.4)	121 (97.6)
Instructing faculty members to use hardware	11 (8.9)	113 (91.1)	9 (7.3)	115 (92.7)	15 (12.1)	109 (87.9)
Evaluation of the human resources	5 (4)	119 (96)	11 (8.9)	113 (91.1)	-	124 (100)
Acquaintance of faculty members and students with rules	4 (3.2)	120 (69.8)	6 (4.8)	118 (95.2)	9 (7.3)	115 (92.7)
Providing equipped studios for recording	4 (3.2)	120 (69.8)	2 (1.6)	122 (98.4)	6 (4.8)	118 (95.2)
Assessment of the needs of faculty members and students	3 (2.4)	121 (97.6)	3 (2.4)	121 (97.6)	8 (6.5)	116 (93.5)

The number of faculty members, equipment, and physical resources of the faculties

The results of questionnaire no. III showed that the Sari Medical School was at a higher level than other faculties of MAZUMS, regarding the number of faculty members, students, equipment and physical resources, and learning management system. Behshahr Nursing and Midwifery School had the lowest number of faculty members, equipment and physical resources. However, the number of faculty members, equipment and physical resources of each faculty was proportional to the number of students in that

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faculty. 30.8% of the area of computer halls of MAZUMS was located in Ramsar Medicine and Pharmacy School. Only 3.1% of the area of computer halls in MAZUMS was located in the Sari Dental School. The history of IT experts' activities related to virtual education in most faculties of MAZUMS was almost the same level and only low in the Sari Pharmacy School (about 2.7%). 23.3% of the learning systems of MAZUMS were located in the Sari Medical School. Only 3.3% of the learning systems of MAZUMS were located in Ramsar Medicine and Pharmacy School, Behshahr Nursing and Midwifery School, and Sari Health School.

Discussion

The present study was conducted to assess the need for virtual education development in MAZUMS during the COVID-19 pandemic. The areas of faculty members' readiness and financial readiness acquired the highest and lowest scores from the participants, respectively.

In a similar study conducted by Najimi et al. in 2017, the mean score of readiness of e-learning development was almost inappropriate. Among the studied areas, the students' readiness and the financial readiness received the highest and lowest scores by the participants, respectively. The individuals' attitude level was announced as moderate and appropriate, and the faculty members' readiness was assessed as inappropriate. In their study, the relationship between gender, executive position and age with the total score of readiness and its areas was not investigated (13). In the present study, the faculty members' readiness was appropriate which is probably due to development of virtual education in MAZUMS in 2020 compared to Isfahan University of Medical Sciences in 2017.

In the study of Bazm et al. in 2015, the results showed that the average readiness of the studied components was 2.8 out of 10 and in the two components of readiness for monitoring and evaluation and support, the university was in an appropriate condition. The results of this study showed the relative readiness of the university in the field of e-learning. Therefore, university policymakers could take action to provide e-learning courses by eliminating weaknesses. Students' and faculty members' readiness were not studied in the Bazm et al. study (14).

The benefit of any needs assessment program is that it removes conjecture from existing information about needs and clarifies required changes. It is necessary to pay attention to needs assessment as one of the important components in many areas, including virtual education, which deals with planning and preparation to achieve analytical objectives (15, 16).

In the present study, the attitude of the subjects regarding the virtual education development in the faculties was almost appropriate. It seems that as other studies suggest, the qualitative growth and internationalization of the teaching process as well as the creation of uninterrupted online communication between professors and students saves time and money and leads to the full dynamism of the educational environment. These are of the most important factors that can explain the appropriate attitude of the subjects to the development of virtual education in colleges (17, 18).

In the present study, the total score of readiness and the infrastructure and faculty members' readiness for virtual education development were significantly higher in faculty members with higher academic degrees. This could be because of the unequal number of faculty members of each degree, as a result of random selection of participants. Therefore, it is suggested for future studies to select equal number of professors of each degree in order to obtain more accurate results.

Also, in our study, there was a positive and significant relationship between the experience of working in the faculty with the total score of readiness and the infrastructure readiness. This component was not studied in previous research. Therefore, it is recommended to conduct more studies in this field.

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Conclusion

The present study showed that the deputies and officials of the education development offices of each faculty have an appropriate attitude towards the development of virtual education. In order to develop virtual education in each faculty, short-term and long-term planning based on the capacities of each faculty, along with allocating the required resources and also empowering more students in the field of virtual education is necessary. Allocating appropriate financial resources for the development of e-learning is also an important factor.

Ethical standards statement

This article was the result of a student dissertation approved by the Deputy of Research and Technology of MAZUMS with the code of ethics IR.MAZUMS.REC.1398. 1408.

Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions

All authors have participated in the design, implementation, and writing of all sections of the present study.

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