KMAN PUBLISHING INSTITUTE
Journal Website

Article history:
Received 23 September 2024
Revised 27 November 2024
Accepted 01 December 2024
Published online 01 May 2025

International Journal of Innovation Management and Organizational Behavior

Volume 5, Issue 3, pp 1-15

E-ISSN: 3041-8992

Ranking the Indicators of the Model for Enhancing the Quality of Virtual University Education with a Knowledge Management Approach

Amir. Sadeghi Samarjani[1], Ali. Maghool[2*], Mohammad. Karimi[2], Moslem. Cherabin[3]

[1] PhD Student of Educational Management, Neyshabur Branch, Islamic Azad University, Neyshabur, Iran
[2] Assistant Professor, Department of Management, Neyshabur Branch, Islamic Azad University, Neyshabur, Iran
[3] Assistant Professor, Department of Educational Management, Neyshabur Branch, Islamic Azad University, Neyshabur, Iran

*** Corresponding author email address**: Ali.maghool@yahoo.com

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Sadeghi Samarjani, A., Maghool, A., Karimi, M., & Cherabin, M. (2025). Ranking the Indicators of the Model for Enhancing the Quality of Virtual University Education with a Knowledge Management Approach. *International Journal of Innovation Management and Organizational Behavior*, *5*(3), 1-15.
https://doi.org/10.61838/kman.ijimob.5.3.14

A B S T R A C T

Objective: The present study aims to rank the indicators of a model for enhancing the quality of virtual university education with a knowledge management approach, conducted at the Electronic Branch of the Islamic Azad University.

Methodology: This study employs a mixed-methods approach with an exploratory objective. The statistical population comprises professors and faculty members of the Electronic Branch of the Islamic Azad University, with 20 individuals purposefully selected for interviews. Data collection tools include semi-structured interviews for qualitative data and a researcher-made questionnaire for quantitative data. Qualitative data were analyzed using Glaser's (1992) coding method, while the Importance-Performance Analysis (IPA) method was applied in the quantitative phase to assess the significance and performance of the indicators. Additionally, Interpretive Structural Modeling (ISM) was utilized to stratify the dimensions of the model.

Findings: The study identified 68 quality enhancement components for virtual university education. The indicator "educational system capabilities" (code 4) ranked first with a weight of 0.0294, positioned in the first quadrant of the Importance-Performance Matrix, where importance is high, but performance is low. For knowledge management indicators, "knowledge retention and prevention of misuse" (code 17) ranked first with a weight of 0.0545. Using ISM, dimensions were stratified, with "university management and leadership" placed at the highest level (Level 10) and "services and responsiveness" at the lowest level (Level 1).

Conclusion: The findings highlight that knowledge management dimensions significantly impact the quality enhancement of virtual university education. The hierarchical structure underscores the importance of "university management and leadership" as a foundational element, cascading down to "services and responsiveness" as an outcome influenced by other dimensions.

Keywords: *Quality enhancement, virtual university education, knowledge management*

1 Introduction

The growth and development of a society is a complex and multidimensional phenomenon. When discussing the development of a society, it is necessary to consider not only improvements in economic conditions, advancements in technology, and an increase in national wealth but also fundamental qualitative and quantitative changes in political, social, economic, and cultural structures. Achieving these goals is impossible without attention to education. Education facilitates the transfer of knowledge to younger generations, fosters the cultivation of educated graduates, and produces specialized human resources for the community (Delghandi et al., 2024; Gutiérrez, 2024; Shariati et al., 2024).

Higher education and universities play a pivotal role in societies by cultivating intellectual graduates, serving as the primary drivers of new ideas and worldviews, initiating philosophical and social movements, and providing a platform for intellectual exchange. Simultaneously, universities supply specialized human resources for various social, economic, political, and cultural sectors (Ebrahimi et al., 2021).

Virtual organizations, on the one hand, revolutionize communication and trust systems in virtual settings and, on the other, enhance absorptive capacity through knowledge management among employees. With the expansion of globalization and information and communication technology (ICT), virtual organizations must strengthen their ability to build capacity among virtual teams. However, they face challenges such as behavioral interventions, including communication and trust issues, which complicate efforts to create absorptive capacity within virtual teams. ICT has transformed knowledge-sharing structures and communication processes, both internally and externally, transitioning from physical to virtual contexts (Homburg, 2018).

Virtualization through ICT enables organizations to collaborate remotely (Schlacht et al., 2017). Consequently, forming diverse teams from geographically dispersed areas has helped virtual organizations acquire enriched knowledge shaped by distinct perspectives and diverse experiences of virtual employees (Raghuram et al., 2019). In an era of global changes, both technologically and structurally, virtual organizations must maintain a knowledge management process for their virtual employees (Fischer & Pöhler, 2018). Virtual universities exhibit significant diversity among their staff members (Kaminska & Borzillo, 2018).

In this context, given today's complex environment, one way for higher education institutions to meet environmental requirements is to adopt ICT generally and virtual education specifically (Rizun, 2016). Over recent decades, advancements in ICT have profoundly impacted global higher education systems, facilitating the emergence of universities and institutions with new teaching and learning systems. Virtual education and virtual universities exemplify this modern system, dating back to the late 1980s and early 1990s (Sepahvand et al., 2015).

Despite the educational and intellectual missions of universities, higher education clients often express dissatisfaction with the quality of e-learning systems and the management of intellectual and knowledge assets (Hsing & Liu, 2018). Today, many universities are striving to enhance the effectiveness of emerging technologies in their educational activities. The global focus on open online education has led higher education institutions to increasingly reconsider how they deliver education to the public (Kaminska & Borzillo, 2018; Kazerooni Shamiri & Moradi, 2019).

Moving toward novel approaches in higher education requires universities worldwide to integrate virtual education technologies into their course offerings (Kazerooni Shamiri & Moradi, 2019). For developing countries, the experience and understanding of virtual education within the education system represent a complex real-virtual, global-local, and traditional-modern experience. In this situation, individual-social relations, power dynamics, hierarchical relationships between professors and students, individualism, classroom boundaries, and overall relationships have undergone significant transformations (Moisil, 2020).

In Eastern societies and developing countries like Iran, where cultural and social values differ, the users' perception of such learning methods varies (Ahmadian et al., 2020; Ebrahimi et al., 2021). Meanwhile, knowledge management encompasses a wide range of activities, from generating knowledge at the organizational level to disseminating and reusing organizational knowledge. Implementing virtual education systems in higher education institutions shifts them toward becoming knowledge-based organizations. Virtual education thus presents an opportunity to integrate knowledge management processes effectively, enhancing intellectual and knowledge assets within the organization.

Many universities and higher education institutions globally have designed and offered virtual education

IJIMOB
E-ISSN: 3041-8992

programs to meet the increasing demand for education (Ahmadian et al., 2020). Virtual education plays a crucial role in expanding higher education by encouraging the exploration of innovative systems, updating knowledge, and providing advanced training, ultimately transforming higher education institutions into lifelong knowledge-based organizations (Gloet & Samson, 2020).

Advancements in knowledge management and virtual education naturally converge, fostering integration. Proper implementation of virtual education tools can organize, store, and share knowledge gained during the educational process (Hoseinbar et al., 2016). The main challenge in today's competitive world is identifying and effectively utilizing an organization's existing knowledge. Consequently, knowledge management has emerged as a distinct field within modern management science, accompanied by its own concepts, language, and functions.

Undoubtedly, the presence of a knowledgeable, aware, and influential manager who not only adapts to changes but also drives them is vital for improving learning outcomes in educational organizations. Knowledge management requires identifying organizational opportunities and threats, as well as addressing knowledge gaps that reveal the disparity between existing and desired organizational knowledge. This study aims to rank the indicators of enhancing the quality of virtual university education using a knowledge management approach.

2 Methods and Materials

This study is a field study in terms of its environment. Based on the applicability of its findings, research can be categorized into fundamental and applied research, with this study falling into the applied category. Research can also be classified temporally as longitudinal or cross-sectional, with the present study being cross-sectional. Given the subject, the nature of this research is descriptive-correlational.

Research can also be divided into qualitative, quantitative, or mixed methods based on the nature of the data. This study employs a mixed-methods approach, integrating qualitative and quantitative methods to achieve its objectives. In mixed-methods research, exploratory designs are considered the most prominent. In exploratory mixed-methods designs, researchers aim to investigate uncertain situations, and in this study, the focus is on designing a model for enhancing the quality of virtual university education with a knowledge management approach for the Islamic Azad University, Electronic Branch.

Initially, qualitative data are collected, followed by quantitative data. In this design, qualitative data are given greater importance. The researcher begins by examining the research subject qualitatively with a limited number of participants and then develops the required tools based on the qualitative findings. Given the primary objective of this study—designing a model for enhancing the quality of virtual university education using a knowledge management approach for the Islamic Azad University, Electronic Branch—interviews will be utilized to gain a deeper understanding and identify influencing factors. Subsequently, quantitative methods will be employed to validate the qualitative findings.

Considering the provided explanations, this study is applied in its objectives and employs an exploratory mixed-methods approach.

3 Findings and Results

In the qualitative phase, through expert interviews, verbal statements were coded, and primary concepts were identified, forming the basis of the initial model. In the quantitative phase, the IPA method was used to assess the importance and performance of quality enhancement indicators for virtual university education with a knowledge management approach, and the ISM method was employed for modeling and determining the interactions among these indicators.

In the qualitative phase, after each interview, the data were analyzed, and concepts were identified through open and axial coding. These concepts were refined in subsequent interviews, and the data were examined based on the stages of open and axial coding. During open coding, primary concepts derived from the interviews were highlighted, while axial coding involved breaking these concepts into finer pieces for detailed description and explanation. Open coding also incorporated findings from interviews and literature review, offering readers a comprehensive overview of the research. For extracting data from interviews and literature review, Glaser's (1992) suggested method of coding key points was employed, focusing on identifying and coding critical elements rather than individual words. In this study, key points from interviews were first converted into open codes, which were subsequently transformed into concepts relevant to the research topic.

IJIMOB
E-ISSN: 3041-8992

Through expert interviews and screening, the most critical quality enhancement indicators for virtual university education with a knowledge management approach were identified and selected. Subsequently, 20 senior managers of the Islamic Azad University were chosen, and a 5-point Likert scale questionnaire was developed to assess the importance and performance of each indicator, addressing the second research question. The importance and performance scores of the indicators were normalized based on the responses from virtual university experts using the Likert scale, and the importance-performance values for the quality indicators were calculated (Table 1).

Table 1

Importance-Performance Values of Quality Assessment Indicators for Virtual University Education with a Knowledge Management Approach

Importance	Performance	Quality Assessment Indicators for Virtual University Education
3.953	3.26	Accessibility and reliability of the system
4.117	3.076	Technological infrastructure systems (internet, hardware, software)
3.752	2.234	Updating the educational system
4.375	2.543	Capabilities of the educational system
4.058	2.428	Support for the learning management system
3.655	2.391	Technical and operational support
3.907	2.728	Organizational support
4.117	2.454	Managing learning interactions
3.843	2.28	Enabling social interaction
4.011	2.614	Utilizing interaction tools in the virtual system
3.907	2.546	Student awareness of evaluation using diverse assessment techniques
3.408	2.454	Exam creation processes based on scientific frameworks and models
3.037	2.304	Clarity of evaluation objectives
3.774	2.561	Evaluation of e-learning content
3.677	2.654	Evaluation of curriculum design
3.489	2.442	Instructor management of educational content and data
3.292	1.898	Provision of necessary services for instructors
3.084	2.601	Support for instructors
3.2	2.519	Use of motivated instructors
3.63	2.245	Instructors' up-to-date knowledge in virtual education
2.899	2.519	Accelerating knowledge production
3.272	2.379	Culturally appropriate infrastructure for e-learning
3.343	3.094	Stable and scientific management
3.343	2.982	Knowledge updates
3.806	3.091	Access for applicants to e-learning services
3.907	2.916	Transformation and reconstruction of traditional higher education models
3.669	2.428	Necessitating research and inquiry among students
3.907	2.754	Enriching education
4.117	2.365	Integration of technology with new educational strategies
3.752	2.097	Provision of tools supporting teaching
3.677	2.442	Facilitating e-learning models
3.851	2.379	Proper delivery of e-learning programs
3.708	2.933	Organizing skill-based learning
4.011	2.654	Proper delivery of e-learning programs
3.578	2.601	Using diverse learning approaches
2.944	2.492	Curriculum design for e-learning
4.034	2.534	Analyzing learner needs and clarifying expectations
3.884	2.754	Learning support and assistance
3.022	2.293	Enhancing abilities and fostering students' personality, emotional, and behavioral growth
3.478	2.709	Establishing student support standards and providing support services
3.519	2.507	Focusing on learning communities through collaborative learning
3.752	3.029	Evaluating the quality of information and alignment of content for e-learning
3.441	2.504	Accessing content without additional cost anytime, anywhere
3.851	2.234	Emphasizing content creation tools for course development
3.379	2.379	Providing resource support (online assistance)
3.285	2.428	Establishing a dedicated e-learning resource center at the university

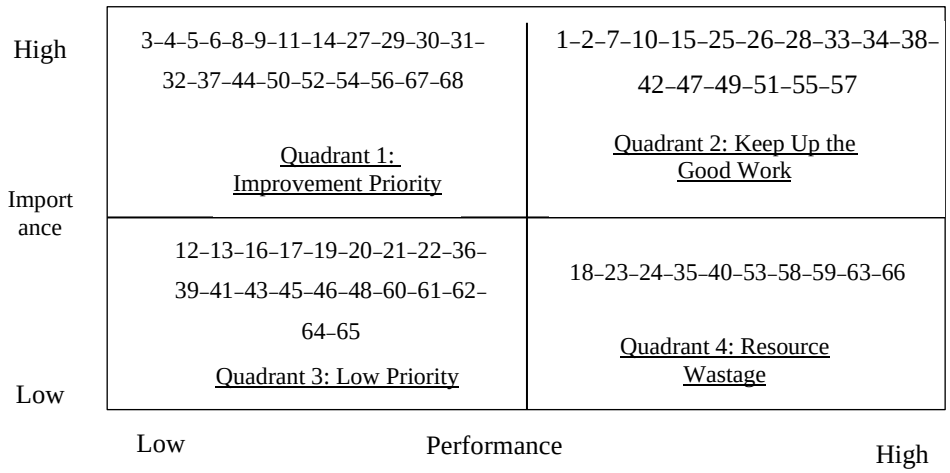
IJIMOB
E-ISSN: 3041-8992

3.953	2.699	Delivering quality services and aligning service levels with expectations
3.536	2.519	Speed in response
3.945	2.712	Reducing financial and time costs and lowering investment expenses in education
3.73	2.365	Planning physical requirements for e-learning
4.034	2.933	Flexibility and adaptability
3.726	2.454	Providing managed services at all levels
3.612	2.784	Designing and implementing courses based on objectives
3.806	2.48	Web-based design principles
3.907	2.857	Quality, relevance, and up-to-date content
3.866	2.365	Offering comprehensive learning packages
4.011	3.124	Student evaluation and feedback
3.452	2.814	Establishing culturally compatible infrastructures for promoting e-learning
3.327	2.642	Creating a technological culture and revising perceptions of technology adoption
3.363	2.428	Practical implementation of a learning society for sustainable national development
3.519	2.428	Perfectionist approach to quality enhancement
3.63	2.454	Practical and relativist approach to quality enhancement
3.536	2.888	Establishing high educational standards
3.399	2.454	Implementing appropriate e-learning models based on international standards
3.469	2.495	Providing resources and financial infrastructure
3.561	3.047	Aligning goals and strategies for e-learning implementation
3.712	2.379	Having clear organizational vision, mission, and goals
3.708	2.428	Ensuring sustainability and quality assurance in e-learning

The table reveals that the average importance score for quality assessment indicators in enhancing virtual university education is 3.641, while the university's performance score averages 2.567. This threshold serves as a benchmark for comparing the dimensions of quality assessment, forming the basis for the Importance-Performance Matrix (Figure 1).

Figure 1

Importance-Performance Matrix for Quality Assessment Indicators in Virtual University Education



As shown, indicators located in quadrants 3 and 4 of the matrix are excluded from the model. Additionally, the weights of the indicators for improvement were calculated and presented in Table 2. According to the results, the indicator "capabilities of the educational system" (code 4) ranked first with a weight of 0.0294. As demonstrated in the Importance-Performance Matrix, this indicator is positioned in the first quadrant, where the university places high importance but exhibits low performance.

IJIMOB
E-ISSN: 3041-8992

Table 2

Weights and Ranks of Quality Assessment Indicators for Enhancing Virtual University Education

Normalized Weight	Indicator	Code	Rank
0.02945	Capabilities of the educational system	4	1
0.0265	Integration of technology and new educational strategies	29	2
0.02516	Managing learning interactions	8	3
0.02431	Support for the learning management system	5	4
0.02289	Emphasis on content creation tools for course development	44	5
0.02281	Provision of tools supporting teaching	30	6
0.02224	Analyzing learner needs and clarifying expectations	37	7
0.02208	Enabling social interaction	9	8
0.02131	Offering comprehensive learning packages	56	9
0.02093	Updating the educational system	3	10
0.02083	Proper delivery of e-learning programs	32	11
0.02059	Utilizing interaction tools in the virtual system	10	12
0.01999	Proper delivery of e-learning programs	34	13
0.01954	Student awareness of evaluation using diverse assessment techniques	11	14
0.0187	Planning physical requirements for e-learning	50	15
0.01854	Web-based design principles	54	16
0.01847	Instructors' up-to-date knowledge in virtual education	20	17
0.01823	Delivering quality services and aligning service levels with expectations	47	18
0.01818	Having clear organizational vision, mission, and goals	67	19
0.01787	Reducing financial and time costs and lowering investment expenses in education	49	20
0.01744	Ensuring sustainability and quality assurance in e-learning	68	21
0.01741	Providing managed services at all levels	52	22
0.01698	Technical and operational support	6	23
0.01693	Organizational support	7	24
0.01686	Provision of necessary services for instructors	17	25
0.01682	Evaluation of e-learning content	14	26
0.01672	Necessitating research and inquiry among students	27	27
0.01667	Facilitating e-learning models	31	28
0.01656	Enriching education	28	29
0.01632	Flexibility and adaptability	51	30
0.01613	Learning support and assistance	38	31
0.01575	Technological infrastructure systems	2	32
0.01568	Practical and relativist approach to quality enhancement	62	33
0.01507	Quality, relevance, and up-to-date content	55	34
0.01423	Transformation and reconstruction of traditional higher education models	26	35
0.0141	Perfectionist approach to quality enhancement	61	36
0.01381	Evaluation of curriculum design	15	37
0.01342	Instructor management of educational content and data	16	38
0.01321	Speed in response	48	39
0.01308	Focusing on learning communities through collaborative learning	41	40
0.01307	Student evaluation and feedback	57	41
0.01284	Using diverse learning approaches	35	42
0.01241	Providing resource support (online assistance)	45	43
0.01241	Providing resources and financial infrastructure	65	44
0.01194	Exam creation processes based on scientific frameworks and models	12	45
0.01184	Accessing content without additional cost anytime, anywhere	43	46
0.0118	Implementing appropriate e-learning models based on international standards	64	47
0.01155	Practical implementation of a learning society for sustainable national development	60	48
0.011	Designing and implementing courses based on objectives	53	49
0.01074	Culturally appropriate infrastructure for e-learning	22	50
0.01056	Organizing skill-based learning	33	51
0.01034	Establishing a dedicated e-learning resource center at the university	46	52
0.01007	Accessibility and reliability of the system	1	53
0.01001	Access for applicants to e-learning services	25	54
0.00997	Evaluating the quality of information and alignment of content for e-learning	42	55
0.00983	Establishing student support standards and providing support services	40	56

IJIMOB
E-ISSN: 3041-8992

0.00841	Establishing high educational standards	63	57
0.00838	Creating a technological culture and revising perceptions of technology adoption	59	58
0.00817	Clarity of evaluation objectives	13	59
0.0081	Establishing culturally compatible infrastructures for promoting e-learning	58	60
0.00809	Enhancing abilities and fostering students' personality, emotional, and behavioral growth	39	61
0.008	Use of motivated instructors	19	62
0.00672	Aligning goals and strategies for e-learning implementation	66	63
0.00547	Support for instructors	18	64
0.00489	Curriculum design for e-learning	36	65
0.00444	Knowledge updates	24	66
0.00405	Accelerating knowledge production	21	67
0.00306	Stable and scientific management	23	68

The t-value for the first sub-hypothesis is 0.302, less than 1.96, rejecting the hypothesis that organizational factors impact the relationship between pressure and whistleblowing motivation.

The t-value for the second sub-hypothesis is 1.258, less than 1.96, rejecting the hypothesis that organizational factors influence the relationship between opportunity and whistleblowing motivation.

The importance and performance scores of the knowledge management indicators were normalized based on a 5-point Likert scale from virtual university experts, and the Importance-Performance values for knowledge management indicators were obtained (Table 3).

Table 3

Importance-Performance Values of Knowledge Management Evaluation Indicators Effective on Enhancing the Quality of Virtual University Education

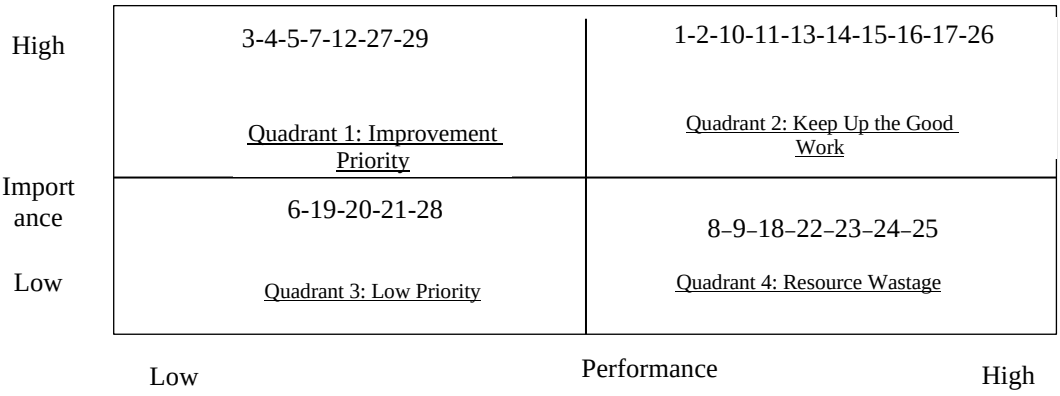
Importance	Performance	Knowledge Management Evaluation Indicators	Rank
4.011	2.936	Identification of knowledge resources	1
3.93	2.905	Knowledge extraction guidelines	2
3.69	2.629	Organizational awareness of employee knowledge	3
3.93	2.686	Interaction and communication with students and stakeholders	4
3.829	2.561	Reviewing documentation to acquire knowledge	5
3.292	2.043	Focusing on creativity, innovation, and providing new ideas and solutions	6
3.866	2.534	Existence of research and development units and knowledge domains within the organization	7
3.625	2.874	Benchmarking and utilizing knowledge and experiences of other organizations	8
3.339	2.95	Collaboration with other organizations	9
4.143	2.874	Existence of knowledge banks and repositories	10
4.011	2.982	Level of knowledge registration and preservation	11
3.669	2.699	Knowledge gained from successes	12
3.806	3.26	Recording and preserving information related to skills	13
3.907	2.77	Utilizing IT tools for knowledge storage	14
3.655	3.061	Guidelines for storing knowledge	15
3.829	2.83	Updating knowledge repositories	16
4.287	3.029	Retaining knowledge and preventing its misuse	17
3.561	2.982	Employee willingness to share knowledge	18
3.276	2.468	Support, encouragement, and motivation for knowledge employees	19
2.797	1.991	Knowledge and experience transfer among employees	20
2.764	2.468	Succession planning in human resource management	21
3.415	2.77	Appropriate interaction and communication between departments	22
3.292	2.874	Synergistic social networks	23
3.363	3.176	Utilizing IT tools for knowledge application	24
3.452	2.741	Level of utilization and application of collected knowledge	25
3.987	2.77	Flexibility in knowledge	26
3.888	2.601	Avoiding redundancies	27
3.465	2.153	Organizational risk-taking in knowledge	28
3.69	2.601	Applying knowledge in decision-making	29

IJIMOB
E-ISSN: 3041-8992

Table 3 demonstrates that the average importance score of the knowledge management evaluation indicators effective on enhancing the quality of virtual university education is 3.629, while the average performance score is 2.714. This average serves as a threshold for comparing knowledge management indicators effective in enhancing the quality of virtual university education, forming the basis of the Importance-Performance Matrix (Figure 2).

Figure 2

Importance-Performance Matrix for Knowledge Management Indicators in Enhancing the Quality of Virtual University Education



Furthermore, the weights of the indicators for improvement were calculated and are presented in Table 4. According to the results of this table, the indicator "retaining knowledge and preventing its misuse" (code 17) ranked first with a weight of 0.0545. As shown in the Importance-Performance Matrix, this indicator is located in quadrant 2, where the university assigns high importance and demonstrates high performance.

Table 4

Weights and Ranks of Knowledge Management Indicators for Enhancing the Quality of Virtual University Education

Normalized Weight	Indicator	Code	Rank
0.0545	Retaining knowledge and preventing its misuse	17	1
0.0531	Existence of knowledge banks and repositories	10	2
0.052	Existence of research and development units and knowledge domains	7	3
0.0506	Avoiding redundancies	27	4
0.0494	Interaction and communication with students and stakeholders	4	5
0.049	Reviewing documentation to acquire knowledge	5	6
0.049	Flexibility in knowledge	26	7
0.0459	Organizational risk-taking in knowledge	28	8
0.0449	Utilizing IT tools for knowledge storage	14	9
0.0435	Identification of knowledge resources	1	10
0.0417	Level of knowledge registration and preservation	11	11
0.0415	Focusing on creativity, innovation, and providing solutions	6	12
0.0407	Knowledge extraction guidelines	2	13
0.0406	Application of knowledge in decision-making	29	14
0.0396	Organizational awareness of employee knowledge	3	15
0.0386	Updating knowledge repositories	16	16
0.0359	Knowledge gained from successes	12	17
0.0275	Benchmarking and utilizing knowledge and experiences of other organizations	8	18
0.0267	Support, encouragement, and motivation for knowledge employees	19	19
0.0248	Level of utilization and application of collected knowledge	25	20
0.0228	Knowledge and experience transfer among employees	20	21
0.0223	Appropriate interaction and communication between departments	22	22
0.0219	Guidelines for storing knowledge	15	23
0.021	Recording and preserving information related to skills	13	24
0.0208	Employee willingness to share knowledge	18	25

IJIMOB
E-ISSN: 3041-8992

0.0139	Synergistic social networks	23	26
0.0131	Collaboration with other organizations	9	27
0.0083	Succession planning in human resource management	21	28
0.0063	Utilizing IT tools for knowledge application	24	29

Based on the importance-performance analysis, indicators in quadrants 3 (low importance, low performance) and 4 (low importance, high performance) were removed. The associated categories and results are summarized in Table 5.

Table 5

Dimensions of the Model for Enhancing the Quality of Virtual University Education with a Knowledge Management Approach

Dimension	Result
Technological factors (internet, hardware, software)	Approved
Support system (technical, operational, organizational)	Approved
Managing learning interactions among students	Approved
Evaluation system (instructors, objectives, courses)	Approved
Instructors	Rejected
Scientific and cultural aspects	Rejected
Education and training (educational objectives)	Approved
Teaching skills (strategies)	Approved
Student learning management	Approved
Content and course resources	Approved
Services and responsiveness	Approved
Educational course design	Approved
Socio-cultural and value aspects	Rejected
Management approaches	Rejected
Standards	Rejected
University management and leadership	Approved
Knowledge creation in the organization (knowledge extraction and documentation)	Approved
Knowledge storage, retention, and preservation	Approved
Utilization and application of collected knowledge	Approved

Indicators in quadrant 1 (focus strategy) and quadrant 2 (continue strategy) will be improved using the ISM technique. Weak indicators are enhanced through interactions with strong indicators. The ISM technique identifies the relationships, impacts, and hierarchical structure of knowledge management indicators on enhancing the quality of virtual university education. Table 6 presents these dimensions.

Table 6

Dimensions of the Model for Enhancing the Quality of Virtual University Education with a Knowledge Management Approach Using ISM

Dimension	Code
Technological factors (internet, hardware, software)	1
Support system (technical, operational, organizational)	2
Managing learning interactions among students	3
Evaluation system (instructors, objectives, courses)	4
Education and training (educational objectives)	5
Teaching skills (strategies)	6
Student learning management	7
Content and course resources	8
Services and responsiveness	9
Educational course design	10
University management and leadership	11
Knowledge creation in the organization (knowledge extraction and documentation)	12
Knowledge storage, retention, and preservation	13
Utilization and application of collected knowledge	14

IJIMOB
E-ISSN: 3041-8992

The ISM process begins with identifying variables related to the research topic. In this study, the variables are the dimensions of quality enhancement for virtual university education using a knowledge management approach, identified in earlier sections.

After identifying the dimensions, they are incorporated into the SSIM. This matrix includes the dimensions listed in rows and columns. Pairwise relationships between the dimensions are determined using the following scale:

3: Highly influential
2: Moderately influential
1: Low influence
0: No influence

The opinions of 20 experts familiar with the research subject were collected, and their feedback formed the SSIM (Table 7).

Table 7

Structural Self-Interaction Matrix (SSIM)

Dimension	Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Technological factors	1	0	45	48	42	58	37	57	53	50	41	34	48	49	52
Support system	2	35	0	54	51	47	45	42	48	54	55	28	34	29	34
Managing learning interactions	3	33	34	0	32	28	35	52	33	47	35	32	28	27	35
Evaluation system	4	24	35	47	0	26	34	53	31	55	27	35	36	24	31
Education and training	5	39	31	45	45	0	38	52	44	57	38	31	35	25	30
Teaching skills	6	28	38	42	47	43	0	48	53	42	54	27	28	35	27
Learning management	7	25	24	51	34	37	35	0	32	53	27	29	25	37	36
Content and resources	8	34	28	55	53	52	33	46	0	54	34	35	28	37	20
Services and responsiveness	9	35	35	38	34	29	24	25	27	0	37	15	17	38	19
Course design	10	31	24	44	45	56	50	58	49	52	0	34	28	37	26
University leadership	11	50	40	45	28	55	42	45	47	57	54	0	44	47	48
Knowledge creation	12	27	51	52	55	57	32	45	47	42	45	18	0	55	54
Knowledge storage	13	28	47	38	43	45	44	42	37	48	47	34	58	0	56
Knowledge application	14	23	45	48	52	55	57	54	55	56	57	18	37	15	0

The reachability matrix is created by converting the SSIM into binary values (0 and 1) based on a threshold value. If a number in the SSIM exceeds the threshold, it is replaced with 1; otherwise, it is replaced with 0.

$$M = \begin{cases} a_{ij} = 1 & if \quad a_{ij} \geq m \\ a_{ij} = 0 & if \quad a_{ij} < m \end{cases}$$

The threshold value is calculated using the formula by Bolanos et al. (2005):

M=2*n

where n is the number of experts. For this study, M=40M = 40M=40. The reachability matrix is then calculated (Table 8).

$RM = M + I$

Table 8

Reachability Matrix

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1	1	1	1	1	0	1	1	1	1	0	1	1	1
2	0	1	1	1	1	1	1	1	1	1	0	0	0	0
3	0	0	1	0	0	0	1	0	1	0	0	0	0	0
4	0	0	1	1	0	0	1	0	1	0	0	0	0	0
5	0	0	1	1	1	0	1	1	1	0	0	0	0	0
6	0	0	1	1	1	1	1	1	1	1	0	0	0	0
7	0	0	1	0	0	0	1	0	1	0	0	0	0	0
8	0	0	1	1	1	0	1	1	1	0	0	0	0	0
9	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10	0	0	1	1	1	1	1	1	1	1	0	0	0	0
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	0	1	1	1	1	0	1	1	1	1	0	1	1	1
13	0	1	0	1	1	1	1	0	1	1	0	1	1	1
14	0	1	1	1	1	1	1	1	1	1	0	0	0	1

IJIMOB
E-ISSN: 3041-8992

The initial reachability matrix is refined for internal consistency using Boolean logic. The adjusted matrix is presented in Table 9, where consistent dimensions are marked with an asterisk (*).

Table 9

Adjusted Reachability Matrix

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1	1	1	1	1	1*	1	1	1	1	0	1	1	1
2	0	1	1	1	1	1	1	1	1	1	0	0	0	0
3	0	0	1	0	0	0	1	0	1	0	0	0	0	0
4	0	0	1	1	0	0	1	0	1	0	0	0	0	0
5	0	0	1	1	1	0	1	1	1	0	0	0	0	0
6	0	0	1	1	1	1	1	1	1	1	0	0	0	0
7	0	0	1	0	0	0	1	0	1	0	0	0	0	0
8	0	0	1	1	1	0	1	1	1	0	0	0	0	0
9	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10	0	0	1	1	1	1	1	1	1	1	0	0	0	0
11	1	1	1	1*	1	1	1	1	1	1	1	1	1	1
12	0	1	1	1	1	1*	1	1	1	1	0	1	1	1
13	0	1	1*	1	1	1	1	1*	1	1	0	1	1	1
14	0	1	1	1	1	1	1	1	1	1	0	0	0	1

To determine the levels and priorities of indicators, the reachability set and antecedent set are defined for each indicator. The reachability set includes variables that can be reached through a particular variable, while the antecedent set includes variables that lead to the target variable. This process is performed using the reachability matrix. After identifying the reachability and antecedent sets for each variable, the common elements are identified. Indicators where the reachability set and common elements are identical are assigned the highest level. These indicators are then removed, and the process is repeated for the remaining indicators to define the next levels.

In this study, instead of calculating reachability and antecedent sets and their intersections manually, the sum of rows (driver power) and columns (dependency) from the adjusted matrix was used. The results of these calculations are shown in Table 10, which categorizes the dimensions into 10 levels.

Table 10

Determining Levels of Dimensions for Enhancing the Quality of Virtual University Education with a Knowledge Management Approach

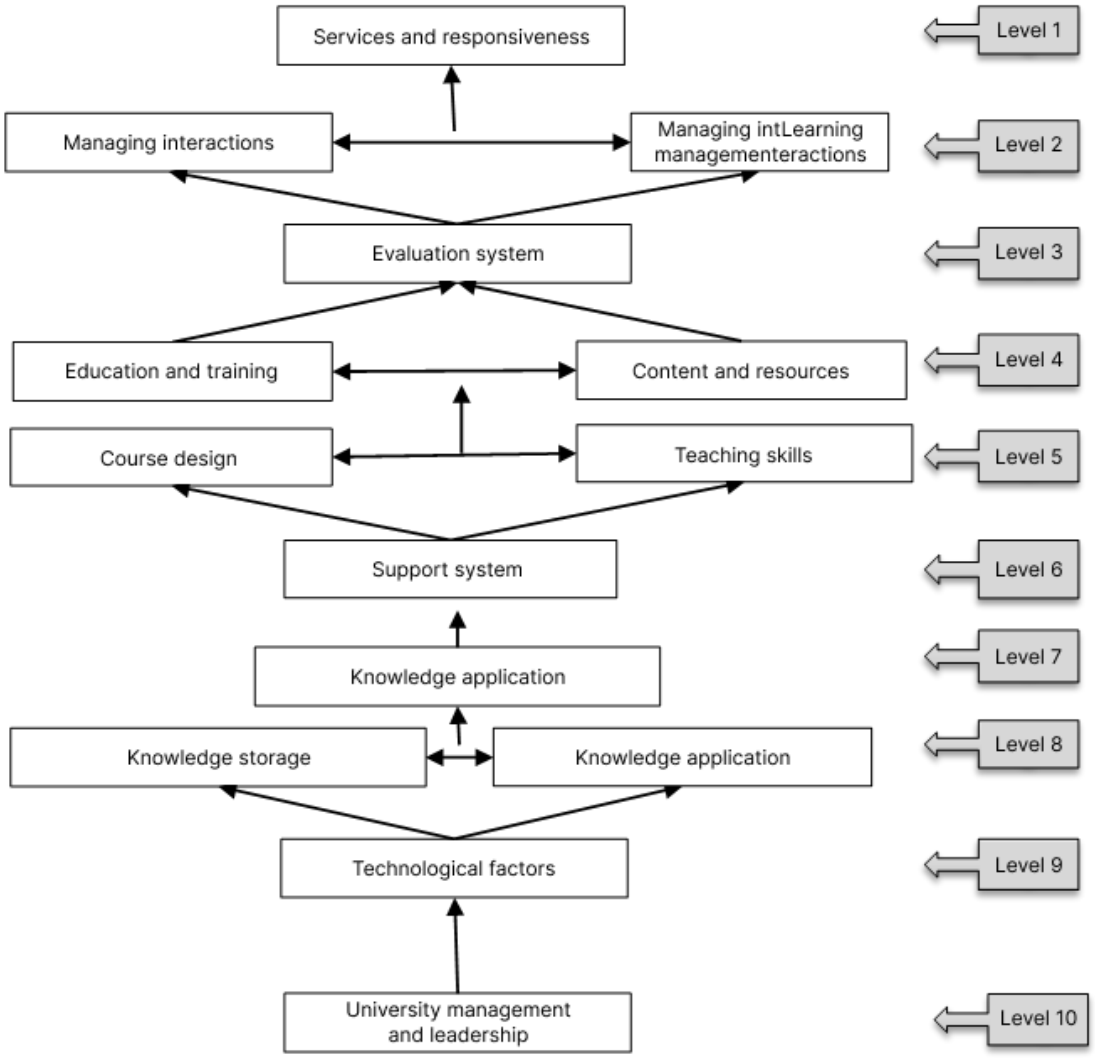
Dimension	D (Driver Power)	R (Dependency)	D - R	Level	Result
Services and responsiveness	9	1	14	-13	1
Managing interactions	3	3	13	-10	2
Learning management	7	3	13	-10	2
Evaluation system	4	4	11	-7	3
Education and training	5	6	10	-4	4
Content and resources	8	6	10	-4	4
Teaching skills	6	8	8	0	5
Course design	10	8	8	0	5
Support system	2	9	6	3	6
Knowledge application	14	10	5	5	7
Knowledge creation	12	12	4	8	8
Knowledge storage	13	12	4	8	8
Technological factors	1	13	2	11	9
University management and leadership	11	14	1	13	10

After defining relationships and levels, the model can be visualized. The dimensions are arranged hierarchically from the highest level at the top to the lowest level at the bottom. In this study, the dimensions are categorized into 10 levels. Figure 3 illustrates the interpretive-structural model (ISM) for enhancing the quality of virtual university education using a knowledge management approach.

IJIMOB
E-ISSN: 3041-8992

Figure 3

Interpretive-Structural Model for Enhancing Virtual University Education with a Knowledge Management Approach

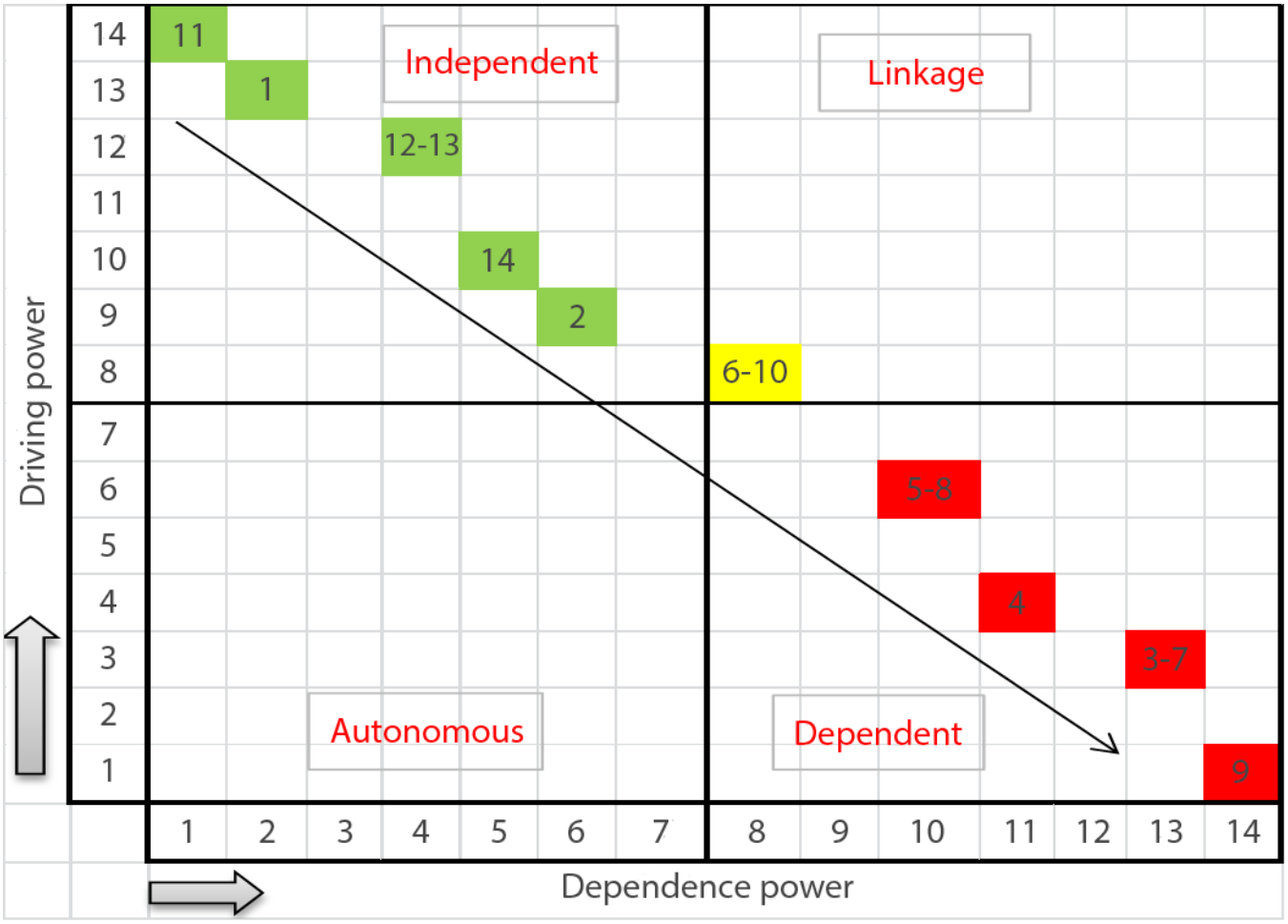


The purpose of MICMAC Analysis is to classify and analyze the driver power and dependency of dimensions. Dimensions are divided into four categories based on these attributes. Figure 4 visually represents the MICMAC analysis for enhancing the quality of virtual university education using a knowledge management approach.

Figure 4

MICMAC Analysis of Driver Power and Dependency

IJIMOB
E-ISSN: 3041-8992



4 Discussion and Conclusion

Based on the findings, the most critical indicators for enhancing the quality of virtual university education with a knowledge management approach were identified through expert interviews and screening. These include the evaluation indicators, which are essential for aligning electronic learning systems, personalizing student adaptation, and managing teaching, learning, and retraining processes.

Modern e-learning must cultivate learners capable of self-directed learning, moving away from traditional teaching methods that focus on transferring information from teacher to learner. Continuous learning and adaptability are essential to meet evolving needs and changes. Educational environments must foster autonomy, competency, and self-regulation, supporting self-directed learning skills. Virtual education, with its inherent emphasis on learner-centered approaches, has become increasingly necessary in the current educational landscape.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

IJIMOB
E-ISSN: 3041-8992

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

References

Ahmadian, Z., Azizi, M., & Amjadi Hoor, J. (2020). Modeling the Relationship Between Virtual Education and Intellectual Capital with the Mediation of Knowledge Management in Higher Education. *Information Management*, *6*(1). https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.aimj.ir/article_125464_d6b5ac70948fae6f155c957fc9c3ca34.pdf&ved=2ahUKEwiul7DM-ImKAxWGQvEDHZw4Jo0QFnoECBkQAQ&usg=AOvVaw35y4xQVqVnjPHODZ5IPyXS

Delghandi, M., karimi, M., Nodehi, H., & Cherabin, M. (2024). Designing an Efficient Virtual Education Pattern in Farhangian University. *Sociology of Education*, *10*(1), 280-294. https://doi.org/10.22034/ijes.2024.2012176.1469

Ebrahimi, M., Alishah, F., & Zamani Pour, F. (2021). Identifying and Analyzing Opportunities and Challenges of Virtual Education from the Perspective of Students. *New Educational Approaches*, *16*(2). https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://nea.ui.ac.ir/article_26778.html&ved=2ahUKEwjQoM3i-ImKAxXcSfEDHW9vBu0QFnoECBgQAQ&usg=AOvVaw0WU6LZP_UCkyWYVQUvBHhM

Fischer, C., & Pöhler, A. (2018). Supporting the Change to Digitalized Production Environments through Learning Organization Development. In C. Harteis (Ed.), *The Impact of Digitalization in the Workplace: An Educational View* (pp. 141-160). Springer International Publishing. https://doi.org/10.1007/978-3-319-63257-5_10

Gloet, M., & Samson, D. (2020). Knowledge Management and Systematic Innovation Capability. *4*(2), 1198-1218. https://doi.org/10.4018/978-1-5225-9273-0.ch059

Gutiérrez, R. A. C. (2024). Staff Affection, the Key Factor in the Loyalty of University Students Using Virtual Library Services That Are Accessible by a Physical Access Space, in Developing Countries. *Tem Journal*, 502-513. https://doi.org/10.18421/tem131-52

Homburg, V. (2018). ICT, E-Government and E-Governance: Bits & Bytes for Public Administration. In E. Ongaro & S. Van Thiel (Eds.), *The Palgrave Handbook of Public Administration and Management in Europe* (pp. 347-361). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-55269-3_18

Hoseinbar, K. a.-N., Hasanimoghadam, A., Vazifeh, Z., & Shokouhi, J. (2016). Examining the Role of Knowledge Management in Virtual Education. First National Conference on Global Management and Economics, Tehran.

Hsing, C., & Liu, S. (2018). Examining Social Capital, Organizational Learning and Knowledge Transfer in Cultural and Creative Industries of Practice. *Tourism Management*, *64*, 258-270. https://doi.org/10.1016/j.tourman.2017.09.001

Kaminska, R., & Borzillo, S. (2018). Challenges to the Learning Organization in the Context of Generational Diversity and Social Networks. *The Learning Organization*, *25*(2), 92-101. https://doi.org/10.1108/TLO-03-2017-0033

Kazerooni Shamiri, H., & Moradi, S. (2019). The Role of Virtual Education and IT Governance in the Meritocracy of Islamic Azad University Managers in Khuzestan Province. *Research in Educational Systems*, *13*(44). https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=http://ensani.ir/fa/article/404841/%25D9%2586%25D9%2582%25D8%25B4-%25D8%25A2%25D9%2585%25D9%2588%25D8%25B2%25D8%25B4-%25D9%2587%25D8%25A7%25DB%258C-%25D9%2585%25D8%25AC%25D8%25A7%25D8%25B2%25DB%258C-%25D9%2588-%25D8%25AD%25D8%25A7%25DA%25A9%25D9%2585%25DB%258C%25D8%25AA-%25D9%2581%25D9%2586-%25D8%25A2%25D9%2588%25D8%25B1%25DB%258C-%25D8%25A7%25D8%25B7%25D9%2584%25D8%25A7%25D8%25B9%25D8%25A7%25D8%25AA-%25D8%25AF%25D8%25B1-%25D8%25B4%25D8%25A7%25DB%258C%25D8%25B3%25D8%25AA%25D9%2587-%25D8%25B3%25D8%25A7%25D9%2584%25D8%25A7%25D8%25B1%25DB%258C-%25D9%2585%25D8%25AF%25DB%258C%25D8%25B1%25D8%25A7%25D9%2586-%25D8%25AF%25D8%25A7%25D9%2586%25D8%25B4%25DA%25AF%25D8%25A7%25D9%2587-%25D8%25A2%25D8%25B2%25D8%25A7%25D8%25AF-%25D8%25A7%25D8%25B3%25D9%2584%25D8%25A7%25D9%2585%25DB%258C-%25D8%25A7%25D8%25B3%25D8%25AA%25D8%25A7%25D9%2586-%25D8%25AE%25D9%2588%25D8%25B2%25D8%25B3%25D8%25AA%25D8%25A7%25D9%2586&ved=2ahUKEwjLrIL7-ImKAxU8bvEDHeaXO6YQFnoECBkQAQ&usg=AOvVaw0EeRXYLkSvBVRKYaBHuxng

Moisil, I. (2020). A Model of the Student Behaviour in a Virtual Educational Environment. *International Journal of Computers Communications & Control*, *3*(1), 108-115. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.researchgate.net/publication/291987675_A_model_of_the_student_behaviour_in_a_virtual_educational_environment&ved=2ahUKEwi5wY6I-YmKAxULc_EDHce_Hz4QFnoECBYQAQ&usg=AOvVaw2-4RhKpN32trzGV30Xi_se

Raghuram, S., Hill, N. S., Gibbs, J. L., & Maruping, L. M. (2019). Virtual Work: Bridging Research Clusters. *Academy of Management Annals*, *13*(1), 308-341. https://doi.org/10.5465/annals.2017.0020

Rizun, M. (2016). Intellectual Capital as a Key Factor of Knowledge Management in Organizations. International Conference on Information System Development,

Schlacht, I. L., Del, M. A., & Nazir, S. (2017). Virtual Reality for Safety, Entertainment or Education: The Mars Mission Test.

E-ISSN: 3041-8992

In *Advances in Applied Digital Human Modeling and Simulation* (pp. 75-83). Springer. https://doi.org/10.1007/978-3-319-41627-4_8

Sepahvand, R., Shariatnejad, A., & Arefnejad, M. (2015). The Impact of Information Technology on Intellectual Capital and Knowledge Management Strategies with the Moderating Effect of Organizational Agility. *Organizational Resource Management Research*, *5*(3), 71-96. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://ormr.modares.ac.ir/article-28-11407-fa.html&ved=2ahUKEwjo9dua-YmKAxVCRvEDHbovOskQFnoECBcQAQ&usg=AOvVaw0e8GM8pwysR6pktvEnl5A4

Shariati, F., Niazazari, K., & Jabbary, N. (2024). Presenting a Model for Virtual Education Considering Educational Equity with a Phenomenological Approach in Schools of Golestan Province [Research Article]. *Iranian Journal of Educational Sociology*, *7*(1), 66-78. https://doi.org/10.61838/kman.ijes.7.1.7

IJIMOB
E-ISSN: 3041-8992