



Satisfaction of Iran's Medical Students with Virtual Education in the Post-Pandemic era

Satisfaction d'étudiants et d'étudiantes en médecine iraniens à l'égard de l'enseignement à distance dans la période post-pandémique

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Abstract

This study aimed to assess medical students' satisfaction with virtual education in Iran during the post-pandemic period. An online survey was conducted, involving 411 students (51.6% male; mean age: 22.7 ± 3 years) from 41 universities. The median proportion of education delivered via e-learning was 10%, with an interquartile range (IQR) of 5-20%. Students reported a median of two hours per week dedicated to e-learning (IQR: 1-7 hours). The average satisfaction score was 12.3 out of 20 (CI 95%: 11.9–12.7), with no significant differences observed based on gender, educational stage, or the region of the medical university.

Keywords

Virtual education, satisfaction, medical students

Résumé

Notre objectif était d'évaluer la satisfaction des étudiants et étudiantes en médecine à l'égard de l'éducation virtuelle dans l'ère post-pandémique, en Iran, en réalisant une enquête en ligne. Quatre cent onze étudiants et étudiantes (51,6 % d'hommes, âge moyen de $22,7 \pm 3$ ans) issus de 41 universités ont participé à l'étude. La part médiane de l'enseignement virtuel par rapport à l'enseignement total dispensé était de 10 % avec un intervalle interquartile (IQR) de 5 à 20 % et le temps médian utilisé pour l'apprentissage en ligne était de 2 heures/semaine (IQR : 1 à 7 heures). Le score moyen de satisfaction était de 12,3 sur 20 (CI 95% : 11.9–12.7), ne montrant aucune relation significative avec le genre, le niveau d'études ou la région de l'université de médecine.

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Mots clés

Enseignement à distance, satisfaction, étudiants et étudiantes en médecine

Introduction

With the outbreak of the COVID-19 pandemic, education at all levels underwent drastic changes. Lockdowns and social distancing measures created an urgent need to find a replacement for traditional, primarily in-person, classroom-based teaching methods. Virtual education, or e-learning, quickly gained prominence as a suitable alternative and became widely adopted. Medical education was no exception. The typically lecture-based classes and clinical rounds at patients' bedsides were suddenly disrupted, as most students were barred from attending classes and hospital rotations (Akers et al., 2020; Sklar, 2020). There was also a risk of students contracting the virus in hospitals and transmitting it to their families and communities (Khasawneh et al., 2020). Since then, virtual education—whether online or offline—has become an integral part of medical training.

In Iran, undergraduate medical training lasts seven years and is divided into four levels: Basic Science (24 months), Physiopathology (18 months), Clerkship (24 months), and Internship (18 months). The earlier levels are primarily theoretical, while the more advanced stages focus on clinical education, as students engage with the healthcare system and interact with real patients (*Medical Education and Regulations in Iran*, n.d.).

Building on the virtual education experiences gained during the pandemic, many universities continued to incorporate e-learning into their routine teaching methods even after pandemic-related restrictions eased (Sato et al., 2024). Given the importance of both theoretical and practical medical science training for developing competent future doctors, it is crucial to assess students' satisfaction with the quality and effectiveness of virtual education. Students' satisfaction can directly influence their motivation, their engagement (Shbeer, 2024), and even their well-being (Xia et al., 2023). Most previous studies conducted in Iran have been limited to students from a single university and were done during the pandemic period (Fazljo et al., 2023; Zhalehjoo et al., 2021; Ziaie et al., 2021). Now that the pandemic has subsided, a national evaluation of medical students' satisfaction with e-learning in the post-pandemic era can provide valuable insights into the current situation and help identify areas for improvement. Therefore, this study aims to assess the role of virtual education in medical training across Iran and evaluate students' satisfaction with this mode of learning in the post-COVID era.

Material and Method

Study Design

This was a cross-sectional study. We did an online survey.

Study Instrument

We used a questionnaire measuring the students' level of satisfaction with virtual learning. This questionnaire was designed by Dr. Abbas Zadeh and colleagues for use in the study entitled "Measuring the level of student satisfaction with the electronic teaching-learning system during the outbreak of the coronavirus pandemic in Mehr Alborz University." Its validity and reliability were confirmed using confirmatory factor analysis and Cronbach's alpha calculation (Nazarzadeh

& Abaszadeh, 2021). After an extensive search and literature review, along with identification of the influencing factors, the authors developed the best questions to evaluate students' satisfaction with virtual education and its influencing factors. They categorized these factors into six domains, including student, professor, system flexibility, technology, user interface design, and environment. Their final questionnaire consisted of 44 phrases, and the students had to rate their agreement with each of them via Likert scale answers from 1 for strongly disagree to 5 for strongly agree.

The student domain assessed the characteristics of the students themselves, such as their learning styles, tendency to use information technology, or anxiety about information technology (9 questions). The professor domain was related to the characteristics of the educators, such as their teaching styles, accountability, or attitude toward technology (7 questions). The flexibility domain included the characteristics of the classes provided through virtual education (4 questions). The technology domain assessed the quality of the tools and information technology used in the virtual education system (4 questions). The user interface design domain evaluated the appropriateness of system interface design (7 questions) and whether the user could easily communicate with the system and meet his/her needs. The environment domain assessed the university with respect to diversity in assessment, interactions between students and faculty, and support services (9 questions). Finally, four questions measured the satisfaction level. The questionnaire for the original article can be found in Appendix A, along with the conceptual model used for its design.

For the purposes of our own study, we also added some questions about demographic and educational characteristics, such as age, gender, education level, and the name of the medical university. We also asked the participants about the share of virtual education relative to the total education they have received in the current semester; the most common virtual education methods used by the faculty; and the virtual learning methods they preferred for theoretical/basic and also clinical courses. We used an online survey platform (Porsline) for data gathering. The link to the questionnaire was shared during the 2023 academic year via social media groups usually frequented by medical students at every stage, all across the country. The participants were asked to invite others to participate by sharing the link with them.

To better evaluate the satisfaction levels of students in different regions of the country, data classification and comparison were performed using the ten educational macro-regions announced by the Ministry of Health and Medical Education. This categorization is based on the universities' resources, and aims to help fairly distribute resources, opportunities, and decision-making power, and to improve educational fairness throughout the country.

Since this categorization only includes public universities, an 11th region was created as a separate group for non-public medical faculties (including Islamic Azad University, Shahed University, Baghiatallah, etc.). A brief text explaining the study objectives was provided and shared along with the link to the questionnaire.

Ethical Considerations

Participation in the study was completely optional, and the questionnaires were filled out anonymously. Ethical approval for this project was issued by the ethics committee of the University of Medical Sciences under the code IR.IUMS.FMD.REC.1402.307.

Funding

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Statistical Analysis

Data were analyzed using SPSS Version 25 software (SPSS Inc., Chicago, Ill., USA). The normality of the data distribution was checked using the Kolmogorov-Smirnov test. The comparison of the level of satisfaction between male and female students was done using the Mann-Whitney U test, and the Kruskal-Wallis test was used for the comparison of the educational regions. Correlation between quantitative variables was measured by the Pearson correlation test.

Results

A total of 411 students, including 212 males (51.6%) and 199 females (48.4%), participated in the study. The mean and standard deviation of the participants age was 22.7 ± 3 years. The distribution of educational levels was as follows: Basic Sciences (41.4%), Physiopathology (21.9%), Clerkship (17.8%), and Internship (19.0%). Table 1 shows the proportion of participants from each of the educational macro-regions.

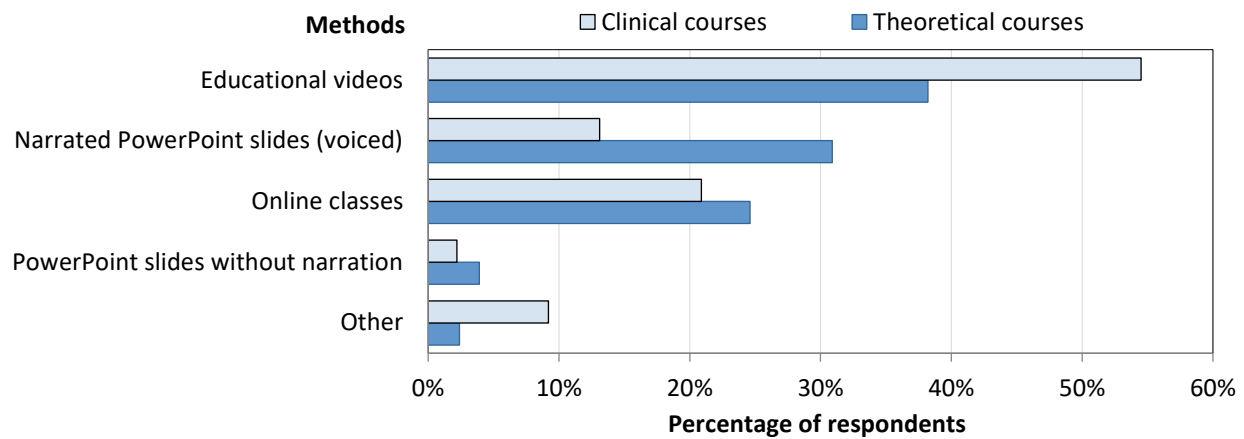
Table 1

Distribution of Participating Students by University and Educational Macro-Region

Educational macro-region	Medical universities	Number of participants (share of the sample)
1	Babol – Golestan – Gilan – Mazandaran – Semnan	38 (9.2%)
2	Ardabil – Tabriz – Urumia	75 (18.2%)
3	Hamedan – Kermanshah Kurdistan	37 (9.0%)
4	Abadan – Ahvaz – Bushehr – Lorestan	61 (14.8%)
5	Fasa – Hormozgan – Shiraz – Yasooj	33 (8.0%)
6	Araak – Alborz – Ghazvin – Ghom – Zanjan	18 (4.4%)
7	Isfahan – shahrood – Shahrekord – Yazd	25 (6.1%)
8	Kerman – Rafsanjan – Zahedan – Zabol	39 (9.5%)
9	Birjand – Mashad	21 (5.1%)
10	Iran – Shahid Beheshti – Tehran	54 (13.1%)
11*	AJA – Baghiatallah – Islamic Azad University – Shahed, etc.	10 (2.4%)

*All non-public schools are categorized under macro-region 11.

The median duration of active engagement with virtual learning in the past week was two hours, with an interquartile range (IQR) of 1 to 7 hours. The median reported share of virtual education relative to the total education received during the current semester was 10%, with an IQR of 5% to 20%. Notably, 17.5% of participants stated that virtual education does not contribute to their learning. The most commonly used methods included narrated (voiced) slide files (41.4%), educational videos (18.5%), online classes (14.6%), and PowerPoint slides without narration (10.9%). Figure 1 illustrates students' preferred virtual learning methods for both basic/theoretical and clinical courses.

**Figure 1***Student's Preferred Virtual Learning Methods*

The mean perceived virtual education satisfaction score among participants was 12.3, on a scale ranging from 4 to 20 points, with a 95% confidence interval (CI) of 11.9 to 12.7. The mean score for the student domain was 35 (CI 95%: 34.5–35.6) out of a possible 9 to 45 points, while the professor domain had a mean of 20 (CI 95%: 19.5–20.4) from a score range of 7 to 45. The flexibility domain mean was 15.15 (CI 95%: 14.8–15.5) from a 4 to 20 point scale, and the design domain scored an average of 25 (CI 95%: 24.5–25.6) out of 30. In the technology domain, the mean score was 14 (CI 95%: 14–14.4) from a range of 4 to 20 points, and in the educational environment domain, the average score was 28 (CI 95%: 27.5–28.8) from a range of 9 to 45 points. The average perceived satisfaction scores, based on our independent variables, are presented in Table 2.

Table 2*Students' Perceived Satisfaction Score (ranging from 4 to 20) Based on our Independent Variables*

Variables	Categories	Mean (95% Confidence Interval)	P value
Educational macro-region	1	12.4 (11–13.9)	0.32
	2	12.3 (11.3–13.3)	
	3	11.4 (10–12.8)	
	4	11.4 (10.5–12.3)	
	5	12.6 (11.4–13.9)	
	6	13.55 (12–15.1)	
	7	13.2 (11.8–14.5)	
	8	13.0 (11.7–14.2)	
	9	12.9 (11.1–14.7)	
	10	12.1 (11.1–13.2)	
	11	11.0 (7.7–14.3)	
Gender	Female	11.9 (11.4–12.5)	0.09
	Male	12.6 (12–13.1)	
Educational level	Basic Sciences	12.7 (12.1–13.3)	0.10
	Physiopathology	12.0 (11.1–12.8)	
	Clerkship	11.4 (10.4–12.4)	
	Internship	12.5 (11.7–13.4)	

The average satisfaction scores given by students from different medical schools showed no statistically significant difference ($P = 0.13$).

In analyzing the correlation between domain scores and perceived satisfaction, a significant positive correlation was observed across all domains ($P < 0.01$). The strongest correlations were found in the design, educational environment, and flexibility domains, with correlation coefficients (R) of 0.70, 0.67, and 0.65, respectively. The weakest correlation with satisfaction was noted in the student domain, with an R value of 0.22.

Discussion

In this study, we investigated medical students' satisfaction with virtual education in the post-COVID-19 pandemic era in Iran. The mean score and standard deviation for satisfaction with virtual education was 12.3 ± 3.9 from the obtainable range of 4 to 20 points, which can be considered average satisfaction. The level of perceived satisfaction did not show any significant association with students' gender, education level, medical university, or the educational macro-regions where they were studying medicine.

The median proportion of virtual education relative to the total education received during the semester was approximately 10%, while the median active engagement time with virtual learning was two hours per week. We could not find any other study reporting the share of virtual education relative to the total medical education offered to the students, nor any study reporting the amount of time medical students spend actively engaging with virtual education after the COVID-19 pandemic, and are thus unable to compare our results. However, some studies have compared the amount of virtual education used before and during the pandemic. For example, in a study from England, the proportion of medical students who were involved in online education for more than 15 hours a week during the pandemic was 23.5%, while it was only 7.3% before the pandemic (Dost et al., 2020).

Also, another study of medical students in Lebanon showed that, before the pandemic, about 9% of medical students used e-learning for more than 25 hours a week. During the pandemic, this ratio reached 45%, with 27.7% of the participants reporting e-learning use of about 13 to 25 hours per week (Bou Zerdan et al., 2023). In the qualitative part of another mixed-method study conducted with medical students and their professors, the participants believed that about 30% of training could be provided in virtual form in the post-pandemic era (Atwa et al., 2022), which is three times higher than the proportion reported by our participants, suggesting a capacity for higher involvement of virtual methods in our medical education. Despite the lack of similar studies to compare the differences between virtual education use during and after the pandemic, it can be assumed that levels in the post-pandemic era are lower than those reported by the studies done during the pandemic, where most of the training was provided virtually (Rajab et al., 2020).

The most common method of virtual education in the medical schools under study was the provision of narrated (voiced) PowerPoint slide decks. The method preferred by most students, both for the basic/theoretical and the practical/clinical courses, was the provision of educational videos. In a similar study conducted in India, the most common methods for virtual education were holding classes online and uploading PowerPoint files to educational websites, although videos were not among the options students could choose in that study (Hameed et al., 2020).

In the study involving Lebanese medical students, 92.3% of the students had received training in the form of online classes, and 66.7% in the form of pre-recorded files (Bou Zerdan et al., 2023).

The difference between the common methods of providing virtual education in this study and others may be due to the difference in infrastructure facilities, access to reliable high-speed internet, or the time interval between the beginning of the epidemic and when the study was conducted. The medical students' preference for educational videos over other methods in this study has been seen in other studies as well (Finn et al., 2022; Li et al., 2024).

The reason for this preference, especially compared to online classes, can be explained by the convenience of accessing the file at a preferred time, not worrying about connection or technological problems during an online class, and having more control over the educational session (such as changing the speed, pausing when needed, etc.) and the greater flexibility of this method (Kyaw et al., 2019). Ziyai et al also reported a similar result in the preference for offline methods (including pre-recorded video and narrated slides) over online methods in virtual education (Ziaie et al., 2021). Meanwhile, a systematic review and meta-analysis comparing the results of electronic education with the traditional class-based methods in medical schools showed that not only is electronic education as effective as the traditional teaching models, but in some aspects, it is superior (Pei & Wu, 2019). On the other hand, it should be noted that satisfaction with this educational method is a multifactorial issue, influenced by a number of variables such as the individual student's learning style, the course content and the teacher's mastery of it, the student's and the teacher's interest and skill in using technology, access to the necessary infrastructure, the learning system environment or design, and many other factors (Çakmakkaya et al., 2024; Dascalu et al., 2023; Gayef et al., 2023; Shakeri et al., 2022). The preference among Iranian medical students for the offline method, and especially pre-recorded videos, may be the result of interactions among the above-mentioned factors (Gholipour Mofrad Dashtaki et al., 2020; Moazami et al., 2014).

In this study, the medical students' satisfaction with virtual education was considered average, which is consistent with the results of previous studies (Abbasi et al., 2020; Tabatabaeichehr et al., 2022). In a study that examined medical students' overall satisfaction with e-learning during the pandemic in one of the medical universities in Turkey, the average score for students' satisfaction, out of 10 points, was reported to be 6.42, which is in line with our results (Çakmakkaya et al., 2024). In another study measuring medical students' satisfaction with virtual education during the pandemic, the average satisfaction score was 26.9 out of a maximum of 50, which is similar to the results obtained in this study (AlQhtani et al., 2021). On the other hand, in a study performed in northern Morocco during the pandemic, 75.2% of the medical students described their experience with virtual education as excellent or good. The method preferred by the participants in this study was a combination of virtual and face-to-face methods (35.6%) and virtual training without compulsory attendance (32.3%) (Bousgheiri et al., 2023).

This large difference between the two results may be due to the difference in the questions used to measure students' satisfaction and the study tools, the difference in resources and infrastructure, as well as individual differences among the students. Elsewhere, research on medical students in Pakistan showed an overall level of satisfaction with virtual training (mostly provided by holding online classes) that was much lower: 88.1% of the students were not satisfied with this training. The point that should be kept in mind when interpreting and comparing the results of this study with the current findings is that apparently in the Pakistan study, the student's answer to the question "Do you consider online education more effective than traditional education methods?" was considered to be an indicator for overall satisfaction. This is different from what was measured in the previously mentioned studies. It should also be noted that the same study reported that more

than half of the students experienced power outages or internet connection problems during online classes, which may be one of the reasons for their dissatisfaction (Abbas et al., 2024).

We found no significant difference between the perceived satisfaction scores of male and female students, which is consistent with the results of most studies (Bączek et al., 2021; Çakmakçaya et al., 2024; Dascalu et al., 2023; Setoodehzadeh et al., 2023). The two exceptions observed were studies among medical students in Riyadh, Saudi Arabia, and Shiraz, Iran. These reported a significant difference between the overall satisfaction scores of males and females, where the satisfaction scores of male students in the Saudi study and female students in the Iranian study were significantly higher than the other gender's scores (AlQhtani et al., 2021; Zarifsanaiey et al., 2024).

When comparing the satisfaction scores of students at different levels of education, no significant difference was observed in the level of perceived satisfaction or the scores in any of the seven influencing domains. This is interesting since students at different levels have different educational needs, and their tasks and courses differ. This lack of difference in satisfaction levels has been reported in some other studies (Bączek et al., 2021; Çakmakçaya et al., 2024). However, many of these did not include students studying at higher educational levels or those involved in clinical courses at the hospitals. One of the studies revealed an inverse linear trend between medical students' satisfaction levels and the number of years they had been studying medicine (AlQhtani et al., 2021), which can be justified by the clinical nature of most courses at higher levels and in the final years of medical education, necessitating more contact and communication with patients.

Comparing the perceived satisfaction scores among the educational macro-regions, students from the 8th region (including the medical universities of Rafsanjan, Zahedan, Zabul, and Kerman) gave the highest scores whereas students from the 4th region (including the medical universities of Ahvaz, Bushehr, Lorestan and Abadan) gave the lowest scores. The fact that students from the 8th macro-region gave the highest scores is very interesting considering the higher degrees of deprivation in this region. However, differences in perceived satisfaction between regions did not reach the level of statistical significance. Considering this result, it can be concluded that despite the differences in regional development and socio-economic conditions, the quality and accessibility of virtual education are almost the same throughout the country, and the level of perceived satisfaction is now the same as well. Although at the beginning of the pandemic, the universities in more deprived areas faced serious challenges due to differences in infrastructure and access to the necessary virtual education resources (Dastani, 2021), the above finding may show that universities have currently overcome these challenges. It can be a positive point in moving towards educational fairness by improving the quality of the education provided and increasing student access to the best available educational resources. Because most of the Iranian studies were limited to a specific university or geographical region, it was not possible to compare the above findings with the results of similar studies, but the satisfaction level reported in most of these studies was moderate, which is consistent with our findings (Rostami et al., 2023).

Study limitations

This study was done by means of an electronic survey; therefore, it may not be possible to generalize the results to all medical students, and there is a high chance of bias towards those who more frequently use social media or the internet.

Conclusion

The medical students' perceived satisfaction with virtual education in the post-COVID-19 pandemic era was average. The degree of satisfaction did not show any significant association with student gender, educational level, or the educational region or place of study. The similarity of virtual education satisfaction levels among students from different regions may indicate that medical schools nation-wide provided the minimum necessary virtual education infrastructure during the pandemic. This may be a valuable opportunity to improve the quality and access to university-level education throughout the country and a step forward through achieving educational fairness in Iran.

Notes

Data Availability

The supporting data collected during the research described in this article are available from [Arghavan Haj-sheykholeslami](#) upon request.

Use of artificial intelligence (AI)

For language editing, we utilized Grammarly, a free AI-powered writing assistance tool, to proofread and improve the English language of the manuscript.

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Appendix A – The questionnaire and its underlying conceptual model

This Appendix includes, for reference, the full questionnaire used in this study, along with the conceptual model that informed its design (Figure A.1).

Notes

- In the questionnaire, the choice of answers was the following:

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
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- The domains (Student, Professor, etc.) were mentioned in the questionnaire guide but were not visible to the participants.

Questionnaire

Student

1. I believe that it is very difficult to work with a computer.
2. I believe that working with computers is very complicated.
3. I believe that working with a computer is a facilitating factor in my success.
4. Computers make me uncomfortable.
5. Computers make me feel tired and confused.
6. Working with the computer causes me a lot of mental stress.
7. I always actively participate in the education process to improve my learning.
8. I am interested in learning knowledge-oriented issues and content.
9. I am always committed to learning and education.

Professor

10. I receive timely explanations and answers on my assignments and tests from the professors.
11. The professors respond to the student's concerns.
12. I believe that the professors find online classes useful.
13. I feel that the professors are interested in using web-based classes.
14. My professors encourage and excite me to use e-learning.
15. The professors are interested and enthusiastic about teaching in online classes.
16. The professors manage the online class effectively and efficiently.

Flexibility

17. Participating in online classes makes my plans and work more flexible.
18. Participating in online classes reduces my commuting time.
19. I believe that virtual education systems are suitable for people with different capacities and abilities.
20. E-learning has allowed me to attend classes that I could not attend in the past.

Design.

21. In my opinion, the content of the courses is relevant and sufficient.
22. In my opinion, the virtual education system provides up-to-date content.
23. In my opinion, the virtual education system provides useful and beneficial content that meets the needs of the students.
24. Connecting to the internet is easy for me.
25. In my opinion, virtual education systems are generally useful.
26. I believe that using the web-based education systems increases the efficiency of learning and education.
27. I believe that the electronic educational systems are generally easy to use.

Technology

28. I feel that the information technology used in e-learning systems is easy to use.
29. I feel that information technology used in e-learning has several useful functions.
30. I feel satisfied with the internet speed.
31. The ease of students' access to the internet in the university affects their satisfaction with the e-learning system.

Environment

32. In virtual education systems, various methods are used to evaluate the students (quizzes, written works, oral presentations, etc.).
33. I believe that if I try harder, I will have a higher chance of getting better results.
34. I believe that e-learning can help to improve interactions between the students.
35. I believe that e-learning can help improve the interactions between students and professors.
36. E-learning system facilitates discussion and exchange of ideas between students and professors.
37. I believe that the virtual education system facilitates the sharing and transfer of knowledge among students.
38. I can receive technical support from the virtual learning technicians when needed.
39. I think that the quality of virtual education support services in the university is good.

Satisfaction

40. I have access to suitable consultants to meet my needs.
41. I am happy with my decision to choose this system (virtual education system).
42. If there is an opportunity in the future, I will be happy to participate in these types of classes again.
43. I feel these courses have met my needs and expectations very well.
44. I will recommend these classes to other students.

Conceptual Model

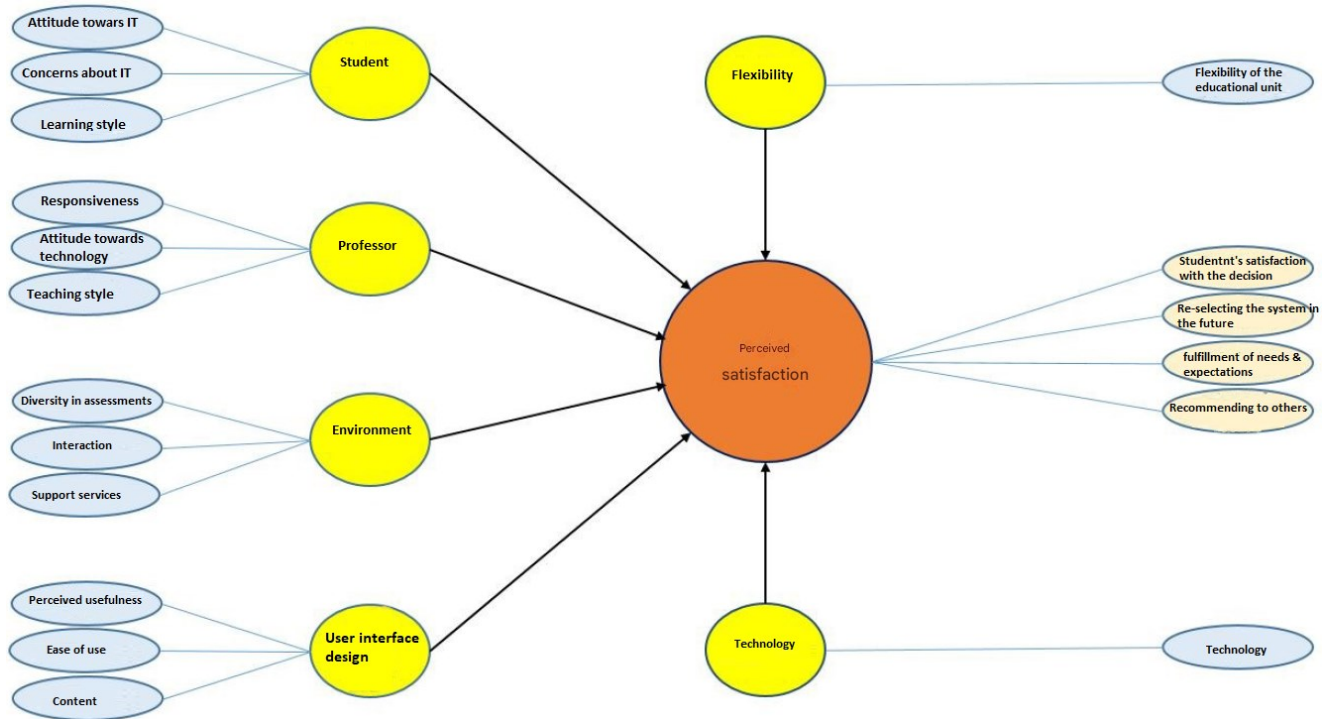


Figure A.1
Conceptual Model Used to Design the Questionnaire