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Presenting a Model for Digital Transformation in Higher Education

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Abstract

The present study offers a model for digital transformation in higher education through a meta-synthesis approach. The research is applied in terms of purpose and qualitative with an exploratory approach in terms of nature. The research population consists of articles related to digital transformation in higher education, either jointly or separately. The data collection method is documentary-library research using the meta-synthesis method, and the sampling method was selected based on inclusion and exclusion criteria in the PRISMA method. To address the research questions, 65 articles were reviewed and analyzed, resulting in the extraction of 15 categories and 95 meaningful codes. The synthesis of findings, after obtaining the opinions of university experts (five educational management professors), was classified into seven dimensions (advanced educational platforms with artificial intelligence, automated administrative processes, immersive learning environments, data-driven decision-making, sustainability and scalability, data privacy, and assessment and evaluation) and 33 categories. Digital transformation in higher education, as one of the most significant global trends, plays a crucial role in improving the quality of education, increasing access to scientific resources, and transforming learning methods. With the advancement of modern technologies such as artificial intelligence, big data, machine learning, the Internet of Things, and blockchain, traditional higher education systems are facing numerous challenges that necessitate fundamental revisions and changes in educational structures and methods.

Keywords: Digital transformation, Higher education, Meta-synthesis.

1. Introduction

Digital transformation is defined as the use of new digital technologies to facilitate significant business advancements that lead to improved customer experience, streamlined operations, or the development of new business models. This involves identifying organizational needs, designing new processes, or redesigning existing processes using digital technologies to deliver value to business customers (Fernández et al., 2023; Parsakia & Jafari, 2023).

Additionally, digital transformation enables organizations to create value by bringing together internal and external capabilities to achieve their goals through digital solutions. Each institution, based on its vision and maturity, goes through specific stages in this process. Universities, as one of the essential and key components of the education system, play a



significant role in shaping both the past and future world (Muhabbat et al., 2024) and have a strategic role as drivers of sustainable development and the transition towards a knowledge-based society (Gkrimpizi et al., 2023; Hamidi et al., 2023; Khoeini et al., 2023).

Given the profound changes in the world of higher education, the objectives, programs, and orientations of universities have increasingly come into focus. Reviewing the developments in higher education from the emergence of the first university in the 13th century to the present day reveals that the higher education system has always been dynamic and adaptable, changing in response to social, cultural, and epistemological transformations (Arasteh et al., 2021; Bond et al., 2018; Jacociunas et al., 2024; Noori et al., 2019; Rahimian, 2023; Rastegar et al., 2022).

Factors such as globalization, localization, and internationalization have driven transformations in higher education systems. Globalization, particularly in the fields of science and technology, has led to numerous changes in higher education due to rapid transformations. Concurrently, the fundamental reliance on a knowledge-based economy and international competition has pushed universities to enhance the quality of education and standardize higher education systems, making internationalization a tool for development and progress (Mohamed Hashim et al., 2022; Mohamed Hashim et al., 2021).

The penetration of digital technologies poses a fundamental challenge in the economic, political, social, and scientific domains of the contemporary era, significantly impacting universities and transforming the daily lives of students, faculty, and staff. The revolution in teaching and learning methods, new avenues for academic activities, powerful tools for knowledge creation and sharing, and new methods for researcher-community interaction are among the achievements of these technologies (Khoeini et al., 2023).

Higher education institutions are thus engaged in a new transformation of the university. Kawoode (2018) and Wildan Zulfikar et al. (2018) describe several drivers of change shaping the future university, including increased competition, digital behavior, changes in work, global mobility, democratization of knowledge and access, continuous learning, and the elimination of industry boundaries (Fernández et al., 2023). Chapko Wid (2018) and Prasana & Choudhury (2013) also highlight that this necessity is influenced by university customers (students) who, due to the era they live in, have high digital expectations from universities. Therefore, universities face a highly competitive environment and feel the need to leverage new digital capabilities to stay relevant in a changing society (Indrák & Pokorná, 2021). Moreover, the most significant pressure for change in universities comes from contemporary students who demand a flexible, personalized, and real-time educational experience. The university's vision must place the student experience at its core (Jacociunas et al., 2024).

As places where knowledge is created, developed, and shared, universities are responsible for researching digital technologies and their social, economic, and political impacts. Universities are also committed to leveraging digital opportunities to provide quality education and address current and future challenges in higher education. Digital technology offers significant opportunities for streamlining work processes, fostering interaction and participation. However, using technology without adequate support can be risky and challenging. Implementing an appropriate digital strategy that addresses stakeholder concerns, enhances their fundamental understanding of digital technologies, develops tools and services aligned with user needs, and fosters digital-based innovations is essential for higher education in the current era (Arasteh & Khabareh, 2020; Arasteh et al., 2021; Jafari et al., 2021; Khoeini et al., 2023; Mohamed Hashim et al., 2022; PourAtashi, 2018; Rahimian, 2023).

Therefore, universities can contribute more than ever to the development of science for the benefit of society and academic environments through digital technologies. Higher education continually faces challenges in response to global changes, including rapid globalization, technological disruption, and the COVID-19 pandemic. Various innovations are required to overcome these challenges, seize opportunities, and prepare students for future issues. The evolution of education is closely linked to the impact of the Industrial Revolution. The current era, known as the fourth era of digitalization, focuses on the complete digitization of all physical assets and their integration into a digital ecosystem. This era integrates various digital technologies such as sensors, controllers, augmented reality, robotics, cloud computing, data analytics, the Internet of Things, artificial intelligence, and high-performance tools to support design and production. The fourth era of digitalization is bringing about significant changes in education. Considering these discussions, the main question is: How can a model for digital transformation in higher education be presented?



2. Methods and Materials

The present study aims to identify the dimensions of digital transformation in higher education using the meta-synthesis method, relying on the study of published resources and documents in this field. Therefore, in terms of purpose, it is an applied research, and in terms of data collection, it is descriptive. Due to the lack of a clear and precise explanation regarding the factors influencing digital transformation in higher education in previous works, the meta-synthesis method has been employed.

This study was conducted to answer the question, "What are the factors influencing digital transformation in higher education?" and was written to explain the stages of its implementation in universities (what?). All articles related to digital transformation in higher education were collected. The steps of the meta-synthesis approach were performed based on the model of Sandelowski and Barroso (2006).

3. Findings and Results

Step 1: Formulating the Research Question

At this stage, the following questions need to be answered:

What? This question refers to the main objective of using the meta-synthesis method in this study. The aim of conducting this meta-synthesis is to identify the dimensions, components, and indicators of digital transformation in higher education.

Who? This question specifies the research population. The research population of this study includes all accessible scientific-research and scientific-promotional articles in the field of digital transformation in higher education from Persian and English databases. Persian articles were collected through the websites of NoorMags, Magiran, SID, and the Comprehensive Portal of Humanities, and English articles through the websites of ScienceDirect, Elsevier, ScienceDirect, and Emerald.

When? The time frame for English articles is from 2010 to 2024, and for Persian articles, from 2012 to 2025, based on Google Trends data.

How? This question refers to the method used to conduct the study. In the meta-synthesis method, previous research texts are used as data for the study. In the present research, the documentary analysis method was employed, analyzing secondary data. The researcher selected articles for the meta-synthesis method based on specific criteria and excluded others. Table 1 presents a summary of the main research questions along with their components.

Table 1. Definition of the Main Research Question

Components	Formulating the Question
What? (Research Question)	Identifying the dimensions, components, and indicators of digital transformation in higher education
Who? (Study Population)	Several reputable databases were reviewed
When? (Time Frame)	English articles from 2010 to 2024
How? (Data Collection Method)	Documentary analysis

Step 2: Systematic Literature Review

In this study, the time frame of 2010 to 2024 was considered for English articles and 2012 to 2025 for Persian articles. Foreign databases included ScienceDirect, Elsevier, and Emerald, while Persian databases included NoorMags, Magiran, SID, and the Comprehensive Portal of Humanities, resulting in 2,270 studies identified for initial review. Based on a search in the IranDoc research background system, no thesis with an exact related title was found.

As previously mentioned, no prior research has comprehensively examined these dimensions using meta-synthesis or provided an appropriate model for the dimensions of digital transformation in higher education. The keywords used in this study are shown in Table 2.

Table 2. Research Keywords

Persian	English
تحول دیجیتال	Digital transformation
آموزش عالی	Higher education
هوش مصنوعی	Artificial intelligence



Step 3: Searching and Selecting Suitable Studies

To select suitable sources for this study, the keyword "digital transformation in higher education" was initially searched in the databases. However, since this keyword was too general, many unrelated topics were found, leading to modifications of the keyword until the final keyword and its English equivalent were used. Additionally, criteria for selecting related articles were considered, summarized in Table 3.

Table 3. Inclusion and Exclusion Criteria for Studies

Criterion	Inclusion	Exclusion
Population	All studies	-
Phenomenon of Interest	Articles related to digital transformation in higher education	Articles unrelated to digital transformation in higher education
Field	No limitation	No limitation
Publication Date	English articles from 2010 to 2024; Persian articles from 2012 to 2025	English articles before 2010; Persian articles before 2012
Language	English and Persian	Languages other than English and Persian
Type of Study	Scientific-research and scientific-promotional articles	Specialized scientific articles, conference papers, books, and notes
Availability	Articles with abstract and full text	Articles without abstract or full text

At this stage, articles were repeatedly reviewed, and those deemed unsuitable or irrelevant were excluded from the process. Article reviews were conducted based on various parameters such as title, abstract, content, and full text. Initially, article titles were reviewed, and those not aligned with the research aim and question were excluded. Next, the abstracts of the remaining articles were reviewed, leading to the exclusion of more unrelated articles. Finally, the remaining articles were reviewed based on content or full text, and those not fitting the topic were removed, leaving the final articles for the next step of the meta-synthesis. The methodological quality of these articles will be assessed in the subsequent step.

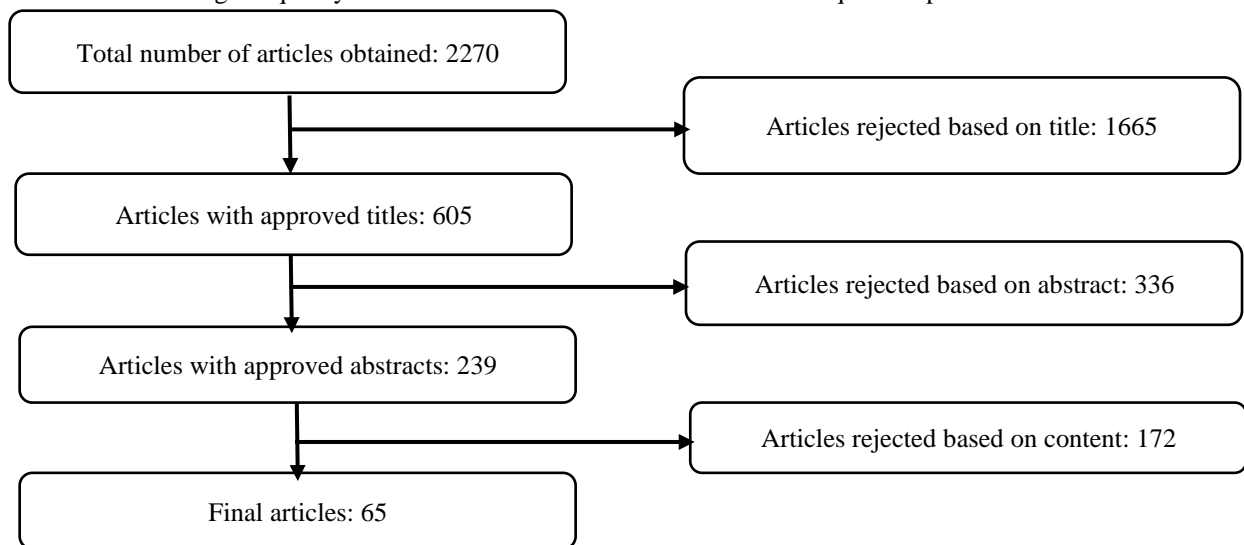


Figure 1. Summary of the Article Screening Process (Research Findings)

Step 4: Extracting Data from Studies

At this stage, data must be extracted from the articles. This step is similar to the first stage of the grounded theory method (open coding). These codes were extracted based on the criteria presented in the first step. The researcher systematically and thoroughly reviewed the articles, repeatedly referring to the research questions to obtain the initial codes.

Step 5: Analyzing and Synthesizing Qualitative Findings

In this stage, three steps were carried out: open coding (coding and tabulating data), axial coding (identifying concepts and relationships between them), and selective coding (analyzing concepts). Accordingly, open coding was conducted using Glaser's method, where all key factors extracted from the studies were initially considered as codes, and then comparisons were made based on shared concepts, leading to categorization.



Table 4. Data Synthesis

Selective Code	Axial Coding
Advanced educational platforms with artificial intelligence	1. AI chatbots and virtual assistants
	2. Personalized learning paths
	3. Intelligent educational systems
	4. Virtual labs and simulations
Automated administrative processes	5. Online admission and registration
	6. Dynamic course content
	7. Mental health and student well-being monitoring
	8. Digital credentials and certificates
Immersive learning environments	9. Course management
	10. Virtual reality and augmented reality
	11. Metaverse technologies
	12. Virtual study groups
	13. Global collaboration and cultural exchange
	14. AI-based project management tools and communities
	15. Global accessibility and inclusion
	16. Ease of access
	17. Multilingual support
Data-driven decision-making	18. Learning analytics
	19. Data-based security systems
	20. Cybersecurity and privacy
	21. Predictive analytics
Sustainability and scalability	22. Cloud computing
	23. Plagiarism detection
	24. Energy-efficient technologies
	25. Sustainable methods
Data privacy	26. Protection of sensitive data
	27. Real-time threat detection
	28. Secure data management practices
	29. User authentication
Assessment and evaluation	30. Automated grading and feedback
	31. AI-based assignments
	32. Plagiarism detection
	33. Academic integrity

Step 6: Quality Control

The designed model includes seven dimensions and 33 categories. In this study, the researcher ensured the quality of the extracted concepts by comparing their views with those of other experts. To achieve this, selected texts were provided to four experts (two master's degree holders specializing in higher education). The kappa coefficient was used to measure the reliability of the designed framework.

The kappa coefficient was calculated for two coders to measure inter-coder agreement. Finally, based on the number of similar and different codes created, the kappa coefficient was calculated to be 0.639, indicating a valid level of agreement.

Step 7: Presenting the Findings

Sixty-six articles selected by the researchers were carefully reviewed over two months, and the required information was identified based on the main objective of identifying the dimensions of digital transformation in higher education. The synthesis of the findings, after incorporating the opinions of university experts (five educational management professors), was classified into seven dimensions (advanced educational platforms with artificial intelligence, automated administrative processes, immersive learning environments, data-driven decision-making, sustainability and scalability, data privacy, and assessment and evaluation) and 33 categories, as shown in Figure 2.



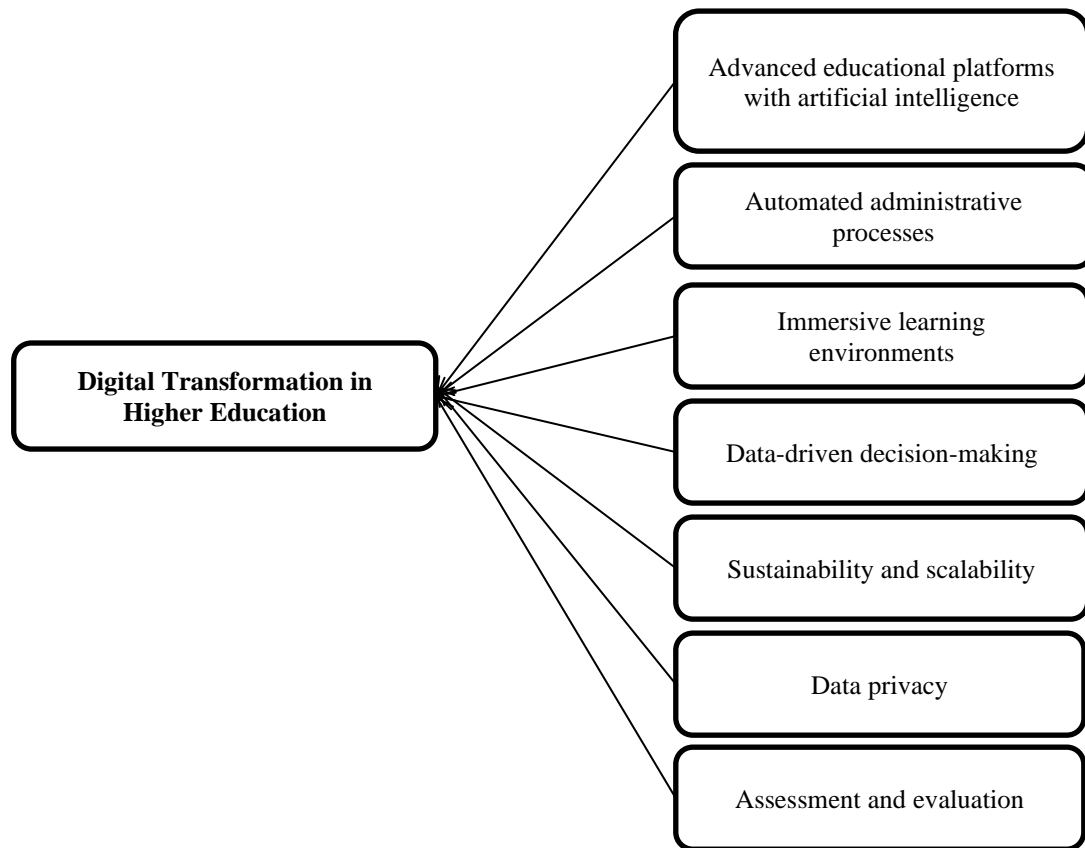


Figure 2. Framework for Digital Transformation in Higher Education

4. Discussion and Conclusion

The results of qualitative studies extracted from previous research using the meta-synthesis approach showed that the factors influencing digital transformation in higher education are classified into seven dimensions and 33 categories. The synthesis of findings, after incorporating the opinions of university experts (five educational management professors), identified seven dimensions:

Advanced educational platforms with artificial intelligence: AI chatbots and virtual assistants, personalized learning paths, intelligent educational systems, virtual labs, and simulations.

Automated administrative processes: Online admission and registration, dynamic course content, mental health and student well-being monitoring, digital credentials and certificates, course management.

Immersive learning environments: Virtual reality and augmented reality, metaverse technologies, virtual study groups, global collaboration and cultural exchange, AI-based project management tools and communities, global accessibility and inclusion, ease of access, multilingual support.

Data-driven decision-making: Learning analytics, data-based security systems, cybersecurity and privacy, predictive analytics.

Sustainability and scalability: Cloud computing, plagiarism detection, energy-efficient technologies, sustainable methods.

Data privacy: Protection of sensitive data, real-time threat detection, secure data management practices, user authentication.

Assessment and evaluation: Automated grading and feedback, AI-based assignments, plagiarism detection, academic integrity.

The results of these findings align with the prior studies ([Arasteh & Khabareh, 2020](#); [Arasteh et al., 2021](#); [Benavides et al., 2020](#); [Bond et al., 2018](#); [Deroncele-Acosta et al., 2023](#); [Fernández et al., 2023](#); [Gkrimpizi et al., 2023](#); [Jackson, 2019](#); [Jacociunas et al., 2024](#); [Jafari et al., 2021](#); [Khoeini et al., 2023](#); [Khosravipour, 2022](#); [Mohamed Hashim et al., 2022](#);

Mohamed Hashim et al., 2021; Muhabbat et al., 2024; PourAtashi, 2018; Rahimian, 2023; Seres et al., 2018; Trevisan et al., 2023).

Digital transformation in higher education requires comprehensive and innovative strategies that leverage modern technologies. The following are key recommendations for this transformation:

Utilizing modern technologies in education and e-learning.

Enhancing digital infrastructure and data security by strengthening cloud computing infrastructure and cloud storage space, along with developing cybersecurity frameworks to protect student and faculty data.

Developing digital skills among faculty members and students by offering training courses to enhance digital literacy for faculty and students and creating specialized workshops on data analysis, programming, and artificial intelligence.

Implementing flexible and blended learning models by combining in-person and online education to increase accessibility and efficiency, using gamification to enhance student engagement.

Promoting international collaborations and leveraging global experiences by participating in international research projects related to digital transformation and exchanging knowledge and cooperation with leading universities in digitalizing education.

Automating administrative and managerial processes by using automation and artificial intelligence in university administrative affairs, developing blockchain platforms for credential verification, and creating big data analysis systems for policy optimization.

Supporting digital innovation and entrepreneurship by establishing innovation centers and university accelerators to support technology-based startups and collaborating with industries to develop digital skills and create employment opportunities.

Digital transformation in higher education requires a comprehensive roadmap and continuous investment. By leveraging modern technologies, enhancing infrastructure, and developing digital skills, universities can play a more effective role in preparing the future workforce.

The limitations of this study include insufficient budget allocation and the lack of cohesive strategies in some countries and universities, which have slowed down the process of digital transformation. Additionally, the implementation of digital transformation requires collaboration between various departments such as information technology, education, and university management, which in some cases, lacks adequate coordination.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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