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Analysis and Standardization of Indicators of Technical Skills of First Secondary Level Teachers

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A B S T R A C T

Purpose: The aim of this research was to analyze and standardize the indicators of technical skills among first secondary level teachers in Karaj in 2021.

Methods and Materials: The research method was descriptive and contextual. The study population comprised all first secondary level teachers across the four districts of Karaj, from which a sample of 329 teachers was selected using a cluster random sampling method. A researcher-developed questionnaire consisting of 27 items was utilized. Data analysis was conducted using confirmatory factor analysis with the aid of Amos software.

Findings: The findings indicate that each component of the technical skills questionnaire, which includes consulting skills, teaching skills, classroom management skills, evaluation skills, and information and communication technology skills, demonstrated favorable internal consistency.

Conclusion: Consequently, it was concluded that each item possesses sufficient power to measure the components of teachers' technical skills, and each component effectively measures the broader construct of teachers' technical skills.

Keywords: *technical skills of teachers, standardization, high school teachers, competency model*

1. Introduction

Historically, the belief that knowledge alone was sufficient for teaching prevailed; possessing information was regarded as the primary condition for education. However, in contemporary times, utilizing skills to tackle major challenges has become critical. Experts now argue that mere knowledge of educational content is inadequate; instead, additional competencies, such as technical skills, are essential, as every profession relies heavily on these skills. The division of tasks within the educational sphere demands that individuals acquire specialized competencies to perform effectively. Consequently, emphasis on teachers' technical skills and mastery of specialized pedagogical techniques forms a foundational aspect of the teaching profession (Herawati et al., 2024; Sadat Mousavi & Ebrahimi, 2024; Sun et al., 2024).

The dynamic nature of today's world necessitates innovative thinking in education to keep pace with rapid and significant global transformations (Sadat Mousavi & Ebrahimi, 2024). Thus, the survival and efficacy of educational systems rely on the diverse knowledge, expertise, abilities, and skills of human resources, particularly teachers. The better prepared and more skilled teachers are, the greater their contribution to enhancing system efficiency. A qualitative shift toward optimized and effective education is imperative because human resources and their training are key determinants of societal progress and development. The modern world requires teachers who not only excel in teaching methods but also exhibit critical thinking and adaptability, remaining responsive to the ever-evolving information landscape and reflecting upon it personally and professionally (Ranjdoost & Aiwazi, 2021).

Education, as a pivotal instrument for scientific advancement, places teachers in a position where they must adapt, like other professional groups, to rapidly changing conditions and evolving technological demands (Por Jafari shir Joposht et al., 2024; Salman Al-Oda et al., 2024). Ahmadi et al. (2016) emphasizes that adapting to these changes requires technological preparedness and the ability to evaluate and align with new developments across various life dimensions. Hence, the success of educational systems is more dependent on the knowledge and skills of teachers than any other factor (Ahmadi et al., 2016). Continuous knowledge updating throughout teachers' careers is essential for their effectiveness (Ram & Esmaeili Shad, 2018; Rasouli et al., 2024). Achieving purposeful education involves thorough professional studies and strategic activities, focusing on comprehensive knowledge and specialized qualifications. Teachers must employ advanced scientific methods and tools to deliver effective education, which demands concerted, ongoing efforts from educational stakeholders to achieve these goals (Şahin et al., 2024; Salari & Seadatee Shamir, 2021).

Teacher effectiveness hinges on a blend of various technical skills, influenced by their personal adaptability and capabilities (Sotoudeh Moghadam et al., 2024; Tajari et al., 2019). Effective categorization and strategic planning for teachers' professional growth are necessary, allowing them to appropriately select and utilize diverse teaching techniques. A proficient teacher needs to adopt creative skills and employ technical competencies in program development. Educational advancement necessitates a transformation in educators' knowledge, attitudes, skills, and methods, requiring professionalization across the teaching profession (Gholamian et al., 2019). The central role of teachers in the education system means that any deficiencies within the system are significantly impacted by teacher performance.

Dashtestani (2014) reports that many teachers lack adequate technological and pedagogical content knowledge necessary for implementing technology-driven education. He advocates for the integration of technology training into teacher education programs (Dashtestani, 2014). Weinert introduced the concept of skills and competence as essential for job performance, defining competence as a cognitive structure that drives specific behaviors. This theoretical approach underpins efforts to elevate teachers' job productivity and professional development. Teachers are thus regarded as key contributors to the sustainability of educational systems and play a decisive role in shaping educational outcomes (Mehrmohammadi, 2012; Naderi et al., 2010; Pajhoheshgar, 2018).

Teachers' skills encompass a combination of qualifications—educational, personal, professional, and social—all influenced by individual capabilities and adaptability (Naderi et al., 2010; Pajhoheshgar, 2018). Fundamental competence includes subject knowledge mastery, while behavioral performance guides skill application (Ahmadi et al., 2016; Mehrmohammadi, 2012; Murray et al., 2015). Communication is a critical skill that enables interpersonal interaction, involving the exchange of information, thoughts, and feelings through verbal and non-verbal means (Ranjdoost & Aiwazi, 2021). Given the evolving nature of classrooms as educational subsystems,

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teacher management styles significantly influence educational outcomes. Effective communication, facilitated by proficient classroom management, is vital for a constructive learning environment (Talebi Khansari, 2019).

Research underscores the importance of teacher competencies and highlights the need to assess these skills comprehensively. Kalantaripour and Madiri Khamene (2021) demonstrated that classroom management strategies and stress coping methods positively impact student success, though coping styles did not mediate the relationship between management and achievement (Kalantaripour & Madiri Khamene, 2021). Talebi Khansari (2019) identified classroom management practices and listening skills as strong predictors of academic motivation (Talebi Khansari, 2019). Mansouri et al. (2015) confirmed teachers' positive attitudes toward technology in education (Mansouri et al., 2015). Therefore, effective human resource management is crucial for achieving organizational goals, making teacher skill identification a top priority. Existing research shows dissatisfaction with current tools for assessing teacher competency, indicating a gap in theoretical frameworks. Addressing this issue requires the development and validation of reliable tools to measure teachers' technical skills, including counseling, teaching, classroom management, evaluation, and ICT skills. The primary goal of this research is to establish a robust instrument for assessing these competencies to enhance the quality and effectiveness of education systems.

2. Methods and Materials

The research method employed in this study was a mixed-method approach, specifically using a sequential guided exploratory design with an instrument-development model. The exploratory design, similar to explanatory research design, involves a two-phase process. Given the complex and largely unexplored nature of many phenomena, exploratory methods are particularly suitable. In the first phase, qualitative methods, using interview tools, were employed to identify the unknown aspects and dimensions of the phenomenon under study. In the second phase, quantitative methods were used to establish the causal relationships between the identified dimensions.

To determine the components influencing teacher competence, the grounded theory method, based on Strauss and Corbin's approach, was applied. Components and indicators of teachers' technical skills were derived from the qualitative phase and used to develop the questionnaire items. The questionnaire items were then evaluated for content validity through quantitative measures, specifically using the Content Validity Ratio (CVR) and Content Validity Index (CVI). Items were rated on a five-point Likert scale.

Initially, 10 experts in the field of academic competence, selected purposefully based on their expertise, background, and knowledge, contributed to the qualitative analysis. After identifying the components and analyzing the data, the core paradigmatic model of the phenomenon was developed.

The study aimed to construct, validate, and standardize a research-based questionnaire assessing first secondary level teachers' technical skills. To ensure construct validity and confirm the model, the researcher's questionnaire, structured around identified components, underwent confirmatory factor analysis. The content validity assessment involved 15 experts from Tehran University of Research Sciences, Islamic Azad University (Karaj branch), and Farhangian University. These experts reviewed the items developed from semi-structured interviews, leading to several iterations of revision and refinement. The final instrument, comprising 27 items, categorized technical skills into four main areas: counseling skills, teaching and classroom management skills, evaluation skills, and technology and information skills.

For sampling, the sample size was determined using the Morgan and Krejcie table, and a cluster random sampling method was applied. The sample consisted of 329 teachers (211 females and 118 males). Of these participants, 188 (57.1%) held a bachelor's degree, 112 (34%) had a master's degree, and 29 (8.8%) had other qualifications. The researcher-developed questionnaire was administered to this sample. Data analysis was conducted using confirmatory factor analysis with Amos software. The instrument-development model proved effective in identifying the key components necessary for assessing the technical skills of first secondary level teachers.

3. Findings and Results

A total of 329 teachers (211 women and 118 men) participated in this study. Of these, 103 participants (31.3%) were under 30 years old, 110 (33.4%) were aged 31 to 40, 96 (29.2%) were between 41 and 50 years old, and 20 (6.1%) were over 50. In terms of education level, 188 participants (57.1%) held a bachelor's degree, 112 (34%) had a master's degree, and 29 (8.8%) had a doctoral degree. Table 1 presents the mean, standard deviation, skewness, and

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kurtosis of the items in the teacher technical skills questionnaire. The technical skills construct consists of four components: counseling skills (items 1–3), teaching and classroom management skills (items 4–21), evaluation skills (items 22–24), and information technology skills (items 25–27).

Table 1

Mean, Standard Deviation, Skewness, and Kurtosis for Each Questionnaire Item

Component	Item	Mean (SD)	Skewness (Kurtosis)
Counseling skills	1	3.45 (1.44)	-0.39 (-1.22)
	2	3.57 (1.36)	-0.52 (-0.98)
	3	3.33 (1.34)	-0.37 (-1.02)
Teaching and classroom management skills	4	2.48 (1.45)	0.48 (-1.17)
	5	3.53 (1.51)	-0.55 (-1.22)
	6	2.94 (1.21)	1.26 (0.59)
	7	2.29 (1.26)	0.63 (-0.72)
	8	2.41 (1.42)	0.56 (-1.07)
	9	2.25 (1.38)	0.72 (-0.87)
	10	2.88 (1.55)	0.16 (-1.50)
	11	2.66 (1.53)	0.33 (-1.39)
	12	3.51 (1.50)	-0.55 (-1.19)
	13	3.40 (1.56)	-0.44 (-1.35)
	14	2.36 (1.50)	0.64 (-1.11)
	15	2.99 (1.29)	1.15 (0.10)
	16	2.90 (1.48)	0.09 (-1.41)
	17	3.50 (1.59)	-0.55 (-1.30)
	18	2.37 (1.41)	0.64 (-0.93)
	19	3.45 (1.56)	-0.50 (-1.29)
	20	3.17 (1.39)	0.83 (-0.73)
	21	3.30 (1.53)	-0.30 (-1.43)
Evaluation skills	22	3.92 (1.35)	-1.08 (-0.12)
	23	2.99 (1.43)	0.04 (-1.29)
	24	3.63 (1.46)	-0.72 (-0.89)
IT skills	25	3.87 (1.38)	-0.99 (-0.32)
	26	4.09 (1.35)	-1.31 (-0.38)
	27	3.55 (1.35)	-0.48 (-0.95)

The mean scores indicate that item 26 had the highest mean, while item 9 had the lowest. As shown in Table 1, the skewness and kurtosis indices for all items were within ±2, indicating a normal data distribution.

This study assessed the fit of the teacher technical skills questionnaire model using confirmatory factor analysis (CFA) with AMOS 24.0 software and the maximum likelihood (ML) estimation method. Three measurement models were compared: a one-factor model, a four-factor model, and a hierarchical four-factor model. The one-factor model assumed all items loaded onto a single factor, while the four-factor model allowed items to load onto their respective latent factors, which were correlated. The hierarchical four-factor model featured items loading onto their latent factors, which, in turn, loaded onto a general factor. Table 2 shows the fit indices for these models.

Table 2

Fit Indices for the Technical Skills Questionnaire Measurement Models

Indicators	One-factor model	Four-factor model	Modified four-factor model	Hierarchical four-factor model	Cut-off Point
Chi-square	1547.57	919.02	838.41	717.32	-
Degrees of freedom	324	318	320	316	-
χ^2/df	4.78	2.89	2.62	2.27	< 3

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GFI	0.651	0.876	0.891	0.903	> 0.90
AGFI	0.593	0.831	0.845	0.857	> 0.85
CFI	0.757	0.898	0.908	0.922	> 0.90
RMSEA	0.107	0.076	0.070	0.062	< 0.08

The fit indices for the one-factor model did not meet the acceptable criteria. However, both the four-factor and hierarchical four-factor models, aside from the RMSEA and X^2/df indices, demonstrated acceptable fit. Specifically, the hierarchical four-factor model showed fit indices closer to the desired cut-off values, suggesting a better fit compared to the competing models. Using modification indices, covariances were added between the errors of items 6 and 15, 7 and 14, 8 and 15, and 9 and 15, resulting in improved fit indices for the hierarchical four-factor model (χ^2/df = 2.27, CFI = 0.922, GFI = 0.903, AGFI = 0.857, RMSEA = 0.062).

Table 3

Measurement Model Parameters for the Teacher Technical Skills Questionnaire

Level	Local Indicator Variables	b	SE	β	t
First	Counseling skills - item 1	1		0.808	
	Counseling skills - item 2	0.862	0.075	0.737	11.44**
	Counseling skills - item 3	0.742	0.071	0.643	10.39**
	Teaching and class management - item 4	1		0.598	
	Teaching and class management - item 5	1.494	0.125	0.854	11.97**
	Teaching and class management - item 6	0.698	0.087	0.499	8.05**
	Teaching and class management - item 7	0.856	0.093	0.589	9.20**
	Teaching and class management - item 8	0.950	0.105	0.579	9.07**
	Teaching and class management - item 9	0.754	0.098	0.474	7.71**
	Teaching and class management - item 10	1.071	0.115	0.596	9.29**
	Teaching and class management - item 11	1.189	0.117	0.670	10.15**
	Teaching and class management - item 12	1.385	0.121	0.796	11.44**
	Teaching and class management - item 13	1.478	0.127	0.820	11.67**
	Teaching and class management - item 14	1.110	0.113	0.639	9.80**
	Teaching and class management - item 15	0.723	0.089	0.505	8.12**
	Teaching and class management - item 16	1.077	0.111	0.628	9.66**
	Teaching and class management - item 17	1.530	0.130	0.835	11.80**
	Teaching and class management - item 18	0.939	0.104	0.575	9.03**
	Teaching and class management - item 19	1.463	0.126	0.813	11.60**
	Teaching and class management - item 20	0.624	0.096	0.388	6.47**
	Teaching and class management - item 21	1.383	0.123	0.780	11.29**
	Evaluation skill - item 22	1		0.775	
	Evaluation skill - item 23	0.887	0.075	0.651	11.88**
	Evaluation skill - item 24	1.205	0.074	0.867	16.38**
	Information technology skills - item 25	1		0.816	
	Information technology skills - item 26	0.982	0.072	0.821	13.69**
	Information technology skills - item 27	0.607	0.070	0.507	8.72**
Second	Technical skills - counseling skills	1		0.608	
	Technical skills - teaching/classroom management	1.100	0.143	0.900	7.71**
	Technical skills - evaluation skills	1.443	0.164	0.876	8.80**
	Technical skills - IT skills	1.177	0.147	0.740	7.99**

Note: In the first-order analysis, items 1, 4, 22, and 25 were fixed with a loading of 1, and therefore, their standard errors and significance levels were not calculated. ** indicates significance ($p < 0.01$).

In the first-order analysis, the highest factor loading was for item 24 (β = 0.867), while the lowest was for item 20 (β = 0.388). In the second-order analysis, factor loadings for the components were as follows: counseling skills (0.608), teaching and classroom management skills (0.900), evaluation skills (0.876), and information technology skills (0.740). All standard factor loadings were above 0.32, indicating sufficient power to measure the components of teachers' technical skills (Table 3).

Figure 1 and the associated findings demonstrate that each item in the four components of the teacher technical skills questionnaire effectively measures its respective

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component. Moreover, each component significantly contributes to the overall construct of teacher technical skills.

To assess the internal correlation of the questionnaire, Pearson correlation coefficients between components were calculated (Table 4).

Table 4

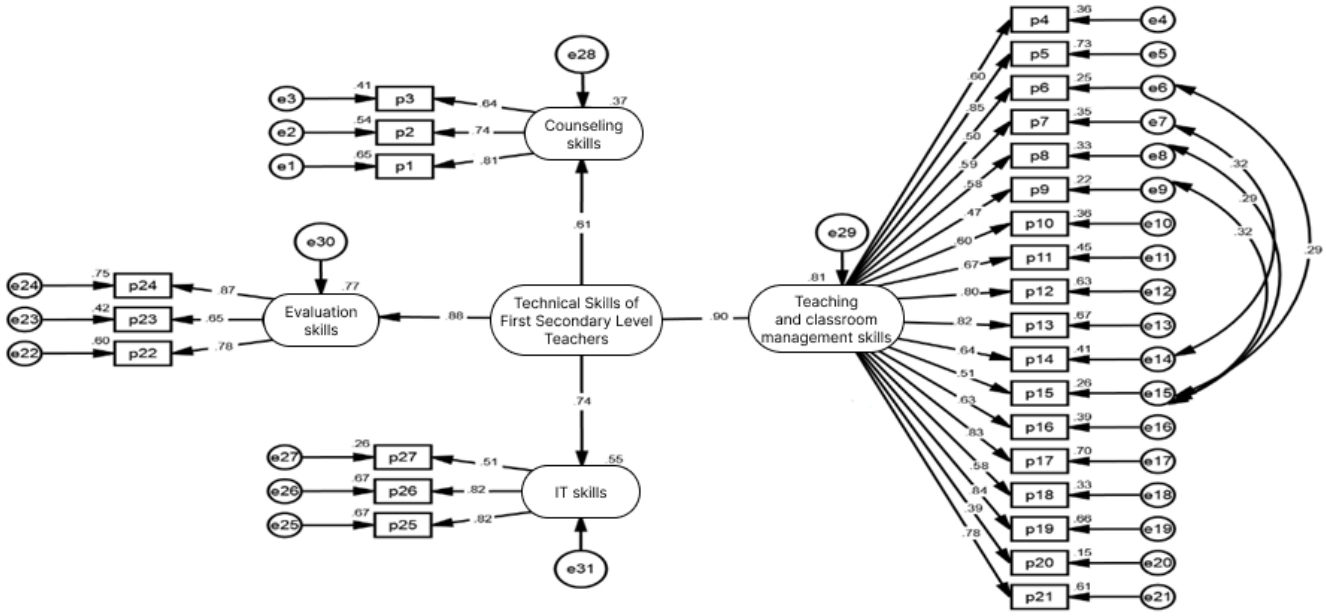
Correlation Coefficients Between Components of the Teacher Technical Skills Questionnaire

Research Variables	1	2	3	4	5
1. Counseling skills	-				
2. Teaching and classroom management skills	0.38	-			
3. Evaluation skills	0.46	0.65	-		
4. IT skills	0.23	0.43	0.58	-	
5. Total score	0.53	0.86	0.79	0.59	
Mean	10.35	52.39	10.54	11.50	84.78
Standard Deviation	3.45	11.50	3.60	3.33	13.44
Cronbach's Alpha	0.78	0.94	0.81	0.75	0.92

The correlation coefficients between components were positive and significant. The internal consistency of the questionnaire was verified through Cronbach's alpha coefficients, which were all above 0.7, confirming favorable internal consistency. Specifically, Cronbach's alpha for counseling skills was 0.78, teaching and classroom management skills was 0.94, evaluation skills was 0.81, information technology skills was 0.75, and the total score was 0.92. These results indicate that the teacher technical skills questionnaire possesses adequate internal reliability and consistency.

Figure 1

Measurement Model of the Teacher Technical Skills Questionnaire Using Standard Data



4. Discussion and Conclusion

Educational transformations today demand the development of skills and behaviors that shape competencies into models. Competence is defined as the observable and

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measurable amalgamation of knowledge, skills, abilities, and personal attributes that enhance individual performance. Although teacher skills and expectations have evolved, the fundamental roles of teachers have remained constant. This study, primarily quantitative, distinguishes between basic competencies and specialized technical skills. The "teacher's technical skills" construct comprises four subcategories: counseling skills, teaching and classroom management skills, evaluation skills, and information and communication technology (ICT) skills. The data collection instrument used in the quantitative portion of this study was a questionnaire developed from qualitative findings.

To address the first research question—whether the factor structure of the teachers' technical skills questionnaire is supported by the collected data—the study aimed to create a model to identify the critical components of technical skills for first secondary level teachers. A preliminary 27-item questionnaire was developed through a literature review and implemented among a sample of 329 teachers. Using Pearson's correlation and confirmatory factor analysis with AMOS 24.0 software and maximum likelihood (ML) estimation, the factors and components underlying teacher skills were identified. The technical skills identified were linked to specific items, and fit indices were used to compare measurement models. The one-factor model, in which all items loaded onto a single factor, was inadequate. The four-factor model, however, restricted each item to its respective factor, yielding improved fit.

The model analysis demonstrated that each of the four components of the teachers' technical skills questionnaire possessed adequate power to measure its respective construct. Additionally, each component was effective in measuring the overall factor of teacher technical skills.

In response to the second research question regarding internal consistency, findings showed that the hierarchical four-factor model's fit indices were closer to the cut-off values preferred by experts compared to the standard four-factor model. Specifically, the lowest factor loading was for item 20 ($\beta = 0.388$). In the second-order analysis, factor loadings for counseling skills, teaching and classroom management skills, evaluation skills, and ICT skills were 0.608, 0.900, 0.876, and 0.740, respectively. Moreover, the correlation coefficients between the questionnaire components were positive and significant. Cronbach's alpha coefficients for all components exceeded 0.7, indicating strong internal consistency. Item 26 had the highest mean, while item 9 had the lowest. The data distribution was normal, as skewness and kurtosis values fell within ±2.

According to findings, none of the fit indices supported the one-factor model's adequacy. However, results shows that the hierarchical four-factor model provided a better fit than the standard four-factor model, confirming good internal consistency for all components. Each item demonstrated sufficient power to measure the components of teachers' technical skills, and each component effectively assessed the overall technical skills construct.

This study's findings align with prior studies that highlight the importance of increasing teachers' awareness of the strengths and limitations of technical skills in instructional design and content development (Abdullahi et al., 2013; Ahmadi et al., 2016; Chamundeswari, 2013; Dashtestani, 2014; Kalantaripour & Madiri Khamene, 2021; Mehrmohammadi, 2012; Naderi et al., 2010; Pajhoheshgar, 2018; Ranjdoost & Aiwazi, 2021; Shah Mohammadi, 2013). The study confirms that the hierarchical four-factor model best fits the data.

Although the research is limited to secondary school teachers in Karaj and may not be generalizable, it emphasizes the importance of technical skill classification. The tool developed in this study can be employed to assess teachers' skills, offering valuable insights for enhancing teacher competence and advancing student academic success, ultimately improving the education system. This study underscores the need for continuous updates in teacher skills. Effective teachers must anticipate societal demands, adapt to change, and update their qualifications accordingly. Therefore, developing and validating new tools to identify the technical skills of secondary school teachers remains essential.

Given the significant influence teachers have on students and the potential for acquiring and transferring skills, it is crucial to focus on the characteristics and methods of teacher education. This will ensure the development of well-rounded, competent, and adaptable educators who can respond effectively to rapid changes, resulting in more robust educational programs and teaching practices.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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