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Original Article

Development and Psychometric Evaluation of an Instrument for Assessing Faculty Members' Attitudes toward Cloud Computing in Medical Universities

Hasti Mohammad Zaheri[1], Hossein Vakilimofrad[1*], Seyyed Abedin Hosseini Ahangari[1], Samad Moslehi[2]

[1] Department of Medical Library and Information Sciences, School of Allied Medical sciences, Hamadan University of medical sciences, Hamadan, Iran.

[2] Department of Biostatistics, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran.

Abstract

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*** Corresponding author:**
Hossein Vakilimofrad
Email: vakili@umsha.ac.ir

Introduction: As cloud computing expands in higher education and academic research, understanding faculty members' attitudes toward this technology has become increasingly critical. This research sought to develop and evaluate the psychometric qualities of a valid instrument for assessing faculty members' attitudes toward cloud computing.

Methods: As a methodological cross-sectional study, it was carried out in two phases: Instrument development and psychometric testing. The population included all faculty members at Hamadan University of Medical Sciences in 2024, and a sample of 217 was determined using the Morgan table and a random sampling method. Data analysis was performed using confirmatory and exploratory factor analysis and SPSS and AMOS version 23 software.

Results: After assessing the face and content validity of the initial 34-item questionnaire, four items were removed. Exploratory factor analysis then organized the remaining 30 items into six factors: "infrastructure," "software," "network," "flexibility," "costs," and "security," which collectively accounted for 74.2% of the overall variance. The reliability of the instrument was assessed using Cronbach's alpha, yielding a coefficient of 0.935. Additionally, CFA ($\chi2$ [368] = 1079.178, $P < 0.001$, GFI = 0.901, CMIN / DF = 2.93, NFI = 0.811, RMSEA = 0.078) demonstrated a good model fit, with all factors showing statistical significance.

Conclusion: The findings confirm that the developed questionnaire is a valid and reliable instrument for assessing faculty attitudes and key service dimensions (infrastructure, software, network, flexibility, costs, and security) of cloud computing in academic contexts. By providing a concise and comprehensive evaluation tool, this study makes a meaningful contribution to the systematic assessment of cloud computing in medical universities and supports future research and informed decision-making.

Introduction

In recent years, cloud computing services have emerged as a pivotal development in information and communication technology, particularly within academic settings. As the volume of information resources continues to expand and faculty members require timely, easily accessible knowledge, sharing information is an effective strategy for addressing these demands. Only a few studies demonstrate how the whole gamut of knowledge management processes can adopt cloud computing in institutions.

Therefore, institutions are ineffective at knowledge sharing due to limited information systems intervention (1, 2). Much like the internet disrupted traditional knowledge monopolies and transformed access to information, cloud computing introduces a groundbreaking paradigm for delivering and consuming resources through innovative technology services (3). Cloud computing is a technology that enables the storage, processing, and access to data and software over the internet. It encompasses service models such as IaaS, PaaS, and SaaS, as well as tools, such as databases, distributed computing platforms, and online collaboration services. Cloud computing is a delivery model providing on-demand access to services over the internet, with seamless availability, allowing users to store resources, software, and computing infrastructure without any local setup required (4). In many organizations, including universities, the use of cloud computing systems has increased productivity, faster information processes, and easier access to data (5, 6). One of the primary benefits of this technology includes enhanced cost efficiency and savings, conservation of physical resources, and minimized investments in hardware and software, making cloud computing a vital instrument for advancing information technology services (7).

With high scalability and accessibility, cloud computing facilitates the technological infrastructure of organizations and universities. In higher education, particularly in teaching and learning, cloud computing plays a significant role in enhancing educational quality and providing rapid access to scientific resources. By using cloud storage services, students can simultaneously and remotely access books, articles, software, and course materials, promoting collaborative learning and academic interaction (8).

Faculty members, as central figures in higher education, significantly contribute to the creation, organization, and dissemination of knowledge. Beyond their core responsibilities in teaching and research, they must evolve from conventional information providers to proactive contributors in knowledge generation and exchange, adapting to technological advancements. This shift demands the integration of instruments such as digital platforms, social media, and knowledge management systems to promote enhanced scientific collaboration and the sharing of professional insight (9, 10). Failure to utilize technological mechanisms for knowledge transfer, specifically tacit knowledge, can lead to scientific isolation, repetition of inefficient activities, and loss of valuable experiences. Tools such as forums, wikis, blogs, file-sharing platforms, and online communication systems provide a foundation for more effective knowledge transfer within academic environments (11, 12).

The success of any technological transformation is contingent upon the attitude of its end-users, namely, the faculty members. To accurately gauge this attitude, a localized and reliable tool is indispensable. Without such an instrument, decisions regarding the advancement of cloud technologies are often made based on conjecture and experience rather than empirical data. This research endeavors to bridge this gap by developing a scientific tool tailored to the specific context of medical universities. By providing a means for the genuine measurement of attitudes, this study facilitates more effective planning for the implementation of new technologies, thereby forging a crucial link between the human and technological dimensions within the digital transformation process. Consequently, the design of such a tool establishes a scientific foundation for subsequent studies and policymaking in the domain of university digital transformation. Given the identified gap in the scientific literature and the pressing need for a more precise understanding of the current landscape, this study is critically important for advancing evidence-based practices in educational technology adoption.

The present research topic is of practical importance, as understanding faculty attitudes is a prerequisite for the successful implementation of cloud technologies (13). The primary objective of this research is to design and psychometrically evaluate a valid and reliable instrument for assessing the attitudes of faculty members in medical universities towards cloud computing services. In terms of originality, seemingly, no native and valid tool is available for this assessment in Iranian universities of medical sciences; therefore, designing such a tool fills the existing research gap and provides a scientific basis for further studies and policymaking in the field of digital transformation of universities.

The findings of this research can empower universities to accurately identify and dismantle cultural, educational, and organizational barriers hindering the adoption of cloud technologies by providing a clear understanding of faculty attitudes. This comprehension enables effective strategic planning for education, professional development, and policy formulation aimed at driving digital transformation. Ultimately, it enhances technology acceptance, fostering an environment where the university evolves into a learning and technology-oriented organization. The developed tool serves administrators by allowing them to assess the level of readiness, acceptance, and potential mental barriers among faculty members, thereby informing more effective educational and technological decision-making. The resultant data serve as a robust foundation for evidence-based managerial decisions and the strategic planning of educational and technological development initiatives.

Methods

A cross-sectional study incorporating an instrument-building methodology was carried out in January 2024 at Hamedan University of Medical Sciences in Iran. The target population included 508 faculty members from the university. Using simple random sampling guided by the Morgan table, a sample of 217 individuals was selected. General practitioners were not considered part of the faculty member sample.

To design and validate the intended instrument, a questionnaire from an English study on cloud computing in universities was first translated into Persian and used as the initial basis (14). Subsequently, searches were conducted in both languages (Persian and English) databases, including the Academic Jihad Scientific Information Database, Google Scholar, Scopus, and Web of Science, to identify relevant studies on cloud computing and its associated instruments. In particular, three primary sources were selected as the basis for extracting the components and items of the final instrument: A study exploring the role of cloud computing services in knowledge sharing at Iraqi universities (14), research on developing a standardized questionnaire for cloud computing adoption in higher education institutions (15), and a localized questionnaire on the acceptance of cloud computing in Iran (16).

The initial version of the questionnaire consisted of 34 items in 6 main components based on different dimensions of cloud computing. Responses to the items were based on a five-point Likert scale (from “strongly disagree” to “strongly agree”). Scoring was also set from 5 to 1, so that higher scores indicated greater understanding and recognition of cloud computing.

Formal validity

For qualitative face validity assessment, the questionnaire was first provided to 16 faculty members with experience in the field of cloud computing to provide their views on the transparency, clarity, appropriateness of vocabulary, and the visual structure of the instrument. Based on the opinions of these experts, two stages of revision were carried out, and finally, by deleting four items, the final version of the instrument was prepared.

Content validity

A combination of qualitative and quantitative methods was used to examine the content validity of the instrument. In the qualitative phase, 16 experts from the fields of medical library and information science (7 persons), information technology (5 persons), medical informatics (3 persons), and biostatistics (1 person) reviewed the items in terms of grammar, vocabulary, positional appropriateness, and scoring system.

In the quantitative phase, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated. For the CVR, experts were asked to rate the items on a three-point scale (essential, useful but unnecessary, unnecessary) (17).

Items with a CVR value higher than 0.80 were considered essential and retained; otherwise, they were removed (17). In addition, items with an acceptance rate of less than 70% across the evaluated criteria were revised.

Then, using the following formula:

"CVR = (Total number of participants / 2) / ((Total number of participants / 2) – Number of essential responses for each item)",

Next, the CVI was calculated based on three criteria — "simplicity," "clarity," and "relevance to the objective" — using the formula:

"CVI = Total number of participants / Total number of favorable ratings (scores of 3 and 4) for each item" (18).

According to Ebadi et al. (19), items with a CVI greater than 0.78 were accepted, those with a CVI less than 0.7 were removed, and the remaining items were revised. Previous studies have also recommended a CVI value above 0.79 and a CVR value above 0.62 according to Lawshe's table for confirming content validity (20, 21).

Instrument reliability

Cronbach's alpha and the intraclass correlation coefficient (ICC) were employed to assess the reliability of the instrument. Coefficients exceeding 0.70 were regarded as acceptable (22).

Data splitting procedure for factor analysis

To mitigate concerns regarding the limited total sample size (N = 217) for full cross-validation, a transparent, pre-analytic data-splitting procedure was employed. This method allows for an examination of whether the derived factor structure generalizes beyond the initial sample. Using a repeatable randomization algorithm, the dataset was partitioned into two independent subsamples: a calibration subsample (n = 87) for Exploratory Factor Analysis (EFA) and a larger validation subsample (n = 130) for Confirmatory Factor Analysis (CFA). The allocation of approximately 60% of observations to the validation phase was intentional, reflecting the greater sample size requirements of CFA for robust parameter estimation and model testing. The factor solution identified in the EFA (with the number of factors determined by parallel analysis and the MAP criterion) was specified a priori and tested in the validation subsample without post hoc modifications. The model's fit is reported using established goodness-of-fit indices (χ^2/df, CFI (Comparative Fit Index)), CMIN/DF, NFI (Normed Fit Index), TLI (Tucker-Lewis Index), (RMSEA, SRMR) alongside all standardized factor loadings (standardized regression weights).

Data collection and analysis

The final questionnaire was administered using a combination of in-person and online methods (the professional version of the Porsline platform) and was distributed via email to university faculty members using a convenience sampling approach, allowing sufficient time for participants to complete the questionnaire. All ethical considerations were fully observed during the data collection process. Participants were informed of the objectives of the study, and their participation was entirely voluntary. They were also assured that their information would be kept confidential and anonymous. The collected data were used exclusively for research purposes, and participants had the right to withdraw from the study at any stage without any consequences.

In the data analysis stage, descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize demographic characteristics. For construct validity, EFA was performed on the calibration subsample (n = 87) using principal axis factoring with varimax rotation; sampling adequacy was assessed using the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. The number of factors was determined by parallel analysis and eigenvalues greater than 1. Subsequently, CFA was conducted on the validation subsample (n = 130) using maximum likelihood estimation, and model fit was evaluated using χ^2/df, CFI, NFI, TLI, RMSEA, and SRMR. Internal consistency was assessed using Cronbach's alpha. Pearson's correlation coefficient was used to examine relationships between quantitative variables where appropriate. All statistical analyses were performed using SPSS and AMOS version 23, with a significance level of $p < 0.05$.

Results

In this section, the results of the design and psychometric analysis of a questionnaire assessing faculty members' attitudes towards cloud computing are presented. First, descriptive statistics of demographic characteristics are presented, followed by the results of the assessment of the face validity of the questionnaire. Then, the findings of the content validity of the report and the reliability of the questionnaire are measured. Finally, a standard questionnaire is presented to assess faculty members' attitudes towards cloud computing.

The mean (SD) age of participants was 43 (SD = 8.7) years. Experience and length of service as faculty members ranged from 1 to 32 years (mean = 11.34 years; SD = 8.7 years)

Table 1 shows that of the 217 faculty members, 115 were male (53%). Most participants were assistant professors (56.7%) and had a PhD (68.7%). As shown in the table, 14.7% of professors do not use cloud computing, 30.4% use it a little, 31.8% moderately, 14.7% a lot, and 8.3% very much.

Table 1. Descriptive statistics of demographic characteristics of respondents (217 people)

Qualitative variables	Categories	Frequency (percentage)
Gender	Male	115 (53%)
	Female	102 (47%)
Education degree	Master	10 (4.6)
	Doctorate (PhD)	149 (68.7)
	Specialty	33 (15.2)
	Subspecialty	25 (11.5)
Academic rank	Instructor	16 (7.4)
	Professor	45 (20.7)
	Assistant Professor	123 (56.7)
	Associate Professor	33 (15.2)
Cloud computing usage rate	No use	32 (14.7)
	Low	66 (30.4)
	Medium	69 (31.8)
	High	32 (14.7)
	Very high	18 (8.3)

During the qualitative content validity assessment, revisions were made to the wording of certain items. As a result, four items were eliminated from the original 34. The remaining 30 items were then subjected to content validity evaluation, incorporating expert opinions, scientific sources, and editorial and literary suggestions provided by 16 expert panels. In quantitatively determining content validity, two methods were considered: CVR and CVI according to the Lavish table. The results of these indicators showed that all items were approved (Table 2).

Table 2. Content validity of the cloud computing questionnaire based on CVR and CVI

Item	Question	CVR	CVI1	CVI2	CVI3
Question 1	Using cloud computing helps preserve the database in the event of a natural disaster or incident.	0.875	0.8125	1	0.9375
Question 2	Cloud computing facilitates better management of computing and hardware resources.	0.75	0.875	1	0.875
Question 3	Cloud computing controls the storage capacity of databases without technical barriers.	0.75	0.8125	1	1
Question 4	Cloud infrastructure is sufficiently accessible to facilitate the process of knowledge sharing among faculty members.	0.75	0.8125	1	1
Question 5	Using cloud computing reduces the technical strain on devices used in storing and sharing knowledge.	0.75	0.75	0.9375	1
Question 6	Cloud-based software is sufficiently accessible for knowledge transfer between faculty members.	0.875	0.8125	0.9375	0.9375
Question 7	Cloud computing provides the necessary software features (such as storage and sharing space) to meet the academic needs of faculty members.	0.625	0.875	0.9375	0.9375
Question 8	Cloud computing allows the use of software facilities from a cloud service provider.	0.875	0.9375	0.9375	0.9375
Question 9	There is software support necessary to resolve potential problems in cloud computing.	0.75	0.8125	0.9375	1
Question 10	Cloud computing services are constantly seeking technical and specialized development and improvement.	0.75	0.9375	0.9375	1
Question 11	Optimal network connectivity is provided in cloud computing services.	0.875	0.75	0.9375	0.9375
Question 12	Cloud computing ensures that information is available to the user promptly.	0.75	0.8125	0.875	0.9375
Question 13	Using a cloud computing service provides benefits such as increased levels of collaboration in group work.	0.875	0.8125	0.9375	0.9375
Question 14	The speed of cloud networks is suitable for the knowledge-sharing process.	1	1	0.9375	1
Question 15	Cloud computing helps faculty members access programs from any device.	1	1	0.9375	1
Question 16	Cloud computing provides the flexibility to change according to the goals and work needs of faculty members.	0.875	0.875	0.9375	1
Question 17	Cloud computing ensures high flexibility in the work of faculty members with Internet browsers.	0.75	0.8125	1	1
Question 18	Cloud computing allows faculty members to access databases anytime, anywhere.	0.875	0.875	1	1
Question 19	Cloud computing provides flexibility in the ways faculty data is managed and updated, such as deleting, adding, and modifying.	0.875	0.875	1	0.9375
Question 20	Cloud computing can respond to the changing needs of faculty members in the knowledge-sharing process.	1	0.9375	0.875	0.9375
Question 21	Cloud computing enables faculty members to implement effective knowledge-sharing strategies while reducing costs.	0.75	0.875	0.9375	0.8125

Table 2. Content validity of the cloud computing ... (continued)

Item	Question	CVR	CVI1	CVI2	CVI3
Question 22	Cloud computing has the potential to reduce the cost of educating students.	0.875	0.9375	0.9375	0.8125
Question 23	Cloud computing can help reduce management and operational costs.	0.625	0.8125	1	0.875
Question 24	Cloud computing has the potential to reduce costs by eliminating the need to purchase hardware, servers, and software.	0.75	0.8823	0.9375	0.875
Question 25	Cloud computing has the potential to reduce costs by eliminating the need to purchase hardware, servers, and software.	0.875	0.8125	0.9375	0.875
Question 26	Security systems implemented in cloud computing can protect faculty members' information.	0.75	0.9375	1	1
Question 27	If security conditions are applied, transferring information through cloud computing provides high security.	0.75	0.9375	1	1
Question 28	In the event of problems with devices and equipment, data can be recovered using cloud computing.	0.875	0.9375	1	1
Question 29	Cloud computing can encrypt some information and identify available and inaccessible data.	0.75	0.875	1	1
Question 30	The confidentiality of information stored or shared is guaranteed by cloud computing.	1	0.75	1	1

CVI1: Simplicity **CVI2: Relevance** **CVI3: Clarity**

The results of EFA for the 65 samples considered showed that the KMO sampling adequacy criterion and Bartlett's sphericity test were obtained with a value of 0.835 ($\chi2$ (435) = 1367.34; $P < 0.001$). The KMO value above 0.8 indicated that the sampling adequacy was at a very good level and also indicated the suitability of the correlation matrix and the ability of the items to be factored for factor analysis.

The results of determining the number of appropriate components and the amount of variance explained by each component, as well as the coefficients of the rotated factor loadings, are reported in Table 3. According to Table 3, the index for selecting components is based on eigenvalues, which, if greater than one, are selected as the main component. The initial value of component 1 (before rotation) is 11.905, which has a large share of the variance. Still, after the Varimax rotation, a better and more balanced distribution has been created between the components. In summary, six components were identified, accounting for 74.2% of the total variance. The factor loadings for all items within these components exceeded 0.4, allowing every item to be included in the CFA. Additionally, as indicated in Table III, the Cronbach's alpha and ICC values for each of the six factors were acceptable, all surpassing 0.7.

Table 3. Determined appropriate components and factor loadings of each item after Varimax rotation

Question	Infrastructure component	Software component	Network component	Flexibility component	Cost component	Security component
Question 1	0.582					
Question 2	0.898					
Question 3	0.548					
Question 4	0.882					
Question 5	0.887					
Question 6		0.887				
Question 7		0.870				
Question 8		0.920				
Question 9		0.844				
Question 10		0.859				
Question 11			0.851			
Question 12			0.938			
Question 13			0.801			
Question 14			0.903			
Question 15			0.852			
Question 16				0.624		
Question 17				0.557		
Question 18				0.600		
Question 19				0.623		
Question 20				0.456		
Question 21					0.501	
Question 22					0.782	
Question 23					0.726	
Question 24					0.735	
Question 25					0.667	
Question 26						0.777
Question 27						0.727
Question 28						0.494
Question 29						0.545
Question 30						0.765

Table 3. Determined appropriate components and factor loadings ... (continued)

Question	Infrastructure component	Software component	Network component	Flexibility component	Cost component	Security component
Initial eigenvalues	11.905	3.256	2.489	2.066	1.474	1.070
Total percentage of variance explained.	39.684	50.539	58.834	65.720	70.634	74.202
Sum of squares extracted after rotation	4.686	4.553	3.738	3.408	3.028	2.846
Cronbach's alpha	0.768	0.760	0.735	0.862	0.836	0.857
ICC (Intragroup Correlation Coefficients)	0.778	0.767	0.736	0.866	0.854	0.859

In CFA from the validation subsample (n = 130), the measurement model was fitted to the data using six factors, each specified based on their corresponding statements, and employing unstandardized estimates (Figure 1). The measurement model with the data in the hypothesized model showed a good fit, and all scales were significant within the acceptable range ($\chi2$ [368] = 1079.17 ($P < 0.001$), GFI = 0.901، CMIN/DF = 2.93، NFI = 0.811, TLI = 0.911, SRMR = 0.063, and RMSEA = 0.078). Finally, all relationships between factors and items, as well as relationships between the six factors, were statistically significant ($P < 0.05$).

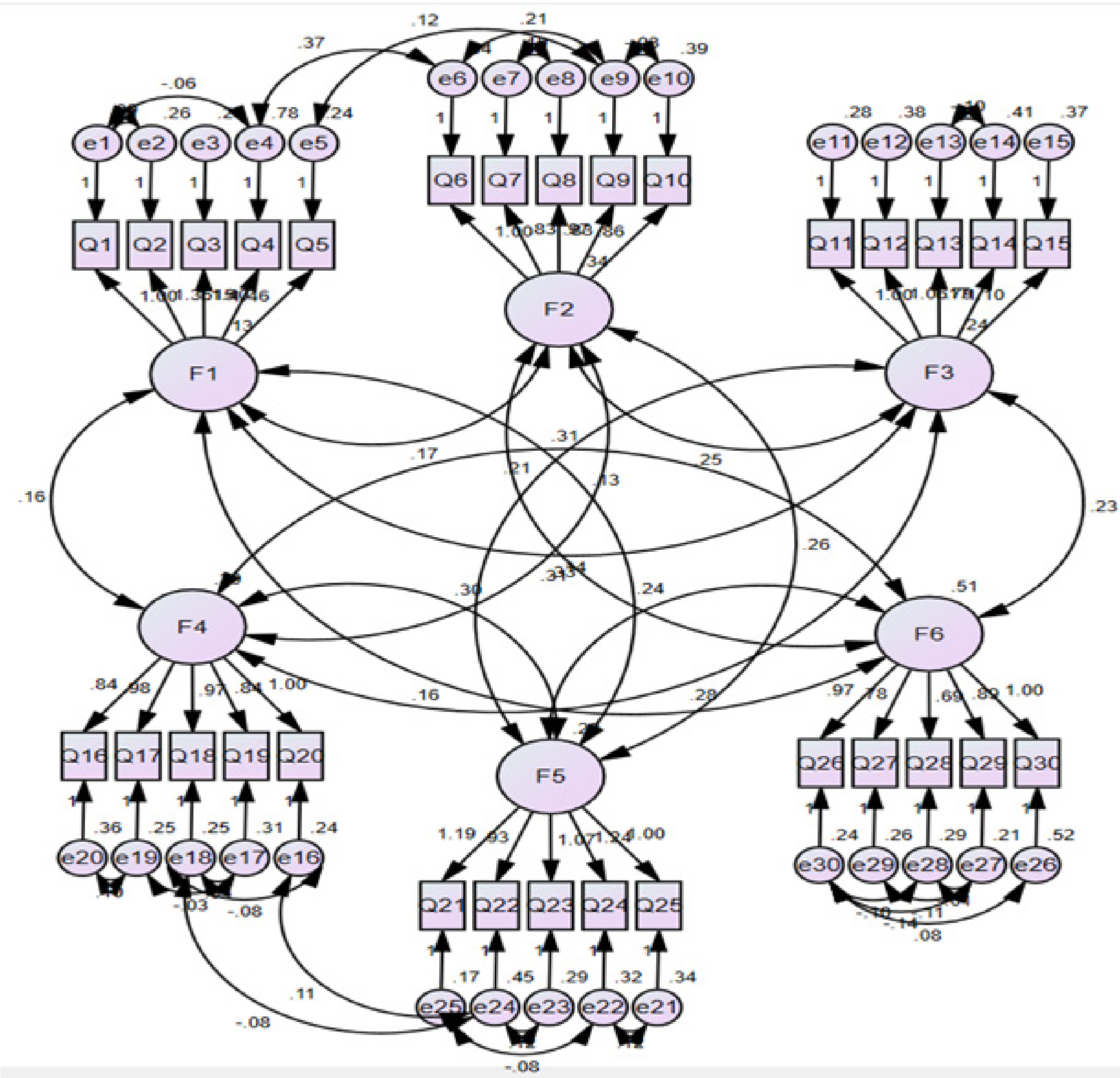

Figure 1. Relationship between items and factors based on CFA

Table 4 presents the factor structure and standardized factor loadings from an EFA of a 30-item scale measuring six distinct dimensions of cloud computing evaluation. The results show that the standardized factor loadings ranged from 0.480 to 0.846 for all questions.

Table 4. Standardized factor loadings of the cloud computing questionnaire

Component	Questions	Standardized factor loadings
Infrastructure	Question 1	0.538
	Question 2	0.597
	Question 3	0.680
	Question 4	0.480
	Question 5	0.654
Software	Question 6	0.604
	Question 7	0.688
	Question 8	0.719
	Question 9	0.590
	Question 10	0.589
Network	Question 11	0.644
	Question 12	0.692
	Question 13	0.544
	Question 14	0.678
	Question 15	0.767
Flexibility	Question 16	0.805
	Question 17	0.731
	Question 18	0.789
	Question 19	0.805
	Question 20	0.720
Cost	Question 21	0.601
	Question 22	0.742
	Question 23	0.727
	Question 24	0.665
	Question 25	0.846
Security	Question 26	0.689
	Question 27	0.761
	Question 28	0.751
	Question 29	0.757
	Question 30	0.828

The findings related to the descriptive statistics of the cloud computing questionnaire, along with its determined components, were presented in Table 5. Table 4 showed that the average total score of respondents in the cloud computing questionnaire was 112.55 (15.27). The range of scores of the respondents to the questionnaire was from 30 to 150. It was divided into three categories: (30-70) at an undesirable level, (71-110) at an acceptable level, and (111-150) at an excellent level. The average reported score of all respondents in the cloud computing questionnaire was at an excellent level.

Table 5. Descriptive characteristics of the cloud computing questionnaire score

Component	Lowest score	Highest score	Range of scores	Average	Standard deviation
Infrastructure	13	25	12	19.45	2.66
Software	5	25	20	17.98	3.17
Network	10	25	15	18.53	2.82
Flexibility	5	25	20	19.01	3.15
Costs	10	25	15	18.90	3.26
Security	11	25	14	18.65	3.24
Total	64	148	84	112.55	15.27

Spearman's rank correlation between factors (determined components) is shown in Table 6. Statistically significant correlations were found between all factors. The lowest correlation was observed between factors 1 and 6 (r = 0.515), and the highest correlation was observed between factors 4 and 5 (r = 0.713).

Table 6. Correlation coefficients between cloud computing factors among participants (n = 217)

Correlation coefficient	Infrastructure	Software	Network	Fourth factor	Costs	Security
Infrastructure	1.000	0.651	0.631	0.607	0.549	0.515
Software		1.000	0.626	0.649	0.595	0.575
Network			1.000	0.694	0.591	0.586
Flexibility				1.000	0.713	0.618
Costs					1.000	0.582

Discussion

The expansion of cloud computing in scientific and research activities has gained significant importance due to its numerous benefits, including access to extensive computing and storage resources, cost reduction, increased processing speed, and facilitation of international collaboration (23). This technology provides researchers with scalability and flexibility in scientific projects. However, effective use of cloud computing requires a detailed understanding of the attitudes and perspectives of the academic community. Examining these attitudes can help identify educational needs, security concerns, and privacy issues, thereby creating a suitable foundation for promoting the adoption of modern technologies among researchers (24).

Higher education institutions are increasingly leveraging cloud computing, recognizing it as a robust framework for the efficient distribution of diverse resources, such as infrastructure, software, and applications. Beyond its role in substantially mitigating IT-related expenditures, cloud computing serves as a pivotal mechanism for fostering educational equity and addressing disparities in access to tertiary education (25).

The present study aimed to investigate the validity and reliability of a questionnaire designed to assess the attitude of faculty members of medical universities towards cloud computing. The design of this instrument was based on standard questionnaires derived from previous valid studies. The initial items were developed using the opinions of experts and specialists in the field of cloud computing and based on the existing theoretical framework.

In the face validity phase, the items were examined in terms of appearance and structure to ensure that they were consistent with the main construct of the study, namely, cloud computing. Content validity was examined with the extensive participation of 16 experts in the fields of medical library and information, information technology, medical informatics, and biostatistics, higher than the usual range in similar studies (10 to 12 people) and is considered as one of the strengths of this study (26-30). In this phase, the questionnaire items were evaluated regarding necessity, simplicity, clarity, and conceptual fit and revised if necessary to provide a scientific and reliable framework for subsequent analyses.

The EFA yielded six primary factors, accounting for 74.2% of the cumulative variance. Given the scarcity of localized research regarding instrument development, expert consensus was sought to validate the survey tool designed to assess the feasibility of cloud computing adoption within Iranian academic libraries (30). The reliability was reported using Cronbach's alpha as 0.78 and 0.86 for the two versions of the questionnaire, respectively.

In the present study, based on factor analysis and literature review, six components were identified and named as infrastructure, software, network, flexibility, costs, and security. Convergent and divergent validity studies showed that each factor operates independently, but concerning the overall structure of cloud computing, confirming the conceptual coherence of the questionnaire. A study with similar results for an instrument structure with 30 items in the form of 5 factors investigated 240 faculty members from a medical university (15). Another similar study indicated that an expert panel of eight academicians is involved in evaluating the judgmental evidence of the instrument for content validity, and items with a CVI greater than 0.80 were included in the final instrument. The final instrument contained 74 items of 5-point Likert scale multiple-choice options, classified under three dimensions (31). Furthermore, Cronbach's alpha coefficient for the entire instrument and each component revealed that the questionnaire has appropriate accuracy, validity, and reliability and is capable of producing stable results under similar conditions.

The findings indicated that the participants had the highest average score in the "Infrastructure" component and the lowest score in the "Software" component. The total score for cloud computing was in the third quartile, indicating a relatively favorable understanding of this technology by faculty members. In other words, the respondents overall showed an acceptable attitude toward cloud computing.

In assessing the reliability of instruments that use multiple items to measure a variable, the internal consistency method is common, and Cronbach's alpha coefficient is considered a suitable indicator in this context. The values obtained in this study confirm the validity and reliability of the instrument (32). In another study, for the first time, a tool was designed to assess the acceptance of cloud computing technology in academic libraries, and the results showed that the questionnaire had acceptable face validity (more than 1.5) and content validity (0.79), Cronbach's alpha and intraclass correlation coefficients were 0.77 and 0.92, respectively (23).

In the field of medical sciences, vast volumes of data are produced, including medical images, lab results, patient clinical records, and research findings. Cloud computing serves as a crucial instrument for managing this data by offering a secure, scalable, and adaptable platform for storage and processing. Moreover, it enhances access for researchers and professionals to the latest scientific knowledge and resources while enabling effective international partnerships in collaborative research efforts (33).

By utilizing cloud services, medical universities can significantly reduce costs associated with physical infrastructure and hardware, thereby increasing productivity, speed, and efficiency in data processing. These features are exclusively essential in educational and research environments, where a need exists for specialized software, up-to-date scientific resources, and continuous access.

According to this study's results, the instrument exhibits strong psychometric qualities regarding validity and reliability. As a result, it serves as a reliable and standardized instrument for assessing faculty members' attitudes toward cloud computing in medical universities. These outcomes align with previous studies on developing and validating instruments for evaluating emerging technologies (26-30). This instrument can be applied in subsequent research to evaluate the readiness, adoption, and implementation of cloud computing in higher education institutions within the health sector.

This study's findings should be interpreted with caution due to certain limitations. The study population was limited to faculty members of medical universities, and generalizing the results to other academic settings may be constrained. Data were collected through a self-report instrument, which may be subject to response bias. Additionally, the study was cross-sectional, and the stability of attitudes over time was not examined. Furthermore, differences in participants' familiarity with cloud computing and variations in university infrastructure may have influenced the results.

Another limitation of this study is the dynamic nature of cloud computing services. Given the continuous changes in information technology, attitude measurement instruments may also need to be revised and adapted to new conditions in the future. However, the instrument designed in this study was developed based on the current conditions of medical universities and is capable of assessing existing attitudes.

Conclusion

This study indicated that the designed instrument for assessing the attitudes of medical university faculty members toward cloud computing possesses desirable psychometric properties. Overall, the findings suggest that the present instrument can serve as a valid and reliable tool for measuring the attitudes of faculty members toward cloud computing in medical universities.

Factor analysis of the instrument indicated that faculty members' attitudes toward cloud computing are multidimensional. Identifying these dimensions enables a more comprehensive understanding of the factors influencing faculty members' attitudes and can provide a scientific basis for educational and managerial planning in medical universities. From a practical perspective, the present instrument has the potential to serve as a standardized tool for evaluating faculty members' attitudes toward cloud computing at different levels within universities. The results obtained through its use can assist higher education administrators and policymakers in identifying barriers and facilitators for cloud adoption, and provide a foundation for designing targeted interventions, developing IT infrastructure, and enhancing faculty members' digital competencies.

Considering the increasing role of cloud-based technologies in education, research, and data management in medical sciences, having a valid and reliable instrument to assess faculty attitudes is of particular importance. Researchers believe that using this instrument in future studies, including longitudinal and interventional research, can help monitor changes in attitudes over time and evaluate the effectiveness of educational programs and technological policies (34). Overall, the designed instrument can be considered an effective step toward supporting evidence-based decision-making and facilitating the successful implementation of cloud computing in medical universities.

Declaration

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Conflict of Interest

The authors declared no conflict of interest.

Ethical Statement

The present study has an ethics code number IR.UMSHA.REC.1403.281, obtained from the Ethics Committee for Biomedical Research of Hamadan University of Medical Sciences.

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Authors' Contribution

Hasti Mohammad Zaheri: Methodology, validation, formal analysis, research, writing - initial draft.

Hossein Vakilimofard (Corresponding Author): Conceptualization, methodology, formal analysis, writing initial draft, revision, and final editing.

Seyed Abedin Hosseini Ahangari: Methodology, formal analysis, and scientific editing.

Samad Moslehi: Validation, formal analysis, writing - initial draft, revision, and final editing.

Use of Artificial Intelligence

Not applicable.

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