Journal Website

Article history:
Received 03 August 2026
Revised 04 November 2026
Accepted 12 November 2026
Initial Publication 16 November 2026
Final Publication 01 September 2027

International Journal of Innovation Management and Organizational Behavior

Volume 7, Issue 5, pp 1-15

E-ISSN: 3041-8992

Validation of an Artificial Intelligence-Based Educational Leadership Model with a Foresight Approach in Schools of Razavi Khorasan Province

Ehsan. Taghaviyan[1], Roya. Afrasiabi[1*], Behrang. Esmaeilishad[1]

[1] Department of Educational Sciences, Boj.C., Islamic Azad University, Bojnord, Iran

*** Corresponding author email address**: afrassiabi@iau.ac.ir

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Taghaviyan, E., Afrasiabi, R., & Esmaeilishad, B. (2027). Validation of an Artificial Intelligence-Based Educational Leadership Model with a Foresight Approach in Schools of Razavi Khorasan Province. *International Journal of Innovation Management and Organizational Behavior*, *7*(5), 1-15.
https://doi.org/10.61838/kman.ijimob.6670

© 2027 the authors. Published by KMAN Publication Inc. (KMANPUB), Ontario, Canada. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

A B S T R A C T

Objective: This study aimed to validate an artificial intelligence-based educational leadership model with a foresight approach in schools of Razavi Khorasan Province, Iran.
Methods and Materials: This quantitative study employed a descriptive-correlational design and structural equation modeling. The statistical population consisted of members of the educational system in Razavi Khorasan Province, from whom 461 school principals, vice-principals, and school technology experts were selected through proportionate stratified sampling. Data were collected using a researcher-developed questionnaire designed to measure the components of artificial intelligence-based educational leadership and its proposed antecedents. The hypothesized measurement and structural models were evaluated using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4. The analysis focused on testing the proposed causal relationships among technological competencies, ethical considerations, symbiotic decision-making, strategic foresight, change management, cultural resistance, and intelligent educational leadership.
Findings: Structural model analysis indicated that all ten hypothesized relationships were statistically significant at $p < 0.001$. Technological competencies emerged as the most influential overall driver of intelligent educational leadership, with a total effect of 0.576. Among the direct predictors, change management demonstrated the strongest direct effect on intelligent educational leadership ($\beta = 0.282$). The combined predictors explained 68.4% of the variance in intelligent educational leadership, indicating substantial explanatory power. Moreover, the overall goodness-of-fit index (GoF = 0.577) demonstrated a strong fit between the proposed theoretical framework and the empirical data, thereby supporting the adequacy of the final model for explaining AI-oriented educational leadership in the school context.
Conclusion: The validated model indicates that effective educational leadership in the era of artificial intelligence requires the integrated development of technological competencies, ethical awareness, human–AI symbiotic decision-making, strategic foresight, and effective management of organizational and cultural change.
Keywords: *Artificial Intelligence, Educational Leadership, Foresight Approach, Educational System, Model Validation, Razavi Khorasan*

1 Introduction

Artificial intelligence (AI) has rapidly evolved from a specialized computational field into a transformative force affecting educational systems, organizational structures, decision-making processes, and leadership practices. In contemporary education, AI is increasingly used not only for instructional support, assessment, and learner analytics, but also for strategic planning, administrative decision-making, resource allocation, performance monitoring, and organizational development. This transformation has generated a growing need to reconsider the competencies, responsibilities, and decision-making frameworks of educational leaders. Schools, as complex and dynamic social organizations, are particularly affected by this shift because their leaders must simultaneously respond to technological innovation, ethical challenges, changing professional roles, data-intensive environments, and future uncertainty. The emergence of AI therefore requires educational leadership to move beyond conventional administrative functions and toward a more technologically informed, adaptive, ethical, and future-oriented model of leadership (Alikarami et al., 2023; Göçen & Döğer, 2025; Landon & Soleimani, 2024; Majiditalab & Reda, 2025).

The application of AI in education has already extended across several important domains. Intelligent systems can support personalized learning, automated feedback, academic assessment, student monitoring, prediction of learning difficulties, administrative optimization, and institutional decision-making. Earlier applications of AI in education demonstrated its potential to improve recruitment, admission, progression, retention, and student support processes by enabling institutions to identify patterns that may be difficult to detect through traditional approaches (Dennis, 2018). More recent developments have expanded the scope of AI from operational support to educational transformation, with machine learning and other intelligent technologies increasingly embedded in teaching, curriculum development, assessment, and educational management (Dadashpour & Dehghanpour, 2023; Guo & Xiao, 2019; Parsarad et al., 2023). Research has also shown that AI-supported teaching strategies can positively affect students' learning experiences and educational outcomes when they are implemented within appropriate instructional frameworks (Bahajab Ghodsi et al., 2023). Similarly, AI-based educational models have been proposed as mechanisms for increasing flexibility, personalization, and responsiveness within educational environments (Fathipour Lat Mahalleh, 2024). These developments indicate that AI is becoming a structural component of educational systems rather than merely an optional technological tool.

The growing use of AI also changes the role of school leaders. Traditional models of educational leadership have typically emphasized instructional supervision, organizational coordination, teacher support, student achievement, school climate, and resource management. In an AI-rich environment, however, leaders must additionally understand digital systems, evaluate technological opportunities, make data-informed decisions, manage algorithmic tools, anticipate technological change, and create organizational conditions that support responsible innovation. The concept of AI-based educational leadership therefore refers to a leadership approach in which intelligent technologies are integrated into strategic, instructional, administrative, and developmental processes while maintaining human judgment and educational values. Recent studies have increasingly emphasized that educational leaders require new forms of digital competence and AI literacy if they are to use emerging technologies effectively and responsibly (Khabareh, 2025; Majiditalab & Reda, 2025). From this perspective, leadership in the age of AI is not simply a matter of adopting new software; it involves the redesign of organizational capabilities, leadership competencies, professional development systems, and institutional decision-making processes (Alikarami et al., 2023; Landon & Soleimani, 2024).

Technological competencies constitute one of the fundamental foundations of this emerging leadership paradigm. School leaders who lack sufficient understanding of AI systems may be unable to evaluate technological tools, assess their educational relevance, interpret AI-generated information, or identify associated risks. Technological competence in this context encompasses digital literacy, AI literacy, data interpretation, awareness of intelligent systems, the ability to evaluate technological solutions, and confidence in using emerging technologies in organizational decision-making. Studies focusing on teacher readiness have similarly indicated that knowledge, readiness, and behavioral intention are central to meaningful AI adoption in educational environments (Ahmadi, 2023). This issue is particularly significant because technological adoption does not occur solely on the basis of availability; it is shaped by users' perceptions, competencies, expectations, and willingness to engage with technology. Research on technology acceptance has repeatedly shown that behavioral

intentions are influenced by perceived usefulness, attitudes, facilitating conditions, and related psychological and organizational factors (Darmansyah et al., 2020). Consequently, leaders' technological competencies may influence not only their direct use of AI but also their capacity to guide schools through the broader process of digital transformation.

AI implementation in education nevertheless involves significant challenges. Although intelligent technologies can facilitate efficiency and innovation, they may also introduce problems related to privacy, surveillance, fairness, bias, transparency, accountability, academic integrity, and overreliance on automated decision-making. The transformation created by AI is therefore simultaneously technical, organizational, and ethical. Research on AI in virtual education has highlighted both substantial benefits and important challenges associated with implementation (Arbabi, 2023). In addition, the rapid diffusion of generative AI has intensified concerns about academic integrity, authorship, originality, and the changing meaning of educational work. The emergence of what has been described as a postplagiarism era suggests that educational institutions must reconsider existing assumptions about assessment, integrity, authorship, and learning in environments where AI-supported content generation is increasingly normalized (Eaton, 2025). The launch and rapid diffusion of tools such as ChatGPT have further demonstrated that AI can create both educational disruption and institutional uncertainty, requiring thoughtful rather than reactive responses from educational organizations (García Peñalvo, 2023).

These concerns underscore the importance of digital ethical leadership. Educational leaders are responsible not only for promoting technological innovation but also for ensuring that innovation remains consistent with fairness, transparency, privacy, professional responsibility, and educational values. Digital ethical leadership involves establishing clear principles for AI use, protecting students' and teachers' data, identifying potential bias, maintaining human oversight, and ensuring accountability for decisions influenced by algorithms. These responsibilities are becoming increasingly important because AI systems do not operate independently of social and institutional contexts. Algorithmic systems can reproduce existing inequalities or reshape institutional practices through apparently neutral technological processes. The growing datafication of education illustrates how algorithms and AI increasingly influence educational policy, institutional priorities, and decision-making, often in ways that are not immediately visible to practitioners (Gulson et al., 2022). Sociological analyses have likewise shown that the mobilization of AI in education is shaped by relationships among institutions, professional groups, commercial actors, technological developers, and broader fields of power (Davies et al., 2021). Educational leaders therefore require ethical as well as technical competence in order to govern AI appropriately.

Another central component of AI-based leadership is decision-making. AI can improve educational decision-making by analyzing large datasets, identifying patterns, generating predictions, and supporting leaders in evaluating alternative courses of action. However, effective leadership cannot be reduced to algorithmic recommendation. Educational decisions frequently involve context, values, professional judgment, interpersonal relationships, and moral considerations that cannot be fully represented through computational models. A more appropriate approach is therefore symbiotic decision-making, in which human judgment and AI-generated analysis complement one another. In such a model, AI contributes computational capacity, data processing, pattern recognition, and prediction, while educational leaders contribute contextual knowledge, ethical interpretation, professional experience, and responsibility. This approach is especially important in student assessment, where AI can support efficiency and analytical consistency but may also raise concerns about validity, transparency, and fairness (González Calatayud et al., 2021). The educational value of AI thus depends not on replacing human decision-makers but on creating productive forms of human–AI collaboration.

The psychological and developmental implications of AI should also be considered. Preparing students and educational professionals for an AI-intensive future involves more than technical training. It also requires the development of adaptability, confidence, critical thinking, resilience, and readiness to function in environments characterized by rapid technological change. Research has shown that preparing students for the AI age can contribute to well-being when readiness is developed through appropriate educational strategies (Dai et al., 2020). This perspective reinforces the need for educational leaders who can connect technological development with human development. Leaders must ensure that AI implementation supports, rather than undermines, student well-being, teacher agency, professional identity, and meaningful educational relationships. In this sense, AI-based leadership should be viewed as a socio-technical process in which

technological innovation is balanced with educational, psychological, and organizational considerations.

Strategic foresight constitutes another important dimension of leadership in AI-driven educational environments. The speed of technological development makes purely reactive leadership increasingly inadequate. School leaders must anticipate future changes in teaching, assessment, professional roles, digital infrastructure, student competencies, and ethical expectations. Strategic foresight enables leaders to identify emerging trends, consider alternative futures, recognize potential risks, and prepare organizational responses before change becomes unavoidable. The increasing integration of AI into education has already transformed expectations regarding future-focused learning, instructional design, assessment, and academic integrity (Eaton, 2025). At the institutional level, AI is also associated with broader transformations in higher education and educational structures, indicating that leadership systems must be capable of anticipating long-term consequences rather than merely responding to immediate technological pressures (Arasteh & Khabareh, 2023). Modern educational technologies therefore require leaders who can combine present evidence with future-oriented thinking.

Change management is equally essential because technological innovation frequently produces organizational resistance. Teachers and administrators may resist AI because of uncertainty, fear of job displacement, lack of competence, perceived loss of professional autonomy, concerns about surveillance, or distrust of algorithmic systems. Effective implementation therefore depends on leaders' ability to communicate the rationale for change, involve stakeholders in decision-making, reduce uncertainty, provide support, establish realistic implementation timelines, and create a culture of experimentation and learning. The literature on AI and educational leadership increasingly identifies effective management and organizational adaptation as critical conditions for successful integration (Khabareh, 2025; Landon & Soleimani, 2024). Iranian studies have also emphasized the increasing relevance of AI and modern educational technologies to contemporary educational systems and the need for institutional adaptation (Hanifehzadeh Noudehi, 2023; Sheikh Shoaei, 2021). Accordingly, change management should be regarded as a core leadership competence rather than a peripheral implementation activity.

Professional development further determines whether AI-based transformation can be sustained. Educational leaders cannot rely on one-time technology training because AI technologies evolve rapidly and continuously generate new technical, pedagogical, and ethical challenges. Professional development should therefore include ongoing opportunities to learn about AI systems, data literacy, digital ethics, instructional applications, organizational change, and emerging policy issues. This is particularly important in educational systems where levels of AI familiarity may vary considerably among administrators and teachers. Recent work on AI in school leadership emphasizes the importance of continuous leadership learning and the development of new professional capacities that correspond to technological change (Göçen & Döğer, 2025). Similarly, research on AI research and policymaking in education has highlighted the need for clearer institutional roles, supportive policies, and capacity-building mechanisms (Sheikh Shoaei, 2021). Without systematic professional development, AI adoption may remain fragmented, superficial, or dependent on individual enthusiasm rather than institutional capability.

The potential of AI in educational leadership must also be interpreted in relation to the broader transformation of educational organizations. Artificial intelligence can support institutional learning, improve the accessibility of information, facilitate evidence-based planning, and increase responsiveness to emerging challenges. However, these outcomes are not automatic. The effectiveness of AI is shaped by organizational culture, leadership capacity, technological infrastructure, professional trust, and institutional policies. Studies examining AI and educational processes have emphasized that AI can substantially affect the organization and quality of education, but that its benefits depend on appropriate implementation and management (Dadashpour & Dehghanpour, 2023; Hanifehzadeh Noudehi, 2023). Research on modern approaches to education similarly suggests that machine learning and AI can contribute to innovation when they are integrated with coherent pedagogical and managerial strategies (Parsarad et al., 2023). This indicates that the unit of analysis should not be the technology alone, but the organizational ecosystem within which technology is introduced.

The Iranian educational context presents particular reasons for developing a localized model of AI-based educational leadership. Although the international literature on AI in education is rapidly expanding, educational systems differ in infrastructure, governance structures, leadership practices, professional cultures, resource distribution,

technological readiness, and policy environments. Models developed in one national or institutional context may therefore not be directly transferable to another. Iranian research has begun to examine AI in teaching, educational transformation, teacher readiness, educational technology, and school management (Ahmadi, 2023; Arasteh & Khabareh, 2023; Bahajab Ghodsi et al., 2023; Fathipour Lat Mahalleh, 2024). Other studies have specifically addressed school leadership and management in the AI era, suggesting a growing recognition that educational leadership itself requires conceptual reconstruction (Alikarami et al., 2023; Majiditalab & Reda, 2025). Nevertheless, there remains a need for empirically validated models that integrate technological, ethical, strategic, organizational, and developmental dimensions into a coherent leadership framework.

This need becomes more evident when the conceptual complexity of AI-based educational leadership is considered. A valid model must explain not only whether leaders use AI, but also how technological competencies shape ethical leadership, human–AI decision-making, strategic foresight, change management, and ultimately intelligent educational leadership. Such a model should also account for professional development as a mechanism that strengthens leaders' capacity to adapt to technological change. In this regard, the international literature provides important but fragmented insights into AI adoption, student assessment, datafication, leadership, organizational transformation, and future-focused learning (Davies et al., 2021; Eaton, 2025; González Calatayud et al., 2021; Gulson et al., 2022). At the same time, domestic studies have contributed context-specific evidence regarding technological readiness, AI-supported teaching, educational transformation, and school management (Ahmadi, 2023; Arbabi, 2023; Bahajab Ghodsi et al., 2023; Khabareh, 2025). What remains insufficiently developed is an integrated and empirically validated structural model that clarifies the relationships among these leadership dimensions within the school system.

Moreover, validation is critical because conceptual plausibility alone does not guarantee empirical adequacy. Educational leadership models should demonstrate measurable construct validity, reliability, explanatory power, and predictive relevance if they are to guide professional development, policy design, or administrative reform. Structural equation modeling provides an appropriate framework for examining multidimensional relationships among leadership constructs and determining the relative importance of different predictors. Within the emerging field of AI-based school leadership, empirical validation can help distinguish central leadership drivers from peripheral factors, identify direct and indirect effects, and determine whether theoretically proposed relationships are supported within a specific educational context. Such evidence is especially important for provincial educational systems in which schools vary in geographical location, technological resources, administrative capacity, and familiarity with AI.

Razavi Khorasan Province provides a particularly relevant setting for such an investigation because its educational system includes schools operating across a large and diverse geographical area, including the metropolitan context of Mashhad as well as numerous other urban and regional settings. In such an environment, AI-based leadership requires models that are sufficiently comprehensive to address diversity while remaining practical for school-level implementation. A validated framework can help educational authorities identify priority competencies, design professional development programs, develop ethical guidelines, support school leaders in managing technological change, and strengthen institutional readiness for future AI developments. It can also contribute to a more systematic understanding of how technological competencies are transformed into educational leadership capacity through ethical, cognitive, strategic, and organizational mechanisms.

Accordingly, the aim of the present study was to validate an artificial intelligence-based educational leadership model with a foresight approach in schools of Razavi Khorasan Province.

2 Methods and Materials

The present study was applied-developmental in terms of purpose and was conducted using a quantitative approach and a descriptive-survey method. The statistical population consisted of 10,950 individuals from the educational system of Razavi Khorasan Province, including school principals (2,500 individuals), vice-principals (7,500 individuals), information technology experts (800 individuals), and managers and deputies of education departments (150 individuals). Using proportionate stratified random sampling and Cochran's formula, while accounting for the design effect and attrition rate, the final sample size was determined to be 461 participants, including 105 principals, 316 vice-principals, 34 IT experts, and 6 education

department managers. Data were collected using a researcher-developed questionnaire based on a five-point Likert scale to measure the dimensions of the model. The face validity, content validity (CVR and CVI), and construct validity of the instrument, together with its reliability based on Cronbach's alpha, composite reliability, and average variance extracted (AVE), were confirmed. Data analysis was conducted using SPSS 28 and SmartPLS at both descriptive and inferential levels, including exploratory factor analysis, confirmatory factor analysis, and structural equation modeling, in order to examine model fit and the statistical significance of the proposed relationships. The validity and generalizability of the findings were supported through proportionate stratified sampling and model fit indices. The study was conducted in full accordance with ethical considerations, including informed consent, confidentiality of information, and the regulations of the Ethics Committee of Islamic Azad University, Bojnord Branch.

3 Findings and Results

An examination of the respondents' demographic characteristics showed that their mean length of service was 17.4 years and that more than half of them (55.9%) held a master's degree. In terms of age, the highest proportion of respondents (42.5%) belonged to the 35–45-year age group, representing a generation positioned between traditional systems and emerging technologies. The geographical distribution of the sample included 39.9% from Mashhad and 60.1% from other areas of Razavi Khorasan Province, indicating an appropriate level of diversity and balance between the provincial center and other counties. In addition, 26.9% of respondents reported a beginner level of familiarity with artificial intelligence, suggesting the existence of a technological literacy gap within the provincial educational system. Subsequently, the structural model was examined to test the causal relationships among the constructs and the research hypotheses.

Before model validation was conducted, the statistical assumptions were examined. Table 1 presents the results of the Kolmogorov–Smirnov test for each of the seven main variables of the study.

Table 1

Results of the Kolmogorov–Smirnov Normality Test

Dimension	K-S Statistic	df	Significance Level	Result
Technological Competencies (TEC)	0.048	461	0.062	Normal
Digital Ethical Leadership (ETH)	0.051	461	0.048	Approximately normal*
Symbiotic Decision-Making (DEC)	0.044	461	0.081	Normal
Strategic Foresight (FUT)	0.053	461	0.038	Approximately normal*
Change Management (CHM)	0.046	461	0.072	Normal
Professional Development (PLD)	0.049	461	0.056	Normal
Intelligent Educational Leadership (AIL)	0.045	461	0.076	Normal

The table shows that five of the seven variables followed a normal distribution at the 0.05 significance level ($p > .05$), whereas the variables of digital ethical leadership and strategic foresight had significance values slightly below 0.05. Nevertheless, considering three important factors, namely the large sample size ($N = 461$), skewness and kurtosis values within acceptable ranges, and the use of the PLS-SEM approach, which does not require multivariate normality, these minor deviations from normality did not adversely affect the validity of the subsequent analyses. Furthermore, the use of bootstrapping in PLS-SEM adequately addresses concerns associated with non-normal data distributions.

Before conducting PLS-SEM, exploratory factor analysis (EFA) was performed using SPSS 28 to examine the underlying factor structure of the data.

Table 2

Results of the KMO and Bartlett's Tests

Test	Statistic	Significance Level	Interpretation
KMO Measure of Sampling Adequacy	0.874	—	Excellent (> 0.80)
Bartlett's Test of Sphericity	$\chi^2 = 8423.6$	0.000	Correlation matrix is not an identity matrix
Degrees of Freedom	660	—	—

The KMO value of 0.874, which falls within the excellent range, indicates that the data were highly suitable for factor analysis. Bartlett's test of sphericity was statistically significant at 0.000, confirming that the correlation matrix was not an identity matrix and that factor analysis was therefore appropriate.

Table 3 presents the complete factor-loading matrix for the 50 questionnaire items after Varimax rotation. The table clearly shows that each item loaded highly on its corresponding factor, with factor loadings above 0.70, while cross-loadings on other factors were below 0.40, indicating a clear and unambiguous factor structure. The seven extracted factors jointly explained 77.8% of the total variance, which is substantially higher than the acceptable threshold of 60%. The highest factor loading (0.852) belonged to item ETH2 on the ethical leadership factor, whereas the lowest loading (0.724) belonged to item TEC5 on the technological competencies factor; both values were clearly above the 0.70 threshold. These findings provide strong evidence for the construct validity of the measurement instrument.

Table 3

Exploratory Factor-Loading Matrix After Varimax Rotation (Loadings Above 0.40 Are Shown)

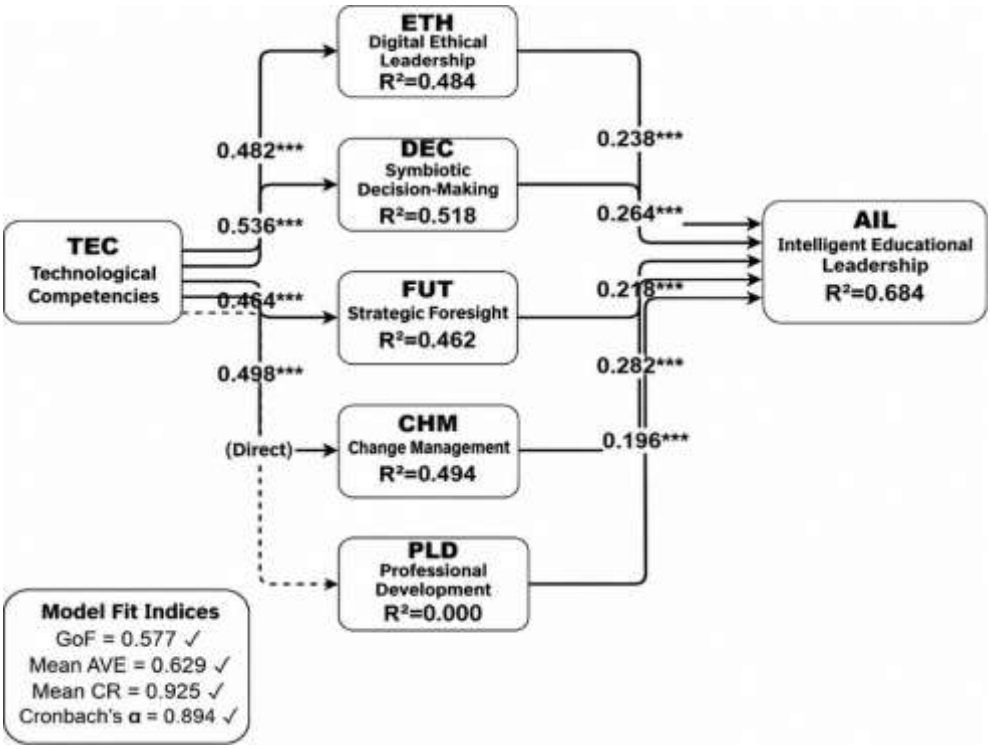
Item	Factor 1 (TEC)	Factor 2 (ETH)	Factor 3 (DEC)	Factor 4 (FUT)	Factor 5 (CHM)	Factor 6 (PLD)	Factor 7 (AIL)
TEC1	0.78						
TEC2	0.81						
TEC3	0.75						
TEC4	0.79						
TEC5	0.72						
TEC6	0.76						
TEC7	0.80						
TEC8	0.74						
ETH1		0.83					
ETH2		0.85					
ETH3		0.78					
ETH4		0.81					
ETH5		0.76					
ETH6		0.84					
ETH7		0.79					
DEC1			0.80				
DEC2			0.77				
DEC3			0.82				
DEC4			0.75				
DEC5			0.78				
DEC6			0.73				
DEC7			0.76				
FUT1				0.81			
FUT2				0.78			
FUT3				0.83			
FUT4				0.76			
FUT5				0.79			
FUT6				0.74			
CHM1					0.82		
CHM2					0.79		

CHM3					0.85		
CHM4					0.77		
CHM5					0.81		
CHM6					0.76		
CHM7					0.78		
CHM8					0.80		
PLD1						0.82	
PLD2						0.78	
PLD3						0.83	
PLD4						0.77	
PLD5						0.75	
PLD6						0.80	
AIL1							0.85
AIL2							0.82
AIL3							0.79
AIL4							0.83
AIL5							0.80
AIL6							0.78
AIL7							0.81
AIL8							0.76
Variance Explained	14.2%	11.8%	10.4%	9.7%	11.5%	8.9%	11.3%
Cumulative Variance	14.2%	26.0%	36.4%	46.1%	57.6%	66.5%	77.8%

The results confirmed the existence of seven distinct factors that were fully consistent with the conceptual model derived from the qualitative phase. The cumulative variance explained by the seven factors was 77.8%, substantially exceeding the acceptable threshold of 60%. All factor loadings were above 0.70, indicating an excellent correspondence between the items and their respective factors.

Figure 1

PLS-SEM Structural Model with Path Coefficients and R² Values



The figure shows that technological competencies (TEC) are positioned at the center-left of the model, with five paths extending toward the intermediate constructs. The strongest of these paths is directed toward symbiotic decision-making (β = 0.536). Intelligent educational leadership (AIL) is positioned on the right side of the model, with $R^2 = 0.684$, highlighted in gold as the principal outcome construct. The color-coded arrows facilitate visual tracking of each path from its origin to its destination. The model-fit indicators shown in the lower-left corner indicate a GoF value of 0.577 and composite reliability coefficients above 0.915.

Table 4

Bootstrapping Results for Path Coefficients, T Values, P Values, and Confidence Intervals (N = 5,000)

Hypothesis	Path	Path Coefficient (β)	SD	T	p	Lower 95% CI	Upper 95% CI	Result
H1	TEC → ETH	0.482	0.038	12.68	0.000	0.408	0.556	Supported
H2	TEC → DEC	0.536	0.034	15.76	0.000	0.469	0.603	Supported
H3	TEC → FUT	0.464	0.041	11.32	0.000	0.384	0.544	Supported
H4	ETH → AIL	0.238	0.032	7.44	0.000	0.175	0.301	Supported
H5	DEC → AIL	0.264	0.029	9.10	0.000	0.207	0.321	Supported
H6	FUT → AIL	0.218	0.035	6.23	0.000	0.149	0.287	Supported
H7	CHM → AIL	0.282	0.031	9.10	0.000	0.221	0.343	Supported
H8	PLD → AIL	0.196	0.036	5.44	0.000	0.125	0.267	Supported
H9	TEC → CHM	0.498	0.037	13.46	0.000	0.425	0.571	Supported
H10	TEC → ETH → AIL	0.115	0.018	6.39	0.000	0.080	0.150	Supported

The results presented in Table 4 indicate that all ten research hypotheses were supported at the $p < .001$ significance level. The strongest direct path was observed between technological competencies and symbiotic decision-making (β = 0.536), whereas the weakest direct path was observed between professional development and intelligent educational leadership (β = 0.196). The mediating path through digital ethical leadership was also statistically significant (β = 0.115). Table 5 presents the coefficients of determination (R^2) and effect sizes (f^2) for the endogenous constructs of the model.

Table 5

Coefficients of Determination (R^2) and Effect Sizes (f^2) for Endogenous Constructs

Endogenous Construct	R^2	Adjusted R^2	Interpretation of R^2	Effect Size f^2
ETH: Digital Ethical Leadership	0.484	0.481	Moderate to strong	0.372 (Strong)
DEC: Symbiotic Decision-Making	0.518	0.515	Strong	0.426 (Strong)
FUT: Strategic Foresight	0.462	0.459	Moderate to strong	0.348 (Strong)
CHM: Change Management	0.494	0.491	Moderate to strong	0.388 (Strong)
AIL: Intelligent Educational Leadership	0.684	0.679	Strong	—

The R^2 value for the main construct of intelligent educational leadership was 0.684. This means that the five predictor variables—digital ethical leadership, symbiotic decision-making, strategic foresight, change management, and professional development—collectively explained 68.4% of the variance in intelligent educational leadership. According to Cohen's (1988) criteria, this value falls within the strong range, exceeding 0.26. The f^2 effect sizes for all paths were within the strong range, above 0.35, indicating the high practical importance of the predicted relationships in the model. Table 6 presents the model's predictive relevance (Q^2).

Table 6

Model Predictive Relevance Indices (Stone–Geisser Q^2)

Construct	Q^2 (Blindfolding)	Interpretation
ETH: Digital Ethical Leadership	0.294	Moderate (0.25–0.50)
DEC: Symbiotic Decision-Making	0.312	Moderate to strong

FUT: Strategic Foresight	0.281	Moderate
CHM: Change Management	0.304	Moderate to strong
AIL: Intelligent Educational Leadership	0.448	Approaching strong

All Q^2 values were greater than zero, indicating that the structural model demonstrated in-sample predictive relevance for all endogenous constructs (Geisser, 1974; Stone, 1974). The Q^2 value for the main construct (AIL = 0.448) approached the strong threshold of 0.50, indicating satisfactory predictive power of the model. Table 7 also presents the overall model fit (GoF).

Table 7

Calculation of the Overall Model Goodness-of-Fit Index (GoF)

Index	**Calculated Value**	**Acceptable Threshold**	**Status**
Mean AVE of All Constructs	0.629	> 0.50	Acceptable
Mean R^2 of Endogenous Constructs	0.528	> 0.26	Acceptable
Calculated GoF	$\sqrt{(0.629 \times 0.528)} = 0.577$	> 0.36 (Strong)	Excellent

The GoF value of 0.577, which is substantially higher than the threshold of 0.36 for strong model fit, indicates an excellent overall fit between the proposed model and the data collected from schools in Razavi Khorasan Province. Table 8 presents the results of the research hypotheses.

Table 8

Final Results of Testing All Research Hypotheses

Code	Hypothesis	β	T	p	Result	Practical Significance
H1	TEC → ETH: Technological competencies predict ethical leadership	0.482	12.68	0.000	Supported	Strong
H2	TEC → DEC: Technological competencies predict decision-making	0.536	15.76	0.000	Supported	Strong
H3	TEC → FUT: Technological competencies predict strategic foresight	0.464	11.32	0.000	Supported	Strong
H4	ETH → AIL: Ethical leadership predicts intelligent educational leadership	0.238	7.44	0.000	Supported	Moderate
H5	DEC → AIL: Decision-making predicts intelligent educational leadership	0.264	9.10	0.000	Supported	Moderate
H6	FUT → AIL: Strategic foresight predicts intelligent educational leadership	0.218	6.23	0.000	Supported	Moderate
H7	CHM → AIL: Change management predicts intelligent educational leadership	0.282	9.10	0.000	Supported	Moderate
H8	PLD → AIL: Professional development predicts intelligent educational leadership	0.196	5.44	0.000	Supported	Weak to moderate
H9	TEC → CHM: Technological competencies predict change management	0.498	13.46	0.000	Supported	Strong
H10	TEC → ETH → AIL: Mediating effect of digital ethical leadership	0.115	6.39	0.000	Supported	Moderate

All ten research hypotheses were supported at the $p < .001$ significance level. This finding indicates that the conceptual model developed on the basis of the qualitative data is strongly supported statistically and is generalizable to the educational population of Razavi Khorasan Province.

4 Discussion

The present study aimed to validate an artificial intelligence-based educational leadership model with a foresight approach in schools of Razavi Khorasan Province. The findings provided strong empirical support for the proposed conceptual framework. All ten hypothesized relationships were statistically significant at $p < .001$, and the model demonstrated substantial explanatory and predictive capacity. Technological competencies emerged as a central antecedent within the model, exerting significant effects on digital ethical leadership, symbiotic decision-making, strategic foresight, and change management. Among these relationships, the strongest direct path was observed between technological competencies and symbiotic decision-making (β = 0.536), followed by the effect of technological competencies on change management (β = 0.498), digital ethical leadership (β = 0.482), and strategic foresight (β = 0.464). Furthermore, intelligent educational leadership was significantly predicted by change management (β = 0.282), symbiotic decision-making (β = 0.264), digital ethical leadership (β = 0.238), strategic foresight (β = 0.218), and professional development

(β = 0.196). The model explained 68.4% of the variance in intelligent educational leadership, while the GoF value of 0.577 indicated a strong overall fit. These findings suggest that AI-based educational leadership is a multidimensional phenomenon in which technological competence functions as a foundational capability that is translated into leadership effectiveness through ethical, cognitive, strategic, developmental, and organizational mechanisms.

One of the most important findings was the strong effect of technological competencies on symbiotic decision-making. This result indicates that school leaders with stronger technological competencies are better positioned to combine human judgment with AI-generated information and analytical capabilities. In educational environments, AI can process large volumes of data, identify patterns, support prediction, and enhance the speed of analysis, but leadership decisions still require contextual understanding, professional experience, ethical interpretation, and awareness of local educational conditions. The observed relationship therefore supports the view that AI should not be conceptualized as a replacement for leadership judgment but rather as an augmentation mechanism that can improve the quality of decision-making when leaders possess sufficient technological literacy. This finding is consistent with studies emphasizing the growing role of AI in educational processes and decision-support systems (Dadashpour & Dehghanpour, 2023; Parsarad et al., 2023). It is also aligned with evidence indicating that effective engagement with AI requires readiness, knowledge, and confidence among educational professionals (Ahmadi, 2023). More broadly, the finding corresponds to research showing that the practical value of technology depends not only on access to digital systems but also on users' behavioral readiness and capacity to adopt and integrate them into decision-making processes (Darmansyah et al., 2020).

The strong relationship between technological competencies and change management also represents a significant finding. Educational leaders who understand AI technologies are likely to manage technological transition more effectively because they are better able to explain the rationale for innovation, identify implementation requirements, address resistance, and develop realistic strategies for institutional adaptation. AI adoption often generates uncertainty among teachers and administrators due to concerns related to professional roles, surveillance, workload, job security, and loss of autonomy. Leaders who lack technological knowledge may unintentionally intensify such concerns, whereas technologically competent leaders are more capable of communicating the opportunities and boundaries of AI and facilitating gradual organizational adaptation. This result is consistent with the argument that school leadership in the age of AI requires capabilities that extend beyond conventional administrative competencies and include the management of technological and organizational transformation (Alikarami et al., 2023; Landon & Soleimani, 2024). It also supports studies emphasizing that the introduction of new educational technologies requires institutional readiness, leadership support, and adaptive management practices (Hanifehzadeh Noudehi, 2023; Sheikh Shoaei, 2021). Therefore, technological competence appears to provide leaders with both the cognitive understanding and the organizational confidence needed to guide schools through AI-related change.

The significant effect of technological competencies on digital ethical leadership further demonstrates that technical understanding and ethical leadership are closely interdependent. Ethical leadership in AI-rich educational environments requires leaders to understand how algorithms function, what kinds of data they use, where bias may arise, and how automated decisions can affect students, teachers, and institutional processes. Without sufficient technological competence, ethical oversight may remain superficial because leaders may lack the knowledge needed to identify risks associated with data privacy, algorithmic bias, transparency, accountability, and inappropriate automation. The present finding is consistent with broader concerns regarding the increasing datafication and algorithmization of education, which have raised questions about how institutional decisions are shaped by opaque technological systems (Gulson et al., 2022). Similarly, sociological analyses have emphasized that AI adoption is embedded in institutional power structures, professional relationships, and competing interests rather than operating as a neutral technological process (Davies et al., 2021). The findings of the present study therefore reinforce the argument that digital ethical leadership depends partly on technological literacy, because ethical governance of AI requires sufficient understanding of the systems being governed.

The relationship between technological competencies and strategic foresight was also statistically significant and relatively strong. This finding suggests that leaders who understand emerging technologies are more capable of anticipating future educational scenarios, identifying opportunities and threats, and preparing schools for technological developments before they become

unavoidable. AI is evolving rapidly and is already influencing teaching, assessment, academic integrity, professional roles, and organizational structures. Leaders who possess technological competencies are more likely to detect the implications of these changes and integrate them into long-term planning. This result is consistent with recent discussions emphasizing future-focused learning and the need to reconsider educational structures in light of AI and postplagiarism environments (Eaton, 2025). It also aligns with evidence that AI is transforming the organization and logic of education and therefore requires institutions to move from reactive adaptation toward strategic anticipation (Arasteh & Khabareh, 2023; García Peñalvo, 2023). Accordingly, technological competence can be interpreted as a prerequisite for meaningful strategic foresight because leaders cannot effectively anticipate the consequences of technologies they do not sufficiently understand.

Among the direct predictors of intelligent educational leadership, change management had the strongest effect ($\beta = 0.282$). This finding indicates that the success of AI-based educational leadership depends heavily on leaders' ability to manage organizational transition rather than merely their ability to access or understand technology. Schools are social systems with established routines, professional identities, informal norms, and organizational cultures. The introduction of AI may disrupt these structures by changing how teachers work, how decisions are made, how performance is monitored, and how educational resources are allocated. Effective leaders must therefore create a climate in which innovation is introduced gradually, stakeholders are involved, uncertainty is addressed, and professional concerns are acknowledged. This result is consistent with research emphasizing that the effective integration of AI into educational leadership requires managerial strategies that support organizational adaptation and coordinated change (Khabareh, 2025; Landon & Soleimani, 2024). It also corresponds to studies that view the transformation of education through AI as an institutional process rather than merely a technological one (Alikarami et al., 2023; Arasteh & Khabareh, 2023). The finding therefore suggests that change management functions as a bridge between technological opportunity and organizational implementation.

Symbiotic decision-making was the second strongest direct predictor of intelligent educational leadership. This result highlights the importance of integrating human and machine capabilities rather than treating AI as an autonomous decision-maker. Educational leadership frequently involves decisions about students, teachers, curricula, school climate, and resource allocation, all of which have contextual and ethical dimensions. Although AI can improve analytical capacity and support evidence-based decision-making, leaders remain responsible for interpreting outputs and adapting them to specific educational realities. The significant effect observed in this study is consistent with research demonstrating the potential of AI for assessment and data-supported educational decision-making while simultaneously emphasizing the need for human oversight (González Calatayud et al., 2021). It also aligns with earlier evidence regarding the use of AI in student recruitment, progression, retention, and administrative decision-making, where intelligent systems can improve predictive capacity but do not eliminate the need for professional judgment (Dennis, 2018). Therefore, symbiotic decision-making may represent one of the defining characteristics of intelligent educational leadership because it combines computational efficiency with human responsibility.

Digital ethical leadership also had a significant direct effect on intelligent educational leadership. This finding indicates that AI-based leadership cannot be considered effective if it is technologically sophisticated but ethically weak. School leaders are responsible for protecting student and teacher information, ensuring fairness, preventing misuse of data, maintaining transparency, and establishing appropriate boundaries for automated systems. The growing use of generative AI has made these responsibilities even more important because issues such as authorship, originality, academic integrity, and responsible use are becoming increasingly complex (Eaton, 2025). Likewise, the rapid emergence of tools such as ChatGPT has created both opportunities and uncertainty in educational settings, making institutional leadership essential for balancing innovation with control (García Peñalvo, 2023). The significant mediating effect of digital ethical leadership in the path from technological competencies to intelligent educational leadership ($\beta = 0.115$) further suggests that part of the influence of technological competence is transmitted through ethical governance. In other words, leaders who understand technology more effectively may be better able to convert that knowledge into responsible and legitimate leadership practices.

Strategic foresight also significantly predicted intelligent educational leadership. This result supports the view that effective AI leadership is inherently future-oriented. Educational leaders must anticipate how emerging

technologies may affect curricula, staffing, assessment, infrastructure, professional development, and student competencies. Future-oriented leadership is particularly important because the speed of AI development means that policies and practices can become outdated rapidly. The finding is consistent with research emphasizing the need for educational systems to prepare learners for the AI age and to develop readiness for environments characterized by continuous technological change (Dai et al., 2020). It also supports recent global perspectives arguing that educational leadership must increasingly address uncertainty, rapid innovation, and future scenarios associated with AI (Göçen & Döğer, 2025). Therefore, strategic foresight should be regarded as a core capability through which school leaders can transform uncertainty into proactive planning.

Professional development had the smallest, but still statistically significant, direct effect on intelligent educational leadership ($\beta = 0.196$). This finding should not be interpreted as indicating that professional development is unimportant. Rather, it may suggest that professional development exerts its influence gradually or indirectly by strengthening other leadership capacities such as technological literacy, ethical judgment, foresight, and change management. AI technologies evolve rapidly, and one-time training is unlikely to provide sufficient preparation for long-term leadership. Continuous learning is therefore necessary for leaders to update their knowledge and adapt to emerging educational, technical, and ethical issues. The finding is consistent with studies emphasizing that AI-related educational innovation requires sustained capacity building and professional learning rather than episodic training (Khabareh, 2025; Majiditalab & Reda, 2025). It also corresponds to research highlighting the need for policy structures and professional development mechanisms that support AI integration across educational systems (Sheikh Shoaei, 2021).

The substantial R^2 value for intelligent educational leadership (0.684) indicates that the proposed predictors jointly explained a large proportion of variance in the main outcome construct. This suggests that the model captures several of the most important dimensions required for AI-oriented leadership in schools. The predictive relevance results also supported the model, with all Q^2 values above zero and the Q^2 value for intelligent educational leadership reaching 0.448. These findings demonstrate that the model is not only explanatory but also has meaningful predictive capacity. The strong GoF value of 0.577 further reinforces the adequacy of the model as an integrated framework. This result is broadly consistent with emerging literature arguing that AI-based leadership should be understood as a multidimensional construct involving technological competence, ethical governance, organizational change, decision-making, and future-oriented planning (Göçen & Döğer, 2025; Landon & Soleimani, 2024; Majiditalab & Reda, 2025). The present study extends this literature by empirically demonstrating how these dimensions interact within the context of schools in Razavi Khorasan Province.

The findings also contribute to the broader literature on AI in education by showing that the effects of AI extend beyond teaching and learning applications. Existing studies have often focused on AI-supported instruction, assessment, virtual education, or student readiness (Arbabi, 2023; Bahajab Ghodsi et al., 2023; Dai et al., 2020; González Calatayud et al., 2021). Other studies have emphasized the broader transformation of education through machine learning and intelligent technologies (Guo & Xiao, 2019; Hanifehzadeh Noudehi, 2023; Parsarad et al., 2023). The present results demonstrate that leadership constitutes an equally important level of analysis. Without leadership capable of integrating technology, ethics, foresight, professional learning, and organizational change, AI initiatives may remain fragmented or fail to become institutionalized. This interpretation is also compatible with research on AI-based educational models and the broader transformation of educational structures (Dadashpour & Dehghanpour, 2023; Fathipour Lat Mahalleh, 2024). Therefore, AI-based educational leadership should be viewed as a strategic organizational capability rather than merely a technological competence.

5 Conclusion

The results are particularly important in the Iranian educational context, where school systems may differ in terms of technological infrastructure, managerial autonomy, digital readiness, and access to professional development opportunities. Previous domestic research has indicated growing awareness of the role of AI in teaching, leadership, educational technology, and institutional transformation (Ahmadi, 2023; Alikarami et al., 2023; Arasteh & Khabareh, 2023). The present study adds to this literature by providing a quantitatively validated model rather than merely describing AI applications or conceptual possibilities. The strong relationships observed across the model suggest that the development of intelligent educational leadership requires coordinated attention to multiple competencies

rather than isolated training in AI tools. In this respect, the study supports the argument that effective school leadership in the AI era requires an integrated framework capable of connecting technological knowledge to ethical responsibility, strategic thinking, organizational change, and professional development.

The study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to draw strong temporal or causal conclusions, despite the use of structural equation modeling to test theoretically specified relationships. Second, the data were based on self-report questionnaires, which may be affected by social desirability, response bias, or differences in respondents' interpretations of AI-related concepts. Third, the study was conducted within Razavi Khorasan Province, and although proportionate stratified sampling improved the representativeness of the sample within the province, caution is required when generalizing the findings to other provinces or national educational systems with different technological infrastructures and organizational cultures. In addition, the rapid development of AI means that some dimensions of technological competence and leadership may evolve over time, requiring periodic revision of the model.

Future research should examine the proposed model using longitudinal designs to determine how AI-based leadership develops over time and whether changes in technological competence lead to measurable changes in ethical leadership, decision-making, foresight, and change management. Replication in other provinces and educational levels would help assess the stability and generalizability of the structural relationships. Future studies could also compare urban and rural schools, public and private schools, or schools with different levels of digital infrastructure. Mixed-method studies would be useful for explaining how school leaders experience AI-related change in practice, while multigroup analyses could determine whether the model differs according to leadership experience, age, professional role, or degree of AI familiarity. Additional constructs such as organizational culture, digital trust, perceived algorithmic risk, teacher resistance, infrastructure readiness, and policy support could also be incorporated into extended versions of the model.

In practice, educational authorities should use the validated model as a framework for designing leadership development programs that integrate technological competencies, ethical governance, strategic foresight, symbiotic decision-making, change management, and continuous professional development. Training programs should move beyond basic instruction in AI tools and instead develop leaders' ability to evaluate AI outputs critically, manage organizational resistance, establish ethical guidelines, protect data, and make balanced human–AI decisions. Schools should establish structured professional learning systems and provide leaders with opportunities to experiment with AI in controlled settings before large-scale implementation. Educational policymakers should also develop clear standards for responsible AI use, support equitable access to technological infrastructure, and create monitoring mechanisms that ensure that AI adoption remains aligned with educational goals, professional values, and student well-being.

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.

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

Ahmadi, S. (2023). *Assessing teachers' readiness and intention to teach artificial intelligence to secondary school students in Tehran* Islamic Azad University, Science and Research Branch].

Alikarami, N., Alikarami, G., & Shohan, J. (2023). School leadership and management in the age of artificial intelligence: Recent developments and future perspectives. Seventh International Conference on Third Millennium Knowledge and Technology in Iranian Economics, Management and Accounting, Tehran.

Arasteh, H., & Khabareh, K. (2023). The role of artificial intelligence and transformation in higher education. *Nasha-e Elm*, *14*(1), 8.

Arbabi, Z. (2023). Benefits and challenges of artificial intelligence in virtual education. *Studies in Psychology and Educational Sciences*, *9*(4), 595-602.

Bahajab Ghodsi, S., Mazaheri, M., & Dahmardeh, M. (2023). The effect of using artificial intelligence strategies in teaching and their impact on students. *Studies in Psychology and Educational Sciences*, *6*(60), 77-86.

Dadashpour, M., & Dehghanpour, A. (2023). Examining the effect of artificial intelligence on the education process. International Conference on Management and Humanities Research in Iran,

Dai, Y., Chai, C. S., Lin, P. Y., Jong, M. S. Y., Guo, Y., & Qin, J. (2020). Promoting students' well being by developing their readiness for the artificial intelligence age. *Sustainability*, *12*(16), 1-15. https://doi.org/10.3390/su12166597

Darmansyah, F. B. A., Hendratmi, A., & Aziz, P. F. (2020). Factors determining behavioral intentions to use Islamic financial technology: Three competing models. *Journal of Islamic Marketing*, *12*(4), 794-812. https://doi.org/10.1108/JIMA-12-2019-0252

Davies, H. C., Eynon, R., & Salveson, C. (2021). The mobilisation of AI in education: A Bourdieusean field analysis. *Sociology*, *55*(3), 539-560. https://doi.org/10.1177/0038038520967888

Dennis, M. J. (2018). Artificial intelligence and recruitment, admission, progression, and retention. *Enrollment Management Report*, *22*(9), 1-3. https://doi.org/10.1002/emt.30479

Eaton, S. E. (2025). Global trends in education: Artificial intelligence, postplagiarism, and future focused learning for 2025 and beyond-2024-2025 Werklund Distinguished Research Lecture. *International Journal for Educational Integrity*, *21*(1), 12. https://doi.org/10.1007/s40979-025-00187-6

Fathipour Lat Mahalleh, G. (2024). Designing an artificial intelligence-based educational model. First International Conference of Outstanding Teachers, Masjed Soleyman.

García Peñalvo, F. J. (2023). The perception of artificial intelligence in educational contexts after the launch of ChatGPT: disruption or panic? *Education in the Knowledge Society*, *24*, 1-9. https://doi.org/10.14201/eks.31279

Göçen, A., & Döğer, M. F. (2025). A global perspective on artificial intelligence in educational leadership. *The Journal of Educational Research*, 1-19. https://doi.org/10.1080/00220671.2025.2510397

González Calatayud, V., Prendes Espinosa, P., & Roig Vila, R. (2021). Artificial intelligence for student assessment: A systematic review. *Applied Sciences*, *11*(12), 5467. https://doi.org/10.3390/app11125467

Gulson, K. N., Sellar, S., & Webb, P. T. (2022). *Algorithms of Education: How datafcation and artifcial intelligence shape policy*. University of Minnesota Press. https://doi.org/10.5749/9781452968797

Guo, Y., & Xiao, Y. (2019). Artificial Intelligence in Education. 4th International Conference on Modern Management, Education Technology and Social Science (MMETSS 2019),

Hanifehzadeh Noudehi, F. (2023). The effect of artificial intelligence and modern educational technologies on education in the modern world. International Conference on Management and Educational Research in Education,

Khabareh, K. (2025). The role of artificial intelligence in educational leadership in schools: A qualitative approach. https://civilica.com/doc/2265231

Landon, F., & Soleimani, M. (2024). Integrating artificial intelligence into educational leadership: Strategies for effective management. *Management Research and Development*(4), 105-121.

Majiditalab, S. S., & Reda, B. (2025). Artificial intelligence and instructional leadership in schools. First International Conference on Artificial Intelligence in Education, Psychology, Educational Sciences and Religious, Cultural, Social and Management Studies in the Third Millennium, Bushehr.

Parsarad, F., Ferdousipour, Z., Rafiei Vardanjani, Z., & Sarvestan, S. (2023). Modern approaches to education with a focus on artificial intelligence and machine learning technologies. International Conference on Management and Educational Research in Education,

Sheikh Shoaei, H. (2021). Challenges, roles and policymaking in artificial intelligence research in education. International Conference on Management, Tourism and Technology,