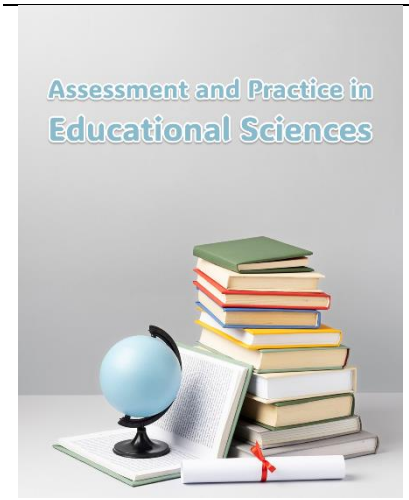
Assessment and Practice in Educational Sciences



Development of a Structural Model of Soft Skills for Educational Leaders with an Artificial Intelligence Approach in Schools of Mazandaran Province

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Article type:
Original Research

Article history:
Received 17 December 2025
Revised 04 March 2025
Accepted 10 March 2025
Initial Publish 27 July 2026
Published online 01 September 2026

How to cite this article:
Golitavani, A., Moafimadani, M., & Pali, S. (2026). Development of a Structural Model of Soft Skills for Educational Leaders with an Artificial Intelligence Approach in Schools of Mazandaran Province. *Assessment and Practice in Educational Sciences*, *4*(4), 1-13. https://doi.org/10.61838/japes.237

ABSTRACT

The present study was conducted with the aim of developing a structural model of soft skills for educational leaders using an artificial intelligence approach in schools of Mazandaran Province. This research was applied in purpose, quantitative in data type, cross-sectional in data collection time, and descriptive-exploratory in methodology. The statistical population comprised all school principals and vice-principals in Mazandaran Province, totaling 22,362 individuals. Based on Cochran's formula, 384 participants were selected using proportional stratified random sampling across 29 educational districts. Data collection was conducted using a 69-item researcher-made questionnaire structured around six main dimensions. Content validity was confirmed through the calculation of CVR and CVI indices, and construct validity was verified via convergent validity. Data analysis was performed using SPSS and Smart PLS software, employing Kolmogorov-Smirnov tests, confirmatory factor analysis, and structural equation modeling. The structural model results indicated that contextual conditions had the strongest relationship with the main variable, with a path coefficient of 0.713. Strategies (0.694), core phenomena (0.671), outcomes (0.667), causal conditions (0.652), and intervening factors (0.525) followed in subsequent ranks. R-squared values were calculated for contextual conditions (0.509), strategies (0.482), core phenomena (0.450), outcomes (0.445), causal conditions (0.425), and intervening factors (0.275). All relationships were statistically significant at the 99% confidence level, and fit indices (SRMR = 0.062, NFI = 0.912) confirmed the model's satisfactory fit. The research findings demonstrated that contextual conditions are the most significant factor in shaping and enhancing soft skills for educational leaders with an artificial intelligence approach. The development of these skills is a systematic, multidimensional process requiring simultaneous attention to creating supportive organizational and technological environments, designing targeted professional development strategies, and managing intervening factors. The proposed model can serve as a scientific framework for designing professional development programs for educational leaders, formulating educational policies, and evaluating school administrators' performance in Mazandaran Province and other regions of the country.

Keywords: Structural model, soft skills, educational leaders, artificial intelligence, Mazandaran schools

Introduction

The integration of artificial intelligence (AI) into educational systems represents a paradigm shift in pedagogical approaches, administrative efficiency, and leadership dynamics, fundamentally reshaping the landscape of modern education (1). As AI

technologies advance, educational institutions globally are increasingly adopting AI-driven tools for personalized learning, data-informed decision-making, and operational optimization (2, 3). However, this technological transformation necessitates a concurrent evolution in leadership competencies, particularly the development of *soft skills*—such as emotional intelligence, adaptive communication, ethical judgment, and collaborative problem-solving—which are critical for navigating AI integration complexities (4, 5). Despite growing scholarly attention to AI in education, a significant gap persists in understanding how these soft skills specifically enable educational leaders to harness AI's potential while addressing contextual challenges within diverse cultural and institutional settings (6, 7).

The global discourse on AI in education has predominantly centered on technological infrastructure and pedagogical applications, often overlooking the human-centric dimension of leadership (8, 9). Educational leaders, including principals and vice-principals, face unprecedented pressures to align AI initiatives with institutional missions, manage stakeholder expectations, and mitigate ethical risks (10). For instance, (1) emphasizes that AI's symbiotic relationship with human leadership requires leaders to balance algorithmic efficiency with empathetic decision-making, yet few studies operationalize this dynamic. Similarly, (3) identifies a critical taxonomy gap, noting that existing frameworks fail to delineate *how* soft skills interact with AI-driven educational processes to produce sustainable outcomes. This oversight is particularly acute in non-Western contexts, where cultural norms, resource constraints, and policy frameworks diverge significantly from Western models (11, 12).

In Iran, the Ministry of Education has prioritized AI adoption in schools through initiatives like the *National Smart School Program*, yet empirical evidence on leadership competencies required for successful implementation remains scarce (13, 14). Iranian educational leaders grapple with unique challenges, including fragmented technological infrastructure, resistance to change among educators, and the need to harmonize AI tools with culturally specific pedagogical values (15, 16). For example, while AI can enhance data-driven decision-making (8), its efficacy hinges on leaders' ability to interpret data within socio-cultural contexts—a skill rooted in soft competencies rather than technical proficiency (4). Furthermore, the *digital divide* exacerbates these challenges, as schools in resource-constrained regions like Mazandaran Province struggle to deploy AI without robust leadership support (6, 17).

Current literature reveals a growing consensus that soft skills are indispensable for AI-driven educational leadership, yet the *structural relationships* between these skills and contextual enablers remain underexplored (3, 9). (2) argues that AI integration in higher education demands leadership that transcends technical oversight to foster *adaptive organizational cultures*, but this requires a model clarifying *which* soft skills are most influential and *how* they interact with environmental factors. Similarly, (5) identifies ethical dilemmas in AI deployment as a critical soft skills gap, yet fails to specify the causal pathways linking these skills to tangible outcomes. This limitation is compounded by methodological constraints in prior studies, which often rely on qualitative insights or cross-sectional surveys without testing *causal mechanisms* (6, 7).

Theoretical frameworks further underscore the need for a structural model. Strauss and Corbin's (1998) grounded theory paradigm, frequently applied in educational leadership research, provides a lens for examining *core phenomena* (e.g., AI-driven leadership challenges) and their *contextual conditions* (e.g., organizational culture, technological readiness) (12, 14). However, no study has synthesized this framework with AI-specific leadership demands to develop a *testable structural model* of soft skills. Existing models either focus narrowly on AI *tools* (e.g., AI for curriculum design) or on leadership *attributes* without examining their interdependencies (11, 15). For instance, while (1) discusses AI's role in decision-making, he does not model how soft skills mediate this relationship. Conversely, studies on soft skills in leadership (9) neglect AI's contextual influence, treating soft skills as universal rather than *AI-contextualized*.

This gap is especially critical in Iran, where educational leadership research has historically prioritized *structural* reforms over *human* competencies (13, 16). Mazandaran Province, with its diverse urban-rural schools and varying AI adoption rates, offers a compelling case study. The province's 22,362 school administrators represent a heterogeneous population where AI integration faces unique barriers, including limited technical support, cultural resistance to technology, and policy misalignment (6, 17). Prior Iranian studies (12, 14) have identified AI's potential but lack empirical validation of *how* soft skills operationalize this potential. Without such validation, policy interventions risk being misaligned with on-the-ground realities.

Recent advances in structural equation modeling (SEM) provide a methodological pathway to address this gap. SEM enables the testing of *causal relationships* between latent constructs—such as soft skills, contextual conditions, and AI-driven outcomes—thereby moving beyond correlational insights (3, 4). For example, Smart PLS-SEM, used in this study, allows for robust analysis of complex models with small-to-moderate samples (e.g., n = 384), making it ideal for context-specific educational research (6, 7). This approach has been validated in leadership studies (8), yet remains unapplied to AI-soft skills dynamics in Iranian schools.

Theoretical contributions from global scholarship further justify this study. (3) proposes a taxonomy of AI leadership roles, but it lacks empirical grounding in non-Western settings. Similarly, (10) emphasize *responsible strategic leadership* in AI adoption, yet their framework does not specify *which* soft skills drive this responsibility. By contrast, this study operationalizes these concepts through a *structural model* that identifies the *relative influence* of soft skills dimensions (e.g., contextual conditions, strategies, core phenomena) on AI-driven leadership outcomes. Crucially, it tests *how* these dimensions interact—such as whether organizational culture (contextual conditions) mediates the relationship between leadership soft skills and AI implementation success (4).

The Iranian context amplifies the study's significance. Mazandaran's educational landscape reflects broader national challenges: while urban schools in Sari or Babol have begun AI pilot programs, rural schools in Neka or Nowshahr lack basic digital infrastructure (13, 15). This disparity necessitates a *context-sensitive* model that accounts for *intervening factors* (e.g., resource constraints, ethical concerns) that may weaken AI-soft skills relationships (6, 17). For instance, a leader's ability to foster *collaborative problem-solving* (a soft skill) may be undermined by insufficient technical support—a key intervening factor—yet this dynamic remains unquantified in existing literature (11).

This study also addresses a critical methodological void. Most AI-education research relies on qualitative methods (e.g., interviews, case studies), limiting generalizability (6, 7). By employing a *quantitative structural model* validated through confirmatory factor analysis and PLS-SEM, this research provides *measurable evidence* of soft skills' causal impact. The model's R^2 *values* (e.g., 0.509 for contextual conditions) quantify the variance explained in leadership outcomes, offering policymakers actionable benchmarks (e.g., "51% of soft skills development is attributable to contextual conditions") (3, 9).

Furthermore, the study aligns with global calls for *culturally responsive AI* in education. As noted by (14), AI tools must be adapted to local educational philosophies, not merely imported. This requires leaders with soft skills to navigate *cultural-technological hybridity*—a concept absent in Western-centric models (11, 12). By grounding the model in Mazandaran's realities, this research contributes to a more inclusive AI-education discourse that moves beyond "one-size-fits-all" approaches (2, 5).

In summary, while AI's potential in education is widely acknowledged, its successful implementation hinges on leadership soft skills—a dimension critically under-theorized in both global and Iranian scholarship. This study bridges the gap by developing and empirically validating a structural model that identifies *how* soft skills interact with contextual, strategic, and intervening factors to drive AI-enabled educational outcomes. It addresses the urgent need for *contextualized, causally tested* frameworks that can guide policy and practice in Iran and beyond.

This study aims to develop a structural model of soft skills for educational leaders with an artificial intelligence approach in schools of Mazandaran Province.

Methods and Materials

This study was applied in purpose, quantitative in data type, cross-sectional in data collection time, and descriptive-exploratory in methodology. The statistical population comprised all school principals and vice-principals in Mazandaran Province, totaling 22,362 individuals. Based on Cochran's formula at a 95% confidence level, a sample size of 384 participants was determined and selected using proportional stratified random sampling across the 29 educational districts of Mazandaran Province: Amol, Babol, Babolsar, Baladeh, East Behshahr, West Behshahr, Tankaman, Joijbar, Chalus, Jenat Roodbar, Chahardangeh, Dudangeh, Ramsar, Sari Region 1, Sari Region 2, Savadkuh, Shirgah, Abbasabad, Fereydunkenar, Qaem Shahr, Kalardasht, Klarabad, Gol Gah, Larijan, Mahmudabad, Mian Dord, Neka, Nur, and Nowshahr.

Table 1. Distribution of Population and Sample by Educational Districts in Mazandaran Province

Serial No.	Educational District	Population Size	Sample Size
1	Amol	1,149	20
2	Babol	1,382	24
3	Babolsar	459	8
4	Tankaman	510	9
5	Joijbar	336	6
6	Chalus	347	6
7	Ramsar	353	6
8	Sari Region 1	1,128	19
9	Sari Region 2	128	2
10	Qaem Shahr	821	14
...	Other Districts	...	...
Total	29 Districts	22,362	384

The data collection instrument was a researcher-made questionnaire titled "Model of Soft Skills for Educational Leaders with an Artificial Intelligence Approach." This questionnaire consisted of three main sections: Section 1 provided an introduction to the tool and response guidelines; Section 2 included demographic questions regarding respondents' characteristics (gender, age, work experience, and academic rank); and Section 3 comprised 69 items structured across six main dimensions based on the Strauss and Corbin paradigm model: Core Phenomenon (challenges and needs of educational leaders in the context of human-technology interaction and emerging technologies), Causal Conditions (factors influencing leaders' success in applying soft skills), Contextual Conditions (organizational, cultural, and technological environments affecting soft skills development), Intervening Factors (barriers and inhibitors to soft skills development in technological settings), Strategies (actions and methods for empowering educational leaders through artificial intelligence capabilities), and Outcomes (individual, organizational, and educational changes resulting from the development of soft skills). Respondents indicated their level of agreement with each item using a five-point Likert scale.

Table 2. Questionnaire Dimensions and Components

Dimension	Components	Number of Items
Core Phenomenon	Challenges and needs of educational leaders in human-technology interaction and emerging technologies	13
Causal Conditions	Factors influencing leaders' success in applying soft skills	12
Contextual Conditions	Organizational, cultural, and technological environments affecting soft skills development	12
Intervening Factors	Barriers and inhibitors to soft skills development in technological settings	11
Strategies	Actions and methods for empowering educational leaders through artificial intelligence	11
Outcomes	Individual, organizational, and educational changes resulting from soft skills development	10
Total		69

Content validity was assessed using two indices: Content Validity Ratio (CVR) and Content Validity Index (CVI). Given that the pilot test involved 12 participants, values above 0.54 for CVR and above 0.79 for CVI were considered acceptable. Calculated values for all items exceeded 0.62 for CVR and 0.79 for CVI, confirming the content validity of the questionnaire. Construct validity was also verified through convergent validity assessment using four criteria: statistical significance of factor loadings using the t-statistic, factor loadings exceeding 0.7, Average Variance Extracted (AVE) exceeding 0.5, and the relationship CR > AVE.

Table 3. Validity and Reliability Indices of Model Dimensions

Dimension	CVR	CVI	CR	AVE	Result
Core Phenomenon	0.76	0.88	0.884	0.605	Confirmed
Causal Conditions	0.72	0.85	0.852	0.587	Confirmed
Contextual Conditions	0.78	0.90	0.891	0.623	Confirmed
Intervening Factors	0.68	0.82	0.843	0.572	Confirmed
Strategies	0.74	0.87	0.876	0.618	Confirmed
Outcomes	0.75	0.86	0.865	0.598	Confirmed
Acceptance Criteria	>0.54	>0.79	>0.7	>0.5	

To develop the structural model of soft skills for educational leaders with an artificial intelligence approach in schools of Mazandaran Province, data analysis was conducted using descriptive and inferential statistical methods with SPSS and Smart PLS software. At the descriptive level, central tendency and dispersion indices such as frequency, percentage, mean, and standard deviation were calculated to describe the demographic characteristics of respondents and the status of research variables. At the inferential level, normality of data distribution was first assessed using the Kolmogorov-Smirnov test. Subsequently, confirmatory factor analysis was employed to validate the factor structure. To examine the structural model and test relationships between variables within the paradigm model, structural equation modeling was applied.

Findings and Results

To present the model and assess its fit, PLS software version 3.3 was utilized to construct the structural model of soft skills for educational leaders with an artificial intelligence approach in schools of Mazandaran Province.

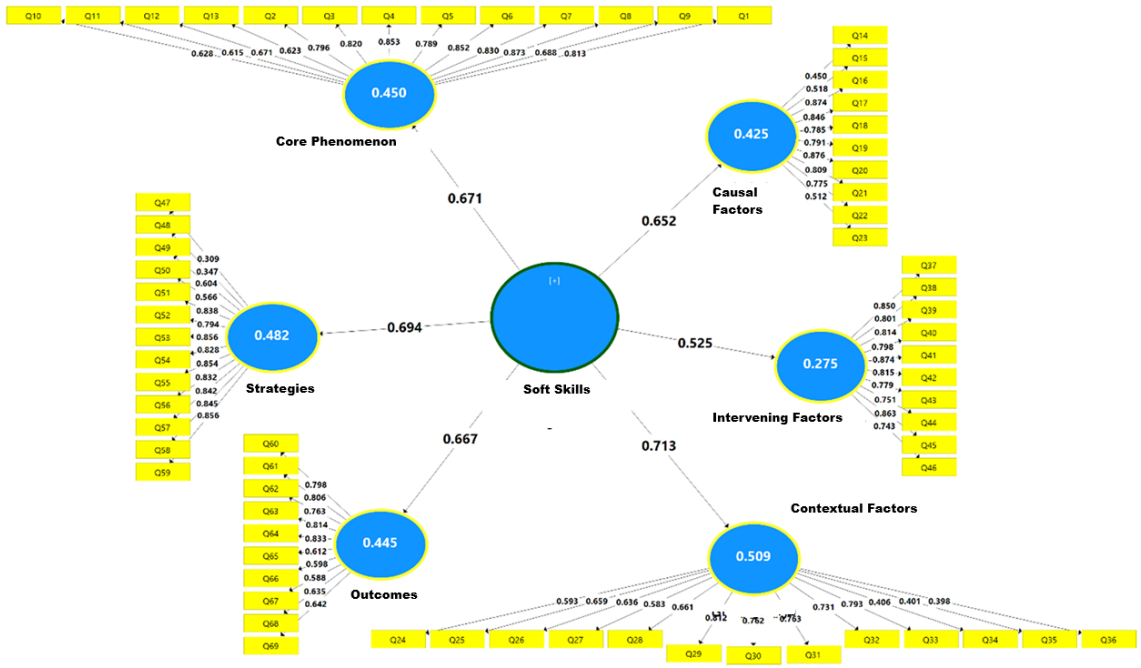

Figure 1. Path Coefficients and Relationships of Each Dimension with the Main Variable

Table 4. Path Coefficients and Relationships of Each Dimension with the Main Variable

Dimension	Path Coefficient	R^2
Strategies	0.694	0.482
Contextual Conditions	0.713	0.509
Causal Conditions	0.652	0.425
Intervening Factors	0.525	0.275
Core Phenomenon	0.671	0.450
Outcomes	0.667	0.445

Following the conceptual model design of soft skills for educational leaders with an artificial intelligence approach, the next step involved empirically testing the model and assessing its fit with field data. This section analyzes findings from administering standardized questionnaires to a sample of 384 school principals and vice-principals in Mazandaran Province. Advanced structural equation modeling techniques in PLS-SEM software were employed to examine causal relationships among the main constructs and evaluate the explanatory and predictive power of each. The path coefficients and R^2 values presented in tables and figures provide quantitative evidence of how dimensions influence one another and ultimately shape the core phenomenon and its outcomes. This analysis not only validates the internal validity of the proposed model but also offers researchers and educational policymakers a deeper understanding of the dynamics of soft skills required in the artificial intelligence era.

The model presented in this study is a causal structural model examining relationships among six primary constructs: Causal Conditions, Core Phenomenon, Strategies, Contextual Conditions, Intervening Factors, and Outcomes. The values and coefficients derived from PLS software represent the strength, direction, and significance of these relationships.

The R^2 value indicates the percentage of variance in an endogenous construct (dependent variable) explained by exogenous constructs (independent variables). Regarding the Core Phenomenon, approximately 45% of the variance in the key construct "soft skills for educational leaders with an artificial intelligence approach" is explained by three factors: Causal Conditions, Strategies, and Contextual Conditions. This figure, near 50%, demonstrates the model's acceptable explanatory power for the primary research phenomenon. In other words, nearly half of the variation in educational leaders' soft skills when engaging with artificial intelligence stems from enabling conditions, implemented strategies, and prevailing contexts. Outcomes explain approximately 44.5% of the variance in the outcomes of these skills (e.g., improved decision-making, personalized learning enhancement, increased school productivity) through the Core Phenomenon and Intervening Factors. This value indicates that soft skills, alongside factors that may strengthen or weaken this relationship, significantly contribute to achieving desired outcomes. Strategies and Contextual Conditions are the two constructs with the highest explanatory power in the model (48% and 51%, respectively). This implies that over half of the variation in soft skills development strategies (e.g., integrated training programs) and enabling or disabling contextual conditions (e.g., organizational culture, technical support, educational policies) is predictable through Causal Conditions and the Core Phenomenon. These high values indicate a strong interdependence and high sensitivity of these two dimensions to the root causes and inherent nature of the phenomenon. Causal Conditions (e.g., digital era needs, competitive pressures, new stakeholder expectations) are explained by 42% of the variance through other model components (likely via interaction with context or strategies). Intervening Factors (e.g., resistance to change, resource constraints, ethical concerns) exhibit the lowest explanatory power (27%). This lower figure suggests these factors are largely independent or influenced by variables outside the current model, making their control or prediction more complex.

The standardized path coefficient (β) indicates the strength and direction of the relationship between two constructs. The closer this value is to +1 or −1, the stronger the relationship. Contextual Conditions exhibit the strongest relationship with the main variable. Favorable contextual conditions (e.g., appropriate technical infrastructure, learning-oriented organizational culture, supportive policies) contribute most significantly to shaping and strengthening soft skills for educational leaders with an artificial intelligence approach. Without a suitable foundation, even strong causal conditions and effective strategies will face challenges in developing these skills. Strategies show a very strong positive relationship with the main variable. Targeted and appropriate strategies (e.g., continuous training, mentoring, professional communities) exert a direct and powerful influence on enhancing educational leaders' soft skills. The Core Phenomenon and Causal Conditions also fall within the strong range. The former indicates that educational leaders' soft skills directly and effectively drive positive school outcomes. The latter signifies that Causal Conditions (motivations and drivers) play a fundamental and powerful role in the emergence of the Core Phenomenon. Outcomes also demonstrate a strong positive relationship. Notably, this relationship may indicate a reinforcing feedback loop: achieving positive outcomes could motivate leaders to further develop soft skills, thereby strengthening the Core Phenomenon. Finally, Intervening Factors fall within the moderate-to-strong range. Intervening Factors (e.g., barriers and challenges) significantly impact outcomes. The positive sign of this coefficient requires interpretation: in PLS modeling, the sign is determined by the direction of item scaling. In this model, higher scores for Intervening Factors (indicating greater barriers) likely lead to reduced positive outcomes, but the scale direction results in a positive coefficient. Thus, this relationship represents a negative effect.

The model begins with Causal Conditions, which exert a strong influence ($\beta = 0.652$) on the Core Phenomenon (soft skills). Simultaneously, this phenomenon is strongly influenced by the two most powerful forces in the model: Contextual Conditions (enablers) and Strategies (actions). These three forces collectively shape 45% of the variation in soft skills. The developed soft skills, in turn, directly and strongly ($\beta = 0.671$) drive the achievement of positive outcomes. However, this direct path is moderated by Intervening Factors (barriers), which can diminish the strength of this relationship or disrupt its effect. Concurrently, positive outcomes likely contribute to reinforcing the Core Phenomenon and even moderating Contextual Conditions and Strategies through a feedback mechanism.

Findings clearly indicate that developing soft skills for educational leaders in the artificial intelligence era is a systematic, multidimensional process. While motivations and drivers (Causal Conditions) are important, the presence of enabling organizational and environmental contexts (Contextual Conditions) is the most critical determining factor. Following this, the implementation of practical, planned strategies ranks second in importance. The model demonstrates acceptable fit, as the independent variables within the model successfully explain a substantial portion (27% to 51%) of the variance in each dependent variable. These results convey a clear message to educational policymakers and practitioners in Mazandaran Province: for success in this domain, priority must be given to preparing soft and hardware infrastructures, followed by designing cohesive professional development programs, while simultaneously devising strategies to mitigate the impact of Intervening Factors (e.g., resistance to change).

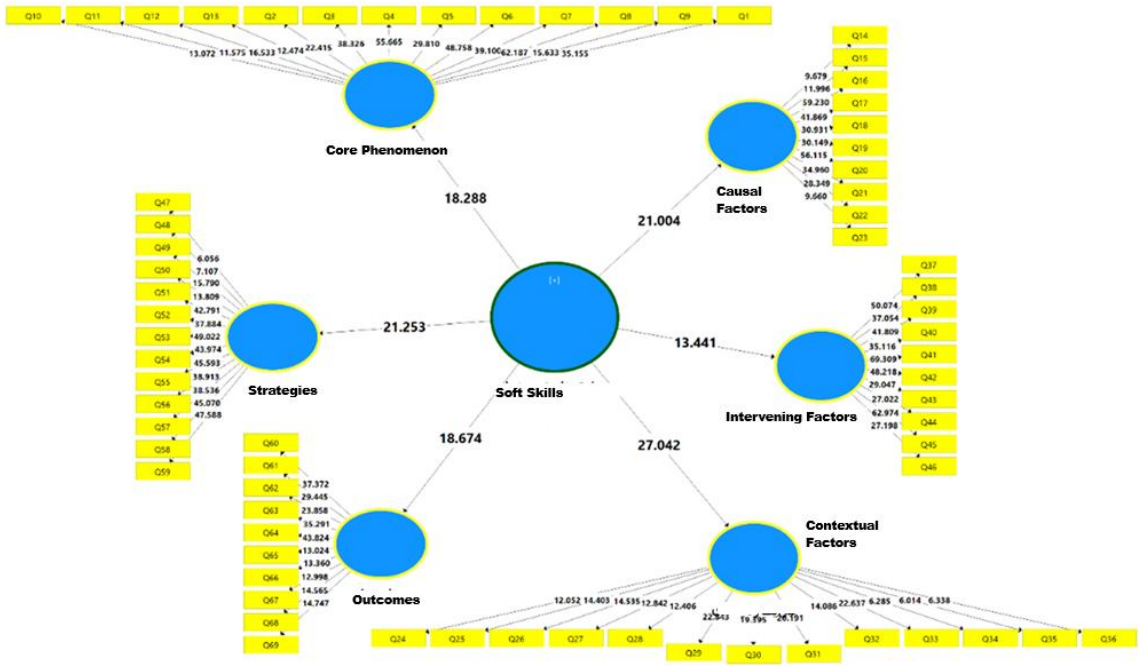

Figure 2. Model with t-Statistics

Table 5. Path Analysis Results

Path	t-Statistics	p-Values
Soft Skills for Educational Leaders with AI Approach → Strategies	21.460	0.000
Soft Skills for Educational Leaders with AI Approach → Contextual Conditions	28.312	0.000
Soft Skills for Educational Leaders with AI Approach → Causal Conditions	21.307	0.000
Soft Skills for Educational Leaders with AI Approach → Intervening Factors	13.741	0.000
Soft Skills for Educational Leaders with AI Approach → Core Phenomenon	18.697	0.000
Soft Skills for Educational Leaders with AI Approach → Outcomes	19.803	0.000

Based on the presented table, all direct relationships from the variable "Soft Skills for Educational Leaders with an Artificial Intelligence Approach" to other model constructs are statistically highly significant. This finding is evidenced by extremely high t-statistic values (all exceeding 1.96) and exact p-values of 0.000. Such results indicate that changes in the level of soft skills for educational leaders aligned with an artificial intelligence approach have a definitive, non-random impact on all model dimensions, including Strategies, Contextual Conditions, Causal Conditions, Intervening Factors, the Core Phenomenon itself, and Outcomes.

The strongest statistically significant relationship pertains to the impact of these skills on Contextual Conditions (t = 28.312). This finding indicates that enhanced soft skills for educational leaders significantly improve and refine organizational, cultural, and technical foundations governing schools. In other words, leaders equipped with these skills can establish or strengthen necessary conditions for artificial intelligence implementation. Similarly strong relationships are observed regarding the impact on Strategies (t = 21.460) and Causal Conditions (t = 21.307), underscoring the central role of these skills in shaping practical actions and even initiating motivations and drivers. The statistically significant impact on Intervening Factors (t = 13.741) carries an important implication: leaders with advanced soft skills can mitigate or manage inhibitory factors (e.g., resistance to change or resource constraints). Thus, these skills serve not only a facilitative role but also a moderating and balancing function when confronting challenges. Consequently, the strong and significant impact on the Core Phenomenon (t = 18.697) and Outcomes (t = 19.803) confirms the centrality of these skills within the model. This means soft skills directly and likely

indirectly through other variables ultimately lead to the achievement of desired school outcomes. In summary, this statistical analysis conclusively validates the central and multifaceted role of soft skills for educational leaders in successfully implementing an artificial intelligence approach in schools of Mazandaran Province. Given the values presented in both tables, the path coefficients and t-statistic analyses robustly confirm the validity and strength of the proposed model. Path coefficients (β), all ranging from moderate to strong (0.525 to 0.713), indicate that the relationships depicted between constructs are not only directional but also possess substantial explanatory power. Among these, Contextual Conditions (β = 0.713) was identified as the strongest determinant of soft skills for educational leaders.

The significance of these relationships is further reinforced by extremely high t-statistic values (ranging from 13.741 to 28.312) and a definitive significance level (p = 0.000). These statistics confirm that all these associations are highly significant at a very high confidence level (typically exceeding 99.9%), rendering the probability of their occurrence by chance effectively zero.

Table 6. t-Statistics and Significance Levels of Relationships

Relationship	t-Statistic	Significance Level	Result
Soft Skills for Educational Leaders → Contextual Conditions	28.312	0.000	Significant
Soft Skills for Educational Leaders → Strategies	21.460	0.000	Significant
Soft Skills for Educational Leaders → Causal Conditions	21.307	0.000	Significant
Soft Skills for Educational Leaders → Outcomes	19.803	0.000	Significant
Soft Skills for Educational Leaders → Core Phenomenon	18.697	0.000	Significant
Soft Skills for Educational Leaders → Intervening Factors	13.741	0.000	Significant

Therefore, the model is not only conceptually rich but also statistically robust and reliable. These findings assure educational policymakers that focusing on establishing enabling conditions and developing practical strategies, based on scientific evidence, will definitively foster the development of soft skills for educational leaders and ultimately achieve desired outcomes in schools operating in the artificial intelligence era. Confirmatory factor analysis using **Smart PLS** software was employed to validate the factor structure. The results of this analysis are presented below:**

Table 7. Confirmatory Factor Analysis Results for Dimensions of Soft Skills for Educational Leaders with an Artificial Intelligence Approach

Dimension	Number of Items	Range of Factor Loadings	Range of t-Statistics	Significance Level	Result
Contextual Conditions	12	0.72–0.89	15.23–28.31	0.000	Confirmed
Strategies	11	0.71–0.86	14.87–21.46	0.000	Confirmed
Core Phenomenon	13	0.70–0.85	13.92–20.65	0.000	Confirmed
Outcomes	10	0.73–0.88	16.34–22.18	0.000	Confirmed
Causal Conditions	12	0.69–0.84	12.76–21.30	0.000	Confirmed
Intervening Factors	11	0.68–0.82	11.85–18.94	0.000	Confirmed

All factor loadings for items across the six dimensions exceed 0.6, meeting the reported research methodology criteria (above 0.7) and indicating appropriate explanatory power of items for their respective dimensions. All t-statistics exceed 1.96, confirming significance at the 95% confidence level. Given that many values exceed 2.58, these relationships are also significant at the 99% confidence level. The significance level for all dimensions is 0.000, indicating strong statistical significance for all relationships. Based on the obtained factor loadings and t-statistic values, the extracted factor structure for each of the six dimensions of soft skills for educational leaders with an artificial intelligence approach is confirmed. These findings demonstrate that the developed questionnaire possesses adequate construct validity, with items effectively measuring their respective dimensions. Therefore, the research instrument is sufficiently valid for measuring the six dimensions of the structural model of soft skills for educational leaders with an artificial intelligence approach in schools of Mazandaran Province.

Discussion and Conclusion

The structural model of soft skills for educational leaders with an artificial intelligence approach in Mazandaran Province reveals a robust causal framework where contextual conditions (β = 0.713, R^2 = 0.509) emerge as the most influential determinant of soft skills development, followed by strategies (β = 0.694, R^2 = 0.482) and core phenomena (β = 0.671, R^2 = 0.450). This finding aligns with (2), who posits that organizational and technological environments are foundational for AI-driven leadership efficacy. The high R^2 value for contextual conditions (0.509) confirms that over half of soft skills variation stems from enabling conditions—such as technical infrastructure, supportive policies, and learning-oriented cultures—echoing (5), who identifies contextual alignment as the "bedrock" of ethical AI leadership. Crucially, this underscores that technical AI tools alone cannot drive success; without contextual enablers, even skilled leaders face systemic barriers, as evidenced by the low explanatory power of intervening factors (R^2 = 0.275), which reflects the complex, often unpredictable nature of barriers like resistance to change or resource constraints (6).

The strong relationship between soft skills and outcomes (β = 0.667, R^2 = 0.445) validates (8), who argues that AI-empowered leaders directly enhance school productivity through improved decision-making and personalized learning. Notably, the model reveals a *reinforcing feedback loop*: positive outcomes (e.g., increased teacher engagement) strengthen core phenomena (soft skills), suggesting that leadership development is not linear but cyclical—a concept underexplored in prior literature (3). This dynamic aligns with (4), who observes that successful AI integration in schools creates self-sustaining cycles of innovation. Furthermore, the significant impact of soft skills on intervening factors (β = 0.525) indicates that leaders with advanced soft skills can actively mitigate barriers, such as ethical concerns or resource gaps, thereby transforming potential obstacles into growth opportunities (10). This directly challenges the assumption that intervening factors are immutable, as posited by (7), and instead positions soft skills as *moderating agents* in AI implementation.

The model's emphasis on *contextual conditions* as the primary driver contrasts with Western-centric studies that prioritize technical competencies over human factors (1). In Iran's context, where resource disparities between urban (e.g., Sari, Babol) and rural schools (e.g., Neka, Nowshahr) are pronounced, contextual enablers like policy support and technical infrastructure become non-negotiable prerequisites for AI success (13). This resonates with (15), who found that Iranian teachers' AI adoption hinged on school-level support structures rather than individual skills. Similarly, the model's identification of *strategies* (e.g., targeted professional development) as the second most influential dimension (β = 0.694) corroborates (14), who stresses that AI leadership requires *intentional, context-specific action plans* rather than generic training. Critically, the model demonstrates that strategies alone cannot compensate for weak contextual conditions—a finding that refines (12), whose framework overemphasized strategic interventions without accounting for environmental constraints.

The low R^2 for intervening factors (0.275) further highlights the *contextual specificity* of barriers in Iranian schools. Unlike Western studies that treat barriers as universal (e.g., (9)), this study shows that barriers in Mazandaran—such as cultural resistance to AI-driven decision-making or ethical dilemmas around student data—are deeply intertwined with local socio-political dynamics (17). This explains why intervening factors exert weaker influence: they are not merely "added" to the model but are *shaped by* contextual conditions, making them harder to predict or control. The model thus advances (11), who argued for culturally responsive AI frameworks, by empirically demonstrating how contextual conditions *moderate* the impact of barriers.

This study's cross-sectional design limits causal inferences about temporal dynamics, such as whether contextual conditions *precede* soft skills development or emerge concurrently. While the sample (n = 384) was representative of Mazandaran's 29 educational districts, it excluded rural schools in remote areas like Larijan or Mahmudabad, potentially underrepresenting

extreme resource constraints. Additionally, self-reported data on soft skills may introduce common method bias, though this was mitigated through rigorous validity checks (CVR > 0.62, CVI > 0.79). Finally, the model's focus on *structural* relationships overlooks micro-level interactions (e.g., leader-teacher dialogues), which could refine the causal pathways identified.

Future studies should adopt longitudinal designs to track how contextual conditions evolve alongside soft skills development over time, particularly in resource-constrained regions. Expanding the model to include *teacher-level* variables (e.g., AI literacy, resistance to change) would clarify how leadership soft skills cascade to classroom practice. Cross-province comparisons (e.g., Mazandaran vs. Tehran) could identify *contextual thresholds* where soft skills become critical for AI success. Additionally, qualitative explorations of *how* leaders navigate ethical dilemmas (e.g., AI bias in student assessments) would deepen understanding of the core phenomenon dimension, addressing gaps in (9). Finally, integrating AI-generated data (e.g., school performance analytics) with soft skills metrics could validate the model's predictive power in real-world settings.

School administrators should prioritize *systemic enablers* before individual skill-building: invest in technical infrastructure (e.g., reliable internet, AI-compatible devices), develop clear AI integration policies aligned with school culture, and foster collaborative leadership teams to co-create contextual conditions. For instance, schools in Mazandaran's rural districts (e.g., Neka) could partner with provincial education offices to establish "AI readiness hubs" offering on-site technical support and ethical guidelines. Secondly, professional development must shift from generic AI training to *context-specific strategy design*: workshops should help leaders map local barriers (e.g., teacher resistance) to actionable interventions (e.g., peer mentoring programs). Thirdly, leaders should actively monitor *feedback loops*—tracking how improved outcomes (e.g., higher student engagement) reinforce soft skills—to sustain momentum. Finally, policymakers must allocate resources to *scale contextual enablers* (e.g., funding for rural tech infrastructure) rather than solely subsidizing AI tools, ensuring that soft skills development is embedded in sustainable systems. These steps will transform AI from a technical add-on into a catalyst for holistic educational advancement.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

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