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Validation of the Professional Development Model for Elementary School Principals with Emphasis on the Heutagogy Approach

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ABSTRACT

Objective: The aim of the present study was to validate the professional development model for elementary school principals, with an emphasis on the heutagogy approach.

Methods: This research was applied in terms of purpose and employed a cross-sectional survey design in terms of methodology. The statistical population included all elementary school principals (first and second cycles) and education administrators of the 19 districts of Tehran, totaling 2,500 individuals. Of these, 114 were district administrators and the remaining 2,386 were elementary school principals. A multistage proportionate stratified sampling method was used. Data were collected using a researcher-developed questionnaire. To ensure accurate measurement of the research constructs, the questionnaire's validity was examined through face validity and content validity. Reliability was assessed using Cronbach's alpha coefficient. The questionnaire was administered to a pilot sample, and the data were analyzed using SPSS software. The overall Cronbach's alpha of the questionnaire was 0.89. To evaluate the fit of the conceptual model extracted from the qualitative phase and confirm the factorial structure of the questionnaire, confirmatory factor analysis was employed.

Results: The results showed that, out of the 118 identified indicators, 117 indicators, along with all 25 components and 6 main dimensions, were confirmed, and only one indicator was removed. Moreover, the significance coefficients obtained from the confirmatory factor analysis fell outside the range of ±1.96, indicating that the relationships between the indicators and the model constructs were statistically significant at the 95% confidence level.

Conclusions: Based on the findings, the professional development model for elementary school principals, with an emphasis on the heutagogy approach, has favorable scientific and statistical validity.

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Introduction

Today, human resource development, and professional development in particular, is no longer a peripheral or occasional activity; rather, it is considered a strategic necessity for the survival, adaptation, and advancement of organizations. Professional development helps organizations prepare their human resources to face emerging issues, engage in continuous learning, and take on more complex roles (Graves, 2019; An San, 2024). In a general sense, professional development is a planned, purposeful, and ongoing process for enhancing individuals' professional knowledge, skills, attitudes, and performance. This process becomes even more important when it pertains to managerial positions, particularly educational management, since managers — in addition to performing executive duties — also take on the roles of guide, facilitator, decision-maker, and change leader (Cheng, Yu, Dong & Zhang, 2024; Moradi et al., 2023). Within this framework, the professional development of managers refers to a set of measures that foster the growth of their professional, managerial, communication, and leadership competencies, enabling managers to carry out their duties more effectively in complex and evolving environments (Hajkhozeimeh et al., 2021; Taheri et al., 2013).

Studies have shown that professional development can bring about positive outcomes such as improved professional attitudes, enhanced performance quality, strengthened communication skills, reinforced critical thinking, problem-solving, self-direction, and adaptability to change (Kahraman & Kuzu, 2016; Roche et al., 2020; Darling-Hammond et al., 2017). For this reason, in educational systems, professional development is recognized as one of the most important tools for improving quality and reforming teaching–learning processes (Rahimi, 2021; Harris et al., 2011). Educational administrators, particularly elementary school principals, stand at the forefront of achieving educational goals, and the quality of their performance directly affects not only teachers but also students, families, and the school culture. Therefore, attention to the professional development of this group of managers is an undeniable necessity (Zojaji et al., 2017; Bander et al., 2020).

Despite this importance, many professional development models and programs in practice continue to rely on formal, top-down training, direct knowledge transfer, and predetermined courses. In these approaches, managers are often treated as passive recipients of content, while lived experience, professional reflection, self-directed learning, problem-centeredness, and

learning within the real context of the school receive less attention (Poell, 2017; Spinello & Corbett, 2020). As a result, some professional development programs are unable to fully respond to the real needs of managers in complex and changing educational environments. This issue becomes even more significant given that the role of the school principal is no longer merely administrative and executive; rather, principals must act as instructional leaders, guides of learning, facilitators of human interaction, and decision-makers in unpredictable situations (Murray, 2015; Sugrue, 2015).

In response to these limitations, novel approaches to learning and professional development have been proposed, one of the most important of which is heutagogy. Heutagogy is a learner-centered approach based on self-determined learning, in which the individual plays an active role in identifying learning needs, choosing a learning path, using resources, solving problems, and reflecting on their own experiences (Hase, 2009; Hase & Kenyon, 2013). Unlike traditional approaches, heutagogy is not limited to the mere transfer of knowledge and skills; rather, it emphasizes the cultivation of capability, self-awareness, flexibility, critical thinking, and the ability to learn in new situations (Hase & Blaschke, 2021; Hase & Blaschke, 2022). From this perspective, the learner is not merely a consumer of knowledge but also its constructor, interpreter, and re-creator.

Applying the heutagogical approach to the professional development of elementary school principals is important because these principals face diverse, dynamic, and at times unpredictable situations, and effectively running a school requires independent decision-making, continuous learning, practical problem-solving, effective interaction with teachers and families, and ongoing review of their own professional performance (Knapke et al., 2024; Kirkgoz, 2023). In such a context, the heutagogical approach can provide a suitable foundation for professional development, since it emphasizes self-direction, experience-centeredness, reflection, and learning within the real context of practice. These features align closely with the professional requirements of elementary school principals and can help enhance their leadership, communication, managerial, and decision-making competencies (Nobles, 2024).

In Iran too, although research has been conducted in recent years on the professional development of school principals, reviews indicate that a considerable portion of these studies have either focused on general and non-operational approaches or have failed to incorporate important

dimensions — such as learner self-organization, professional self-reflection, experience-based learning, continuous feedback, and the role of the school's real context — in a coherent and systematic manner into their proposed models (Badri, Rahimian, Taheri & Abbaspour, 2022; Khamari, Faribarzi & Naseri, 2024). Furthermore, many existing models have paid insufficient attention to the real conditions of Iranian elementary schools, including environmental differences, resource constraints, social expectations, educational policies, and cultural and regional diversity (Badri et al., 2022; Yousefi, Maleki-Avarsin & Talebi, 2020). These shortcomings indicate that there is still a need for a model that can explain the professional development of elementary school principals — with an emphasis on the principles of heutagogy — within a coherent, applicable, and locally grounded framework.

In domestic (Iranian) research, "professional development" has increasingly been recognized as one of the key mechanisms for improving educational quality and school performance, particularly in relation to the new roles of teachers and principals. The findings indicate that contemporary approaches to professional development in Iran have moved beyond formal, occasional training and now emphasize components such as continuous learning, empowerment, flexibility, and adaptation to technological and cultural change; in some studies, for instance, the professional development of education administrators has been redefined within the framework of digital culture and its associated competencies (such as digital literacy, agility, and ecosystem thinking) (Mohagheghian, Nadi & Karimi, 2025; Nadi Khorasgani, Nadi & Karimi, 2025). At the teacher level as well, studies have emphasized the link between professional development and the enhancement of instructional competencies, professional identity, and readiness to face environmental changes and emerging technologies (Nadali, Sharafai & Heydari, 2025; Fathabadi et al., 2025; Khamari et al., 2024). In the field of school management, research evidence also shows that principals' professional development is associated with components such as school-based management, effective decision-making, and the enhancement of the school's educational functions, and is shaped by individual, organizational, and environmental factors (Roshangias, Odrun & Akbari, 2025; Ghasemi, Zarei & Rasoulian, 2023; Sahranavard Nashtifani et al., 2023; Barati, 2022). In addition, some studies focusing on heutagogy have emphasized the necessity of providing self-determined learning environments, flexible structures, continuous feedback, and

institutional support for professional growth (Gholampour, Mahmoudi Boroung & Mohammadi Hosseini, 2025; Saeedavi, Hosseinpour & Barakat, 2023).

In foreign (international) research, professional development has increasingly been explained within the frameworks of lifelong learning, self-direction, and organizational flexibility, and approaches such as heutagogy have been highlighted as a response to the complexities of contemporary educational environments. Meta-analytic and bibliometric analyses show a growing trend of attention to heutagogy in the field of professional development, and this approach — relying on learner agency, self-regulated learning, and personalized learning pathways — has considerable capacity to redesign professional training in digital and blended environments (Verma, 2025; Kumar, 2020). On the other hand, studies have shown that effective professional development is achieved when it is accompanied by organizational support, collaborative learning, coaching/mentoring, and practice-based learning opportunities, while also attending to individuals' motivation and lived experience (Grynova et al., 2025; Amemasor et al., 2025). The role of principals as instructional leaders in facilitating teachers' professional development and reshaping the school's learning culture has also been emphasized (He, Guo & Abazie, 2024), and some studies have specified that principals' professional development should be redefined in line with the emerging requirements of instructional leadership, equity-orientation, and technology (Mullen & Hall, 2024). In the same vein, qualitative evidence also shows that heutagogy-based learning environments can strengthen self-efficacy, critical thinking, and professional identity, and provide the ground for deeper, self-determined learning (Imsiyah et al., 2024; Alex & Mukuka, 2024; Sahlin, 2023).

Despite this body of research, a significant gap still remains: a considerable portion of domestic and international studies have either focused on teachers' professional development or examined principals' professional development at a general level, paying less attention to the specific requirements of management at the elementary level. Furthermore, studies related to heutagogy have mainly been limited to conceptual explanation, identification of facilitating factors, or scattered applications in learning environments, and have paid less attention to the "design or validation of a model" of professional development for school principals based on field evidence. Accordingly, it can be said that no locally grounded, coherent, qualitative-data-based model has yet been specifically designed and validated for the "professional development of elementary

school principals with an emphasis on the heutagogy approach" that can present its dimensions, components, and the relationships among them within an explanatory framework reliable for policy-making and implementation. Therefore, the present study seeks to address this gap by drawing on the lived experience of experts and qualitative analysis, and to validate a model for the professional development of elementary school principals in light of the heutagogy approach. Accordingly, the following question was raised: How valid is the theoretical model of professional development of elementary school principals with an emphasis on the heutagogy approach?

Material and Mrthods

The present study is applied in terms of purpose, since it was conducted with the aim of designing a model for the professional development of elementary-level principals and improving managerial practice within the educational system. In terms of methodology, the present study was conducted using a cross-sectional survey method. The purpose of this stage is to test, validate, and relatively generalize the components and relationships identified in the qualitative stage to a broader population of elementary-level principals.

The statistical population of this study includes all elementary school principals (first and second cycles) and education administrators of the nineteen districts of the city of Tehran, totaling 2,500 individuals. Of these, 114 are administrators of the nineteen districts, and the remaining 2,386 are elementary school principals. Given the size of the statistical population, and since the population size was very large, sampling was carried out. The Krejcie and Morgan table was used for this purpose. This table correctly determines the exact sample size needed such that it is representative of the entire population. Accordingly, 333 individuals were determined as the sample. Since the researcher anticipated that some questionnaires might not be returned or might be incomplete, a 10% increase was applied to the sample size, and the number of distributed questionnaires was set at 366 to maintain adequate representation of the entire population. In the end, after collecting the questionnaires and removing incomplete ones, 356 questionnaires constituted the final sample.

Given the geographical extent of the city of Tehran, the diversity of managerial structures across the nineteen districts, and the variation in the number of schools per district, a multistage proportionate stratified sampling method was used. In the first stage, the population was divided into 19 independent strata based on the education districts. In the second stage, from each stratum

(district), a sample proportionate to the number of managers in that district was selected. Selection within each stratum was carried out by simple random sampling to preserve equal chances for all managers. For the district administrators (114 individuals), given the small size of this population, a complete census method was used so that all of them would be included in the study. For the nineteen districts, sample allocation was based on the ratio of each district's principals to the total number of school principals (2,386 individuals).

The basis for data collection in the quantitative section was a questionnaire. The questionnaire was prepared and distributed through field methods. The questionnaire consisted of several sections, including the initial questionnaire specifications, the questions themselves, and a section on demographic information related to the sample group. The questionnaire, comprising 118 questions organized into 25 components, was designed using a 7-point Likert scale ranging from completely agree (7) to completely disagree (1), as detailed below. At this stage, out of the 366 distributed questionnaires, after removing incomplete ones, 356 questionnaires formed the basis of the analysis.

To ensure the accurate measurement of the research constructs, the questionnaire's validity was examined through face validity and content validity. Face validity was assessed by providing the initial version of the questionnaire to a number of elementary school principals and experts in the field of educational management, and obtaining their opinions regarding the clarity of the statements, the appropriateness of the wording, the ordering of the items, and the degree of ambiguity in the questions. Based on the feedback received, necessary revisions were made to the wording and structure of some items, including rewriting certain items, simplifying statements, and removing ambiguous items.

Content validity was also examined through expert judgment. For this purpose, the questionnaire was sent to a group of university faculty members specializing in educational management, curriculum planning, and research methodology to evaluate the appropriateness of the items in relation to the research objectives, the dimensions of the extracted paradigmatic model, and the heutagogy approach. After the suggested revisions were applied, the questionnaire was judged by the experts to have adequate and comprehensive content. Therefore, the questionnaire was confirmed by both experts and respondents in terms of face and content validity.

Cronbach's alpha coefficient was used to assess the reliability of the questionnaire. The questionnaire was administered to a pilot sample, and the data were analyzed using SPSS software. The results obtained showed that the overall Cronbach's alpha of the questionnaire was 0.89. To evaluate the fit of the conceptual model extracted from the qualitative stage and to confirm the factorial structure of the questionnaire, confirmatory factor analysis was used.

Results

Confirmatory factor analysis was used to assess construct validity and ensure the adequacy of the measurement instrument. The main purpose of this analysis was to examine the degree of correspondence between the observable indicators and the extracted latent constructs, and to confirm the factorial structure of the research's conceptual model. The confirmatory factor analysis was based on the opinions of 356 district and elementary school administrators of the Tehran Department of Education, seeking to answer the question of whether the identified dimensions, components, and indicators possess a coherent factorial structure within the proposed model. In what follows, each of the dimensions, components, and their indicators is analyzed.

Confirmatory Factor Analysis of the Causal Factors Dimension

The output of the confirmatory factor analysis test for the causal factors dimension consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

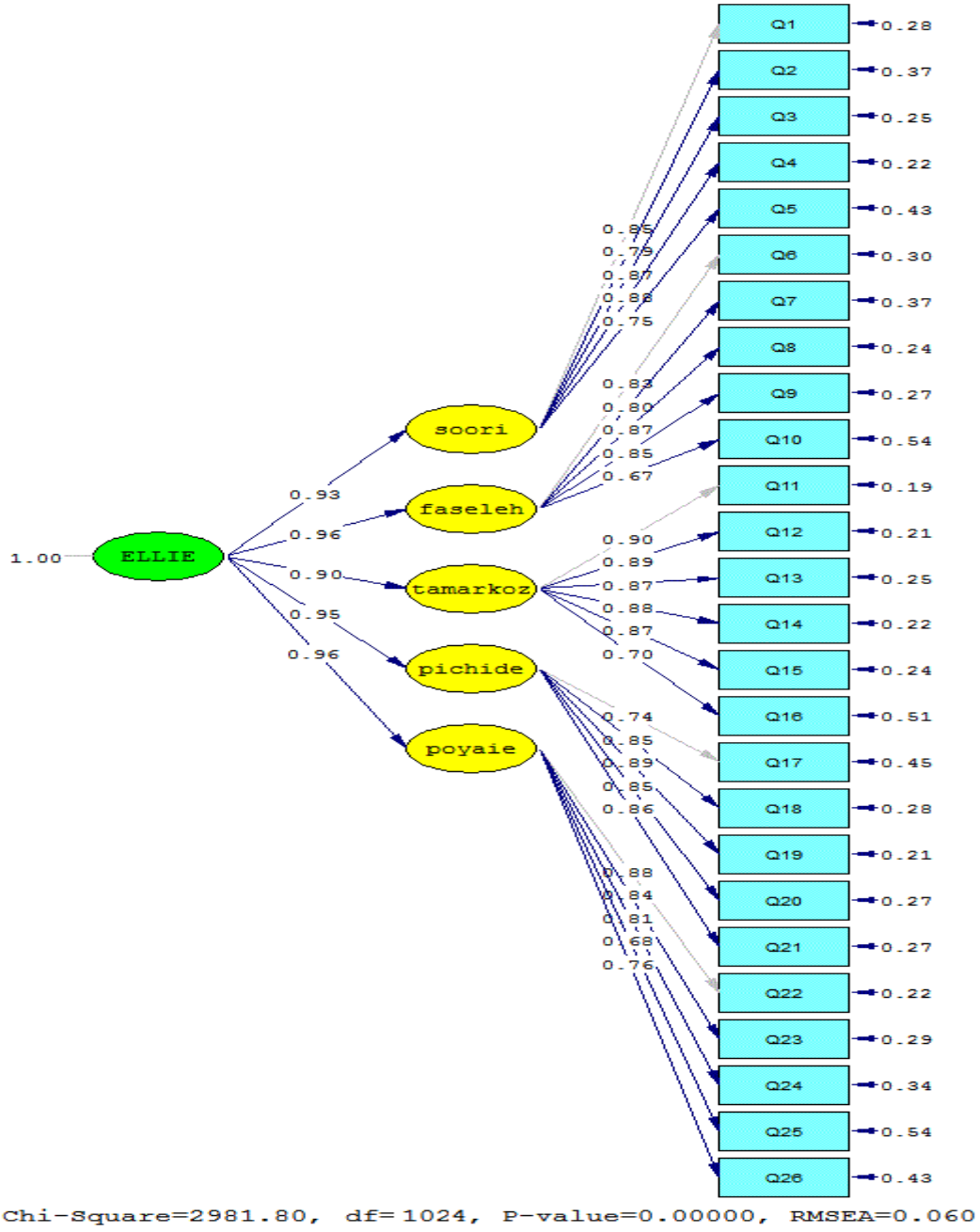

Figure 1. Standardized values for the causal factors dimension

As can be seen, all factor loadings are greater than 0.6, indicating the high explanatory power of the components in defining the “causal factors” construct.

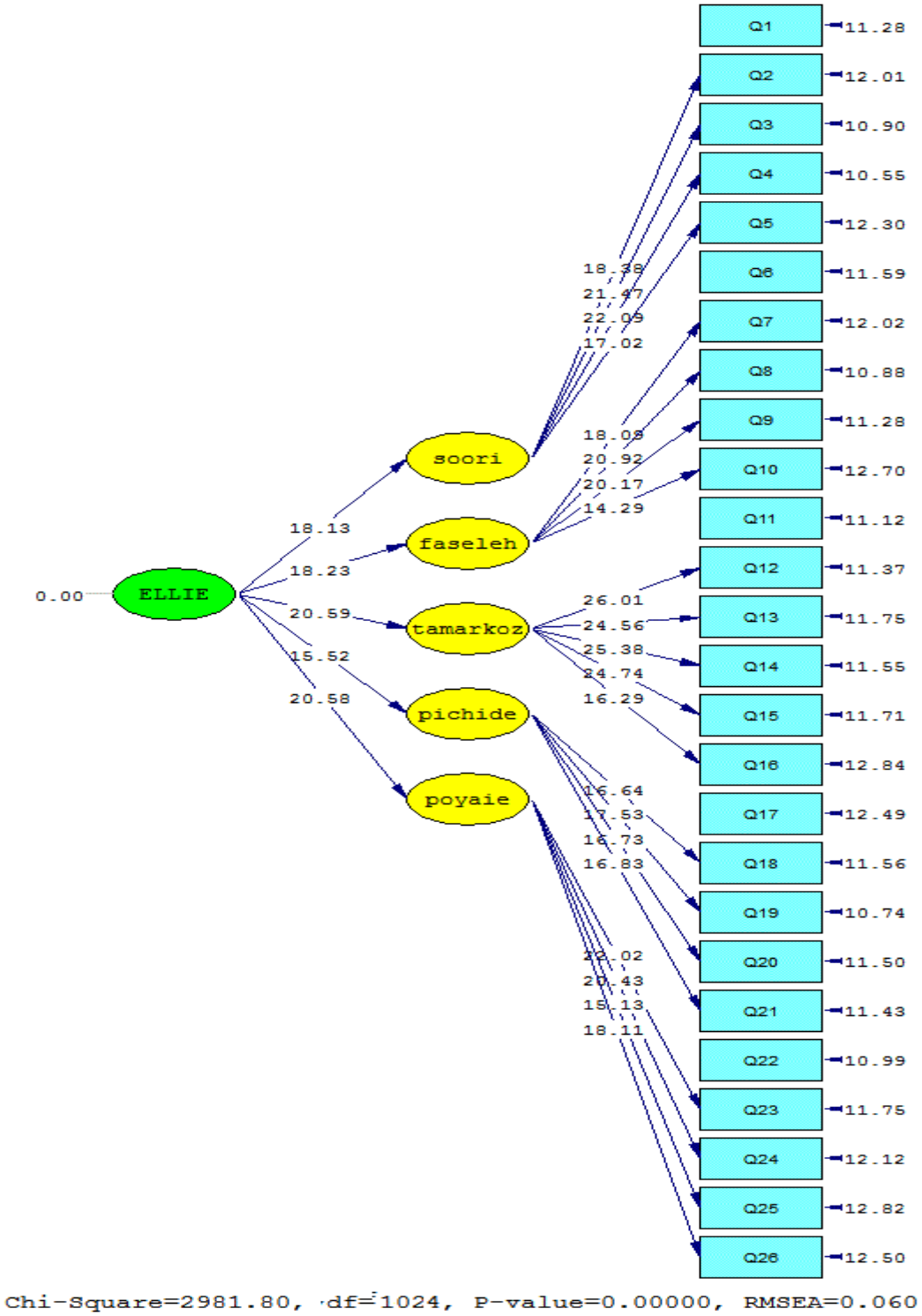

Figure 2. Significance values (t-values) for the causal factors dimension

The significance values range from 14 to 25, which are considerably higher than the critical value of ±1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 1. Factor loadings and significance coefficients of the causal factor's components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Ineffectiveness of professional development programs	0.93	18.13	Significant
Mismatch between managerial training and school realities	0.96	18.23	Significant
Centralization of training programs	0.90	20.59	Significant
Complexity of school management issues	0.95	15.52	Significant
Dynamism of the educational environment	0.96	20.58	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of causal factors. In other words, each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 2. Fit indices of the causal factor's measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	2981.80	1024	2.91	0.060	0.95	0.94	0.93	0.92	0.91
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good fit	Adequate	Excellent	Excellent	Good	Good	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.91) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.060 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.92 and AGFI = 0.91 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (0.95 and 0.94) indicate a high degree of correspondence between the proposed model and the actual data.

Overall, based on all the indices, the measurement model of "causal factors" has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

Confirmatory Factor Analysis of the Contextual Factors Dimension

The output of the confirmatory factor analysis test for the contextual factors dimension consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

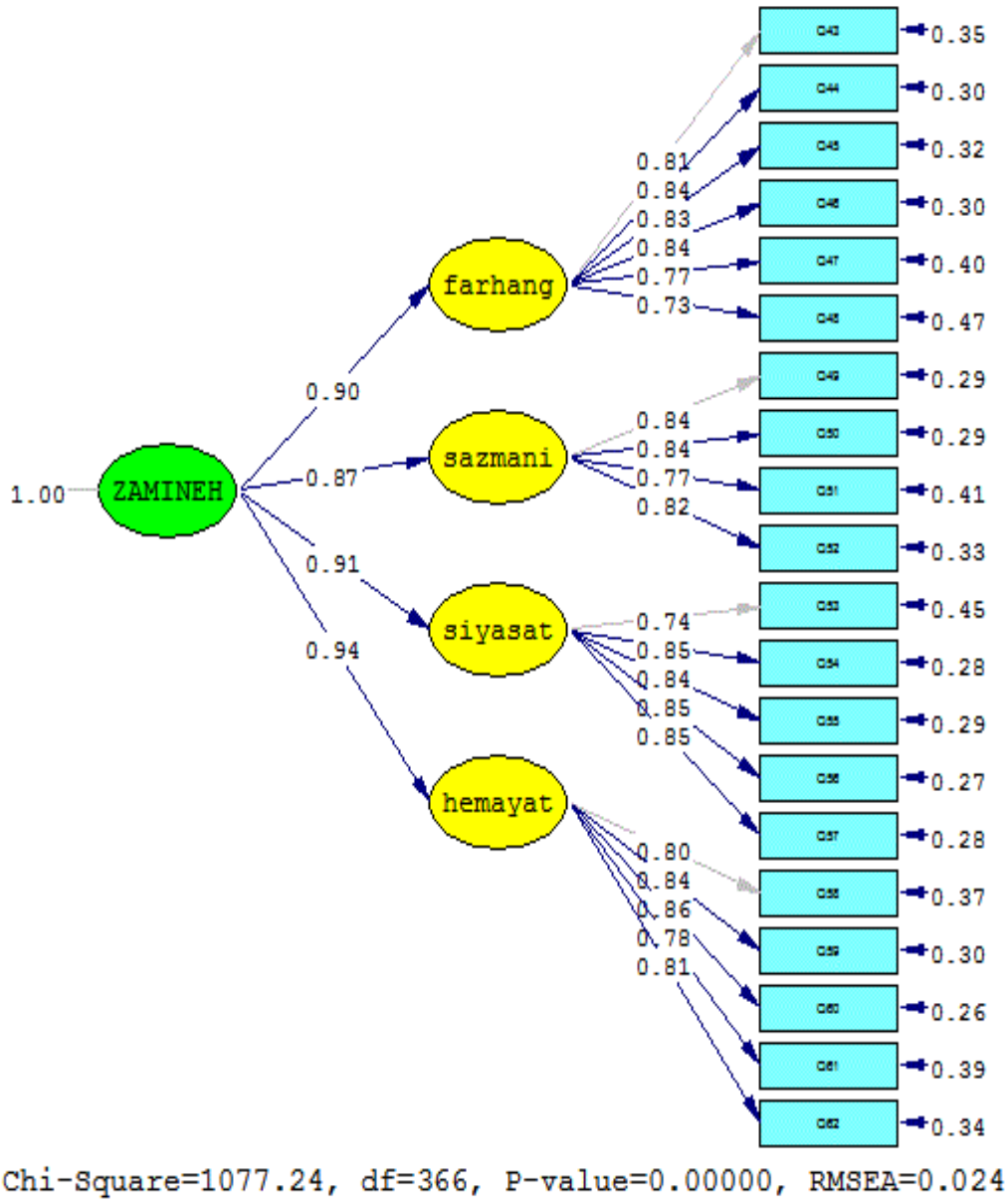

Figure 3. Standardized values for the contextual factors dimension

As can be seen, all factor loadings are greater than 0.7, indicating the high explanatory power of the components in defining the “contextual factors” construct.

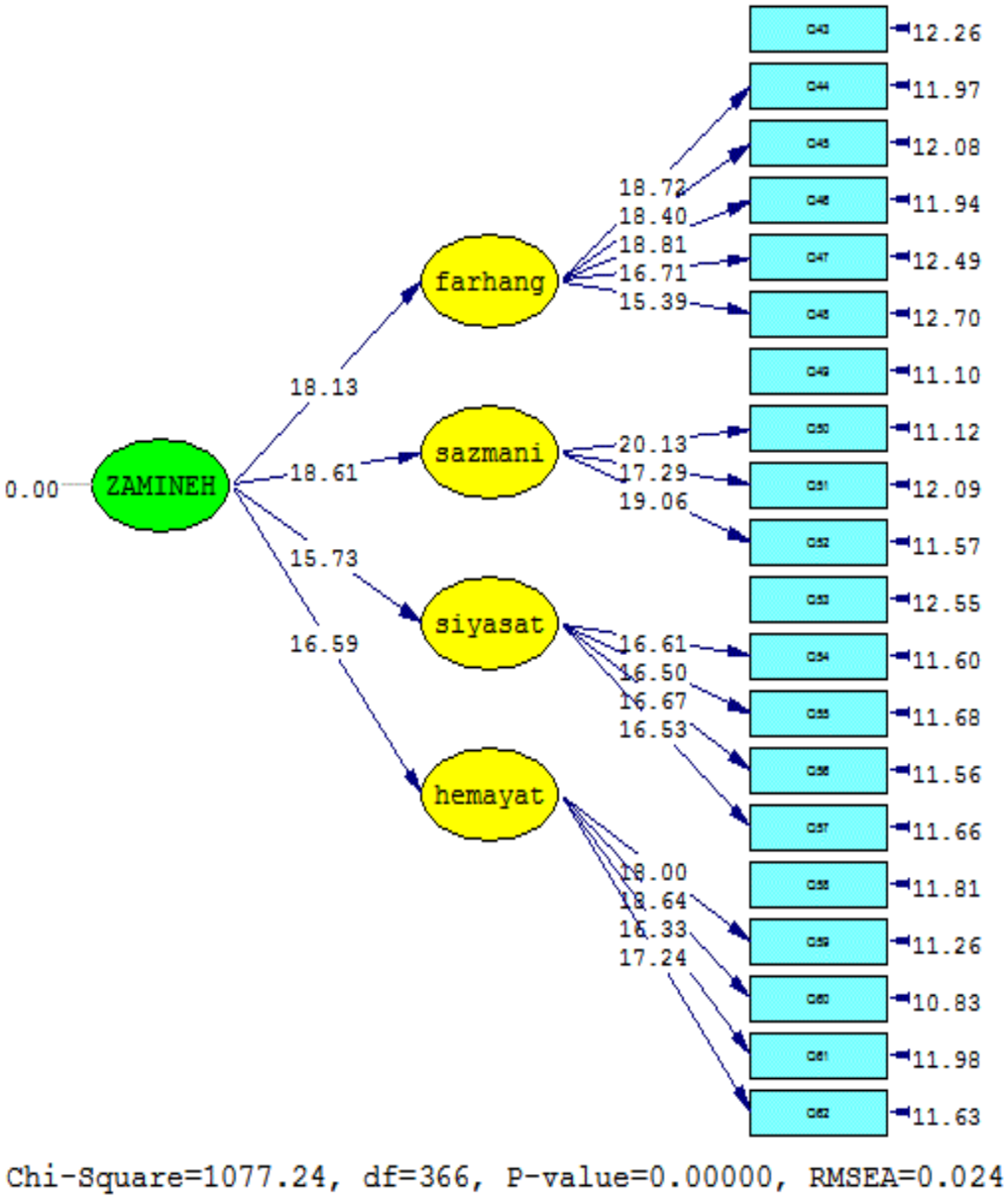

Figure 4. Significance values (t-values) for the contextual factors dimension

The significance values range from 15 to 21, which are considerably higher than the critical value of ±1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 3. Factor loadings and significance coefficients of the contextual factor's components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Learning culture and professional interaction	0.90	18.13	Significant
School organizational structure and characteristics	0.87	18.61	Significant
Educational system policies and structure	0.91	15.43	Significant
Organizational support for managers	0.94	16.59	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of contextual factors. In other words, each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 4. Fit indices of the contextual factor's measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	1077.24	366	2.94	0.024	0.96	0.96	0.95	0.94	0.93
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good	Very good	Excellent	Excellent	Excellent	Good	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.94) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.024 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.94 and AGFI = 0.93 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (0.96 and 0.96) indicate a high degree of correspondence between the proposed model and the actual data.

Overall, based on all the indices, the measurement model of "contextual factors" has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

Confirmatory Factor Analysis of the Intervening Factors Dimension

The output of the confirmatory factor analysis test for the intervening factors dimension consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

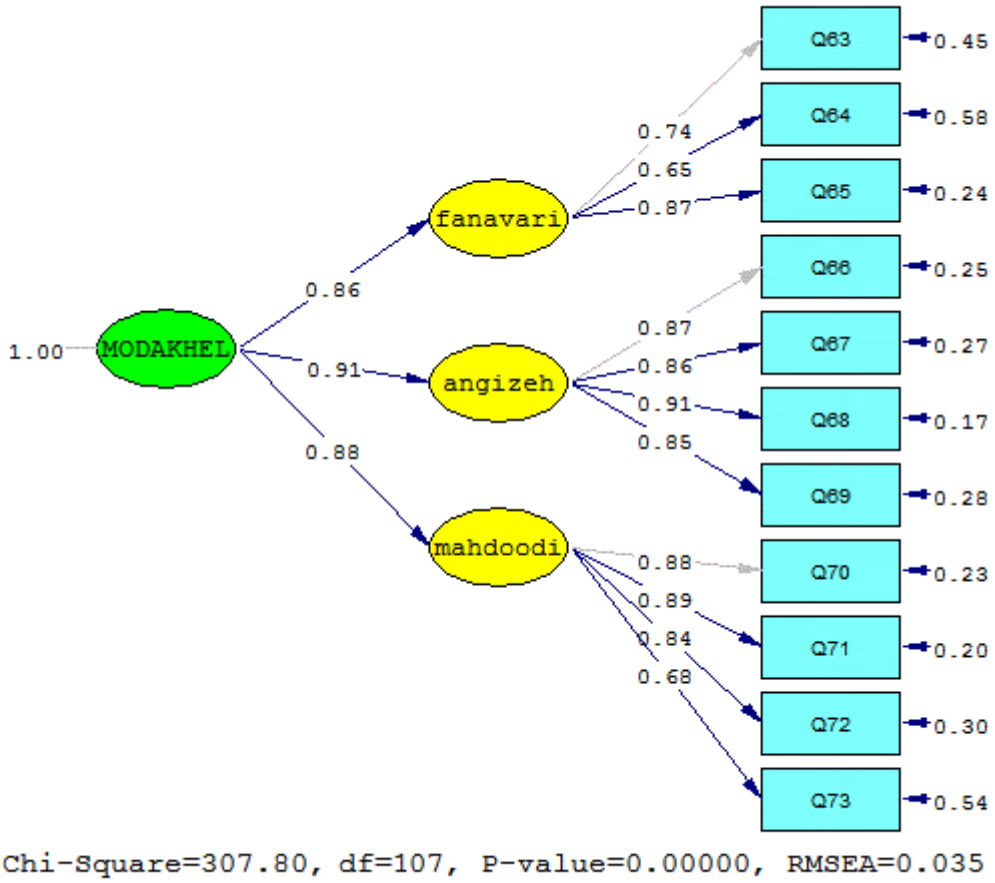

Figure 5. Standardized values for the intervening factors dimension

As can be seen, all factor loadings are greater than 0.6, indicating the high explanatory power of the components in defining the “causal factors” construct.

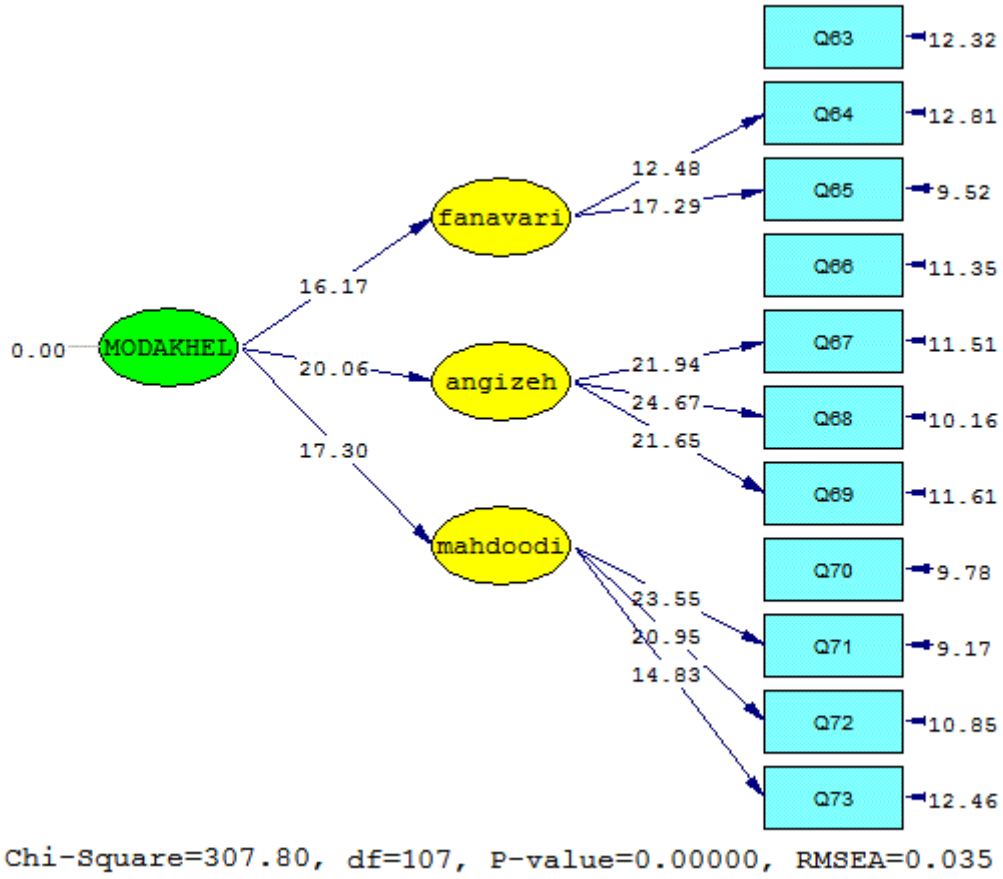

Figure 6. Significance values (t-values) for the intervening factors dimension

The significance values range from 12 to 25, which are considerably higher than the critical value of ±1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 5. Factor loadings and significance coefficients of the intervening factors components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Communication and learning technologies	0.86	16.17	Significant
Managers' motivation and individual characteristics	0.90	20.06	Significant
Managers' time and occupational constraints	0.88	17.30	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of intervening factors. In other words,

each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 6. Fit indices of the intervening factors measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	307.80	107	2.88	0.035	0.95	0.94	0.93	0.91	0.90
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good	Very good	Excellent	Excellent	Good	Good	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.88) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.035 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.91 and AGFI = 0.90 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (0.95 and 0.94) indicate a high degree of correspondence between the proposed model and the actual data.

Overall, based on all the indices, the measurement model of “intervening factors” has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

Confirmatory Factor Analysis of the Central Phenomenon

The output of the confirmatory factor analysis test for the central phenomenon consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

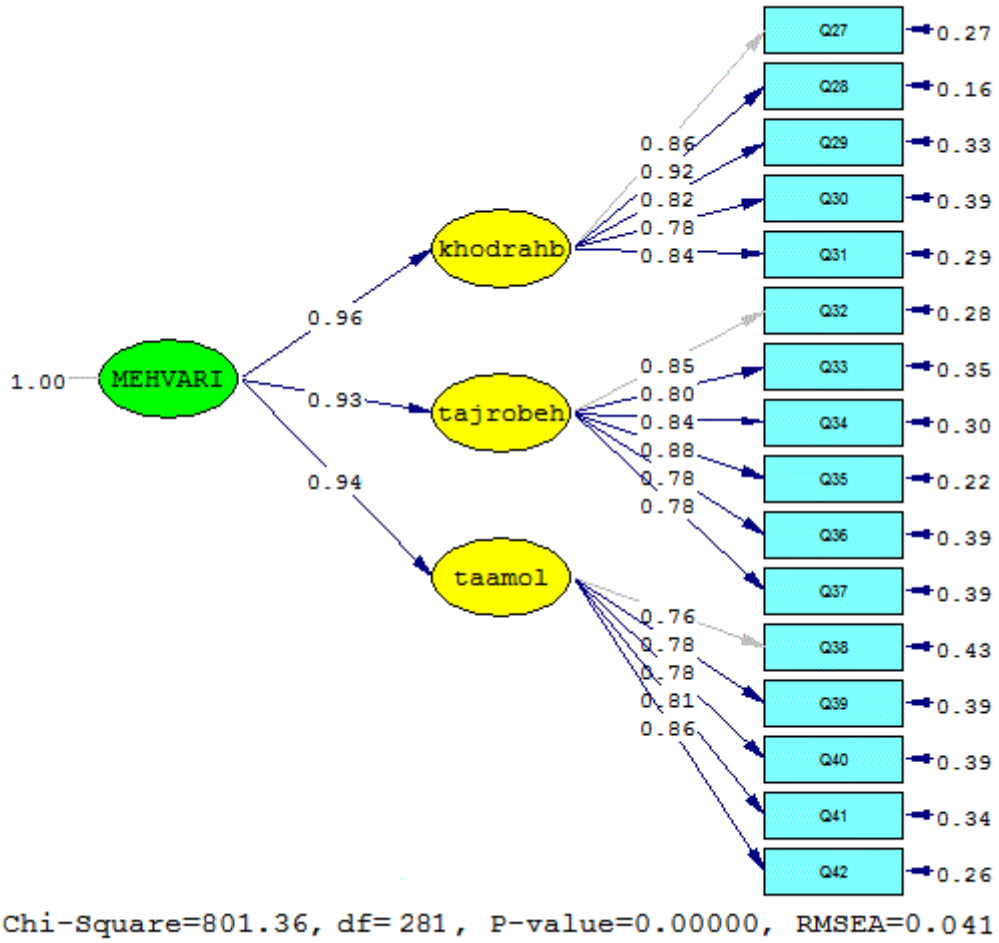

Figure 7. Standardized values for the central phenomenon

As can be seen, all factor loadings are greater than 0.7, indicating the high explanatory power of the components in defining the "central phenomenon" construct.

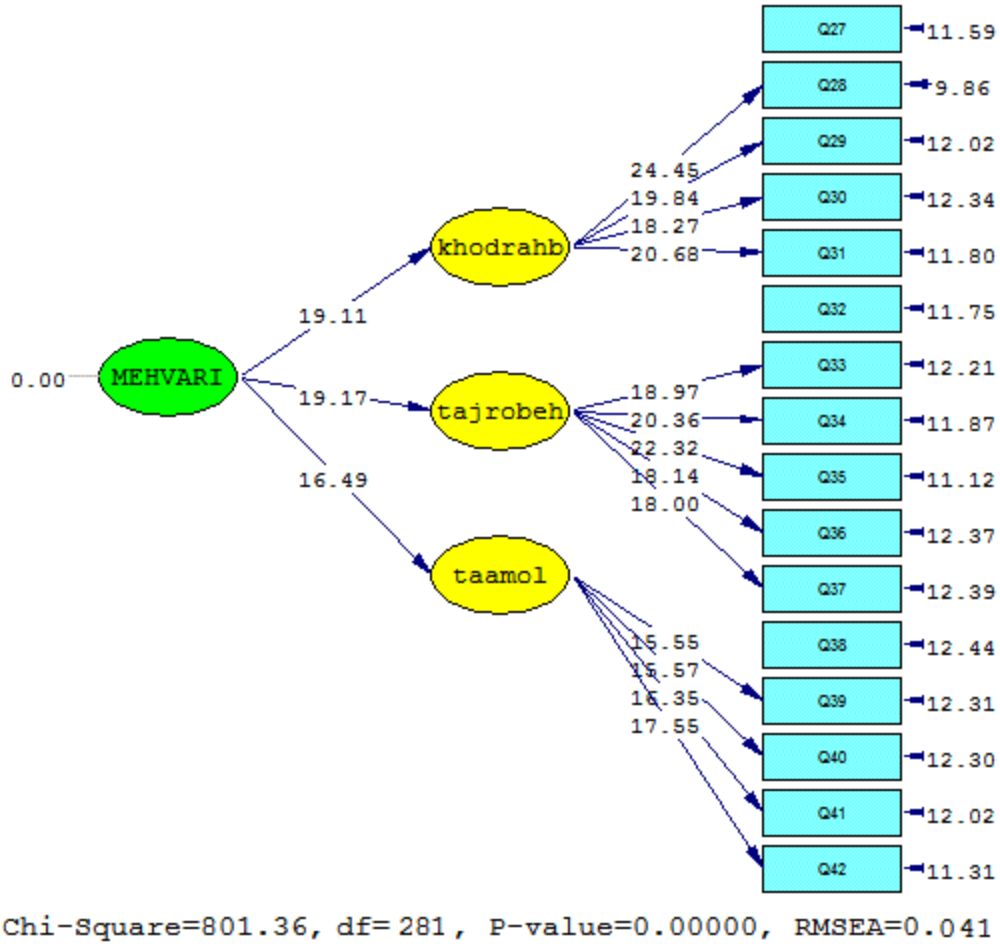

Figure 8. Significance values (t-values) for the central phenomenon

The significance values range from 15 to 25, which are considerably higher than the critical value of 1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 7. Factor loadings and significance coefficients of the central phenomenon components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Self-direction in professional learning	0.96	19.11	Significant
Experience-based managerial learning	0.93	19.17	Significant
Continuous reflective learning	0.94	16.49	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of the central phenomenon. - The very

high factor loadings show that the central phenomenon plays a role in enhancing the professional development of elementary school principals. - The strong significance coefficients indicate a stable and meaningful relationship between the components and the construct.

In other words, each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 8. Fit indices of the central phenomenon measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	801.36	281	2.85	0.041	0.97	0.97	0.95	0.93	0.91
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good	Very good	Excellent	Excellent	Good	Excellent	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.85) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.041 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.93 and AGFI = 0.91 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (both 0.97) indicate a high degree of correspondence between the proposed model and the actual data. - This dimension has high theoretical and statistical coherence.

Overall, based on all the indices, the measurement model of the “central phenomenon” has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

Confirmatory Factor Analysis of the Strategies Dimension

The output of the confirmatory factor analysis test for the strategies dimension consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

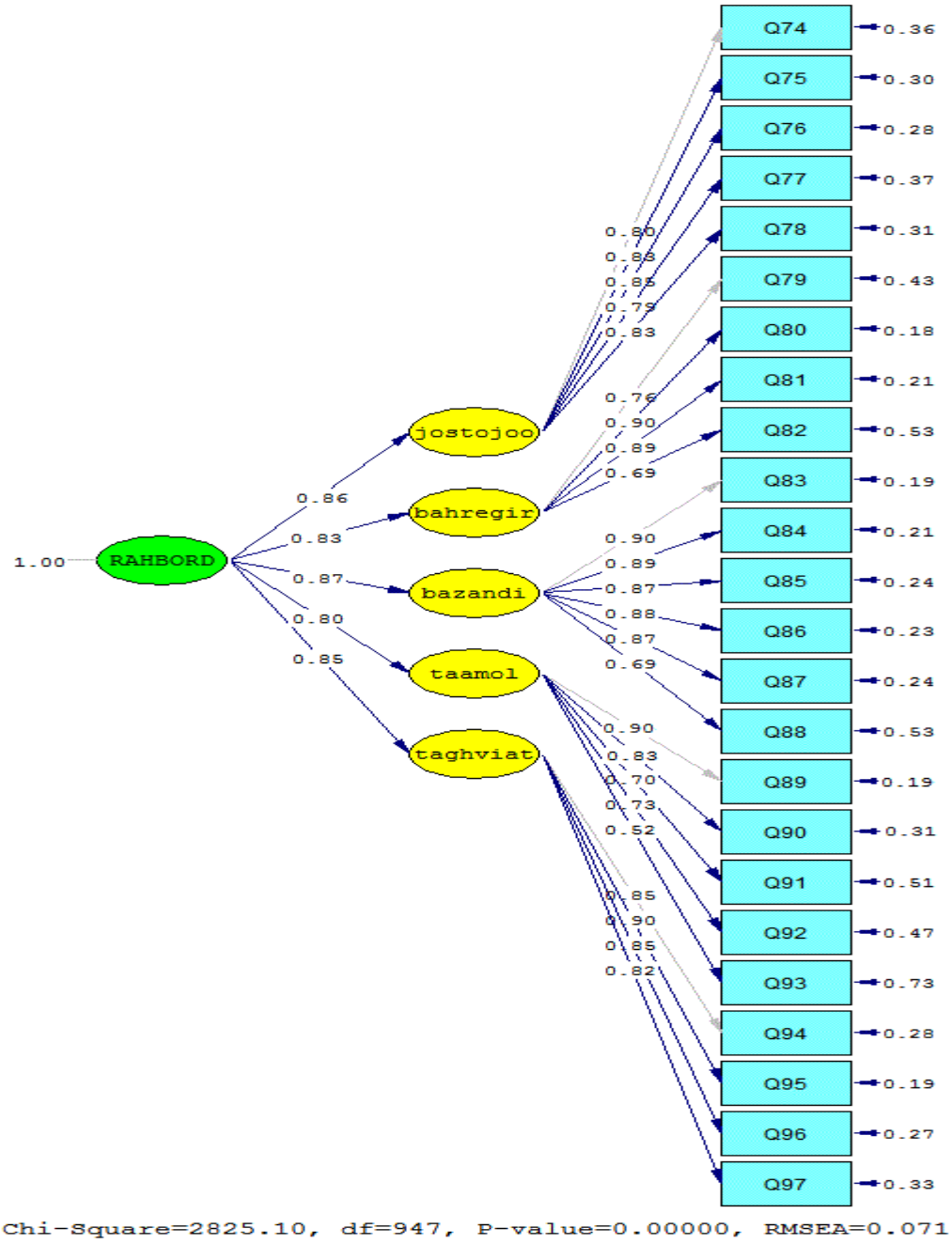

Figure 9. Standardized values for the strategies dimension

As can be seen, all factor loadings are greater than 0.5, indicating the high explanatory power of the components in defining the "strategies" construct.

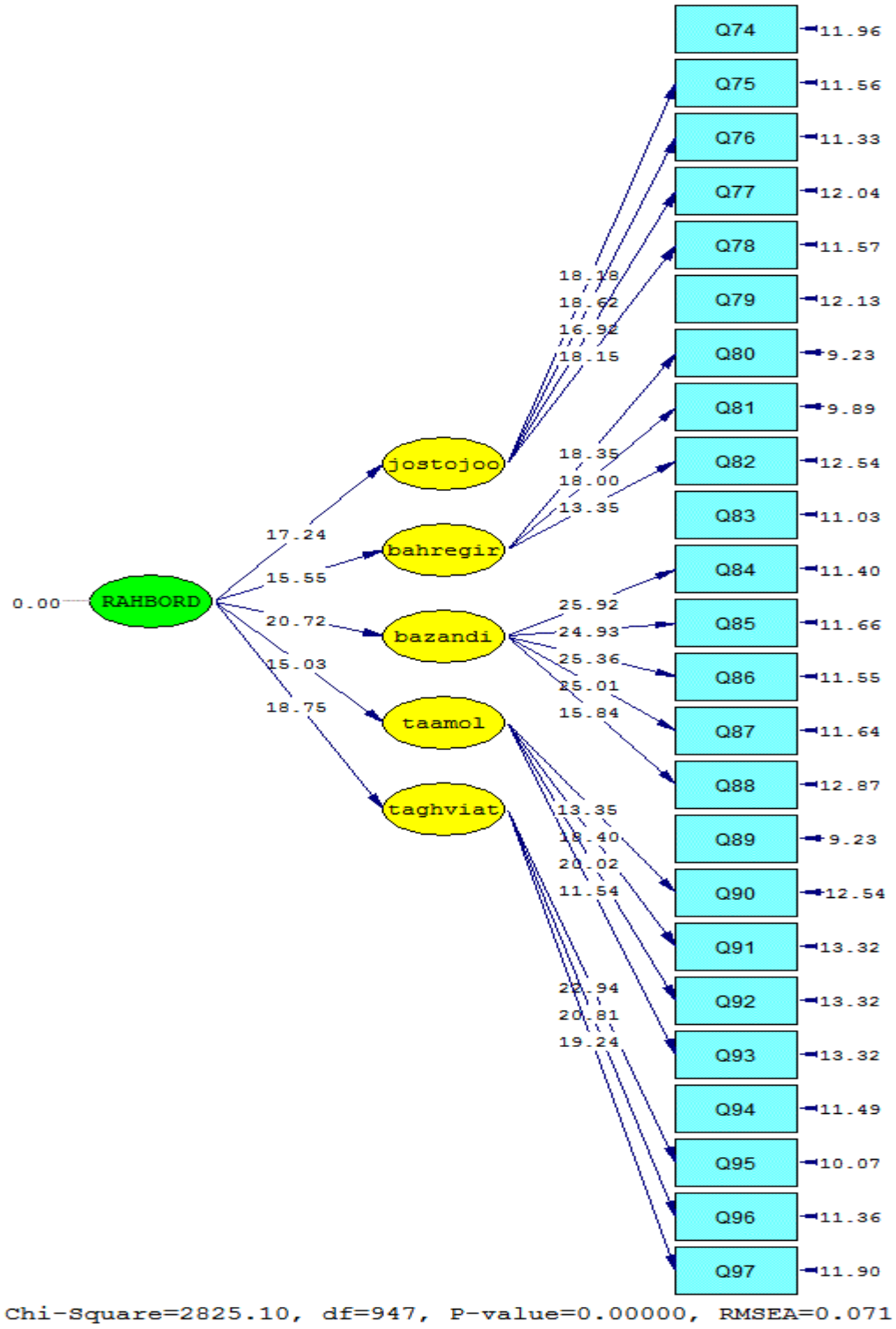

Figure 10. Significance values (t-values) for the strategies dimension

The significance values range from 13 to 26, which are considerably higher than the critical value of ±1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 9. Factor loadings and significance coefficients of the strategies components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Active pursuit of professional knowledge	0.86	17.24	Significant
Utilization of technology and learning resources	0.83	15.55	Significant
Reflection on managerial experiences	0.87	20.72	Significant
Professional networking among managers	0.81	15.03	Significant
Collaborative learning in schools	0.85	18.75	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of strategies. In other words, each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 10. Fit indices of the strategies measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	2825.10	947	2.98	0.071	0.94	0.94	0.93	0.91	0.90
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good	Adequate	Good	Good	Good	Good	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.98) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.071 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.91 and AGFI = 0.90 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (both 0.94) indicate a high degree of correspondence between the proposed model and the actual data.

Overall, based on all the indices, the measurement model of "strategies" has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

The results of the confirmatory factor analysis showed that the construct "strategies for the professional development of elementary school principals with the heutagogy approach" has a good fit, and the items related to this construct have acceptable and significant factor loadings.

This indicates that the designed items have been able to adequately explain the concept of strategies for the professional development of school principals.

Confirmatory Factor Analysis of the Consequences Dimension

The output of the confirmatory factor analysis test for the consequences dimension consists of two diagrams — standardized coefficients and significance levels — which were calculated and are presented as follows:

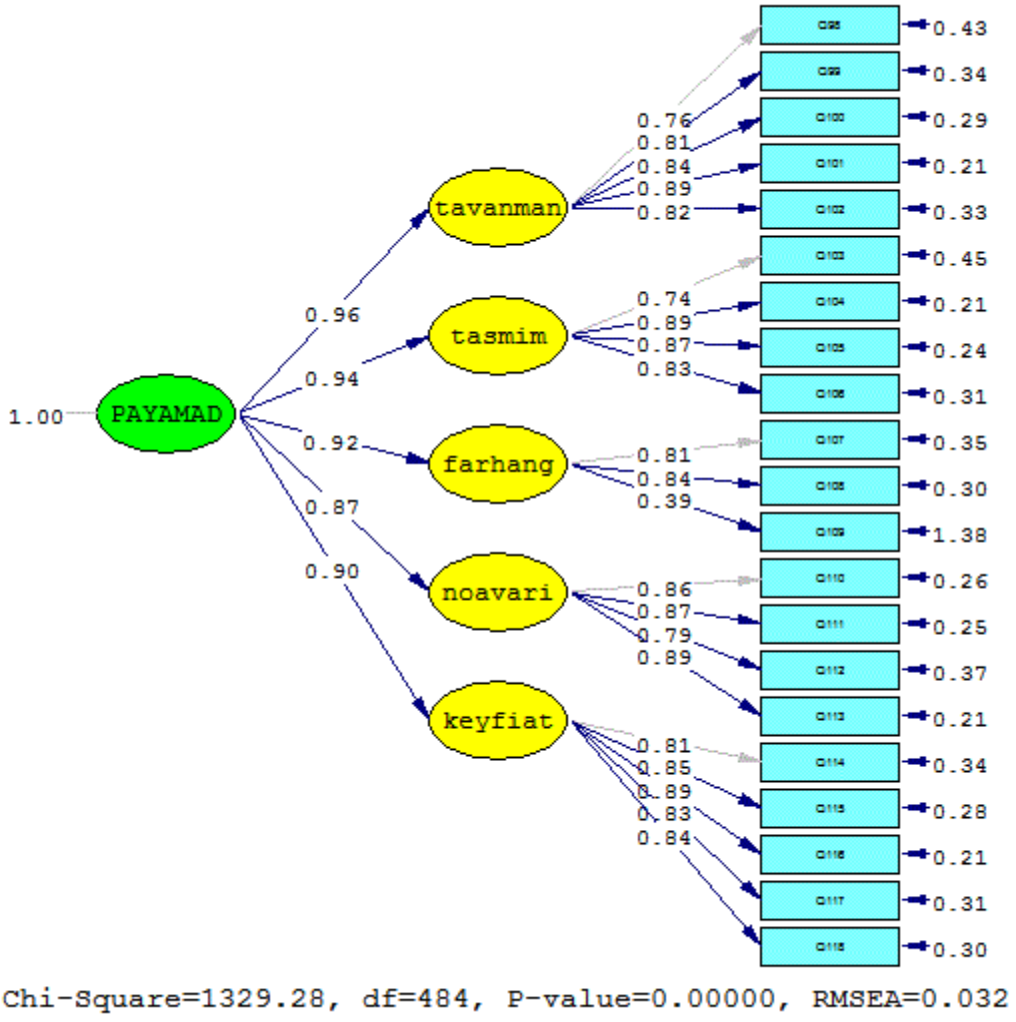

Figure 11. Standardized values for the consequences dimension

As can be seen, all factor loadings, except for indicator 109, are greater than 0.7, indicating the high explanatory power of the components in defining the “consequences” construct.

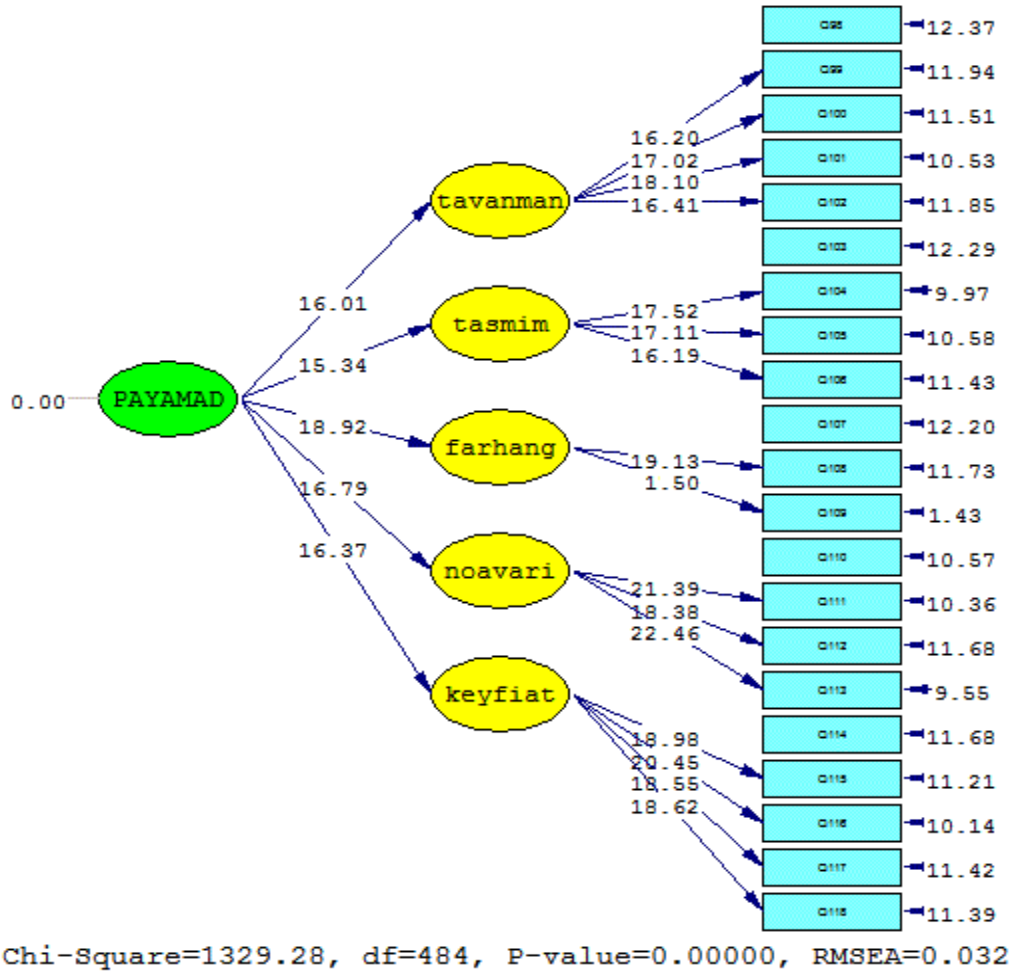

Figure 12. Significance values (t-values) for the consequences dimension

The significance values range from 15 to 23, which are considerably higher than the critical value of ±1.96; therefore, the relationships between the indicators and the construct are considered significant at the 0.001 confidence level.

Table 11. Factor loadings and significance coefficients of the consequences components

Components	Standardized factor loading (λ)	Significance coefficient (T-value)	Result
Professional empowerment of managers	0.96	16.01	Significant
Improved managerial decision-making	0.94	15.34	Significant
Formation of a school learning culture	0.92	18.92	Significant
Innovation in school management	0.87	16.79	Significant
Improved student learning and performance	0.90	16.37	Significant

These results indicate that the construct in question has favorable convergent validity, and the selected indicators are significantly related to the concept of consequences. In other words, each component makes a notable contribution to explaining the latent dimension, and the measurement model of this construct has considerable statistical stability.

Table 12. Fit indices of the consequences measurement model

Fit indices	χ^2	df	χ^2/df	RMSEA	CFI	IFI	RFI	GFI	AGFI
Obtained value	1329.28	484	2.75	0.032	0.97	0.96	0.96	0.94	0.93
Acceptable range	—	—	< 3	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90
Interpretation	—	—	Good	Very good	Excellent	Excellent	Good	Good	Good

The results obtained show: - The chi-square to degrees-of-freedom ratio (χ^2/df = 2.75) falls within the acceptable range (< 3), indicating that the model has an overall good fit. - The RMSEA value of 0.032 is also below 0.08, indicating a small approximation error between the observed and estimated covariance matrices. - The values of GFI = 0.94 and AGFI = 0.93 indicate the goodness of fit and the adjusted adequacy of the model, and fall within a very favorable range. - Likewise, incremental indices such as CFI and IFI (0.97 and 0.96) indicate a high degree of correspondence between the proposed model and the actual data.

Overall, based on all the indices, the measurement model of "consequences" has a very favorable and statistically acceptable fit and can be included as a valid construct in the final structural analysis.

The results of the confirmatory factor analysis showed that the construct "consequences of the professional development of elementary school principals with the heutagogy approach" has a good fit, and the items related to this construct have acceptable and significant factor loadings. This indicates that the indicators considered have been able to adequately explain the various dimensions of the outcomes resulting from enhancing the professional development of elementary school principals.

Discussion

The aim of the present study was to validate the professional development model of elementary school principals with an emphasis on the heutagogy approach. Analysis of the results showed that

the professional development model of elementary school principals with an emphasis on the heutagogy approach has favorable scientific and statistical validity. To examine the validity of the model, confirmatory factor analysis was used to assess the degree of correspondence between the model's theoretical structure and the empirical data. The results showed that, out of the 118 identified indicators, 117 indicators, along with all 25 components and 6 main dimensions, were confirmed, and only one indicator (indicator 109) was removed due to a factor loading below the acceptable threshold.

Examination of the factor loadings showed that all the factor loadings obtained for the indicators (except for the removed indicator) were greater than 0.4, indicating an appropriate and acceptable relationship between the indicators and their respective components. Moreover, the significance coefficients obtained from the confirmatory factor analysis fell outside the range of ±1.96, indicating that the relationships between the indicators and the model constructs are significant at the 95% confidence level. These results indicate that the identified indicators have been able to significantly measure their respective components, and each of the components also plays an effective role in explaining the model's six dimensions. In other words, the model's factorial structure has internal coherence and consistency, and the indicators appropriately represent the intended theoretical constructs.

On the other hand, the results of the confirmatory factor analysis showed that the identified components, together, form a coherent structure that ultimately leads to the explanation of an underlying construct in the form of the professional development model of elementary school principals with the heutagogy approach. This indicates that the model's six dimensions are not only conceptually related to one another but also show a statistically significant correlation, and collectively they are able to comprehensively explain the concept of the professional development of elementary school principals within the framework of self-directed learning.

Within the framework of the research's paradigmatic model, the three constructs of "central phenomenon," "strategies," and "consequences" are presented as the most important elements explaining the process of professional development of elementary school principals with the heutagogy approach. Analysis of the measurement model results showed that the indicators related to the central phenomenon have acceptable factor loadings and have been able to adequately reflect the concept of the professional development of elementary school principals with the heutagogy

approach across various individual, organizational, and managerial dimensions. This construct in fact represents the core of the research's conceptual model, which is influenced by the other identified factors in the form of causal, contextual, and intervening conditions, and ultimately leads, through a set of strategies, to specific consequences.

Next, the construct "strategies," as the set of measures and policies employed in the professional development of elementary school principals with the heutagogy approach, was examined. The results of the confirmatory factor analysis showed that the indicators related to this construct also have favorable factor loadings. This finding indicates that the strategies identified in the study cover important dimensions of educational, managerial, and supportive measures aimed at improving principals' professional development. Implementing these strategies can lay the groundwork for improving principals' professional empowerment, the quality of managerial decision-making, the formation of a learning culture in schools, increased innovation in schools, and improved learning quality.

The construct "consequences" represents the results and achievements obtained from implementing the strategies for the professional development of elementary school principals with the heutagogy approach. The results of the analysis showed that the indicators of this construct also have appropriate factor loadings and are able to adequately explain the multidimensional consequences of the professional development of elementary school principals. These consequences are observable at various levels. In fact, the realization of these consequences indicates the effectiveness of the adopted strategies and the success of the empowerment and development programs for principals.

Overall, the results of the examination of the measurement model showed that the research constructs have appropriate validity and fit, and the indicators used have been able to significantly measure the various dimensions of the research's conceptual model. This indicates that the conceptual framework extracted from the qualitative stage of the research has appropriate theoretical and empirical coherence and has the capacity to be tested within the framework of structural equation modeling.

The final results show that the proposed model has acceptable validity and reliability, and its structure has been statistically confirmed. The confirmation of 117 out of the 118 indicators identified in the qualitative stage indicates a high degree of correspondence between the qualitative

and quantitative findings of the study, and shows that the process of extracting indicators and components from the qualitative data was carried out with appropriate rigor and coherence. It can therefore be concluded that the professional development model of elementary school principals with an emphasis on the heutagogy approach has the necessary validity and can be used as a valid framework for explaining and enhancing the professional development of principals within the educational system.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Islamic Azad University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection, and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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