



## Presenting a Model for Digital Identity Management in Schools with Emphasizing the Role of Educational Justice

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### Abstract

**Introduction and Purpose:** In the digital age, identity has emerged as a fundamental dimension of human existence and the cornerstone of the educational, cultural, and political foundations of society. With the increasing integration of digital technologies in schools and the critical importance of safeguarding student privacy and security, digital identity management has become a significant challenge for educational systems. This study aims to propose a comprehensive, indigenous model for digital identity management in Iranian schools.

**Methodology:** This research is developmental-applied in nature and employs an exploratory sequential mixed-methods design. In the qualitative phase, the grounded theory strategy—following the systematic approach of Strauss and Corbin (1998)—was utilized to explore the primary dimensions of the model. Participants included 16 experts in educational management, information technology, and digital identity, selected through purposive and theoretical sampling. In the quantitative phase, the Fuzzy Delphi Method (FDM) was used for screening and refining indicators; the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method was applied to structure the relationships between dimensions; and Structural Equation Modeling (SEM) was used for model validation. The quantitative population comprised 12,345 secondary school teachers in Kermanshah province, from which 384 participants were selected using multi-stage cluster sampling.

**Findings:** The analysis of qualitative data identified 89 conceptual codes, 17 sub-categories, and 6 core categories within the paradigmatic model. Causal conditions included digital governance and policy-making, technological infrastructure and maturity, and human competencies. Contextual conditions comprised school culture, organizational structure, learning environments, and individual user characteristics. Environmental and structural challenges, alongside human resistance, were identified as intervening conditions. The core phenomenon involved the development of authentication infrastructure, protection of security and privacy, behavioral empowerment and identity literacy, and continuous monitoring and improvement. The DEMATEL results indicated that "Organizational and Educational Outcomes" (D-R=1.1908) is the most influential factor, while "Behavioral Empowerment and User Identity Literacy" (D-R=-2.36856) is the most influenced, yet significant factor in terms of total system interactions. SEM results confirmed that all direct path coefficients were positive, and model fit indices (GFI=0.92, CFI=0.91, RMSEA=0.084) indicated a favorable model fit.

**Conclusion:** Digital identity management in schools is a multidimensional, interdisciplinary, and transformative phenomenon situated at the intersection of educational governance, information technology, data security, school culture, digital literacy, and student development. The proposed model serves as a robust framework for policy-making, executive planning, and designing educational interventions regarding digital identity management in schools.

**Keywords:** Digital Identity Management, Schools, Grounded Theory, Fuzzy Delphi, Educational Justice.

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## Introduction

In today's complex world, the use of the technologies of the Fourth Industrial Revolution has become a necessity rather than an advantage to keep up with the ever-increasing progress of human societies (Fasihi, 2011). Electronic devices have surrounded the entire life of mankind, and it is perhaps safe to say that there is no job, profession, or industry that does not involve digital devices. This invasion has also continued in families, such that in the 2016 census, 53 percent of Iranian households had access to the Internet and 64 percent of Iranians are members of at least one social network (Beigi, Qayumi, Alani, and Solhjoo, 2011). In this era, digital technology is a vital driver of development in change management, which is solving problems and drivers for achieving development, or in other words, the practical desire to achieve a better situation compared to the current undesirable situation, day by day (Malek-Mohammadi, 2019).

Identity is one of the most fundamental dimensions of human existence and the educational, cultural, economic and political foundation of societies. How children's identities are formed as the foundations of this national structure is important at the current critical juncture, which is considered the era of the communications revolution and the dominance of media culture. The importance of paying attention to this issue is doubled when we know that cyberspace, while positively affecting the identity of children and adolescents, has also created negative and threatening effects, including the fluidity of children's and adolescents' identities or their lack of identity, the development of social distrust, altruism and dishonesty (Keshavarz et al., 1402). Previous research has shown that cyberspace, by providing various possibilities for discovering identity, can also fuel an identity crisis and a sense of lack of identity in adolescents (Akbari, 2008).

The development of electronic communication networks has brought human identity to a new stage. At this stage, individuals with their own cultures, races, and environmental conditions can play an active role in the formation of human collective identity (Akbari, 2008). Digital identity management is the management and control of personal information or digital entities such as users, devices, and services in the Internet space and the digital world. This includes the management of identification, authentication, access, and information security (Rasouli et al., 2020). In the digital age, individuals and businesses are more dependent than ever on services provided in cyberspace, and providing services in this space requires building trust by creating a trust framework for providing digital identity services (Akbari and Turkman, 2012). Digital identity management is very important in schools. This is for various reasons, including security, protecting personal information, and preventing possible abuse. By using digital identity management, schools can benefit from features such as controlled access to school systems, protection of student information, and creation of a secure space for teaching and learning activities (Kabovi and Phiri, 2019). Despite the importance of this issue, a review of the research literature shows that no comprehensive study has been conducted on providing a native model for digital identity management in Iranian schools. Therefore, the present study was designed and implemented with the aim of filling this theoretical gap and providing a comprehensive model for digital identity management in schools.

## Theoretical foundations and research background

### The concept of digital identity

Digital identity refers to the set of information and data that identifies an individual, organization, or device in the digital space. In the digital age, individuals and businesses are more dependent than ever on services

provided in cyberspace. Providing services in this space requires trust building through the creation of a trust framework for providing digital identity services (Akbari and Turkman, 1402).

In the field of education, the concept of digital identity goes beyond a simple user identifier and is defined as the primary domain in which it is implemented, negotiated, and perpetuated. This view shows that digital identity is an integral part of the professional and personal identity of individuals in the current era (Kebowie and Fieri, 2019). Previous studies have shown that traditional centralized identity management systems face significant challenges, including data breaches, limited transparency, and limited user control, which highlights the need to move towards decentralized systems (Rassoli et al., 2020). In his study “Digital Identity and Identity Management Technologies,” Ruiz (2015) concluded that there are many technologies available for identity management in the form of open specifications, open source tools, and commercial applications. Currently, several standards are competing in the field of identity management. Initially, SAML, which stands for Security Assertion Markup Language, was the only suitable option with a sufficiently high level of adoption. Recently, another technology called WS-Federation has also attracted the attention of the community. Ruiz also emphasized the importance of selecting and deploying these technologies based on technical maturity and understanding of standards.

Recent research has shown that decentralized identity management systems based on blockchain technology can provide effective solutions to identity management challenges in education. By providing capabilities such as autonomous identity, these systems allow users to have greater control over their data and reduce dependence on centralized institutions. Also, the use of decentralized identifiers standardized by the World Wide Web Consortium can increase the verifiability and privacy of educational systems (Rasuli et al., 2020).

#### Digital Identity Management in Education

Digital identity management in schools can be an important and sensitive issue. The use of Digital technologies are essential for education and communication in schools, but issues such as student privacy, information and user security, and maintaining the confidentiality of educational data must be considered. The use of digital identification tools and systems, such as learning management systems and student information management systems, requires the adoption of measures related to security and identity management (Keshavarz et al., 1402).

The use of digital identification tools and systems requires the adoption of measures related to security and identity management. These measures may include the use of secure login systems such as two-step login, educating users about security issues, and establishing sound policies and procedures for data management and maintaining the confidentiality of personal information. To implement this successfully, collaboration between school administrators, ICT managers, teachers, and parents is crucial (Rassoli et al., 2020).

Recent research has shown that personalized learning environments face serious challenges in the area of data confidentiality. These challenges include security issues, data governance, information circulation, trust, user needs and experience, and system performance and scalability. Current mechanisms for protecting data privacy in learning environments—including mechanisms based on access control, cryptography, trust, and rules—have significant limitations. These limitations are largely due to their reliance on centralized identity management systems, their lack of support for user ownership and control of data, and their inability to adapt to complex and evolving learning scenarios (Kebowie and Fieri, 2019).

#### Challenges of Digital Identity Management in Learning Environments

In higher education, researchers have identified digital identity as one of the main dimensions of professional identity formation. Studies show that educators and students use a variety of strategies to manage their digital identities, including audience design, contextual disclosure, and the use of dual accounts (Kebowie and Fieri, 2019). Also, research has shown that the identity of educators in social networks is composed of a set of acceptable identity fragments, each of which is intentional, authentic, .(transitional, incomplete, and socially constructed (Ruiz, 2015

One of the most important structural challenges in digital identity management is the lack of coordination between systems. In many educational systems, the data of students, teachers and schools are scattered in different systems and there is no single, valid and traceable digital identity. This issue can cause rework, information error, weak security, difficulty in authentication and decrease in user trust (Rasuli et al., 2020). This finding is in significant agreement with domestic researches about the evolution of education; So that Haghighi and Abbaszadeh (1402) considered the most important challenge of education in the third millennium to be the policy of change and transformation, and Sahrai and Zare (1402) introduced the policy of transformation and transformation of the education system into an efficient and effective system as one of the most important challenges of educational policy.

## **Research background**

### **Domestic background**

Mohammadifar and Malekian (1402) in a research entitled "Review of digital identity infrastructures" addressed several research streams that have been investigated in the researches and pointed out its importance. They showed that the infrastructure of digital identity in educational systems needs special attention, which has been less investigated so far.

Akbari and Turkman (1402) have stated in a research titled "Presenting the Grand Design of Digital Identity Ecosystem Architecture" that in the digital age, people and businesses are more dependent on the services provided in the virtual space than ever before. Providing services in this space requires building trust through creating a trust framework for providing digital identity services. They emphasized the necessity of designing a coherent architecture for the ecosystem of digital identity.

Rasouli et al. (2020) in a research titled "Proposing a digital identity management framework: a hybrid approach" concluded that "strategic planning" is the most influential factor in digital identity management. Also, the sub-factors "Using the maturity model of digital identity management", "Commitment to the whole organization", "Integration of digital identity management system with other systems", "Integration of digital identity management program" and "Integration of identity management and access management" were respectively ranked as the most influential sub-factors of "Strategic planning". They also found that "access management" is the most permeable factor in digital identity management and the sub-factors "control access to all resources only through the digital identity management system", "a solution to manage access to premium accounts", "multi-factor authentication support", "access to all resources and information" and "determining how the user can access resources outside the organization" were ranked as the most permeable sub-factors.

Haghighi and Abbaszadeh (1402) considered the most important challenge of education in the third millennium to be the policy of change and transformation, and Sahrai and Zaree (1402) introduced the policy of transformation and transformation of the education system into an efficient and effective system as one of the most important challenges of educational policy making. Kamali and Kamali (1402) in their research on change management in education emphasize that this organization, as an important organization, needs transformation and change management has wide consequences in it.

### **Foreign background**

Kebowi and Phiri (2019) in a study entitled "A Framework for Digital Identity Management" concluded that the respondents were from banks (14%), the government of the Republic of Zambia (12%), churches (6%), hospitals (16%), insurance (16%), mobile phone companies (10.7%), universities (21%), service companies (1.3%) and other schools (1.3%) and were less. The studied paradigms included usefulness, trust, ease of use, image and user satisfaction. The results helped create a framework that guided the research.

Ruiz (2015) in a research entitled "Digital Identity and Identity Management Technologies" concluded that there are many technologies for identity management in the form of open specifications, open source tools and commercial applications. Currently, several standards are competing in the field of identity

management. Initially, SAML was the only suitable option with a sufficiently high adoption level. Recently, another technology called WS-Federation has also attracted the attention of the community. Although this technology has not received as much attention as SAML, it is presented as a valid option in identity management.

Surveys have shown that digital identity is a new issue in today's era, which is considered one of the necessities of today's era. The review of previous articles and research shows that the important issue of digital identity has been less discussed in the current era, and the review of this issue can bring about innovation in the field of digital identity. Especially in the field of digital identity management in Iranian schools, a comprehensive study that provides a local model suitable for the educational structure of the country has not been done. In addition, the existing researches have mostly focused on the technical aspects of identity management, and its educational, cultural and organizational dimensions have received less attention. Therefore, the current research was designed and implemented with the aim of filling this theoretical gap and providing a comprehensive model for digital identity management in schools.

## **Research methodology**

### **Research methodology and outline**

The current research is a developmental-applied research in terms of its purpose, and in terms of methodology, it follows a sequential exploratory mixed design. In mixed research, in order to achieve a deep and comprehensive understanding of complex organizational and educational phenomena, qualitative and quantitative approaches are combined in a single study (Johnson and Christensen, 2004). This approach provides the possibility of taking advantage of the strengths of both qualitative and quantitative paradigms and adjusts the limitations caused by the use of single methods (Tashakuri and Tadawoli, 2003).

According to us Given the emerging topic and the existence of theoretical gaps in the field of "Digital Identity Management in Schools", this research was designed and implemented in four consecutive and complementary steps:

1. Qualitative phase (exploratory): Using the data-based theory strategy (Strauss and Corbin's systematic approach) to explore the concepts, categories, and initial dimensions of the model.
2. Consensus assessment phase (screening): Using the fuzzy Delphi technique to localize, refine, and finally confirm the indicators extracted from the qualitative phase.
3. Relationship structuring phase (drawing the network of effects): Using the DEMATEL technique to identify the extent and direction of mutual relationships (perceptual impact and effectiveness) between the main dimensions of the model.
4. Quantitative phase (confirmation and validation): Using structural equation modeling to empirically test the model and measure its fit in the statistical population of teachers.

### **Data-driven theory strategy (qualitative phase)**

In this study, the data-driven theory strategy with the systematic approach of Strauss and Corbin (1998) was used to explore the initial dimensions of the digital identity management model. This approach was chosen because of the specific and structured methodological steps in data analysis (triple coding). Although the researcher entered the field with a theoretical background and sensitivity resulting from a review of the research literature, in order to maintain the exploratory nature of the data-driven strategy, the imposition of default codes on the data was avoided and categories were allowed to be inductively extracted from the empirical realities of the field.

Data analysis in this strategy is based on a coding process in three stages:

Open coding: In this stage, the implemented interview texts were examined as a unit of analysis, line by line and paragraph by paragraph. The open coding process consists of two stages: primary coding (level one), which involves extracting primary and sub-concepts directly from the participants' key words and

sentences, and focused coding (level two), which involves continuously comparing primary concepts, merging overlapping codes, and categorizing them into secondary concepts and subcategories.

**Axial coding:** In this stage, the relationships between subcategories are established around a “central category” (the core of the digital identity management phenomenon in schools) based on Strauss and Corbin’s paradigmatic model. This model consists of five structural components: causal conditions, contextual conditions (the governing context), intervening conditions, strategies (processes and interactions), and consequences.

**Selective coding:** In this final stage, the researcher systematically links the central category to other categories, formulates the relationships in the form of theoretical propositions, and draws the final model of the qualitative phase. In this step, the integration of categories and the refinement of the theory are completed.

#### Data Collection Tools

Given the sequential and exploratory nature of this research, the data collection tools are designed in each phase in accordance with the purpose of that phase, and the output of one phase provides the input for the next phase.

**Qualitative Phase: Semi-Structured Interview Protocol:** In the first phase (data-based theory), the main tool is the “semi-structured interview protocol”. This protocol includes open and flexible questions that are developed based on a preliminary study of the research literature and, at the same time, allows the interviewer to ask additional exploratory questions according to the flow of the conversation. The tool is supported by the recording of upstream documents (fundamental transformation document, etc.) and a systematic review of theoretical literature to increase the researcher’s theoretical sensitivity.

**Screening and Structuring Phase: Expert-Based Questionnaires:** This phase includes two separate tools designed to refine and weight the categories extracted from the qualitative phase: the Fuzzy Delphi Questionnaire (designed based on a fuzzy scale and allowing experts to determine the “importance and necessity” of each indicator using linguistic variables) and the Pairwise Comparison Matrix Questionnaire (DEMATEL technique) designed to draw a network of relationships (influence and influence) so that experts can determine the intensity of the interrelationships between components based on their perceptual judgment.

**Quantitative phase: researcher-made questionnaire (validation of the model):** The final tool of this research is a standardized questionnaire that was compiled directly from the refined outputs of the previous stages (database theory and Delphi). The structure of the questionnaire consists of 89 items that measure the six dimensions of the model (including causal conditions, contextual conditions, intervention, central phenomenon, strategies and consequences) in the form of a five-point Likert scale (1: very little to 5: very much). The content validity of the items of this questionnaire has been reviewed and modified by a group of experts in educational management and information technology before the final distribution.

#### Society, sample and sampling method

**Qualitative phase (experts):** The statistical population of the qualitative phase included elites and experts in the fields of educational management, information technology and media, education specialists and managers with experience and knowledge of virtual space issues in schools.

The criteria for entering the panel of experts included: 1) having a specialized doctorate degree or academic degree in related fields (educational management, curriculum planning, educational technology), 2) having at least 5 years of experience in executive management or policy making at various levels of education and training, and 3) having scientific-research works, writings or research projects in the field of modern educational technologies, digital literacy or digital identity.

In this phase, a combination of “judgment-oriented purposeful sampling” was used to initiate and select the initial interviewees, and “theoretical sampling” during the coding process. The number of interviews was

determined based on the rule of theoretical saturation. Theoretical saturation was obtained from the 12th interview, and for more certainty, the interviews were continued up to 16 people. The demographic composition of 16 participating experts shows that 62.5% of them are men and 37.5% are women. In terms of education level, 81.2% of the participants have a doctorate degree or higher and 50% of them have more than 20 years of work experience. This statistical distribution shows the high level of expertise, academic knowledge and experiential nobility of the participants on the subject of digital identity management in schools.

**Quantitative Phase:** The statistical population of the quantitative phase included all official secondary school teachers (1st and 2nd) working in government and non-government schools of Kermanshah province in the academic year 1405-1404, with an approximate number of 12,345 people. Based on the table of Karjesi and Morgan (1970), the minimum required sample was estimated to be 373 people, and in order to cover the possible attrition rate and increase the power of the test in structural equation modeling, 400 questionnaires were distributed and finally 384 healthy and analyzable questionnaires were used as the criterion.

In order to select a representative sample from the geographical area of Kermanshah province, a multi-stage cluster sampling process was carried out as follows: In the first stage (geographical clustering), among the regions and cities of Kermanshah province, which were divided into three geographical regions (east of the province, west of the province, and the center), the cities of Kangavar (representative of the east), Sarpol Zahab (representative of the west) and the three districts of Kermanshah city (representative of the center) were selected. In the second stage (choosing schools), a list of first and second secondary schools (girls and boys) was extracted from each of the selected regions in a simple random manner. In the third stage (selection of teachers), in selected schools, questionnaires were given to qualified teachers by systematic random method.

Examining the demographic characteristics of the participants showed that the majority of respondents are women (59.9%), people between the ages of 30 and 40 (40.1%), and those with a master's degree with 10 to 20 years of experience (43%). This distribution structure indicates that the statistical sample of the research has sufficient work experience and a suitable level of education to evaluate and respond to issues related to digital identity management in schools.

#### Audit and methodological quality in the qualitative phase

In order to measure and guarantee the quality and validity of the findings from the analysis of the database theory, instead of the traditional concepts of validity and reliability (which are specific to quantitative positivist studies), the four criteria of "reliability" proposed by Lincoln and Guba (1985) were used.

A) Credibility or believability (internal validity equivalent): The measures taken included member review (returning the analyzed text of the interviews along with the extracted codes to 4 participants) and long-term registration in the research field (deep intellectual engagement of the researcher with the phenomenon of digital identity in schools for more than a year).

b) Qualitative transferability or generalizability (external validity equivalent): The researcher has tried to describe the institutional background of schools, the structural conditions of Iranian education and the contextual characteristics of the interviewees in full detail so that the reader can evaluate the possibility of transferring the model to other educational contexts.

c) Reliability or similarity (reliability ratio): The researcher selected 3 interviews from the 16 conducted interviews and re-coded them at a time interval of 10 days. The calculations performed using the retest reliability method showed an agreement coefficient of 84.6 percent, which is higher than the standard threshold (70 percent), and the reliability and validity of the coding process was confirmed.

d) Verifiability or impartiality (equivalent to objectivity): The entire research process, including the raw documentation of the interviews, initial codes, the stages of connecting categories and the formation of a

paradigm model, was evaluated and finally approved by two supervisors and a consultant, as well as an external expert expert in the field of qualitative methodology.

#### Validity and reliability of the quantitative phase measurement tool

Form and content validity: To verify the form validity, the initial questionnaire was given to 10 university professors in the fields of educational management, educational technology and research method experts. Their proposed amendments regarding the clarity of phrases, simplification of double-sided sentences and V Reich's writing was applied.

To scientifically measure content validity, the content validity ratio (CVR) was used based on the Lavish formula (1975). A questionnaire consisting of 89 items was provided to 10 experts to determine the necessity of each item on a three-level spectrum of "necessary", "useful but not necessary", "not necessary". According to Lavish's table, the minimum acceptable CVR value for a 10-person panel is 0.62. The results of the calculations showed that all 89 items obtained a value equal to or greater than 0.62, and as a result, all items were retained.

Reliability (internal consistency): In order to initially examine the reliability of the tool, a pilot study was conducted on 40 teachers from the statistical population. After collecting the questionnaires, Cronbach's alpha coefficient was calculated for the entire questionnaire and for the six dimensions of the paradigm model. Cronbach's alpha coefficient was calculated as 0.89 for the entire questionnaire and between 0.88 and 0.90 for the six dimensions, indicating the desired internal consistency of the research tool.

#### Methods and techniques of data analysis

Data analysis in this study was carried out in accordance with the mixed methodological chain, in two main phases: qualitative and quantitative, using four distinct methods:

First step: Coding of data-based theory (qualitative phase): The text obtained from the interviews was analyzed using the structured approach of Strauss and Corbin (1998) in three stages of open, axial, and selective coding.

Second step: Fuzzy Delphi technique: In order to deal with the uncertainty and subjective ambiguity of the experts in the agreement measurement phase, Fuzzy Delphi was used. The experts' views on the importance of each indicator were converted into triangular fuzzy numbers using linguistic variables, and after merging the judgments using the simple fuzzy mean, defuzzification was performed using the geometric mean method. Indicators whose d-fuzziness value was less than a certain threshold (0.7) were removed from the model.

Step 3: Fuzzy/Deterministic DEMATEL Technique: In order to measure the structural relationships between the main dimensions confirmed in the second step, the steps of forming the initial direct relationship matrix, normalizing the direct relationship matrix, calculating the total relationship matrix, and extracting the impact (D) and effectiveness (R) indices were implemented in DEMATEL.

Step 4: Structural Equation Modeling (SEM): The empirical validation of the final research model was carried out using the covariance-based approach and AMOS software. This section included two main steps: confirmatory factor analysis (CFA) to test the measurement models and path analysis and structural model testing to examine the structural relationships between the main dimensions and confirm the generality of the model. Goodness-of-Fit indices such as GFI, CFI, TLI, and RMSEA were used to measure the fit of the model. SPSS version 26 software was used to organize the descriptive statistics of the respondents.

## Findings

### Qualitative Data Analysis

#### Open Coding

During the open coding stage, the transcribed interview texts were examined line by line and paragraph by paragraph. A total of 89 conceptual codes were extracted from the interviews. During the open coding

process, a total of 254 conceptual codes were identified without considering overlaps. After merging the overlapping codes, 89 categories were formed by considering overlaps, which ultimately formed 17 concepts (subcategories).

An example of interview excerpts and open code extraction is presented below:

One of the experts stated regarding the need for an integrated infrastructure: "To manage digital identity in schools, an integrated technical infrastructure must first be defined. This integrated system must be designed in a way that defines access levels based on age and educational needs, while at the same time having strong security layers to prevent identity theft or forgery. Without a coherent technical infrastructure to accurately identify users, digital identity management will remain just a slogan." This narrative led to concepts such as "unified technical infrastructure," "age-based access levels," "layers of security," and "identity theft prevention."

Another privacy expert stated, "The issue of privacy protection in schools goes beyond technical issues and is directly tied to family trust. When we talk about digital identity management, we need to ensure that sensitive student data, from grades to their psychological behaviors in cyberspace, is not leaked. Many schools still do not have transparent protocols for data protection, and this is a huge legal and structural gap." This narrative led to concepts such as "privacy protection," "family trust," "sensitive data protection," "transparent protocols," and "legal gap."

Regarding the role of teachers, one of the experts stated: "We cannot advance digital identity management without considering the key role of teachers. The teacher in the classroom is the front line of facing identity challenges. Unfortunately, many of our colleagues are still not sufficiently familiar with modern concepts of identity management and new threats in cyberspace. For this model to be successful, specialized empowerment courses must be held for teachers so that they can show the right path of digital activity to students as leaders and coaches." This narrative led to concepts such as "the key role of teachers," "the front line of facing identity challenges," "specialized empowerment of teachers," "digital leadership and coaching," and "identification of identity anomalies."

#### Axial coding

In the axial coding stage, the main categories (causal conditions, intervening conditions, strategies, contextual conditions, and consequences) were considered as the axis and then other concepts (subcategories) were related to them according to commonalities or homogeneity and synonymy. In the following, each of these categories is explained in detail:

##### Causal conditions:

Based on the data analysis, three main categories were identified as causal conditions: These include: digital governance and policy-making in the education system, school infrastructure and technological maturity, and human competencies and digital identity culture. Concepts related to these categories included the existence of upstream documents related to digital identity and security in education, student data protection policies, legal frameworks for privacy protection in schools, official guidelines for the use of online educational platforms, a system for monitoring and evaluating the digital performance of schools, stable access to secure and high-speed internet, the existence of standard learning management systems, digital identity authentication systems for students and staff, cybersecurity and information protection protocols, the integrity of school information systems, digital literacy of school administrators, media literacy and digital identity formation of teachers, students' awareness of digital identity responsibilities, an organizational culture based on digital accountability, and a positive attitude of stakeholders towards digital identity management.

Contextual conditions: Four main categories were identified as contextual conditions: the cultural and social context of technology use in school, the school's organizational structure and management, the digital learning environment and educational interactions, and the individual characteristics of the users of the school environment. Related concepts included the culture of responsible technology use among students,

the level of acceptance of educational technologies among teachers, the sensitivity of the school community to privacy, the level of parental participation in monitoring students' digital activity, behavioral norms related to online interactions in the educational environment, the school principal's support for digital innovations, the existence of an IT team or person in charge in the school, the coordination system between principals, teachers, and staff in digital matters, the flexibility of the school structure in accepting new technologies, the existence of effective communication mechanisms in managing digital information, the use of e-learning platforms in the educational process, the level of online interaction between teachers and students, students' access to digital learning tools, the diversity of digital educational resources in the school, the management of educational communications in online platforms, students' self-management skills in the digital space, the level of users' responsibility in using user accounts, users' awareness of the consequences of behavior in cyberspace, the level of users' trust in the school's digital systems, and users' ability to manage their digital footprint.

#### Intervening conditions:

Two main categories were identified as intervening conditions: environmental and structural challenges of the education system and human and behavioral resistances in the digital space. Related concepts included the lack of sufficient funding for the development of digital infrastructure, unequal access of schools to technological facilities, frequent changes in educational policies and guidelines, poor coordination between institutions related to digital education, resistance of some teachers to the use of new technologies, parental concerns about the security of students' information, user distrust of digital systems, weak motivation of employees to participate in digital transformation, and improper or unethical use of digital identity in the school environment.

#### Core category:

The core category included four main components: developing authentication infrastructure (establishing integrated school user authentication systems, designing secure mechanisms for digital identification of students and staff, standard management of identity information in educational databases, and employing tools to control the authenticity and validity of user accounts), protecting digital identity security and privacy (developing mechanisms to protect user identity data, applying access levels appropriate to the role of users in school systems, anticipating preventive measures against information intrusion and abuse, managing the confidentiality of personal information in online educational platforms, and monitoring and controlling users' digital footprints in educational environments), behavioral empowerment and user identity literacy (teaching students the principles and skills related to digital identity, raising teachers and staff awareness of digital rights and responsibilities, promoting professional and behavioral ethics in virtual school interactions, strengthening users' ability to manage educational accounts and profiles, and developing behavioral sensitivity to the consequences of being in the online environment. digital), and continuous monitoring and improvement of digital identity (developing executive policies for managing digital identity in schools, designing indicators for evaluating the performance of users' digital identity, establishing a system for continuous monitoring of the status of digital identity in schools, utilizing corrective feedback to improve management processes, and adapting digital identity procedures to legal and educational requirements).

#### Background conditions: culture, school structure, learning environment and user characteristics

The background conditions in this research include the cultural and social context of using technology in school, the structure and organizational management of the school, the digital learning environment and educational interactions, and the individual characteristics of the users of the school environment. This section shows that digital identity management does not happen in a vacuum, but is formed in the real school context, human relations, culture of technology use, management structures and individual differences of users. Therefore, even if the appropriate policy and infrastructure are in place, the quality of implementation of digital identity management depends on the context in which the school operates.

This finding is in line with the research of Kabovi and Phiri (2019); Because they have examined variables such as usefulness, trust, ease of use, image and user satisfaction in the framework of digital identity management. These variables show precisely that the adoption of digital identity is a function of users' perception, experience and satisfaction. In the current research, the cultural and social background of the school is also important; That is, if school users do not perceive technology as useful, safe and reliable, the probability of adopting digital identity management decreases. School is a sensitive environment; Because its users include young students, teenagers, teachers, administrators, and parents, and each group has a different level of digital literacy, trust, concern, and need.

The category of school organizational structure and management is also comparable with the findings of internal researches about organizational transformation in education. For example, Barzoui (1402) considered organizational changeability as a multidimensional cycle that is driven by human power and must achieve it with their behavior, energy and flexibility. In the present study, school structure, management style, leadership style, division of duties, accountability system and coordination between principal, teachers, counselors, technology experts and parents have a decisive role in digital identity management. If the traditional school structure is centralized, inflexible and lacks clear processes, the implementation of digital identity will be disrupted.

The category of digital learning environment and educational interactions shows that the digital identity is not only for entering the systems, but it is connected with learning, educational communication, evaluation, assignments, attendance and absence, teacher-student interaction, school-family communication, and even the formation of the student's digital personality. This section is consistent with researches related to the evolution of education after Corona, which emphasize that education should be student-centered, question-based, authentic, purposeful, and prepare students to face the unknown. In such an environment, digital identity becomes a tool for engagement, personalized learning, safe interaction and tracking of student growth.

The category of individual characteristics of users of the school environment is also of special importance. Students differ in terms of age, cognitive maturity, media literacy, level of access to technology, style of using virtual space, attitude towards privacy and level of responsibility. Teachers also differ in terms of ability to work with systems, attitude towards technology, digital teaching experience and readiness for change. Parents may also have different sensitivities to the collection of their children's data. Therefore, the digital identity management model should be flexible, leveled and designed to suit different user groups.

Intervening conditions: structural challenges and human resistances

Intervening conditions in the model include two main categories, i.e. environmental and structural challenges of the educational system and human and behavioral resistances in the digital space. This finding shows that the path of digital identity management in schools is not a linear path without obstacles. Even if the right policy, infrastructure, and context are in place, intervening factors can slow, distort, or render the implementation of the model ineffective. These factors usually affect the process from outside or inside the school and change the intensity and quality of the strategies.

The category of environmental and structural challenges of the educational system is in significant agreement with domestic researches about the evolution of education. For example, Haghighi and Abbaszadeh (1402) considered the most important challenge of education in the third millennium to be the policy of change and transformation. Also, Sahrai and Zare (1402) have introduced the policy of transformation and transformation of the education system into an efficient and effective system as one of the most important challenges of education policy. In the current research, digital identity management is under the same macro issue; Because the educational system must move from a traditional, paper-based, insular and low-connected structure to a data-oriented, secure, integrated and responsive structure. This transition is associated with budgetary, legal, managerial, infrastructural and executive challenges.

One of the most important structural challenges is the lack of coordination between systems. In many educational systems, the data of students, teachers and schools are scattered in different systems and there

is no single, valid and traceable digital identity. This issue can cause rework, information error, weak security, difficulty of authentication and decrease of user trust. This finding is consistent with the research of Rasouli et al. (2020). (What steps should be taken to move digital identity management from the idea and policy level to the implementation stage? Strategies are actually the connecting link between the conceptual model and school practice.

The first strategy is to develop school-based policies and implementation guidelines. Macro-policies should be translated into the language of the school; that is, it should be clear what responsibilities the principal, teacher, student, parent, and technology expert have. This strategy is consistent with the research of Rasouli et al. (2020), who identified strategic planning, the commitment of the entire organization, and the integrity of the digital identity management program as important factors. At the school level, if the responsibilities, access levels, authentication methods, data retention methods, and accountability mechanisms are not clear, the implementation of the model will be faced with ambiguity and errors.

The second strategy is to design a role-based access system. In a school, not all users should have access to all data. The principal, deputy principal, teacher, counselor, student, and parent should each have access to data and services in accordance with their role. This is consistent with Rasouli et al.'s emphasis on access management, multi-factor authentication, and resource access control. In explaining this strategy, it should be said that both digital justice and digital security depend on proper access management; that is, the user should have access to the extent they need, no less, no more.

The third strategy is user education and empowerment. Teachers and administrators should be trained in how digital identity is managed, what risks it poses, and how they can guide students in responsible use. Students should also be familiar with concepts such as digital footprints, privacy, secure passwords, impersonation, data abuse, and digital ethics. This strategy is consistent with educational transformation studies such as Mirzaei et al. (1402) because both emphasize changes in methods, technologies, and meaningful learning. Digital identity management should be part of the school's digital education program, not just the task of the technology department.

In addition, the component "protection of security and privacy of digital identity" was identified as an effective causal variable with D-R index=0.534. The scientific explanation of this finding shows that security and privacy are a prerequisite for creating "organizational and user trust". Until the security of the data and identity information of the stakeholders is ensured, the actors will not be willing to actively participate in the digital ecosystem of the school. This result is consistent with the findings of Akbari and Turkman (1402) as well as Ruiz (2015), who introduced security and trust as the cornerstones of sustainable digital identity management.

On the other hand, another surprising finding was the placement of the "behavioral empowerment and identity literacy of users" component as the most influential (disabled) factor with a D-R index of -2.36856, and at the same time, the most important component in terms of interactions of the entire system with an index of  $D+R=2.36856$ . This analysis shows that the identity literacy and responsible behavior of users in cyber space is the final output and dynamic product of all the school's security, organizational and strategic processes. In other words, the main goal of digital identity management in schools, beyond the registration and authentication of formal identities, is to educate competent and capable digital citizens. This explanation is in line with the results of researches related to student-centered education for managing the unknowns of the digital space and the findings of Kabovi and Phiri (2019) about the importance of the perception and capability of the end user.

Finally, the investigation of the direct relationship network based on the threshold (0.087) showed that the digital identity management system in schools is a dynamic and self-renewing cycle. In this network, organizational goals and security guide the strategies, and the process of "monitoring and continuous improvement" acts as a mediator and results in the behavioral empowerment of users by continuously modifying the strategies. This dynamic feedback cycle is consistent with models of sustainable development and change capacity of educational organizations, which consider the survival of educational

organizations to be dependent on continuous monitoring and continuous adaptation to the changing needs of stakeholders.

### **Final conclusion**

As a final conclusion, digital identity management in schools is not a mere technical project, but a transformative whole that takes place in the educational and organizational context of the school. The stability of this system depends on the alignment of organizational goals, establishing security and protection of privacy, and finally focusing on behavioral empowerment and identity literacy of actors as the final output of the system. In order to successfully overcome the challenges of the digital age, schools are required to adopt a systematic, flexible and education-oriented approach to digital identity management.

Based on the research findings and its comparison with internal and external background, it can be concluded that digital identity management in schools is a multidimensional, interdisciplinary and transformational phenomenon. This phenomenon is at the junction of educational governance, information technology, data security, school culture, digital literacy, change management and student education. Internal backgrounds have mainly emphasized education transformation, change management, transformational leadership, and educational policy, and external backgrounds have focused more on identity management frameworks, trust, technology standards, post-corona education, and learning transformation. The current model connects these two currents and shows that the school needs a native, school-oriented and educational model for digital identity management in order to enter the digital era.

The general conclusion is that realizing digital identity management in schools requires simultaneous attention to policy, infrastructure, culture, security, identity literacy, change management and continuous monitoring. If these dimensions are seen in an integrated way, digital identity management can lead to the improvement of security, trust, educational quality, individual growth of students and organizational transformation of schools. But if this issue is reduced only to system installation or user account definition, not only the desired results will not be achieved, but also distrust, user resistance, data fragmentation and security damage may increase. Therefore, the proposed research model can be the basis. It is intended to be a reference for policy-making, executive planning, and designing educational interventions in the field of digital identity management in schools.

### **Research limitations**

Like other scientific studies, the present study was accompanied by limitations that should be considered in interpreting the findings and generalizing the results:

1. In the qualitative section, data were collected through semi-structured interviews with experts; therefore, some relevant perspectives and experiences may not have been reflected in the research due to the purposeful nature of the sampling.
2. The qualitative findings were to some extent affected by the participants' perceptions and subjective perceptions, and although measures were taken to increase the validity of the data, the full effect of individual biases cannot be eliminated.
3. The community of participants was limited to experts in the fields of educational management, educational technology, and digital identity; therefore, the direct perspective of all school actors such as teachers, students, and parents is not fully reflected in the final model.
4. In the quantitative part, the analysis of the relationships between the components was carried out using the DEMATEL method and based on the experts' judgment; as a result, the results are partly dependent on their subjective judgments.
5. The number of experts in the quantitative part was limited, and although it is acceptable for this method, increasing the number and diversity of experts could have led to greater richness of the results.

6. The present study was cross-sectional in nature and the data were collected in a specific time period; therefore, given the dynamics of the digital identity field, there is a possibility that some findings will change in other time conditions.

7. The presented model is mostly explanatory and conceptual and has not yet been extensively tested in the field; therefore, its implementation effectiveness in different schools should be judged with caution.

8. Also, contextual differences between schools in terms of facilities, organizational culture, and socio-economic conditions can affect the implementation of the model.

## **Recommendations**

### **Practical Recommendations**

Given the set of research findings (data-driven, fuzzy Delphi, DEMATEL analysis, and structural equation modeling), practical recommendations are presented in several main areas:

#### **A) Recommendations based on policy and governance (macro level)**

Developing a national framework for digital identity management in schools: Given the causal role of "governance", it is recommended that the Ministry of Education develop and communicate a comprehensive digital identity regulation focusing on student rights, data security standards, and unified authentication protocols.

Reviewing the infrastructure of educational platforms: Based on the finding related to the necessity of "infrastructure integration", it is recommended that systems such as "Shad" use decentralized identity management models to increase security and user ownership of their data.

Allocation of budget line for school cybersecurity: Given the causal role of "security protection", it is necessary to foresee specific credits to upgrade the security layers of servers and specialized training for school technology officials.

#### **B) Suggestions based on management and organizational structure (school level)**

Redesigning the school's organizational culture: Given the impact of "school culture" on model acceptance, administrators should move from prescriptive approaches to collaborative approaches and provide a trust-based environment for digital interactions between teachers and students.

Creating a "Digital Identity Monitoring and Improvement" Unit: Based on Dematel's finding that "continuous monitoring" is important, it is suggested that a working group consisting of a consultant, educational coach, and technology manager be formed in the school structure to continuously monitor students' identity and behavioral challenges in cyberspace.

Clarifying organizational consequences for stakeholders: Since "organizational consequences" are the main driver of the system, administrators should clearly explain the benefits of identity management (such as reduced bureaucracy, greater security, and facilitating learning) to teachers and parents in order to reduce human resistance.

#### **c) Recommendations based on strategies and empowerment (operational level)**

Implementation of the "Identity Literacy" movement: Given that "empowerment" is the most important component of the research, it is suggested that short-term training courses focusing on "digital footprint", "online reputation" and "privacy management" be designed for students instead of purely technical training.

Development of a digital identity code of ethics in each school: It is suggested that action strategies be developed in the form of a local charter with the participation of students so that they feel responsible and own the management of their identity.

Using flipped learning models to empower teachers: In order to promote “human competence”, it is suggested that in-service courses for teachers be held out of a theoretical mode and based on real scenarios (such as facing identity theft or cyberbullying).

#### d) Public and social suggestions

Holding "Digital Parents" workshops: Considering the background conditions of the model, it is suggested that schools hold digital identity explanation sessions for parents to align the home and school environments so that the student's behavioral conflict in these two environments is minimized.

#### Research suggestions

Designing and testing a model for empowering students' identity literacy in the digital space of schools

Investigating the role of school organizational culture in the acceptance and establishment of a digital identity management system

Comparative analysis of digital identity management models in Iranian schools and leading countries

Identifying implementation barriers to implementing digital identity management in schools from the perspectives of teachers, parents, and students

Investigating the impact of identity literacy education on students' digital behavior

Designing and validating a digital identity measurement tool in educational environment

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