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Exploring the Key Components of Initiating and Establishing Electronic Learning in Zanjan University of Medical Sciences

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Abstract

Background & Objective: By considering the importance and position of virtual education at higher education institutes, the present study was conducted with the aim of designing and codification of detailed roadmap, as well as the successful establishment of virtual education at Zanjan University of Medical Sciences.

Materials and Methods: The present study was performed by directed content analysis method. Sources including books, articles, dissertations, and results of interview with 10 experts in this field were used to determine the effective components of successful virtual education. Data were collected by in-depth semi-structured interview and observation. The context of interviews was implemented word by word and analysis were performed at the same time. The detailed roadmap of virtual education was designed according to the strategic plan of virtual education center at Zanjan University of Medical Sciences.

Results: Four components including skills and knowledge of virtual learning, structure and process for virtual learning development, motivation and attitude, and finally standards were determined as the key components for establishment of virtual learning center at the university.

Conclusion: Findings could be used as a basis for other universities and institutes regarding the development of virtual learning and is useful for setting and establishing the virtual education centers.

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Introduction

Since ancient times, the education of students has been more efficient with the help of teaching aids. The variable form of education has undergone frequent changes due to recent problems in healthcare systems and economic issues. Outdated systems, which included in-person classes and teacher-centeredness, have been replaced by novel learner-centered training methods. In addition, the development of internet networks and the interest of many people in the use of electronic devices have facilitated the communication of people with each other while decreasing cost and time (1). The idea of using computers and computer networks for academic and scientific activities dates back to the 1960s. However, today's form of e-learning and its widespread use was initiated in the early 1990s, and it grew rapidly due to the high capabilities of the web. Today, e-learning has consolidated its position in the educational system of many countries (2, 3). Known as virtual e-learning, this novel training method has been recognized as one of the most advanced teaching techniques in the world. In this type of training, the educational content is presented using images, audio, and text. Moreover, the communication between teachers and learners or among learners themselves improves the quality of education and increases the possibility of memorizing the content.

Widely used today, the new system is blended learning, where teachers combine multimedia classroom learning with e-learning technology (4). There are various components for the implementation

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of e-learning in any higher education system, which are determined using learning models. On the other hand, various models exist for implementing e-learning, including people-process-product (3P), chain of people, process, output, and social learning-based model. Nonetheless, the main objective of all of these models is to present a framework for more successful implementation of virtual e-learning centers so that new technology challenges and anxiety of learners could be decreased and the e-learning could be effectively designed and executed in this regard. These models are useful tools in the strategic planning process to determine factors affecting educational success (5, 6).

A literature review revealed that various studies have been performed in different countries, including Iran, to identify key factors affecting e-learning success. For instance, Zhaidary et al. identified motivation, leadership, support of students and faculty members and service provision method as the key factors involved in successful virtual training (7). In another research by Goi et al. in Malaysia, program content, web page accessibility, learners' participation and involvement, website security and support, institution commitment, interactive learning environment and instructor competency entailed critical success factors of E-learning program implementation (8). A similar study was performed by Kritparcha et al. in Thailand, where other factors such as learners' acceptance, teaching and learning support system, infrastructures, management system, curriculum and study design, as other components involved in this area (9).

Some studies have addressed this issue in Iran. For example, Mohammadzadeh et al. studied the effective success factors for e-learning in public universities of Tehran, reporting that the factors of management, support services, educational content, and students' features were involved in the successful implementation of e-learning (10). Therefore, there is a lack of consensus over the key effective factors for e-learning, which could be due to the difference in the context of studied organizations and the research methods employed in the studies. Given the importance and necessity of implementing e-learning in medical universities of the country and with regard to various needs, problems, and requirements existing in various universities for successful implementation of e-learning, the present study aimed to determine the key effective components for the successful implementation of this education method in Zanjan University of Medical Sciences, Zanjan, Iran.

Materials and Methods

The present study was performed using directed qualitative content analysis (11). First, the related texts were reviewed to identify the key effective factors for the establishment of virtual learning based on various existing models and previous studies. To this end, we collected all related articles published up to December 2019 in databases of Google Scholar, Scopus, Iran Medex, Elsevier, SID, Ovid, Science Direct, PubMed, and Magiran. To do a wide and deep search, the keywords included virtual learning, e-learning, virtual/electronic education, e-learning/virtual learning establishment, e-learning/virtual learning initiation, e-learning/virtual learning model, and e-learning/virtual learning roadmap. The papers were selected from Farsi or English articles with available full texts. All factors that were thought to play a role in setting up e-learning were collected and presented in the form of a conceptual framework with the study of the research literature and evaluation of aspects of effective factors for e-learning. Even though the conceptual framework of the research was developed based on previous research and existing models, the experiences of managers and faculty members involved in e-learning were used to present the essential components of virtual education establishment in Zanjan University of Medical Sciences. Contrary to quantitative methods, the number of participants is not pre-specified and depends on the research process and emerging categories (11). Therefore, interviewees were selected

by purposive sampling, and interviews continued until data saturation. In total, 10 subjects were enrolled in the study. The inclusion criteria were being a faculty member or head of the department and having the experience of virtual education in medical universities for a minimum of two years.

Each interview lasted 40-60 minutes, and interviews were carried out by two of the main researchers. One-two interview sessions were held depending on the time and interest of participants and the need for acquiring more information. In order to obtain valid information, some interview techniques such as multiple interviews, exploration, interview completion techniques and reflection to provide a calm and comfortable environment. In addition, in order to keep in touch with the subjects during the research, receive more information and clarify some of their information, the participants were contacted via telephone and video conference in addition to frequent in-person meetings. All interviews were recorded and verbatim transcription of the interview was carried out after each one, followed by the analysis of the received information. The interviews were of the in-depth semi-structured type, meaning that other questions of the interview were determined based on information obtained from the reviewed qualitative content analysis and according to the main question of the research (i.e., what are the key effective factors for e-learning development?". Complementary questions were asked when there was a need for more exploration. Some of the questions asked during the interviews were: what are the effective factors for the establishment of virtual education in university? What are the skills and features required in beneficiaries of virtual education?

What are the steps and processes of virtual education establishment? What should electronic content standards be in a successful e-learning system? How can an e-learning system be assessed in a university? What are the key equipment and human resource infrastructures involved in the development of a virtual education system in a university? Moreover, data analysis was carried out using directed content analysis, meaning that the recorded information was carefully checked several times and implemented verbatim after each interview in the shortest time possible. Following that, the information was typed again and compared with recorded content. Manual data analysis was initiated during the primary data collection stages, which helped the round-trip process between creating concepts and collecting data and directed the next data collection stages to achieve proper data. During the data analysis process, the units of analysis are determined first, which was the entire text of each interview in the present research. Coding of phrases was carried out after determining the semantic units, during which semantic units were turned into codes. Afterwards, codes were summarized and classified, followed by the formation of the secondary and primary categories.

Basic steps for achieving success in setting up and establishing virtual education in Zanjan University of Medical Sciences were developed using a centralized group discussion method after the qualitative analysis and based on the model of effective factors for virtual education and their role and relationship and according to the strategic plan of virtual education. To this end, a two-hour focused group discussion was held, and the participants included the researchers of the current study along with a number of experts in the field of virtual education. The in-person group meeting was held and managed by a manager, a facilitator, and a secretary. In order to make the most of meeting time, a summary of interviews was presented at the beginning of the session, and its participants shared their views and experiences about the infrastructures required to establish virtual education in Zanjan University of Medical Sciences based on the interviews and the strategic virtual education plan of the university. The text of the conversations in this focus group was recorded for qualitative analysis, which was carried out after typing the text.

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A mix of several methods, including member checking, conducting more interview sessions with some of the subjects, frequent phone calls with participants, and effective interaction between the research team and participants were employed to increase rigor and more accurately interpret the data. Moreover, the codes and themes were reviewed by two research members and two supervisors to reach a consensus and increase the confirmability of results regarding the accuracy of the coding process and data interpretation. It is noteworthy that the researchers adhered to ethical considerations by gaining permission to enter the research setting, receiving written informed consent, and receiving permission from the subjects to record interviews. In addition, the participants were ensured of the confidentiality terms regarding their personal information and they were allowed to withdraw from the study at any time.

According to the directed qualitative content analysis, we first analyzed the related texts (e.g., results of similar studies) and existing models related to the key factors for virtual education development in different universities. The primary coding led to the extraction of 59 initial codes based on the analysis of the data obtained from in-depth interviews and focus groups. After qualitative analysis, the initial codes were classified into four main classes and 14 subclasses (Table 1). Table 2 presents the details of components along with initial codes and participants' codes.

Table 1: Main themes and sub-themes resulting from qualitative content analysis

(main themes)	(sub-themes)
E-learning skills and knowledge/e-learning	Learners' skills
	Teachers' skills
	Knowledge of teaching-learning concepts
	Effective communication and interaction skills
	Assessment and test skills
The structure and development process of e-learning/e-learning	Evaluation and control of e-learning
	Hardware and software infrastructure
	Cultural themes
	specialized human power
	Incentive and support systems
Motivation and attitude	Intrinsic motivation
	External motivation
Electronic content standards	Technical standards
	Ethical considerations

Knowledge and Skills of E-learning /Virtual Education (Electronic Learning)

According to the participants' experiences, one of the important components for the development and establishment of virtual education in university is the skills and knowledge required in virtual education, which include learners 'skills, teachers' skills, effective communication and interaction skills, assessment and test skills, and knowledge of teaching-learning concepts.

Learners' skills: Some of the subjects explained the need for some necessary skills to learn via e-learning

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(e.g., working with computers and mobile apps) and familiarization with and use of the special academic software (Navid). In this regard, some of the statements of students are presented below:

Participant 1 (P1): I believe that a learner should know how to work with a computer…

Participant 2 (P2): Students should have mobile and computer competence…Personally, I first introduce the learning management system (LMS), explain its facilities, method of work, and advantages, and conduct a survey…

Teachers' skills: According to the subjects, some of the teachers' skills, including information and telecommunication technology (ICT), affect virtual education development in the university. For instance, one of the participants expressed:

Participant 6 (P6): Students and teachers share some common features, the most important of which is ICT.

Participant 10 (P10):…I think teachers should have the skill of communicating with students in the virtual system…

Effective communication and interaction skills: Given the lack of face-to-face communication between teachers and students in virtual education, it is crucial to be familiarized with communication skills and interact with one another to hold a useful online and offline virtual education course. In this regard, some of the participants mentioned:

Participant 4 (P4): Content should be interactive. The interaction of the teacher with the student and the student with the teacher should be observed.

Participant 6 (P6):…. Because you do not have face-to-face interaction with students. For instance, behaviorists believe that content should be presented in fragments and not in whole in order to motivate learning in the students.

Evaluation and test skills: From the perspective of the subjects, proper evaluation of students could improve the education process and quality. In this regard, some of the participants expressed:

Participant 1 (P1):…Teachers' familiarization with the implementation of the test in Navid System and designing comprehension questions can improve evaluation. In fact, teachers should not simple questions that could be easily answered based on handouts in the virtual education method and should ask more comprehension questions…

Participant 10 (P10):… The teacher can assign a part of the final grade to the homework or projects offered to students during the semester…

Knowledge of teaching-learning concepts: Familiarization with teaching and learning skills is one of the effective requirements of virtual education, which can improve the course presentation quality and motivate students to learn more efficiently. For instance, some of the subjects stated:

Participant 1 (P1):…Teachers should use different methods to attract students to the content. Some of the courses are in a way that they could be taught through games. Another method is to design tests in the middle of slides so that students could move on to the next stage after answering the questions correctly…

Participant 8 (P8): Teaching and learning, whether in the virtual system or in person, share a series of principles and can be generalized in both environments. Proper education should be goal-based. In addition, it should be based on the educational needs of students…it also should create coherence in learning of students and must be interesting to them…

The Structure and Process of E-learning/Virtual Education Development

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The participants introduced infrastructure as one of the important components for the development and establishment of virtual education in the university. These components include the evaluation and control of e-learning, hardware and software infrastructure, cultural components and specialized human resources.

Virtual education control and evaluation: Content presentation method and continuous assessment of the data played a fundamental role in the experience of some of the participants in terms of successful implementation of virtual education. In this regard, participants affirmed:

Participant 1 (P1): Teachers should be assessed by students and vice versa. Educational content should also be controlled according to quality standards.

Participant 6 (P6):... The experience should include proper training, course assessment, teacher evaluation, appropriate assignments and content and general skills of the course. The score allocated to these six components will show students' perception of the course... it is also 100% crucial to evaluate the quality of the content.

Hardware and software infrastructures: Hardware and software facilities are the basis for the establishment and use of virtual education in any university. Some of the subjects marked:

Participant 8 (P8): All standards published in the Virtual University of Medical Sciences should be established in the center as the required technological infrastructure.

Participant 6 (P6): Technological infrastructure is of paramount importance. A group that encompasses software engineers, who produce content, should be involved in technical discussions. In addition, we need special computers, acoustic rooms and a recording device.

Participant 10 (P10):... We need good bandwidth, high Internet speed, server, computer, and LMS.

Cultural components: The cultural preparation of all individuals working in the university can play a fundamental role in the success of any virtual education institution. Acceptance of e-learning as an effective learning method by administrators, as well as professors and students is extremely important. In this respect, some of the students mentioned:

Participant 6 (P6): It is crucial to teach the cultural aspects of this type of learning before its implementation. First, the pedagogical umbrella should be evaluated and we have to understand the attitude of professors and students.

Participant 10 (P10):.... Culturalization should occur in the university...

Specialized human resource: Recruiting expert and skilled force can play an important role in the successful implementation of virtual education. In this regard, some of the participants affirmed:

Participant 1 (P1): Trained personnel in the IT and medical education field, updating of those working in the virtual education center, and being familiarized with new software are crucial.

Participant 5 (P5): I believe that the production team should be stronger and more accurate... time is really important for those involved in the clinical field. Something simpler should be designed. For instance, a group should come to the hospital. The workforce is extremely important. We need someone who is trained in virtual education and not a graduate in the field of computer. We must be proficient in terms of virtual education. We have had the experience. We need someone who can go to another university and use their experiences.

Participant 10 (P10): In terms of infrastructure, we need to increase the number of skilled human

resources in the field. Someone who has studied in the field of educational design and virtual education.

Motivation and Attitude:

According to most subjects, motivation and attitude played a fundamental role in the implementation and continuation of virtual education in the university. An example of students' experience in this area is presented below:

Incentive and support systems: Supporting faculty members and establishing incentive systems could be effective in the implementation of any new method.

Participant 3 (P3): These behavioral theories are so influential in the e-learning system that it is the feedback that is rewarded. Teachers can reward students with their feedback, which can even be a sticker…The cash part of it is not that important for colleagues and its spiritual aspect is more important. It is important to see these motivations by educational managers and students.

Participant 5 (P5): We need to motivate teachers. They think that their efforts dedicated to this area are not that valued. Therefore, we need to highlight this area since it is very time-consuming…motivation should constantly occur…the main issue of clinical workers in related to their promotion.

Participant 7 (P7): Holding workshops to empower faculty members. It must be considered in yearly promotion scores as an educational activity and even in ranking promotion of teachers. This is important if our goal is to identify interested people, introduce active people to other members, and turn them into role models.

Intrinsic motivation: Teachers' intrinsic motivation is one of the requirements for presenting courses virtually.

Participant 6 (P6): Teachers who seek advantages do not know the advantages of virtual education. Their best gain is to understand the advantages of this educational system. Before talking about motivation, it is better to express the benefits and advantages of e-learning before the financial aspects of the issue.

Participant 8 (P8): As a teacher, the best reward is to know that this type of educational method can help the learning process of students and has more advantages, compared to in-person classes. This is the best motivation to continue.

External motivation: Considering support and incentive systems for faculty members who hold their classes online can motivate others to do the same.

Participant 7 (P7): Giving grades and educational points is good for improving the rank and base…

Participant 9 (P9): Scoring encourages people. Even though this tradition is wrong, it increases participation. The application process is long, and a long path discourages people ...

Electronic Content Standards:

All participants explained that it is essential to follow technical principles and professional ethics in the production of electronic content. Some of the statements of the subjects are presented below:

Technical standards: According to most participants, adhering to technical standards and principles increases the attraction of the educational content. For instance:

Participant 1 (P1): Good content should be short and the audio should be synced with the audio. It also should have an order. The objectives should be clear. The teacher should introduce himself and a reference should be presented at the end. According to the audience, content can be multimedia. Therefore, it is important to know who is going to learn the content.

Participant 10 (P10): To produce good content, the standards announced by the Virtual University of Medical Sciences must be met. The content should be

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short and the professor must address students. It is good to have multimedia content because learning systems are different for various people.

Professional ethics: Respect for copyright is one of the points that should be considered in preparing educational content.

Participant 4 (P4): We must adhere to copyrights and ask professors whether they give consent for downloading their content or not…

Participant 9 (P9): Respecting the copyrights by using the university's logo is legally accepted and the content can be used in other places.

Table 2: Qualitative analysis of data related to key themes effective in launching and developing virtual education

Main classes	Subclasses	Basic codes	Participant code
E-learning skills and knowledge/e-learning	Learners' skills	Learning computer skills in learners	P1, P2, P3, P4, P8
		Learning skills to work with mobile applications in learners	P2
		Have basic skills and skills to work with the Internet and ICT	P6, P7
		Familiarity with educational technologies	P1, P3
		Ability to log in and use the e-learning system	P2, P7, P9, P10
		Familiarity with LMS space	P2, P7, P9, P10
		Having the ability to self-regulate and self-manage	P7, P6, P7
		Time Management	P3, P5, P6, P8
	Teachers' skills	Computer skills in teachers	P1, P2, P4, P9, P10
		Teachers' skills in working with mobile applications	P2
		Basic PowerPoint Production Skills	P10
		Basic ICT skills and Internet skills	P2, P4, P6
		Participate in e-learning courses as an inclusive including virtual master and e-learning fellowship	P1, P2, P3, P4, P5, P9
		Improving individual competencies in the virtual field by participating in relevant empowerment courses	P6, P7, P9
		The power to attract students to virtual learning	P3,p7
		To stimulate the student's active learning power	P3,p4
		Creating interest and motivation in students	P9, P10
		Familiarity with students' abilities	P3.p6
		The proper information to students	P1, P5, P10
		Continuous monitoring of student activities	P5,p7
	Knowledge of teaching-learning concepts	Creativity for the production of educational content	P10,p4
		Teacher's previous acquaintance with theories and psychology of learning in e-learning	P6
	Effective communication and interaction skills	Providing the possibility of effective interaction between the student and the content	P1, P3, P5, P8, P9, P10
		Content feedback and test usage	P5,p7
		The multimedia of content fit different learning systems	P1, P2, P3, P4, P10
	Assessment and test skills	Formative and final evaluation of the student by the relevant professor	P1, P2, P3, P4, P5, P9, P6, P7, P8, A5 P10
		Periodic evaluation of professors by students	P1, P2, P3, P4, P5, P6, P7, P8, P10
Structure and process of e-learning / virtual learning	Evaluation and control of e-learning	Evaluate the quality of content produced in terms of compliance with standards	P1, P4, P5, P6, P7, P8, P9
		Evaluate infrastructure, system, and website	P4, P7, P8, P6, A5
		Evaluation of human resources involved in virtual education	P3,p7
		Periodic surveys of professors and educational administrators of the university regarding the virtualization unit	P3, P7, P8

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Continue of Table 2: Qualitative analysis of data related to key themes effective in launching and developing virtual education

Motivation and attitude	Hardware and software infrastructure	Hardware infrastructure, network, and software required for content preparation	P1, P2, P3, P4, P5, P9, P6, P7, P8, A4 P10, A1
		Facilitate the content preparation process	P1, P2, P9
	Cultural themes	Culture building in the university to provide a suitable platform for virtualization	P3, P6, P8, P10
	specialized human power	Sufficient manpower	P1, P2, P3, P5, P6, P7, P8, P10
		Personnel trained in information technology and medical education	P9,p7
	Incentive and support systems	Granting copyright to the content produced by the professors for reference and in other words inserting the name and logo of the university in the produced content	P1, P2, P3, P4, P5, P9, P10 P6, P7, P8,
		Free and available internet for faculty members	P6, P9, P10
		Clarify the benefits of e-learning for teachers	P6, P9
		Facilitate the process of accessing hardware facilities for content production	P4, P5
		Holding empowerment workshops for professors	P1, P7, P9
		Downloadable content produced by professors with their permission	P4, p3
	Intrinsic motivation	Spiritual support for professors involved in e-learning	P3, P7, P8, P10
	External motivation	Material incentive support	P1, P4, P7, P8
		Pay tuition	P4, p3
		Impact on improving the base and rank of professors	P1, P2, P5, P7, P8, P10
Electronic content standards	Technical standards	Full compliance with virtual standards for video and audio	P4, P9, P10
		Formative and final evaluation	P1, P3, P5, P6
		Express goals at the beginning of the content	P10,A6
		Introducing the instructor	P6, P10
		It is necessary to determine what media and educational materials we need to achieve behavioral goals	A6
		Preparation of educational materials appropriate to the method of content presentation	A5
		Content should be competitive, research, and credible.	A1
		Proper referencing	P6, P10
	Ethical considerations	Observance of all general moral issues in virtual classes	P1, P2, P7, P8, P10
		Observance of copyright in content production and proper referencing	P1, P2, P3, P4, P5, P9, P10 P6, P7, P8,
		Registration of university logo on production content	P2, P3, P6, P9, P10

In the end, the subjects expressed their opinions in the focus group meeting based on the results of interviews and the strategic plan of Zanjan University of Medical Sciences. Classification of their opinions revealed that the required organizational infrastructures can be classified into three general classes of financial resources, information and communication technology and information and motivation in human resources. In addition, there were six main steps to establish virtual education at Zanjan University of Medical Sciences, including promoting organizational culture in e-learning among professors and students, improving the quality and standards of e-learning in the university, developing the physical infrastructure

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and equipment of e-learning, developing human resources, using new technologies in e-learning and generating revenue and reducing costs and sharing electronic content and experiences. Ultimately, eight classes of measures were predicted for facilitating this movement, the results of which are presented in Figure 1.

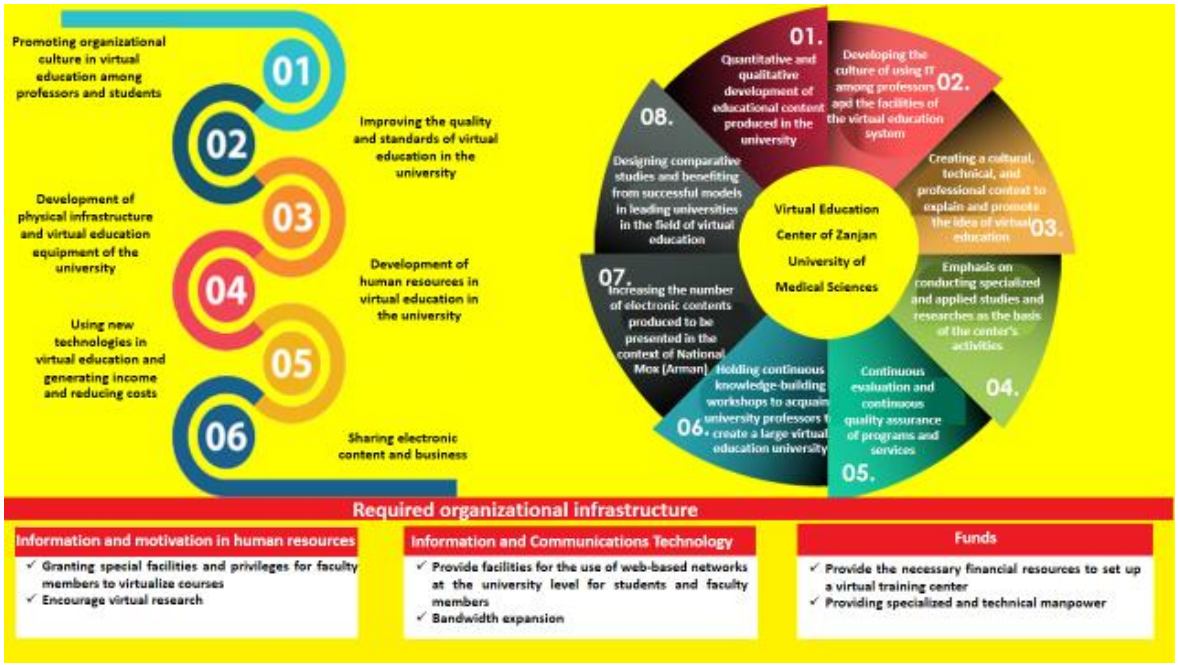

Figure 1 - Basic steps to achieve the establishment of virtual education in Zanjan University of Medical Sciences

Results

Participants:

In the second stage, eight faculty members with work experience in the education field (44.44%), 7 education managers at the education department level (38.88%), and three school dean and vice chancellor for education (16.66%) participated. The mean experience of cooperation in educational activities of the participants was 7±3 and their mean age was 36±5 years. The third stage was carried out with the cooperation of the educational officials of the schools, heads of departments, and faculty members (15). Overall, there were 15 education managers and officials, 13 of whom were male (87%) and the rest (13%) were female. The mean experience of cooperation in educational activities of the participants was 9±4 and their mean age was 38±4 years. In the first phase, 159 free codes related to the components of the comprehensive assessment system were extracted and classified. In the second phase, the draft of the comprehensive assessment system framework was developed with 29 items in four categories. In addition, the integration of 11 items (turning them into five comprehensive items) and the edition of five items for more transparency were proposed in the qualitative evaluation of content validity. The framework of the comprehensive assessment system with 23 items was entered quantitatively in the content validity evaluation phase. According to the results, four items with CVR<0/49 were eliminated from the framework (Appendix 1). In

addition, the CVI of all items was reported higher than 0/7, which led to their remaining in the framework. Ultimately, the framework of the comprehensive assessment system was finalized with 19 items. The quantitative CVIs of the mentioned framework are presented in Table 1.

The final version of the comprehensive assessment system was compiled in 19 items and four main axes, including 'goal' (1 item), 'managerial structure and organization' (2 items), 'assessment system design and implementation framework' (12 items) and 'quality assurance of assessment system' (4 items). The mentioned framework emphasized the necessity of developing the main goals of the assessment system and the alignment of the evaluation program with the curriculum and learning processes for educational institutions. Moreover, the necessity of forming various committees to carry out policymaking, implementation, and monitoring of the assessment system in the educational institution was mentioned in the axis of 'structure and organization'. In the axis of 'design and implementation of the comprehensive assessment system', which included the most items in the framework, educational institutions were required to prepare a suitable structure for the assessment system. The axis encompasses various components, such as the use of blueprint, standardization of minimum pass level methods, holding formative and summative tests, and a suitable feedback mechanism. The axis of quality assurance of program evaluation included the development of instructions to improve the quality of the test, considering the quality assurance process related to the various components of the comprehensive assessment system, establishing the essential infrastructures, sufficient resources, and advocacy program and meta-evaluation of the comprehensive assessment system. In this axis, the focus was on faculty empowerment as one of the key criteria for quality assurance.

Discussion

According to the results of the present study, the main components of establishing e-learning in the university, including e-learning skills and knowledge, e-learning development structure and process, motivation and attitude, and standards were identified and refined. Each of these primary and secondary components will be discussed below. The first component was the skills and knowledge of e-learning. According to Table 2, the statements of the interviewees were classified into five subcategories, the most important of which was the skills of students and teachers. Meanwhile, students and teachers shared some of the skills, including mobile and computer competence, having basic information technology skills, and knowledge of how to work with the Internet. Given the increasing growth of technology, the students and teachers were relatively familiarized with these skills, which is why this factor was less important from the perspective of the subjects. In addition, based on the experiences of some of the participants, self-regulation ability and time management skills in students were crucial for the successful implementation of e-learning systems. Students will be able to plan and manage more appropriate and effective time to classify, take notes, review and answer questions if they use self-regulated learning strategies in e-learning. Such students have intrinsic motivations of progress and self-regulation, which helps them have a more positive attitude and higher motivation, compared to other students, which contributes to their academic achievement (12). Azizi et al. conducted a research on students of the University of Babol to evaluate the relationship between self-regulation and academic achievement of students. According to their results, self-regulation had a positive and significant effect on students' academic achievement. These scholars also showed that having the experience of working with e-learning systems and more knowledge of computers increased the use of self-regulation strategies in students. Therefore, higher-year students have more self-regulation skills due to more experience and were more successful in e-learning (13). In terms of teachers' skills, having previous experience and

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upgrading individual abilities through participation in virtual empowerment courses for teachers was emphasized by a significant number of participants in the present study in addition to having basic computer and Internet skills.

It seems that the participation of a large number of participants in this study as learners in virtual MSc courses and e-learning fellowships, as well as participation in virtual training workshops held by the university and the usefulness of these courses were a key factor for this opinion. In a research on the needs of instructors and students for successful e-learning, Gillett et al. emphasized the importance of a previous experience as an active teacher and acquiring the necessary technical skills (14). Moreover, a number of participants pointed out other abilities of teachers, including attracting students, motivating the power of active learning and creating motivation in students, familiarization with students' capabilities, their proper informing about the course matters and continuous follow-up of their activities. While these factors were rarely mentioned in other studies, all of the above are essential features for the success of a teacher in all educational systems. Virtual education is no exception in this regard. In addition to the skills of students and teachers, knowledge of the concepts of teaching and learning, communication skills and effective interaction, as well as assessment and testing skills were sub-components of the main component of e-learning skills and knowledge.

Analytical evaluation of the interviews showed that almost all participants mentioned the necessity of interactive and multimedia virtual content. In general, there is consensus among researchers and educational experts regarding the effect of interaction on learning. Consistent with our findings, Lou et al. revealed that the effectiveness of virtual teaching was in line with the components of teachers' interaction with students, cooperation between students, active learning, immediate feedback and meeting students' expectations by professors (15). In fact, effective interaction awakens the thinking process of students, causing the learners to more accurately analyze the received information. Therefore, interaction in e-learning acts as a driving force for achieving educational goals, and its presence is crucial for creating a sense of presence in a community, unity and transfer of learning. Moreover, multimedia and attractive content is essential and was pointed out by most participants in the current research. Various studies have mentioned different features of content for holding a high-quality virtual education office. For instance, Selim believes that the simultaneous use of audio and video and dynamic simulation programs along with high-level interaction were among the essential components of virtual education courses (16). Such content can include activities that fit the learning style, which increases motivation for learning in students. In order to produce high-quality multimedia content, teachers should have sufficient knowledge of the Internet and educational software, and having previous experience in using the same content produced by professors called medical education and e-learning can provide the necessary motivation to provide quality electronic content.

Another issue pointed out by some of the participants was giving feedback on the content, the effect of which should not be overlooked. Similar to traditional education, students should constantly review their understanding of course content and the extent to which expectations are met in e-learning, which could be facilitated by teachers' feedback. According to Kearsley et al., there was a direct relationship between the use of feedback in e-learning and students' progress and satisfaction (17). Obviously, teachers need to assess students' activities in order to give feedback. Therefore, students' formative assessment is also performed by providing continuous feedback. In the evaluation of pedagogical barriers to the development of e-learning, researchers such as Bou Kamal et al. and Shirkhani et al. introduced important factors of students' learning quality assessment and inappropriate traditional conventional evaluation methods. However, it seems

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that we can deal with these challenges by making changes in the existing evaluation techniques while considering teachers' workload (18, 19). In this respect, Hoadley et al. considered the use of some criteria for assessment to be crucial, mentioning the students' load of activities, delivered content and its method of expression as e-learning evaluation criteria (20). According to most participants, periodic assessment of teachers by students was crucial. Without a doubt, evaluation is an inseparable part of any educational system, including virtual education, since it could help identify the strengths and weaknesses of teachers in a system. On the other hand, teachers can act based on students' opinions on how to teach their virtual units, in order to improve the quality and increase student satisfaction in the coming years.

The structure and process of e-learning development in university was the next key factor for the establishment of a virtual education system. This factor was assessed in three subclasses of virtual education control and evaluation, hardware and software infrastructures and cultural components and expert human resources. Most subjects mentioned the need for various evaluations, including the evaluation of the quality of content, infrastructures, system and website. In addition, a number of students considered the evaluation of human resources working in virtual education and periodic assessment of educational managers and teachers of the university to be significantly important in this regard. In the proposed model, it was pointed out that virtual education evaluation should focus on the individual, process and learning products (6). According to all participants, the hardware and software infrastructures are the intrinsic foundation of virtual education. Some of the subjects mentioned faculty members' access to free internet an important factor in this respect. Many other researchers have addressed the need for evaluation of this issue in the development of e-learning. In a research by Khan et al., which introduced the well-known Khan model in virtual education development, the researchers proposed some quality improvement criteria in virtual education, including technological infrastructures, interface design, management, resource support and organizational factors in addition to educational and assessment factors (6). According to the results of the foregoing research, providing technological infrastructure along with the development of human resources involved in e-learning was one of the most important factors for the success of an e-learning system in universities and higher education institutions. These results are congruent with the results obtained by Afyooni et al. and Clarck et al. regarding the existence of hardware facilities in the establishment of virtual education (21, 22). Moreover, the effect of human resources and support on successful virtual education should not be overlooked since success cannot be achieved without the presence of experts to assist the use of infrastructures and continuously support faculty members and students despite having the strongest technological infrastructures. This was also pointed out by Afyooni et al. and Clarck et al. (21, 22).

Motivation and attitude were presented as other key components for the establishment of virtual education, which was confirmed by many of the interviewees. Numerous studies have been performed on internal and external motivation factors that affect the acceptance and development of e-learning. For instance, Lee et al. and Vafaee et al. reported that stimulating internal and external motivations along with creating a positive attitude towards e-learning among teachers were extremely important requirements for the design of virtual education and moving towards its implementation in formal university education (23, 24). Educational reform at various levels of the university requires creative and committed instructors along with supportive and hard-working executive management. In addition, university authorities should not overlook the internal and external motivations for teachers in order to successfully set up an e-learning system. Similar to

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many other people, teachers may not be that eager to accept new and high-risk situations, especially without receiving additional rewards for taking on new responsibilities. According to Quinn, if a university wants to increase the number of instructors participating in its e-learning, it should consider satisfying the instructors who have been involved in this area the first time and giving them a chance to learn (25). Internal motivation can be made by the university's spiritual support of teachers involved in virtual education, whereas external motivation can be made by material incentive support, tuition payment, and considering virtual education in improving the base and rank of professors. According to Lundie et al, if the reward system does not provide the incentives for the extra time required for virtual courses, anti-technology instructors will have many excuses to avoid holding virtual classes (26). Similar to the opinions of many participants in the current research, Lousdale mentioned that internal satisfaction in the effectiveness of motivation and higher efficiency were among the factors for success in the academic environment (27). According to Taylor, this issue was related to e-learning, and instructors in virtual training programs were motivated more by internal motivation as the ability to gain new audiences, the opportunity to develop ideas, and overall job satisfaction than by external motivation (28).

The last factor mentioned by the participants was adherence to the standards of electronic content. According to the qualitative assessment of interviews, all of the subjects emphasized the importance of factors such as respect for copyright in content production, granting copyright to the content produced by the professors by inserting the name of the university logo in the produced content, and proper referencing in this regard. Many researchers believe that adherence to all of these points can lay the foundation for adherence to ethical issues in virtual education and prevents the occurrence of various immoral instances in e-learning, including plagiarism, infringement of intellectual property rights, and lack of adherence to the principle of trusteeship. Therefore, establishing ethical responsibilities for teachers in terms of their own rights and others' rights is essential due to the free and wide flow of cyberspace (29). The necessity of adherence to technical standards has also been mentioned. In line with our findings, Ileana considered adherence to standards as one of the most important criteria for e-learning programs. In the process of e-learning and education, compliance with standards has long been considered as an extremely important component, in a way that numerous institutions have attempted to standardize the discussions made in the field of e-learning (30). Providing content in accordance with the standard has increased the quality of content produced, which in itself can create more motivation for students to study courses and lead to academic achievement and the success of the virtual education system.

Our findings will have the most use in the context of the present study after a deep recognition of effective factors for virtual education development in ZUMS as one of the medical universities of Iran despite providing valuable information for managers, researchers and teachers in the field of medical education.

Conclusion

According to the results of the present study, the key effective factors for the establishment of virtual education were e-learning knowledge and skills, structure and process of e-learning development, motivation and attitude of teachers and adherence to e-learning standards. In order to establish a successful e-learning system, there is a need for financial support of the process and providing expert human resources along with the expansion of information technology infrastructures. Most important of all, a need for informing and creating motivation in human resources is felt in this area. The results of this study can be used as a basis for the development of virtual education in other universities of medical sciences on a par with ZUMS in Iran.

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