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# Design and Validation of a Skill-Oriented Learning System Model in Technical and Vocational High Schools in Tehran

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ABSTRACT

**Purpose:** The present study aimed to design and validate a skill-oriented learning system model for technical and vocational high schools in Tehran.

**Methods and Materials:** This study was applied in terms of purpose and employed a mixed-methods (qualitative–quantitative) design within a pragmatic paradigm. In the qualitative phase, semi-structured interviews were conducted with 15 experts, including university professors, executive managers, educational specialists, principals, and experienced instructors in technical and vocational education in Tehran. Participants were selected through purposeful sampling based on the principle of theoretical saturation. Qualitative data were analyzed through coding procedures, leading to the identification of the dimensions and components of the proposed model. In the quantitative phase, a researcher-made questionnaire derived from the qualitative findings was administered to 360 teachers from technical and vocational high schools in Tehran selected through stratified random sampling from a statistical population of 5,701 teachers during the 2024–2025 academic year. The validity of the instrument was confirmed through convergent and discriminant validity, while reliability was verified using Cronbach's alpha and composite reliability indices. Data analysis was performed using structural equation modeling through Smart PLS software.

**Findings:** The qualitative findings identified four major dimensions of the skill-oriented learning system, including curriculum and content, teaching–learning process, assessment and evaluation, and support and environmental context, encompassing 14 components and 50 indicators. The quantitative findings demonstrated that all structural paths in the proposed model were statistically significant. Curriculum and content had significant positive effects on assessment and evaluation ($\beta=0.470$, $t=11.456$, $p<0.001$) and the teaching–learning process ($\beta=0.732$, $t=17.598$, $p<0.001$). Support and environmental context significantly affected assessment and evaluation ($\beta=0.519$, $t=12.793$, $p<0.001$) and the teaching–learning process ($\beta=0.123$, $t=2.774$, $p=0.006$). In addition, assessment and evaluation significantly influenced the teaching–learning process ($\beta=0.132$, $t=2.665$, $p=0.008$). The model fit indices indicated strong explanatory and predictive power, with $R^2$ values of 0.934 and 0.946, $Q^2$ values of 0.651 and 0.654, and GOF values of 0.880 and 0.861 for the endogenous variables.

**Conclusion:** The findings indicate that an effective skill-oriented learning system in technical and vocational schools requires the integration of competency-based curricula, active and flexible teaching–learning processes, authentic assessment systems, and strong environmental and industrial support. The proposed model demonstrated high validity and strong structural fit and can therefore serve as a comprehensive framework for improving vocational education quality, enhancing students' labor market readiness, and strengthening alignment between educational systems and societal needs in Tehran.
***Keywords:*** *Skill-oriented learning, technical and vocational education, competency-based education, teaching–learning process, assessment and evaluation, vocational schools.*

## 1. Introduction

In the contemporary era, rapid technological transformations, globalization of labor markets, and the emergence of knowledge-based economies have fundamentally altered the philosophy and structure of educational systems worldwide. Traditional educational approaches that primarily emphasize theoretical knowledge transmission are no longer sufficient to prepare learners for dynamic and technology-driven occupational environments. Instead, educational systems are increasingly expected to equip students with practical competencies, adaptive expertise, creativity, problem-solving abilities, and employability skills that can respond effectively to the changing demands of society and industry (Buddhadev, 2025; Rafiq-uz-Zaman, 2025). Within this context, skill-oriented learning has emerged as one of the most significant paradigms in contemporary education, particularly in technical and vocational education and training (TVET), because it seeks to bridge the gap between education and employment through competency-based and practice-oriented learning experiences (Allais, 2022; Le et al., 2022).

Technical and vocational education systems play a strategic role in national development by preparing skilled human resources capable of supporting industrial growth, entrepreneurship, technological innovation, and sustainable economic development. Countries that have successfully linked vocational education to labor market demands have generally demonstrated stronger industrial productivity and lower unemployment rates among graduates (Ganji, 2023; Sauffie, 2015). Accordingly, policymakers and educational planners in many countries have shifted toward designing educational systems that emphasize practical competence, workplace readiness, lifelong learning, and integration with industry. This transformation has become especially important in the twenty-first century, where digital technologies, artificial intelligence, automation, and Industry 4.0 have dramatically changed occupational structures and professional skill requirements (Ana et al., 2020; Deckker & Sumanasekara, 2025).

The concept of skill-oriented learning extends beyond simple technical training and involves a multidimensional educational process in which cognitive, technical, social, communicative, and entrepreneurial competencies are developed simultaneously. In modern educational discourse, skill-oriented systems are expected to cultivate not only technical proficiency but also soft skills such as teamwork, communication, critical thinking, adaptability, and innovation (Le et al., 2022; Yeap et al., 2021). This perspective aligns with the broader movement toward competency-based education, where educational success is measured not merely by academic achievement but by the learner's demonstrated ability to perform effectively in authentic professional contexts (Buddhadev, 2025; Yayan Adrianova et al., 2021). Consequently, technical and vocational schools are increasingly viewed as environments for experiential learning, project-based learning, collaborative problem-solving, and integration of real-world occupational scenarios into educational practice.

Despite the recognized importance of vocational education, many educational systems continue to face serious challenges in implementing effective skill-oriented learning models. Research has shown that technical and vocational schools in many developing countries suffer from outdated curricula, insufficient alignment with labor market needs, weak collaboration with industry, inadequate infrastructure, and limited teacher competencies in emerging technologies (Kennedy et al., 2017; Mousavi, 2024). Moreover, educational programs often remain heavily theoretical and examination-oriented, resulting in graduates who possess formal certificates but lack the practical competencies required for employment and entrepreneurship (Abbaszadeh et al., 2018; Bagheri Far & Salehi, 2016). Such challenges have intensified concerns regarding graduate unemployment, skills mismatch, and the inefficiency of vocational education systems in responding to contemporary economic and technological changes.

In Iran, technical and vocational schools represent a major component of secondary education and are expected to contribute substantially to workforce development and youth employability. However, several studies have indicated that existing vocational education programs are not fully aligned with the real needs of society and industry. For example, previous research has demonstrated that vocational curricula in Iran often lack responsiveness to local industrial changes, technological innovation, and emerging occupational demands (Abbaszadeh et al., 2018; Azizi et al., 2018). Similarly, investigations into skill training systems have highlighted persistent weaknesses related to educational content, instructional methods, teacher preparation, workshop equipment, and coordination between schools and employers (Bagheri Far & Salehi, 2016; Mousavi, 2024). These deficiencies reduce the effectiveness of vocational education in preparing students for successful labor market participation.

Another critical issue concerns the relationship between vocational education and societal expectations. Modern societies increasingly require graduates who are capable of independent learning, technological adaptation, and interdisciplinary collaboration. Therefore, vocational schools can no longer rely solely on traditional workshop-based instruction. Instead, they must adopt flexible and innovative learning systems that integrate digital technologies, simulation-based learning, industry partnerships, and personalized educational pathways (Deckker & Sumanasekara, 2025; Lytvyn et al., 2020). The growing integration of artificial intelligence, virtual reality, and digital learning environments into education has created new opportunities for transforming technical and vocational learning processes. Studies have demonstrated that technologies such as virtual reality can significantly enhance practical training by providing safe, interactive, and realistic learning environments for skill development (Zhao et al., 2018). Likewise, the expansion of digital infrastructures has increased the possibility of flexible, modular, and learner-centered educational systems within vocational education (Lytvyn et al., 2020).

Teacher competency is another essential factor influencing the effectiveness of skill-oriented learning systems. Instructors in vocational schools are expected not only to possess technical expertise but also to demonstrate pedagogical competence, digital literacy, mentoring ability, and familiarity with contemporary industrial practices. Research indicates that many vocational teachers require additional professional development to adapt to Industry 4.0 technologies and twenty-first-century learning approaches (Ana et al., 2020; Yayan Adrianova et al., 2021). Effective vocational teachers should be capable of facilitating experiential learning, integrating real-world projects into instruction, encouraging collaborative learning, and fostering innovation among students. Without competent and professionally updated instructors, vocational schools may struggle to provide relevant and effective educational experiences.

Furthermore, the COVID-19 pandemic highlighted structural vulnerabilities in vocational education systems across the world. The interruption of face-to-face workshops, practical training sessions, and internships demonstrated the urgent need for more resilient and technologically integrated learning systems (Yeap et al., 2021). Vocational schools were compelled to adopt digital learning strategies despite limitations in infrastructure and preparedness. This experience reinforced the importance of designing educational systems capable of combining practical skill development with flexible and technology-supported learning models. Consequently, contemporary discussions about TVET reform increasingly emphasize hybrid learning environments, digital simulation tools, industry collaboration, and adaptive curriculum design (Deckker & Sumanasekara, 2025; Yeap et al., 2021).

International experiences also provide valuable insights into the development of successful skill-oriented educational systems. Countries such as Malaysia, South Korea, Japan, and several European nations have implemented reforms focused on competency-based curricula, strong school–industry collaboration, modular educational structures, and continuous professional development for teachers (Ganji, 2023; Sauffie, 2015). Comparative studies indicate that effective vocational systems are characterized by strong institutional coordination, continuous curriculum updating, practical learning opportunities, and responsiveness to labor market transformations (Allais, 2022; Rafiq-uz-Zaman, 2025). However, transferring such models to other contexts requires careful consideration of local cultural, economic, organizational, and educational conditions.

Another important dimension of skill-oriented learning concerns gender inclusion and equitable educational opportunities. Recent studies have emphasized the importance of developing vocational schools that empower female students and increase their participation in skill-based education and employment pathways (Abdukodirovna et al., 2024). Inclusive vocational systems can contribute to social development by reducing educational inequality and expanding opportunities for diverse groups of learners. Therefore, contemporary skill-oriented educational models should address not only economic productivity but also



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broader social objectives related to inclusion, empowerment, and sustainable development.

Theoretical perspectives on learning further support the transition toward skill-oriented education. Constructivist and experiential learning theories emphasize the importance of active learner engagement, contextualized practice, collaborative interaction, and authentic problem-solving experiences (Freebody, 2013). From this perspective, learning becomes a dynamic process through which students construct knowledge through participation in meaningful activities rather than passive reception of information. Such theoretical foundations are highly compatible with the principles of vocational education, where practical engagement and real-world application constitute essential dimensions of effective learning.

Although numerous studies have examined individual aspects of vocational education, such as curriculum development, teacher competencies, educational technologies, or industry collaboration, fewer studies have attempted to develop comprehensive and integrated models of skill-oriented learning systems specifically tailored to the context of technical and vocational high schools in Tehran. Existing research in Iran has primarily focused on isolated challenges or comparative analyses rather than providing a multidimensional framework that simultaneously addresses curriculum content, teaching–learning processes, assessment systems, environmental support, and industry interaction (Khosravi Rad et al., 2023; Nikfallah et al., 2024). Consequently, there remains a significant need for a comprehensive model capable of guiding policymakers, school administrators, and educators toward more effective implementation of skill-oriented learning systems.

Moreover, rapid economic and technological changes in Tehran, as one of the largest metropolitan and industrial centers in Iran, have increased the necessity of revising traditional vocational education structures. The labor market in Tehran increasingly demands graduates with digital literacy, practical competence, entrepreneurial capability, and adaptive learning skills. However, the extent to which current vocational schools are prepared to meet these demands remains uncertain. Therefore, identifying the dimensions, components, and indicators of an effective skill-oriented learning system within the context of Tehran's technical and vocational schools represents an important educational and policy-related necessity.

Accordingly, the present study aimed to design and validate a model of a skill-oriented learning system in technical and vocational high schools in Tehran.

## 2. Methods and Materials

This study was applied in terms of purpose, as applied research aims to develop practical knowledge within a specific field. Since the present study sought to develop a skill-oriented learning system model for technical and vocational high schools in Tehran, it is considered an applied study. From the perspective of paradigm, the research was pragmatic and was conducted using a mixed-methods (qualitative–quantitative) approach. In terms of data collection, the study was descriptive. In the qualitative phase, the dimensions and components of the model were identified and extracted through interviews with experts, and ultimately the qualitative model of the skill-oriented learning system in technical and vocational high schools was developed. In the quantitative phase, the designed model was validated using a descriptive strategy and the structural equation modeling approach.

The participants in the qualitative phase consisted of experts and specialists in the fields of technical and vocational education, curriculum planning, educational management, and learning. These individuals belonged to the following three main groups:

- University professors and researchers in the field of educational management.
- Senior executive managers and experts at central and regional levels of the Ministry of Education, the Technical and Vocational Training Organization of Iran, and the General Directorate of Education of Tehran who were directly associated with technical and vocational high schools.
- Experienced and successful principals and instructors of technical and vocational high schools in Tehran with at least one decade of effective professional experience and deep familiarity with the educational challenges and needs of these schools.

The criteria for selecting the experts are presented in Table 1. At least two of the listed criteria were required for participant selection.


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**Table 1**

*Criteria for Selecting Experts in the Qualitative Phase*

| Criteria | Description |
|---|---|
| Scientific and Academic Expertise | Educational management, curriculum planning, educational sciences; teaching or research experience in learning, technical and vocational education, or educational innovation; publication of scientific articles, books, or research projects related to the research topic |
| Executive and Managerial Experience | At least 5 years of managerial experience (head, deputy, department manager) in technical and vocational high schools, district education offices in Tehran, or the Technical and Vocational Training Organization; participation in the design, implementation, or evaluation of skill-oriented educational programs at school or district level |
| Practical and Instructional Experience | At least 10 years of teaching experience in technical and vocational high schools in Tehran; experience in training successful students or leading outstanding skill-development projects; receipt of certificates or awards related to effectiveness in skill-based education |
| Willingness and Ability to Participate | Expressed willingness and sufficient time to participate in interviews |

The statistical population in the quantitative phase consisted of all teachers employed in technical and vocational high schools in Tehran during the 2024–2025 academic year (approximately 5,701 individuals, including 3,263 women and 2,438 men). Stratified random sampling was employed. The Cochran formula used to calculate the sample size was as follows:

$$n = \frac{\frac{Z^2pq}{d^2}}{1+\frac{1}{N}\left(\frac{Z^2pq}{d^2}-1\right)} \approx 360$$

**Table 2**

*Sample Size in the Quantitative Phase*

| Criteria | Frequency | Percentage of Population | Sample Size |
|---|---|---|---|
| Female | 3,263 | 57.2 | 206 |
| Male | 2,438 | 42.8 | 154 |
| Total | 5,701 | 100.0 | 360 |

In the qualitative phase, sampling was conducted with the participation of 15 individuals based on the principle of theoretical saturation. Purposeful sampling was used in this phase.

**Table 3**

*Characteristics of Participants in the Qualitative Phase*

| Criteria | Frequency |
|---|---|
| University Professors and Researchers | 6 |
| Senior Executive Managers and Experts | 4 |
| Principals of Technical and Vocational High Schools in Tehran | 5 |

In the qualitative phase, data were collected through semi-structured interviews. The questions raised during the interview process included the following:

- From your perspective, to what extent is the curriculum content of technical and vocational high schools in Tehran aligned with actual labor market needs and emerging occupations (such as information technology and modern services)?
- What teaching methods are commonly used by teachers in technical and vocational skill instruction? How would you describe the role of the teacher in skill-oriented classrooms (as an instructor, facilitator, or lecturer)?
- In your opinion, what is the main criterion for assessing students' success in a skill-oriented system? Are current assessment methods (such as portfolios and practical projects) capable of accurately evaluating students' competencies?
- What are the major limitations regarding equipment and physical space in technical and vocational schools?
- Are programs such as internships, targeted educational visits, or inviting specialists effectively implemented?
- Do students have the opportunity to select instructional modules or adjust their learning paths

according to their interests and abilities? What mechanisms exist to support students with different learning levels?

- In your opinion, what is the greatest challenge in implementing a skill-oriented learning system in technical and vocational high schools in Tehran? What factors contribute to overcoming these challenges?

In the quantitative phase, a researcher-made questionnaire was used for data collection. The measurement scale was designed based on a five-point Likert scale covering a full spectrum from agreement to disagreement. In this scale, a score of 5 represented "very high," while a score of 1 represented "very low." The characteristics of the questionnaire are presented in Table 4.

**Table 4**

*Characteristics of the Questionnaire*

| Variable | Indicator | Number of Items | Item Range |
|---|---|---|---|
| Curriculum and Content | Labor Market-Oriented Content | 3 | 1–3 |
| Curriculum and Content | Soft Skills-Based Content | 3 | 4–6 |
| Curriculum and Content | Competency-Based Content | 4 | 7–10 |
| Curriculum and Content | Modular Curriculum Structure | 3 | 11–13 |
| Curriculum and Content | Curriculum Structure and Content | 5 | 14–18 |
| Teaching–Learning Process | Active and Workshop-Based Teaching Methods | 3 | 19–21 |
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | 4 | 22–25 |
| Teaching–Learning Process | Interactive and Collaborative Learning | 4 | 26–29 |
| Teaching–Learning Process | Flexible and Personalized Learning | 4 | 30–33 |
| Assessment and Evaluation | Performance-Based Evaluation | 3 | 34–36 |
| Assessment and Evaluation | Continuous and Corrective Feedback | 5 | 37–41 |
| Support and Environmental Context | Equipment and Physical Space | 3 | 42–44 |
| Support and Environmental Context | Professional Competence of Instructors | 3 | 45–47 |
| Support and Environmental Context | Continuous Interaction with Industry and Society | 4 | 48–50 |

To examine the validity of the qualitative phase, Creswell's (2003) qualitative data validation strategies were employed, including member checking through reviewing extracted codes with participants, transferability through triangulation (using literature and interviews with technical and vocational education experts), dependability through expert confirmation, and consistency through recoding. To evaluate the reliability of the interview protocol, the inter-coder agreement percentage method was applied. Initially, a research colleague experienced in qualitative data coding was invited to participate in the study. Three interviews were selected from the interview results and independently coded by two coders (the researcher and the research colleague). In each interview, codes identified similarly by both coders were categorized as agreements, while dissimilar codes were categorized as disagreements. Subsequently, the researcher and the research colleague coded the three interviews, and the intra-topic agreement percentage, used as an indicator of analytical reliability, was calculated using the following formula:

$$\text{Agreement Percentage} = \frac{2 \times \text{Number of Agreed Codes}}{\text{Total Number of Codes}} \times 100$$

Based on this analysis, the reliability coefficient for the interview protocol in the present study was 87%. According to researchers, this value is considered desirable, as the minimum acceptable reliability coefficient is reported to be 0.60 (60%).

In the quantitative phase, convergent validity (AVE) and discriminant validity indices were used.

**Table 5**

*Convergent Validity*

| Variable Name | AVE |
|---|---|
| Curriculum and Content | 0.942 |
| Teaching–Learning Process | 0.930 |
| Assessment and Evaluation | 0.922 |
| Support and Environmental Context | 0.901 |

As shown in the above table, the AVE values for all variables in the model exceeded the standard threshold of 0.50, indicating the appropriateness of the model fit.

**Table 6**

*Analysis of the Fornell–Larcker Criterion for Assessing Discriminant Validity*

| Construct | Curriculum and Content | Teaching–Learning Process | Assessment and Evaluation | Support and Environmental Context |
|---|---|---|---|---|
| Curriculum and Content | 0.971 | | | |
| Teaching–Learning Process | 0.969 | 0.964 | | |
| Assessment and Evaluation | 0.943 | 0.939 | 0.960 | |
| Support and Environmental Context | 0.913 | 0.917 | 0.948 | 0.949 |

As shown in the table above, the values on the main diagonal are greater than the values below them, indicating appropriate discriminant validity and a good fit of the measurement model of the skill-oriented learning system model.

In the quantitative phase, the reliability of the measurement instrument was calculated using Cronbach's alpha, the values of which are presented in the table below.

**Table 7**

*Reliability of the Measurement Instrument*

| Variable | Indicator | Number of Items | Item Range | Cronbach's Alpha |
|---|---|---|---|---|
| Curriculum and Content | Labor Market-Oriented Content | 3 | 1–3 | 0.873 |
| Curriculum and Content | Soft Skills-Based Content | 3 | 4–6 | 0.886 |
| Curriculum and Content | Competency-Based Content | 4 | 7–10 | 0.918 |
| Curriculum and Content | Modular Curriculum Structure | 3 | 11–13 | 0.865 |
| Curriculum and Content | Curriculum Structure and Content | 5 | 14–18 | 0.937 |
| Teaching–Learning Process | Active and Workshop-Based Teaching Methods | 3 | 19–21 | 0.885 |
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | 4 | 22–25 | 0.919 |
| Teaching–Learning Process | Interactive and Collaborative Learning | 4 | 26–29 | 0.903 |
| Teaching–Learning Process | Flexible and Personalized Learning | 4 | 30–33 | 0.909 |
| Assessment and Evaluation | Performance-Based Evaluation | 3 | 34–36 | 0.902 |
| Assessment and Evaluation | Continuous and Corrective Feedback | 5 | 37–41 | 0.926 |
| Support and Environmental Context | Equipment and Physical Space | 3 | 42–44 | 0.843 |
| Support and Environmental Context | Professional Competence of Instructors (Teachers) | 3 | 45–47 | 0.917 |
| Support and Environmental Context | Continuous Interaction with Industry and Society | 4 | 48–50 | 0.902 |

As shown in the table above, all variables in the model have acceptable Cronbach's alpha values.

The composite reliability index, similar to Cronbach's alpha, is a criterion for evaluating the internal consistency of the model; however, this criterion has greater precision. Unlike Cronbach's alpha, in composite reliability, all indicators are not treated as equal, and indicators with higher factor loadings are assigned greater importance and are evaluated separately. Therefore, the values of this index are more precise and realistic. The following table presents the composite reliability values, indicating the appropriate fit of the model.

**Table 8**

*Composite Reliability (C.R.) Index*

| Variable Name | Composite Reliability |
|---|---|
| Curriculum and Content | 0.981 |
| Teaching–Learning Process | 0.977 |
| Assessment and Evaluation | 0.960 |
| Support and Environmental Context | 0.958 |


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Given that the composite reliability values are above 0.70 for all variables, this index indicates an appropriate model fit.

## 3. Findings and Results

First, qualitative findings are presented in Table 1.

**Table 9**

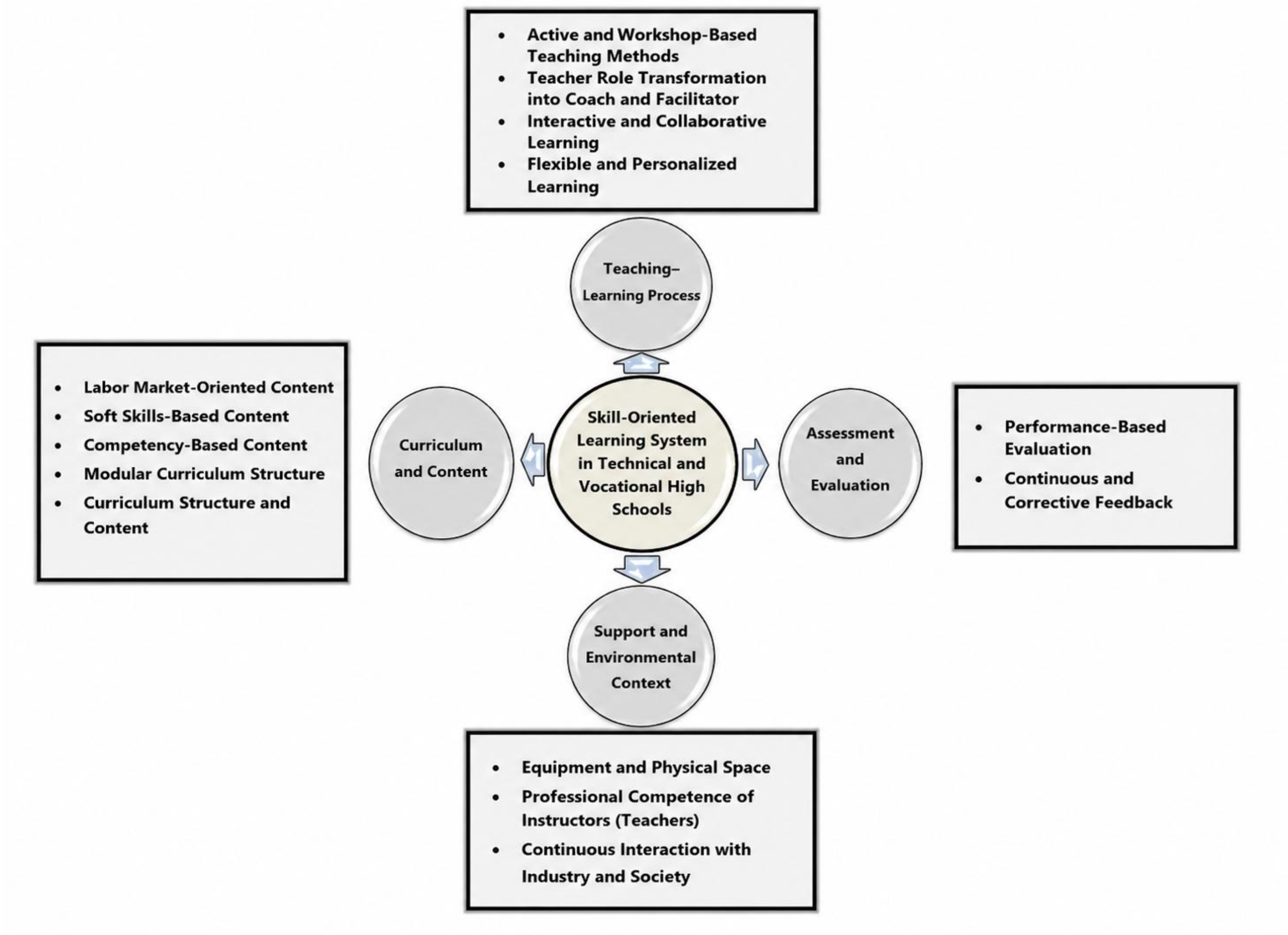
*Categorization of the Identified Dimensions*

| Dimension | Component | Open Code |
|---|---|---|
| Content (this dimension refers to "what" is learned) | Labor Market-Oriented Content | Alignment of course syllabi with emerging occupations in Tehran, such as IT and modern technical services. |
| Content | Labor Market-Oriented Content | The extent of participation by Tehran-based industries and trade associations in developing standards. |
| Content | Labor Market-Oriented Content | Updating content based on technological changes in local industries. |
| Content | Soft Skills-Based Content | Key soft skills are clearly stated in course syllabi, competency standards, and educational objectives of each module or project. |
| Content | Soft Skills-Based Content | Specific behavioral learning outcomes are defined for each soft skill, such as "effective communication" or "critical thinking"; for example, "the student can present his or her technical idea in simple language to a non-specialist within 3 minutes." |
| Content | Soft Skills-Based Content | Designing short 2–3-hour modules for each key skill, accompanied by practical activities and assessment tools. |
| Content | Competency-Based Content | Mastery of specialized knowledge, tools, technologies, and processes related to a profession, such as installing air-conditioning systems, troubleshooting electronic circuits, or designing digital graphics. |
| Content | Competency-Based Content | Presenting content not in a textbook-oriented form, but in competency packages. |
| Content | Competency-Based Content | The ability to apply technical knowledge in real work environments, solve practical problems, operate machinery, and carry out real projects. |
| Content | Competency-Based Content | Critical transferable skills such as effective communication, teamwork, critical thinking, problem solving, creativity, project management, professional ethics, and flexibility. |
| Content | Modular Curriculum Structure | The possibility of completing modules independently. |
| Content | Modular Curriculum Structure | Selection of modules by students. |
| Content | Modular Curriculum Structure | Curriculum flexibility for different learner levels. |
| Content | Curriculum Structure and Content | Existence of a digital library including open online courses, technical standards, parts catalogs, and applied software related to the field. |
| Content | Curriculum Structure and Content | Use of specialized simulation software to practice skills in a safe and controlled environment, such as welding simulators, industrial electricity simulators, engine repair simulators, and computer network simulators. |
| Content | Curriculum Structure and Content | Teaching profession-related digital skills, such as specialized software, basic artificial intelligence, and the Internet of Things, not as a separate course but as part of each project. |
| Content | Curriculum Structure and Content | Alignment of content with the skill standards of the Technical and Vocational Training Organization of Iran. |
| Content | Curriculum Structure and Content | Inclusion of real workplace scenarios in textbooks. |
| Teaching–Learning Process (this dimension refers to "how" learning occurs and represents the core of the skill-oriented system) | Active and Workshop-Based Teaching Methods | The extent to which the modern master–apprentice method is used. |
| Teaching–Learning Process | Active and Workshop-Based Teaching Methods | Prioritizing "doing" over theory. |
| Teaching–Learning Process | Active and Workshop-Based Teaching Methods | Using simulation-based approaches in teaching, such as simulating a recruitment process, customer presentation, or workshop incident management. |
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | The teacher spends most of the time on individual guidance, stimulating questions, and process feedback rather than lecturing. |
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | Designing activity guides and project guide sheets instead of relying solely on textbooks. |
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | The teacher models professional behavior, such as observing safety, discipline, perseverance, and peaceful conflict resolution. |

| | | |
|---|---|---|
| Teaching–Learning Process | Teacher's Role as Coach and Facilitator | Using open-ended questions such as "Why did you choose this method?", "What would you do if your materials changed?", and "What is your opinion about your teammate's solution?" |
| Teaching–Learning Process | Interactive and Collaborative Learning | Existence of discussion and exchange groups focused on project problems. |
| Teaching–Learning Process | Interactive and Collaborative Learning | Conducting peer review of each other's work using a standard checklist. |
| Teaching–Learning Process | Interactive and Collaborative Learning | Regular group presentations and project defense sessions in the presence of other students, teachers, and industry guests. |
| Teaching–Learning Process | Interactive and Collaborative Learning | Use of simple online collaboration platforms, such as work groups, for project planning and documentation. |
| Teaching–Learning Process | Flexible and Personalized Learning | The student can choose among several optional modules related to his or her main profession; for example, in computer studies, choosing between "network security" and "mobile application development." |
| Teaching–Learning Process | Flexible and Personalized Learning | Longer sessions, such as 3–4-hour sessions, for uninterrupted project work. |
| Teaching–Learning Process | Flexible and Personalized Learning | Remedial programs for students with slower progress and challenging plans for advanced students. |
| Teaching–Learning Process | Flexible and Personalized Learning | The possibility of accelerating or deepening learning based on competency assessment rather than merely the passage of time. |
| Assessment and Evaluation (in a skill-oriented system, the written score is not the criterion; rather, "competency attainment" is the criterion) | Performance-Based Evaluation | Use of progress checklists completed by the student or teammates. |
| Assessment and Evaluation | Performance-Based Evaluation | Designing assignments based on real industrial or service scenarios in Tehran; for example, "Design and build a model of a smart irrigation system for the green space of a residential complex in Tehran." |
| Assessment and Evaluation | Performance-Based Evaluation | The assignment results in the production of a tangible product or service, an oral presentation, or a professional portfolio. |
| Assessment and Evaluation | Continuous and Corrective Feedback | Existence of a portfolio file for each student. |
| Assessment and Evaluation | Continuous and Corrective Feedback | Use of performance observation checklists by the teacher while the student is working. |
| Assessment and Evaluation | Continuous and Corrective Feedback | Holding individual or group progress review sessions every two weeks. |
| Assessment and Evaluation | Continuous and Corrective Feedback | Emphasis on "sandwich feedback," beginning with a strength, followed by an area for improvement, and ending with encouragement. |
| Assessment and Evaluation | Continuous and Corrective Feedback | Existence of a feedback documentation system, such as in the student's digital portfolio, showing the progress trajectory. |
| Support and Environmental Context (this dimension is particularly critical in Tehran due to differences among districts and available facilities) | Equipment and Physical Space | Alignment of technical school workshop equipment with real equipment available in the Tehran market. |
| Support and Environmental Context | Equipment and Physical Space | Ratio of the number of devices to the number of students, that is, equipment per capita. |
| Support and Environmental Context | Equipment and Physical Space | Safety and standardization of the workshop environment. |
| Support and Environmental Context | Professional Competence of Instructors (Teachers) | Teachers' real work experience in the relevant industry. |
| Support and Environmental Context | Professional Competence of Instructors (Teachers) | Mastery of technology and artificial intelligence. |
| Support and Environmental Context | Professional Competence of Instructors (Teachers) | In-service training courses to familiarize teachers with new technologies. |
| Support and Environmental Context | Continuous Interaction with Industry and Society | A structured and supervised internship program with a clear contract, learning objectives, and an industry mentor at the workplace. |
| Support and Environmental Context | Continuous Interaction with Industry and Society | Monthly targeted visits to production, service, and innovation centers in Tehran. |
| Support and Environmental Context | Continuous Interaction with Industry and Society | Inviting master craftsmen, specialists, and entrepreneurs as guest instructors to transfer experience and evaluate projects. |
| Support and Environmental Context | Continuous Interaction with Industry and Society | Participation in national skills competitions and regional exhibitions. |

**Figure 1**

*Skill-Oriented Learning System Model in Technical and Vocational High Schools in Tehran Based on the Research Results*




Based on the descriptive findings of the study, out of 360 participants, 57.2% were female and 42.8% were male. In terms of age, the highest frequency belonged to the group over 40 years old (47.5%), and the lowest frequency belonged to the group under 30 years old (25.6%). Regarding educational level, most respondents held a bachelor's degree (46.4%), while the smallest group held a doctoral degree (17.8%). In terms of work experience, the group with 11 to 15 years of experience had the highest frequency (33.1%), whereas the group with 3 to 5 years of experience had the lowest frequency (14.2%). Overall, the sample under study mainly consisted of women, individuals over 40 years old, respondents with bachelor's degrees, and those with 11 to 15 years of work experience.

Next, for quantitative validation and examination of model validity, the parametric and nonparametric conditions of the data were first assessed. The Kolmogorov–Smirnov test was used to examine the normality or non-normality of the data distribution, as described below.

**Table 10**

*Results of the Kolmogorov–Smirnov and Bartlett Tests for the Skill-Oriented Learning System Model Questionnaire*

| Number of Items | Chi-Square | KMO | Degrees of Freedom | Significance |
|---|---|---|---|---|
| 50 | 24468.320 | 0.985 | 1225 | 0.000 |

As shown in the table above, the KMO value is 0.985 and close to 1, indicating that the selected sample size is appropriate. In addition, the value of Bartlett's test of sphericity, represented by chi-square (24468.320), with a significance level of 0.000, is smaller than 0.01. This indicates that the correlation matrix of the data allows factors to be extracted from it. Therefore, model adequacy is confirmed, and in addition to sampling adequacy, the data related to the research topic are suitable for confirmatory factor analysis within the framework of structural equation modeling.

In this section, all items under the research variables were entered into the model, and then the relationships among the variables were drawn based on the research objectives. Factor loading is defined as the correlation relationship between the observed and latent variables. Factor loading is the correlation coefficient between latent and observed variables in a measurement model. In other words, it specifies the extent of variance explained by the observed variable. The significance of factor loading is assessed using the t-value statistic. Typically, the factor loading value should be higher than 0.70, and the t-value should be higher than 1.96. Otherwise, the relevant item should be removed from the model. In this regard, the following diagram examines the t-value and factor loading values under conditions of coefficient significance.

**Figure 2**

*Skill-Oriented Learning System Model in the Unstandardized State*

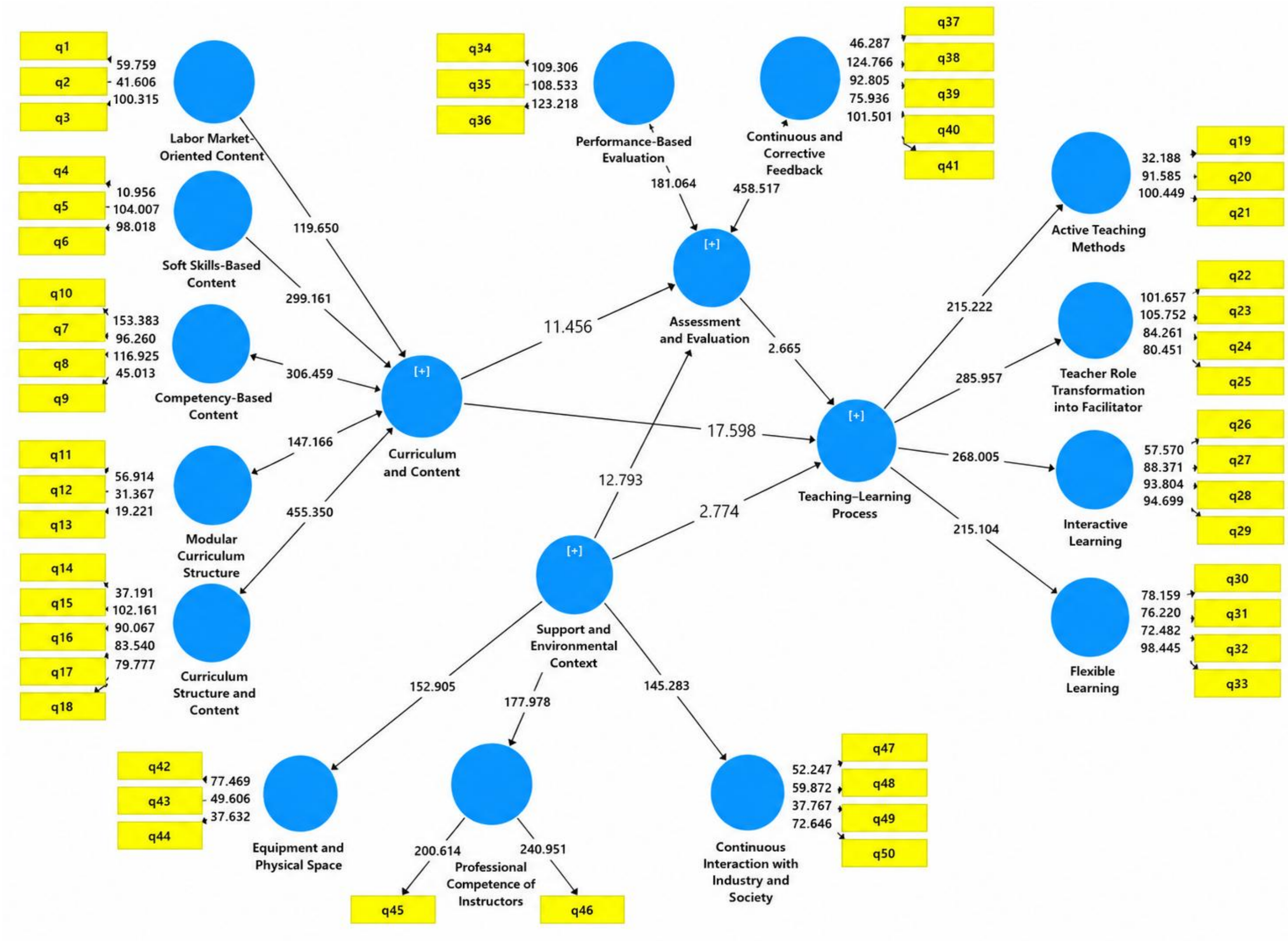




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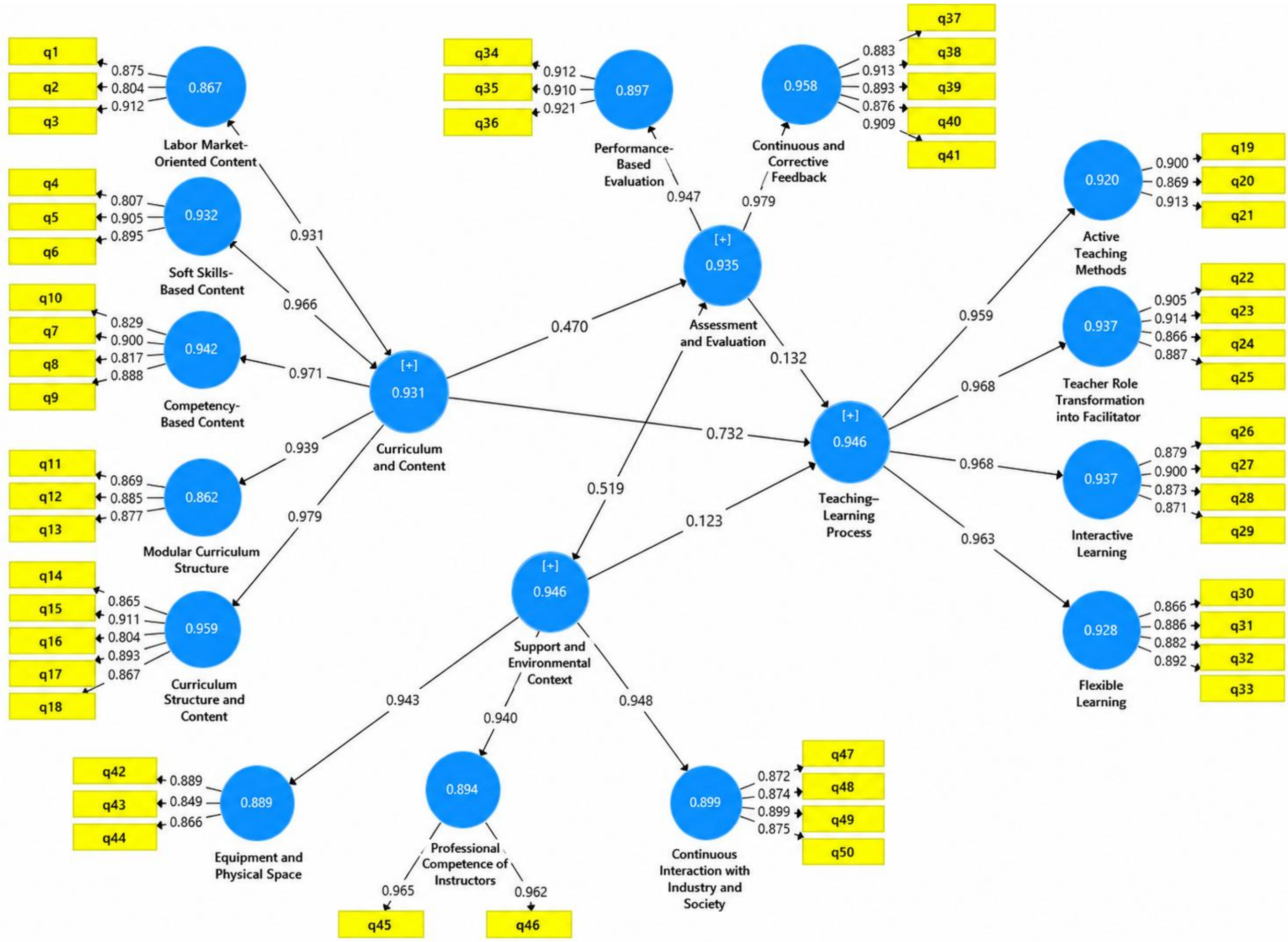
**Figure 3**

*Skill-Oriented Learning System Model in the Standardized State*



In the following table, path coefficients, which indicate the magnitude of the effects of each independent variable on the dependent variable, are reported, and their significance is examined.

**Table 11**

*Estimation of Regression Coefficients*

| Paths | Standardized Coefficients | t-Value | Significance Level | Result |
|---|---|---|---|---|
| Curriculum and Content → Assessment and Evaluation | 0.470 | 11.456 | 0.000 | Confirmed |
| Support and Environmental Context → Assessment and Evaluation | 0.519 | 12.793 | 0.000 | Confirmed |
| Curriculum and Content → Teaching–Learning Process | 0.732 | 17.598 | 0.000 | Confirmed |
| Support and Environmental Context → Teaching–Learning Process | 0.123 | 2.774 | 0.006 | Confirmed |
| Assessment and Evaluation → Teaching–Learning Process | 0.132 | 2.665 | 0.008 | Confirmed |

The regression coefficients table shows the effects of exogenous variables (curriculum and content, support and environmental context) on endogenous variables (assessment and evaluation, teaching–learning process). The results indicate that all examined paths are statistically significant. Curriculum and content have a positive and significant effect on assessment and evaluation with a coefficient of 0.470 and on the teaching–learning process with a coefficient of 0.732. Support and environmental context also affect assessment and evaluation with a coefficient of 0.519 and the teaching–learning process with a coefficient of 0.123. In addition, assessment and evaluation show a significant effect on the teaching–learning process with a coefficient of 0.132. All t-values are greater than 1.96,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and all significance levels are smaller than 0.05; therefore, all research hypotheses are confirmed.

**Table 12**

*Model Goodness-of-Fit Indices*

| Endogenous Variables | Multiple Correlation Coefficient (R) | Squared Multiple Correlation Coefficient ($R^2$) | $Q^2$ | GOF |
|---|---|---|---|---|
| Assessment and Evaluation | 0.935 | 0.934 | 0.651 | 0.880 |
| Teaching–Learning Process | 0.946 | 0.946 | 0.654 | 0.861 |

The results of the model fit indices indicate the high quality of the structural model of the study. The $R^2$ values for the endogenous variables indicate very strong explanatory power; accordingly, the exogenous variables were able to explain 93% of the variance in assessment and evaluation and 94% of the variance in the teaching–learning process, which indicates a strong model fit. In addition, the $Q^2$ index, which was used to evaluate the predictive power of the model, was much higher than the strong threshold of 0.35 for both endogenous variables (0.651 and 0.654, respectively), indicating the high ability of the model to predict the dependent components. Furthermore, the GOF values for both variables (0.880 and 0.861) were far above the strong criterion of 0.36, and all of these values indicate the highly appropriate and desirable fit of the research model.

## 4. Discussion and Conclusion

The present study aimed to design and validate a skill-oriented learning system model for technical and vocational high schools in Tehran. The findings of the qualitative phase led to the identification of four major dimensions, including curriculum and content, teaching–learning process, assessment and evaluation, and support and environmental context, encompassing 14 components and 50 indicators. In the quantitative phase, the structural model demonstrated highly favorable fit indices, and all proposed relationships among the variables were confirmed. Overall, the results indicate that the effectiveness of a skill-oriented learning system in technical and vocational schools depends on the integration of competency-based curricula, active and flexible instructional processes, authentic assessment systems, and supportive educational and industrial environments.

One of the most important findings of the study was the significant role of curriculum and content in improving both the teaching–learning process and assessment and evaluation. The results showed that curriculum and content had a strong positive effect on the teaching–learning process and a substantial effect on assessment and evaluation. This finding indicates that the foundation of skill-oriented learning begins with the nature and structure of educational content. When curricula are aligned with labor market needs, technological developments, and competency-based standards, instructional processes become more effective and authentic evaluation becomes more achievable. This finding is consistent with the studies emphasizing that vocational education systems should move beyond traditional textbook-centered instruction toward flexible, modular, and competency-oriented educational frameworks (Allais, 2022; Khosravi Rad et al., 2023). Similarly, comparative investigations of vocational education systems in developed countries have shown that educational content closely linked to industrial and occupational requirements significantly enhances graduate employability and workforce readiness (Ganji, 2023; Rafiq-uz-Zaman, 2025).

The qualitative findings related to curriculum content demonstrated the importance of integrating labor market-oriented content, soft skills education, competency-based learning, modular curriculum structures, and digital technologies into vocational education. These results support the argument that modern vocational schools should not merely train students for routine technical tasks but should prepare them for dynamic occupational environments requiring adaptability, communication skills, problem-solving, and technological literacy (Buddhadev, 2025; Le et al., 2022). The identified emphasis on soft skills is particularly important because modern industries increasingly value interpersonal and cognitive competencies alongside technical expertise. Previous studies have similarly highlighted the necessity of integrating soft skills and twenty-first-century competencies into vocational curricula to improve students' professional adaptability and long-term employability (Yayan Adrianova et al., 2021; Yeap et al., 2021).

Another major finding concerns the teaching–learning process dimension, which emerged as the central component of the skill-oriented learning system. The identified components of this dimension included active teaching methods, transformation of the teacher's role into a facilitator, interactive learning, and flexible and personalized learning. The findings indicate that skill-oriented education cannot be effectively implemented through traditional lecture-based methods. Instead, practical engagement, experiential learning, project-based instruction, collaborative activities, and individualized learning pathways are essential for developing occupational competence. This result aligns with constructivist and experiential learning perspectives, which emphasize active learner participation and authentic educational experiences (Freebody, 2013). Furthermore, it is consistent with research suggesting that vocational education should emphasize practical performance, student-centered learning, and real-world problem solving rather than passive knowledge transfer (Buddhadev, 2025; Le et al., 2022).

The transformation of the teacher's role from lecturer to coach and facilitator represents another important aspect of the findings. In the identified model, teachers were expected to guide learners individually, encourage inquiry and reflection, provide continuous feedback, and model professional behavior. This finding corresponds with previous research emphasizing that vocational teachers in modern educational systems require pedagogical flexibility, mentoring skills, technological competence, and industry familiarity (Ana et al., 2020; Yayan Adrianova et al., 2021). In many traditional educational settings, teachers continue to function primarily as transmitters of theoretical knowledge. However, the present findings suggest that effective skill-oriented education requires teachers who can create participatory and authentic learning environments. Such findings are also supported by studies indicating that vocational teacher competencies directly influence students' practical learning outcomes and readiness for employment (Ana et al., 2020; Kennedy et al., 2017).

The findings related to interactive and collaborative learning further highlight the importance of social learning processes within vocational education. Group projects, peer evaluation, collaborative discussions, and teamwork were identified as key indicators of effective skill-oriented learning environments. This result reflects the reality that contemporary workplaces increasingly depend on collective problem solving and interdisciplinary collaboration. Therefore, vocational schools must prepare students for social and organizational interaction in addition to technical performance. Similar conclusions have been reported in studies emphasizing collaborative learning and communication skills as critical components of vocational competence in the twenty-first century (Le et al., 2022; Yeap et al., 2021).

Flexible and personalized learning was also identified as an essential feature of the proposed model. The findings indicated that students should be able to choose optional modules, progress according to competency achievement rather than fixed time structures, and receive differentiated educational support based on their learning needs. This reflects the broader educational shift toward learner-centered systems that recognize individual differences in interests, abilities, and learning pace. Previous research has similarly demonstrated that flexibility and personalization improve learner motivation, engagement, and skill acquisition in vocational settings (Deckker & Sumanasekara, 2025; Lytvyn et al., 2020). The increasing integration of digital learning environments and intelligent educational technologies has further expanded opportunities for adaptive and personalized vocational learning systems.

Another important finding concerns assessment and evaluation, which was identified as a major dimension of the skill-oriented learning system. The results demonstrated that assessment and evaluation significantly influenced the teaching–learning process. In the proposed model, authentic performance-based assessment, continuous feedback, portfolio systems, and practical project evaluation were emphasized as essential mechanisms for competency validation. This finding suggests that written examinations alone are insufficient for evaluating vocational competence. Instead, assessment should focus on actual performance, practical application, and demonstrated mastery of occupational tasks. This result aligns with competency-based educational frameworks that emphasize authentic assessment methods for measuring learners' practical capabilities (Buddhadev, 2025; Le et al., 2022).

The emphasis on continuous and corrective feedback is also noteworthy. The findings suggest that ongoing formative assessment can support students' gradual improvement and self-regulated learning. Feedback mechanisms such as progress reviews, observation checklists, and digital portfolios enable students to identify strengths and weaknesses and continuously refine their competencies. This finding is consistent with studies highlighting the importance of reflective and formative assessment approaches in vocational education (Freebody, 2013; Yeap et al., 2021). Moreover, continuous feedback may strengthen learner motivation and professional confidence by creating a supportive educational climate.

The support and environmental context dimension also demonstrated significant effects on both assessment and evaluation and the teaching–learning process. This finding indicates that effective skill-oriented learning systems require not only appropriate curricula and instructional strategies but also adequate infrastructure, professional teacher competence, and strong industry collaboration. The qualitative findings identified workshop equipment, physical facilities, teacher professional development, and continuous interaction with industry and society as critical factors. This result supports prior research emphasizing that vocational education quality is strongly influenced by the availability of modern facilities, technological resources, and authentic industrial partnerships (Kennedy et al., 2017; Moses, 2016).

The identified importance of industry collaboration is particularly significant. Structured internships, targeted industrial visits, and the involvement of professionals and entrepreneurs in educational activities were recognized as central elements of effective vocational education. This reflects the understanding that technical and vocational schools cannot function independently from economic and industrial systems. Instead, strong school–industry partnerships are necessary to ensure curriculum relevance, workplace readiness, and practical skill acquisition. Previous studies have similarly demonstrated that cooperation between vocational schools and industry significantly improves educational quality and employment outcomes (Moses, 2016; Rafiq-uz-Zaman, 2025). In addition, collaboration with industry allows schools to remain responsive to technological innovation and labor market transformations.

The findings related to technological integration and digital competencies are also highly relevant in the contemporary educational context. The identified model emphasized simulation technologies, digital libraries, artificial intelligence, and profession-related digital skills as integral components of vocational learning. These findings are consistent with recent studies highlighting the transformative role of digital technologies and artificial intelligence in education (Deckker & Sumanasekara, 2025; Zhao et al., 2018). Simulation-based learning environments, in particular, provide safe and interactive opportunities for practical training and can compensate for limitations in physical workshops and industrial access. Moreover, digital literacy has become an essential requirement across nearly all occupational sectors, making technological integration a critical component of modern vocational education.

The high values of $R^2$, $Q^2$, and GOF in the structural model indicate that the proposed model possesses strong explanatory power, predictive capability, and overall fit. These results suggest that the identified dimensions collectively provide a comprehensive framework for understanding and improving skill-oriented learning systems in technical and vocational schools. The strong relationships among curriculum content, instructional processes, assessment systems, and environmental support further demonstrate that vocational education reform requires systemic and multidimensional approaches rather than isolated interventions. This finding supports systemic perspectives on educational reform, which emphasize the interdependence of educational structures, teaching practices, institutional environments, and labor market relationships (Allais, 2022; Khosravi Rad et al., 2023).

The findings of the present study also have important implications for educational policy and reform in Iran. Given the increasing demand for skilled human resources, technological adaptation, and entrepreneurial capability, technical and vocational schools must undergo substantial transformation to remain relevant and effective. The identified model provides a practical framework for redesigning vocational education systems in Tehran and potentially in other regions of Iran. By emphasizing competency-based learning, flexible curricula, authentic assessment, teacher development, and industry collaboration, the proposed model may contribute to reducing the gap between education and employment while improving students' readiness for contemporary labor markets.

One limitation of the present study was that the quantitative phase was conducted only among teachers in technical and vocational schools in Tehran, which may limit the generalizability of the findings to other provinces and educational contexts. Another limitation was the reliance on self-report questionnaires, which may be influenced by participants' subjective perceptions and response biases. In addition, the study focused primarily on educational and organizational dimensions of skill-oriented learning and did not directly assess students' actual occupational performance or long-term employment outcomes.

Future research could examine the implementation and effectiveness of the proposed model in different geographical regions and educational settings. Comparative studies between public and private vocational schools or between different technical fields may provide deeper insights into contextual factors influencing skill-oriented learning systems. Longitudinal studies investigating the impact of competency-based educational reforms on students' employment success, entrepreneurial activities, and professional development would also be valuable. Furthermore, future studies could explore the role of emerging technologies such as artificial intelligence, virtual reality, and adaptive learning systems in enhancing vocational education quality and accessibility.

From a practical perspective, educational policymakers and school administrators should prioritize the revision of vocational curricula based on labor market demands and emerging technological trends. Greater investment in workshop facilities, simulation technologies, and digital educational infrastructures is necessary to strengthen practical learning opportunities. Teacher professional development programs should focus on competency-based instruction, digital literacy, mentoring skills, and industry engagement. Moreover, stronger partnerships between vocational schools and industries should be established through structured internships, collaborative projects, and participation of professionals in educational activities. Finally, assessment systems should move beyond traditional written examinations toward authentic performance-based evaluation approaches that better reflect students' real competencies and occupational readiness.

## Authors' Contributions

Authors equally contributed to this article.

## Declaration

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

## Transparency Statement

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

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## Declaration of Interest

The authors report no conflict of interest.

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## Ethical Considerations

All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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