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Original Article

Essential Competencies of Faculty Members in Virtual Education: A Post COVID-19 Analysis

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ABSTRACT

Background: The limitations of teachers' competencies in traditional settings, coupled with the evolving roles and responsibilities required for effective instruction in virtual education, underscore the significance of examining the specific competencies necessary for educators in this context. This study aimed to investigate the competencies that faculty members must possess for virtual education in the post-COVID-19 era and identify their priorities.

Methods: This research was designed in two distinct phases. The initial phase was carried out between June and November 2023. It involved a statistical sample of 225 faculty members from Shahid Bahonar University of Kerman, Iran, who were selected through a stratified sampling technique. The primary tool utilized for data collection was a standardized questionnaire comprising 31 items, designed on a Likert scale to assess various competencies. Validity (CVR=0.877; CVI=0.94) and reliability (α=0.88) were checked and confirmed, and SPSS V26 was used to analyze the data. In the second phase, the Stepwise Weight Assessment Ratio Analysis (SWARA) was utilized alongside a questionnaire to evaluate and weigh the competencies. The statistical population for this segment comprised 12 academic experts, and data analysis was conducted using Excel software.

Results: The overall average score for all competencies exceeded the established criterion of 3.4, indicating that all 31 competencies are deemed essential. Among these, teaching skills emerged as the most significant, with a mean score of 4.68. The average importance ratings across the various competency categories were relatively similar (ethical-social: 4.29, technical-technological: 4.26, educational-learning: 4.29, individual-managerial: 4.28, supervisory-supportive: 4.27). The overall average for all competencies reached a significant level, recorded at 4.28. Utilizing the SWARA method for ranking, the competencies were prioritized as educational-learning, ethical-social, individual-managerial, technical-technological, and supervisory-supportive.

Conclusion: The competencies of faculty members, as the front line of education, are essential for effective virtual education. This research aimed to comprehend the current conditions and examine the significance of these competencies, ultimately concluding that they are indispensable.

Keywords: Education, Distance, Faculty, Competency, COVID-19, SWARA

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Introduction

Recent technological advancements have resulted in novel applications, enabling the integration of innovative learning strategies and effective teaching methodologies within educational settings (1). In the meantime, e-learning and information technology are among the most widely used terms in education. Many academic centers and universities have integrated this form of education into their long-term strategic plans and generally allocate substantial resources to this area (2). Today, changes and developments in the field of education and turning to virtual education in schools and universities along with face-to-face education are inevitable (3).

The application of digital technology in education has been a subject of discussion for several decades (4). Following the COVID-19 pandemic, the issue has gained significant prominence in both public discourse and political agendas (5). The onset of COVID-19, accompanied by widespread lockdowns, has fundamentally altered lifestyles across various regions globally. Notably, the impact on the educational sector has been profound (6). These changes necessitated the integration of virtual platforms and internet resources into educational practices to meet established learning objectives (7). As the pandemic has subsided, universities are reevaluating their conventional roles and developing innovative educational frameworks. Simultaneously, the growing accessibility of modern technologies in higher education, the rising demand for higher education, the opportunities and challenges associated with the integration of information and communication technology, the necessity for economic functions to ensure the availability of pristine resources, and the application of information technology to offer educational services in global markets have all had significant effects (8-12).

While the COVID-19 pandemic had detrimental effects across numerous sectors, it appears to have positively impacted the field of education by compelling educators to adopt virtual teaching methods. Consequently, it is essential to enhance this mode of instruction through comprehensive in-service training programs focused on effective virtual teaching practices and the requisite skills for successful online education. The diverse characteristics and roles of faculty members in fostering effective teaching within virtual environments highlight the necessity of equipping educators with critical educational, social, and cognitive competencies (13).

The effectiveness of designing and delivering virtual education, akin to traditional face-to-face instruction, is influenced by various factors, including the educator, the student, technological resources, instructional design, financial support systems, and educational policies (14, 15). Notably, the role of instructors in these courses is of paramount significance (16).

In accordance with the evolving landscape of educational topics, it is essential to have an effective instructor who covers all the elements of e-learning optimally and comprehensively, thereby maximizing the achievement of educational objectives. The competencies of the electronic instructor create the necessary background for developing the relationship between the learner and the instructor as the main element of successful learning (17). The instructor can change the e-learning environment from passive to active through learner-centered training (18). Researchers acknowledge that virtual teachers need various competencies to teach effectively in a virtual environment, which, due to the characteristics of this environment, are often different from teaching skills in a face-to-face environment (19).

The evolving role of educators has rendered their prior competencies inadequate. Beyond the essential skills required in conventional educational settings, teachers must also receive support in diverse areas. A critical initial step toward this goal is to assess the competencies of faculty members within the context of virtual education in the post-COVID-19 landscape (20). In contemporary academia, the ability of universities to advance and innovate is increasingly dependent on the provision of training programs aimed at

enhancing the skills of faculty members. This need has become particularly pronounced in the context of the growing emphasis on virtual education, especially highlighted during and after the COVID-19 pandemic. The shift towards online learning necessitates that educators possess specific knowledge, skills, and competencies tailored for virtual environments. Therefore, identifying and prioritizing these competencies is essential for faculty development. By focusing on these areas, universities can foster the professional growth of their educators, which in turn is expected to enhance the overall quality of virtual education offered (21, 22).

Several studies have been conducted in the field of faculty members' professional competencies, and most of these studies have investigated learning competencies in non-virtual learning environments. In addition to understanding technical and operational aspects, teachers need to acquire the necessary knowledge in pedagogical skills (23, 24). In this framework, Gilzene has listed 11 roles for virtual education instructors, including technology-savvy educational designer instructor, technician, facilitator, performer, supporter, editor, librarian, evaluation specialist, and graphic designer (25). The research results of Bornet and colleagues (2020) show that in the e-learning environment, teachers' professional skills include technical skills, educational competence, and communication skills (9). Amundsen (2012) suggests that faculty development, in a general sense, is any intervention that aims to provide the necessary opportunities for faculty members to improve their scholarly roles as research scientists, educational researchers, and teachers (23). Hajizadeh and colleagues (2021) state that the necessary characteristics for virtual education and learning system faculty members include management and encouragement, interaction, student support, digital skills and commitment, positive attitude and facilitation (27). The findings from the research conducted by Sadeghpour and Mirzaei (2008) indicate that the effective development and execution of high-quality virtual education courses necessitate comprehensive preparation of educators across various social, cultural, economic, and educational aspects (28). The research conducted by Daneshvar and Mehr Mohammadi (2012) investigated the essential qualifications required for virtual education teachers. Their findings suggest that virtual educators must possess three critical qualifications: pedagogical, technological, and the combined qualifications of pedagogic knowledge and technology. The growing prominence of virtual education and the proliferation of e-learning environments underscore the importance of these qualifications for virtual teachers (29). Pourjamshidi and Fard Danesh (2014) identified several factors that influence the interaction between teachers and learners in web-based educational settings. These factors encompass technical and instrumental skills, communication skills, commitment and order, mastery of scientific content, motivation, and attitudes toward virtual education (30). Mehralian and Maghami (2022) consider the competencies of an electronic teacher to include 16 components in 8 dimensions: social, ethical, managerial, individual, teaching skills, supervision, educational commitment, and technology (17).

A closer analysis of the findings from current studies on virtual education reveals the importance of selecting instructors who possess not only pedagogical expertise but also strong digital skills and competencies, enabling them to navigate and manage the virtual learning environment effectively. Given the significant challenges associated with virtual education in the country, employing qualified and dedicated instructors for university-level online education is imperative. Many of these challenges are linked to the capabilities of faculty members. If instructors possess strong proficiency in utilizing the available resources and tools within the virtual classroom and educational system, the limitations related to faculty performance can be substantially mitigated (31).

In this research, the competencies targeted for measurement were thoroughly defined by analyzing the specifics of existing models and indicators, along with insights from prior studies conducted by the researchers. Efforts were made to align these competencies with cultural characteristics. Accordingly, five main competence dimensions were identified: 1) ethical-social, 2) technical-technological, 3) educational-learning, 4) individual-managerial, and 5) supervisory-supportive.

The analysis of existing research literature reveals that, while numerous studies have examined the competencies required for teachers in virtual education, each study has concentrated on particular dimensions, lacking a thorough and integrative assessment of these competencies. Consequently, this paper investigates the competencies of faculty members at Shahid Bahonar University of Kerman concerning virtual education in the post-COVID-19 context. The competencies identified are subsequently prioritized utilizing the Stepwise Weight Assessment Ratio Analysis (SWARA) method. In accordance, the research poses the following questions:

1. To what extent do the faculty members require essential competencies for virtual education in the post-COVID-19 era?

2. Is there a relationship between the educational groups of faculty members and their competencies for virtual education in the post-COVID-19 era?

3. Is there a relationship between the academic rank of the faculty members and their competencies for virtual education in the post-COVID-19 era?

4. What is the prioritization of the competencies needed by faculty members for virtual education in the post-COVID-19 era using the SWARA method?

Methods

Study Design and Setting

This research was carried out in two phases.

A. Phase 1: A descriptive survey was initially employed to investigate the competencies of faculty members in the context of virtual education. This part of the research was carried out between June and November 2023 at Shahid Bahonar University of Kerman, Iran.

B. Phase 2: The competencies were ranked using experts' opinions in the subsequent phase. This part of the research was carried out in November 2023. The SWARA method was used to rank the competencies. SWARA, developed by Kersuline and colleagues, is a relatively recent methodology that enables decision-makers to effectively evaluate and weigh various indicators. Compared to similar approaches, the most significant advantage of SWARA lies in its capacity to assess the precision of experts' opinions regarding weighted indicators throughout the research process (32). The main steps for weighting by the SWARA method are as follows:

Step 1. Sorting the indicators

Initially, the indicators prioritized by decision-makers are identified and ranked according to their significance. Consequently, the most essential indicators are assigned to higher categories, while those of lesser importance are allocated to lower categories.

Step 2. Determining the relative importance of each indicator (Sj)

At this phase, the relative importance of each indicator should be determined compared to the previous indicator. This value is displayed as Sj in the SWARA technique.

Step 3. Calculating the coefficient (Kj)

This coefficient, which is a function of the relative importance of each indicator, is calculated using Equation 1.

Equation 1: Kj=Sj+1

Step 4. Calculating the initial weight of each indicator

The initial weight of the indicators is calculated through Equation 2. In this regard, it should be noted that the weight of the first indicator, which is the most important

indicator, is considered 1.

Equation 2: $q_j = \frac{q_{j-1}}{K_j}$

Step 5. Calculating the final normal weight

In the final phase of the SWARA method, the ultimate weights of the indicators, referred to as the normalized weights, are determined using Equation 3.

Equation 3: $w_j = \frac{q_j}{\sum q_j}$

Participants and Sampling

In the first phase, the statistical population of the research was 545 faculty members of Shahid Bahonar University of Kerman in 2023, and 225 people were selected as a statistical sample based on Morgan's table. A stratified random sampling method was used to select the statistical sample. For this purpose, the number of faculty members was determined, and the questionnaires were randomly distributed among the faculty based on the statistical sample of each class. The reason for using this sampling method was to use all educational groups in this research. Table 1 shows the number of faculty members of Shahid Bahonar University of Kerman educational groups and the number of samples related to each category.

In the second phase, the opinions of 12 university faculty members were used to rank the competencies (one expert per faculty, except for technical and engineering faculty, where two experts were selected). In this part, it was necessary to use experts with experience and expertise. Therefore, experts were chosen among the vice-chancellors and heads of faculties.

Tools/Instruments

In the initial phase of the study, a researcher-made questionnaire was employed to gather data. The questionnaire used a 5-point Likert scale with 31 items and two sections. The first section addressed demographic information, while the second section contained inquiries regarding the significance of faculty competencies for the effective implementation of virtual education. These competencies were classified into five overarching categories: ethical-social, technical-technological, educational-learning, individual-managerial, and supervisory-supportive. In the analysis of each competency, a significance threshold of 3.4 was established based on the assigned grades. This threshold was derived by dividing the number of intervals by the number of scales, resulting in an interval of 0.8. Consequently, the significance levels of academic faculty members' competencies for virtual education in the post-COVID-19 era were determined, as illustrated in Figure 1.

Validity- To measure the validity of the questionnaire, face validity and content validity were assessed based on the viewpoints of a group of ten experts. This group included three professors specializing in human resources management, one from educational sciences, one professor of psychology, three

Table 1: Population size and the statistical sample size for each faculty

Faculties	Population	Sample
Mathematics and computer	53	22
Management and economics	20	8
Engineering	122	50
Basic Sciences	60	25
Physics	22	9
Literature and Human Sciences	68	28
Law and theology	44	18
Physical Education and Sports Science	15	6
Agriculture	75	32
Veterinary medicine	36	15
Art and architecture of Saba	30	12
Total	545	225

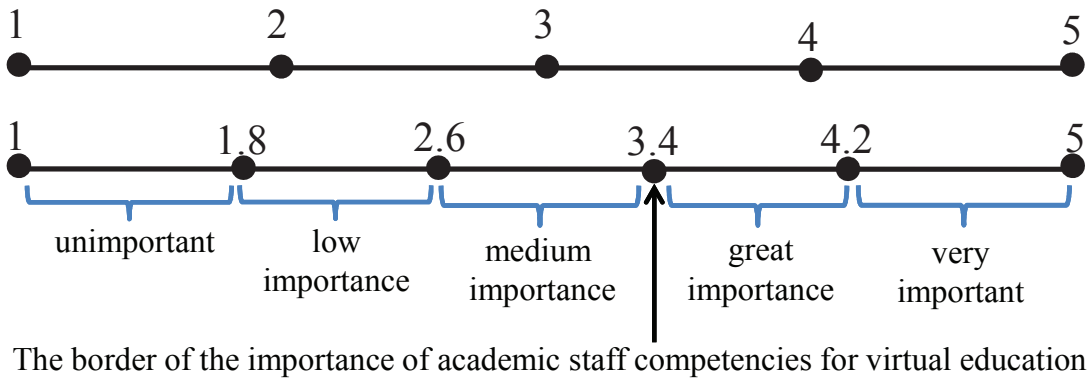

Figure 1: Rating the significance of academic faculty members' competencies for virtual education

professors in educational management, one from computer engineering, and one from information technology. These experts possessed extensive experience in teaching and online education over several years.

***Face validity**:* The experts assessed the grammatical structure of the sentences and the spelling of the items, leading to subsequent corrections.

Content validity: The content validity was also checked using the Content Validity Ratio (CVR) and Content Validity Index (CVI). The calculation of the CVR was based on the assessments provided by the ten experts mentioned above. They were then asked to rate each question on a three-point Likert scale:

- Essential
- Useful but not necessary
- Not necessary

After gathering the opinions of experts, CVR was calculated using the following formula:

In this formula:

N: total number of experts.

n_e: the number of experts who have chosen the necessary option.

The minimum acceptable CVR value was determined based on the number of experts who evaluated the questions (0.62 with 10 experts; opinion) (33).

A questionnaire was used to check the CVI index, which determined each item's degree of relevance, simplicity, and clarity with a four-part spectrum (1-4). The number of experts who chose options 3 and 4 was divided by the total number of experts. If the resulting value was less than 0.7, the item was rejected; if it was between 0.7-0.79, it should be revised, and if it was more than 0.79, it was acceptable (34).

Table 2 shows the values of these two indicators. Since the value of CVR obtained by experts (10 people) was more than 0.62, the validity of the questionnaires was confirmed. As the values obtained for this index for all questions were higher than the critical value of 0.79, the validity of the questionnaire was confirmed.

Reliability- After distributing questionnaires and collecting 30 samples, the internal consistency of the questionnaire was checked. Reliability was confirmed as Cronbach's alpha of the questionnaire (0.88), and the correlation of all variables was more than 0.7 (Table 2).

The research tool in the second phase of the research was a questionnaire that measured the significance of competencies based on experts' opinions.

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

Data Collection

During the initial phase of the study, researchers conducted in-person data collection. In the second phase, online questionnaires were distributed to experts via social networks. The experts were requested to provide their insights regarding the importance of the competencies necessary for professors in virtual education.

Table 2: Validity and reliability values of the questionnaire

Variables	CVR	CVI	Alpha
Ethical-Social Competencies	0.866	0.90	0.92
Technical-Technological Competencies	0.850	0.90	0.84
Educational - Learning Competencies	0.875	1.00	0.88
Individual-Managerial Competencies	0.829	1.00	0.84
Supervisory-Supportive Competencies	0.966	0.90	0.90
Total	0.877	0.94	0.88

Table 3: Demographic Characteristics of Participants

Gender	N	Age	N	Experience	N	Academic rank	N
Female	58	20 to 30	3	Less than 5	14	Instructor	8
Male	167	31 to 40	45	6 to 10	46	Assistant Professor	124
		41 to 50	77	11 to 15	59	Associate Professor	70
		51 to 60	62	16 to 20	52	Professor	23
		61 to 70	38	21 to 25	34		
				26 to 30	15		
				More than 30	5		

Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics. Statistical indicators, such as frequency, mean, and standard deviation, were investigated in the descriptive statistics section. An analysis of variance test was employed to analyze inferential statistics. SPSS 26 software was used for data analysis.

In the second phase, after evaluating the questionnaires, the data were ranked using the SWARA method in the EXCEL software.

Results

Demographic Characteristics

The demographic characteristics of participants in the first phase are shown in Table 3. Most participants in the statistical analysis were male individuals with the academic rank of assistant professor.

Analysis of Research Questions

Q1. Table 4 presents findings regarding the significance of faculty competencies in virtual education following the COVID-19 pandemic. All professors who responded to the questionnaire have gained experience in virtual teaching due to the COVID-19 pandemic, which necessitated the adoption of e-learning systems. Consequently, they are equipped to address the research questions posed. In addressing the first research question, Table 4 illustrates that the average ratings for all questions exceed 4, indicating that faculty members perceive all teachers' competencies as essential for virtual education in the post-COVID-19 era.

Q2, Q3. To address the second and third research questions, an ANOVA test was conducted to examine the relationship among faculty members' competencies, educational groups, and academic ranks. The findings indicated no significant association between the educational group, academic rank of faculty members, and their competencies (Table 5).

Q4. In the second phase, to address question 4 and evaluate the competencies of faculty members in virtual education, experts were administered a questionnaire designed to assess the significance of each competency.

Based on SWARA's method, the experts were asked to rank the competencies based on their significance, shown in the first column of Table 6. Also, the second to fourth steps of SWARA's method can be seen in columns 2 to 4 of the table, respectively. Ultimately, the final step of the SWARA method was executed by normalizing the weights of the competencies. This process resulted in determining the final weights and rankings of the competencies, which are presented in column 5 of Table 6.

Table 4: Significance of competencies for virtual education

Questions	Min	Max	Mean±SD*
Ethical-Social Competencies			
1. Social facilitation and consultation space	2	5	4.35±0.60
2. Conflict management	2	5	4.26±0.76
3. Professional and ethical commitment	3	5	4.41±0.69
4. Creating motivation for virtual learning	1	5	4.44±0.81
5. Cognitive skill	2	5	4.18±0.83
6. Intercultural skills	3	5	4.12±0.75
**Mean	3	5	4.29±0.31
Technical-Technological Competencies			
7. Technological skills (hardware and software)	2	5	4.27±0.83
8. Updating teaching resources and methods	3	5	4.26±0.48
9. Technical support	2	5	4.29±0.81
10. Production and presentation of content	3	5	4.24±0.50
**Mean	3	5	4.26±0.39
Educational - Learning Competencies			
11. Strategies and applications of learning theories	1	5	4.30±0.99
12. Teaching skills	3	5	4.68±0.47
13. Educational commitments	2	5	4.20±0.50
14. Educational design and planning	3	5	4.18±0.40
15. Resource identification skills	2	5	4.16±0.40
16. Scholarly, research and knowledge-sharing skills	1	5	4.26±0.87
17. The skill of facilitating the training process	1	5	4.24±0.89
18. Online lectures	2	5	4.28±0.83
**Mean	3	5	4.29±0.31
Individual-Managerial Competencies			
19. The skill of a positive attitude toward synchronous and asynchronous teaching	2	5	4.35±0.61
20. Time management and training course management	1	5	4.16±0.51
21. Encouraging and motivational skills	1	5	4.23±0.87
22. Organizational, administrative, and operational skills	2	5	4.18±0.84
23. Diagnostic skills (analytical, initiative, creativity)	1	5	4.47±0.73
24. Leadership skills, guidance, and guidance of students	2	5	4.29±0.49
25. Crisis management skills	2	5	4.30±0.49
**Mean	3.43	5	4.28±0.31
Supervisory-Supportive Competencies			
26. Final evaluation and course	2	5	4.37±0.54
27. Maintaining contact with the student after completing the course	2	5	4.18±0.83
28. Feedback	2	5	4.22±0.58
29. Monitoring the learning activities of learners	3	5	4.30±0.46
30. The skill of spiritual and legal support of the input and output of virtual education	2	5	4.28±0.52
31. The skill of encouraging learners to group and self-evaluation	3	5	4.25±0.46
**Mean	3	5	4.27±0.23
Total Mean	3.74	4.68	4.28±0.17

*Standard Deviation; **The average minimum questions per competency is calculated for the entire sample, resulting in a value that may differ from the minimum for each competency or question.

Table 5: Competencies of faculty members for virtual education

Educational group						
Academic rank	**Mean±SD**	**Situation**	**Sum of Squares**	**df**	**F**	**P value**
• Instructor	4.29±0.77	Between Groups	0.090	3	0.909	0.431
• Assistant Professor	4.27±0.50	Within Groups	7.321	221		
• Associate Professor	4.28±0.41	Total	7.411	224		
• Professor	4.29±0.53					
Faculties	**Mean±SD**	**Situation**	**Sum of Squares**	**df**	**F**	**P value**
• Mathematics and Computer	4.29±0.45	Between Groups	0.034	10	0.873	0.520
• Management and Economics	4.32±0.42	Within Groups	7.083	214	0.034	
• Engineering	4.28±0.58	Total	7.411	224		
• Basic Sciences	4.28±0.37					
• Physics	4.23±0.41					
• Literature and Human Sciences	4.26±0.56					
• Law and Theology	4.29±0.69					
• Physical Education and Sports Science	4.25±0.37					
• Agriculture	4.28±0.43					
• Veterinary Medicine	4.29±0.47					
• Art and Architecture of Saba	4.30±0.56					

SD: Standard Deviation; df: degree of freedom; F: Fisher's test

Table 6: Ranking of competencies using the SWARA method

Competency	**S_j**	**$K_j=S_j+1$**	**$q_j=(q_j-1)/K_j$**	**$w_j=q_j/\sum q_j$**
Educational-Learning	0	1	1	0.374
Ethical-Social	0.533	1.533	0.652	0.244
Individual- Managerial	0.413	1.413	0.462	0.173
Technical- Technological	0.408	1.408	0.328	0.123
Supervisory-Supportive	0.425	1.425	0.230	0.086

* SWARA: Stepwise Weight Assessment Ratio Analysis

Consequently, based on the software's results and the data presented in Table 6, the ranking of faculty members' competencies is as follows: Educational-learning, ethical-social, individual–managerial, technical-technological and supervisory-supportive.

Discussion

In addressing the initial research question regarding the competencies necessary for faculty members in e-learning, the findings indicate that faculty members perceive all categories of competencies—including educational-learning, ethical-social, individual-managerial, technical-technological, and supervisory-supportive—as vital for effective virtual education.

The study found that "creating motivation for virtual education" has the highest average score among the various "ethical-social" competencies examined. This suggests that from the perspective of faculty members, the most critical ethical-social factor in virtual education is the ability to motivate teachers and students to engage effectively in online learning environments. Maghsoodi and colleagues (2022) demonstrated in their study that fostering motivation for virtual education is a crucial determinant of faculty members' satisfaction with this mode of instruction (35). One of the key elements influencing students' academic advancement, particularly within e-learning contexts, is the notion of motivation (36). In the e-learning context, where the virtual setting often limits the interactions between teachers and learners, learners'

motivation becomes crucial for success. Compared to traditional learning methods, where the physical presence of teachers and peers can provide additional motivation, e-learning environments require a more intentional approach to maintaining learners' engagement and drive. This is particularly significant in virtual and distance education, as the dropout rates in e-learning courses tend to be higher than in traditional face-to-face learning environments (13). Furthermore, the lowest average scores pertain to intercultural competencies, indicating that cultural differences are diminished in virtual education due to the absence of face-to-face interactions with students, simplifying this aspect's management. Swartz and colleagues (2019) demonstrated that intracultural competencies can influence virtual collaborations, suggesting that specific adverse outcomes from learner interactions may be mitigated through virtual educational environments (37).

Comparative analysis of the average "ethical-social" competencies against a critical threshold of 3.4 indicates that faculty members regard all competencies within this domain as highly significant. Adherence to ethical principles in virtual education settings plays a crucial role in the educational process, reflecting the moral attributes of educators. These competencies necessitate skills and abilities, including fostering positive interactions between instructors and learners, guiding students in the ethical use of the Internet, acknowledging individual differences, and promoting respect for the rights and perspectives of others (37). The faculty member's focus on social dimensions, student needs, and support for the educational benefits of social engagement and collaborative activities is crucial in virtual education. Additionally, these competencies necessitate the instructor's proficiency in utilizing technological tools to facilitate student interaction (36). This category of competencies highlights the transformed landscape of virtual education and 21st-century educational models facilitated by integrating innovative technological tools that foster an interactive environment for learners and instructors (38). These findings are generally in line with the studies of Narenji and colleagues (2014), Abedi and colleagues (2017), Hajizadeh and colleagues (2021), in addition to Egielewa and colleagues (2022) (15, 27, 39, 40). Also, these findings are in line with the findings of Karimi and colleagues (2017) and Mehraliyan and Maghami (2022) from the point of view of emphasizing ethical-social competencies (17, 41).

By comparing with a critical value of 3.4, it is clear that all "technical-technological" competencies hold a prominent status in the context of virtual education and are significant for implementing optimal virtual education. Moreover, the close proximity of the average scores for these four competencies indicates that technical and technological competencies hold an equally important position for faculty members. The educator in virtual learning environments should possess expertise in technology and provide technical support. Studies indicate that technological proficiency plays a crucial role in enhancing virtual education. This aspect necessitates that educators not only possess the ability to utilize educational methods and tools but also adapt these technologies to align with lesson content. In a virtual learning environment, teachers must engage with computers, computer networks, the Internet, and Learning Management Systems (LMS) (42). Consequently, the role of the e-teacher is crucial in implementing these technologies and tools within the classroom setting. Additionally, the e-teacher plays a vital role in integrating these tools into the curriculum and assisting students in navigating the LMS (43). These findings are generally in line with the studies of Toulabi and colleagues (2015), Karimi and colleagues (2016), and Abedi and colleagues (2017) (15, 41, 44). Also, these findings are in line with the findings of Mehralian and Maghami (2022), and Bashir and colleagues (2021) regarding the significance of technical and technological competencies (17, 45).

Among the various "educational-learning" competencies, teaching skills were perceived as the most important by faculty members, with an average rating of 4.68. The findings suggest that it is essential for educators in online learning environments to acquire proficiency in virtual teaching methodologies and the ability to deliver effective instruction in conventional classroom settings. The resource identification skills were deemed the least significant competency. However, all educational and learning competencies are essential for faculty members in virtual education. Compared to classroom teaching, virtual teaching requires different roles and characteristics (46). Various studies have investigated the educational dimension and its significance. Research indicates that deficiencies in teachers' educational skills in online education can negatively impact the quality of virtual learning systems (47). Educators must thoroughly understand pedagogical principles and the dynamics of education within virtual environments. This entails developing the necessary skills for educational design and addressing all phases of the educational process. Instructors should be adept at effectively facilitating active, student-centered learning that aligns with relevant theories and instructional models in digital settings, while also employing various technological tools to meet course objectives (48). These findings are in line with the findings of Mehralian and Maghami (2022), Bashir and colleagues (2021), Toulabi and colleagues (2015), Karimi and colleagues (2016), Abedi and colleagues (2017), and Dos Santos (2022) regarding the importance of educational-learning competencies (15, 17, 41, 44, 45, 49).

Among "individual-managerial" competencies, diagnostic skills (analytical, initiative, creativity) with an average of 4.47 were more significant from the perspective of faculty members. This indicates that an effective virtual education instructor must possess strong identification skills. In virtual education, competency and diagnostic skills enable learners to be guided toward achieving practical goals through creative and innovative methods and approaches. Furthermore, based on the critical value of 3.4, all personal managerial competencies are highly significant. While the competency related to time and course management had a lower average compared to other competencies, it remains a crucial aspect from the perspective of faculty members. Possessing individual characteristics such as tolerance of ambiguity, adaptability and patience when interacting with students and navigating the challenges of the virtual education landscape, along with practical communication skills in online teaching, can be effective for success in virtual education (50).

Management skills represent a significant variable influencing virtual education. For instance, educators engage as members of specialized teams focused on virtual curriculum development. These teams typically comprise not only the instructor but also information and communication technology experts, network specialists, subject matter experts, and educational psychologists. The role of the virtual educator encompasses several responsibilities, including defining content outlines, creating and producing multimedia resources, designing learning activities, and establishing evaluation methods (51). A teacher appointed as a virtual curriculum design team member must possess not only teaching experience and subject matter expertise but also an understanding of the unique characteristics of the virtual environment. In the implementation phase of the virtual curriculum, teachers play a pivotal role in managing this environment. During this phase, they utilize synchronous and asynchronous communication tools to oversee the virtual setting of the designed curriculum. The teachers tailor their communication with students based on various factors, including the subject matter, educational objectives, learners' cognitive levels, and accessibility to learning resources. In other words, the educator aims to transfer authority over the learning process to the students by creating conducive conditions and overseeing the process. Sometimes, the educator assumes

direct control of the learning experience, presenting foundational content based on the available tools and resources in the environment (51). These findings are in line with the findings of Mehralian and Maghami (2022), Hajizadeh and colleagues (2021), Moosavi and colleagues (2023), Garakani and Dehghani (2022), and Hamidian Divkolaei and Bagheri (2023) regarding the importance of individual-management competencies (17, 27, 52-54).

Based on the critical threshold of 3.4, "supervisory-supporting" competencies are considered essential. Consequently, it can be concluded that supervisory-supportive competencies play a significant role in virtual education. Among the identified competencies, ongoing communication with students post-course is deemed less critical, potentially due to the inherent characteristics of communication in virtual learning environments. In contrast, the final evaluation of the course holds greater significance. This emphasis may stem from faculty members' desire to assess, compare, and refine the outcomes of their online teaching efforts. A thorough evaluation is essential for fostering inclusive progress and enhancing educational effectiveness. It reflects the instructors' proficiency in utilizing technologies and tools within the classroom, as well as their ability to integrate these resources into the curriculum and support students in navigating the learning management system. Providing continuous and clear feedback on student performance in a virtual education setting is vital, as it limits opportunities for direct comparison with peers in a traditional classroom context. In a virtual education environment, the teacher's feedback to the learner becomes even more important (17). This feedback helps the student identify their weaknesses and work on improving them, which is crucial for developing the student's ability to manage their learning (44). These findings are in line with the findings of Mehralian and Maghami (2022), Fazel and Harandi (2024), and Moosavi and colleagues (2023) regarding the importance of supervisory-supporting competencies (17, 38, 52).

The average competencies of all categories are close to each other and at a significant level. The average of the total competencies of faculty members for virtual education is at a substantial level, with a value of 4.28, which indicates the high importance of all competencies.

Finally, according to the software outputs, the "Educational-Learning" competencies were identified as the most significant, followed by ethical-social, individual–managerial, technical-technological and supervisory-supportive.

Examining the second and third questions revealed no significant relationship between the faculty members's competencies and their respective educational groups or academic ranks. In summary, there were no significant differences in the competencies of faculty members across various faculties, including instructors, assistant professors, associate professors, and professors, compared to virtual education.

Examining the fourth research question, along with the ranking of faculty competencies by experts using the SWARA method, revealed that educational and learning competencies (strategies and applications of learning theories, teaching skills, educational commitments, educational design and planning, resource identification skills, scholarly, research and knowledge-sharing skills, the skill of facilitating the training process, online lecture) are deemed significantly more important than other competencies. Consequently, greater emphasis should be placed on educational and learning competencies.

Limitation and Suggestions

The findings of this research are derived exclusively from survey data collected from faculty members at Shahid Bahonar University of Kerman, which represents a limitation. This study employed a subjective assessment of faculty members to evaluate their competencies in virtual education. Nevertheless, significant efforts were made to ensure the validity and reliability of the research outcomes. It is

recommended that future researchers assess the qualifications of faculty members for virtual education across various universities and higher education institutions. Alternative ranking tools should also be utilized, particularly those based on fuzzy logic.

Conclusion

The findings of this study demonstrate that all competencies evaluated by faculty members are crucial for the successful implementation of virtual education and significantly contribute to enhancing educational quality. Among the various competencies assessed, teaching skills emerged as the most critical. This finding underscores the paramount importance of the fundamental essence of teaching in virtual education, surpassing other skills in significance. The primary responsibility of faculty members, whether in traditional or virtual settings, remains the dissemination and expansion of knowledge and scientific understanding. Consequently, faculty members identified this as the most vital competency for virtual education. Furthermore, the research indicates that faculty members perceive all competency categories equally important. Compared to the critical value of 3.4, all competencies were deemed highly significant, ranking educational-learning competencies as the most significant. This suggests that in the context of virtual education, educators' teaching and learning competencies play a pivotal role in enhancing performance quality and overall improvement in virtual educational settings.

In the current landscape, it is imperative for universities to acknowledge the significance of virtual education. As we navigate the post-COVID-19 era, it becomes essential to fully grasp the realities, conditions, and competencies involved in implementing virtual education. A thorough examination of the strengths, weaknesses, opportunities, and threats, coupled with an assessment of the competencies within the virtual education environment, such as ethical, social, technical, technological, educational, learning, individual, managerial, supervisory, and supportive competencies, especially in university faculty members, is crucial for ensuring its successful implementation. This study aimed to investigate a subset of prevailing conditions and assess the significance of virtual education competencies among academic faculty members in the post-COVID-19 landscape. The findings indicate that these competencies play a crucial role in the effective implementation of virtual education modalities.

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Authors' Contribution

The authors (AF and AH) contributed equally to the article's preparation and presentation. AF was more involved in the literature review, statement of the problem, and statistical analysis, while AH focused on data collection and research methodology. Both authors made revisions and approved the final manuscript.

Conflict of interest

None declared.

Ethical Considerations

This study followed ethical guidelines and received approval from the Research Ethics Committee of Kerman University of Medical Sciences, Kerman, Iran (IR.KMU.REC.1402.411). All participants provided informed consent before their involvement in the study. Participants were thoroughly informed about the study's nature and confidentiality measures. Prior to their involvement, they were assured that all provided information would be treated with strict confidentiality. Furthermore, the confidentiality protocol extended to the participants' demographic characteristics, data distribution, analysis procedures, and information extraction processes

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Availability of Data and Materials

The data supporting the study's findings are available from the corresponding author upon reasonable request.

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