

“Examining the relationship between total quality management practices and perceived students’ practical competence: The role of instructor self-efficacy”

AUTHORS	Fadi Dandachli  Mazen Massoud   Ali Sankari 
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Fadi Dandachli, Ph.D., Faculty of Business Administration, Department of Management and Marketing, Jinan University, Lebanon. (Corresponding author)

Mazen Massoud, Associate Professor, Faculty of Business Administration, Department of Management and Marketing, Jinan University, Lebanon.

Ali Sankari, Associate Professor, Faculty of Business Administration, Department of Management and Marketing, Jinan University, Lebanon.

Fadi Dandachli (Lebanon), Mazen Massoud (Lebanon), Ali Sankari (Lebanon)

EXAMINING THE RELATIONSHIP BETWEEN TOTAL QUALITY MANAGEMENT PRACTICES AND PERCEIVED STUDENTS' PRACTICAL COMPETENCE: THE ROLE OF INSTRUCTOR SELF-EFFICACY

Abstract

Lebanese technical schools have a vital responsibility to develop young talents and improve their practical abilities. These institutions are assessed on the competencies demonstrated by students, not just on knowledge transfer. Yet graduates face employment challenges due to a focus on theory rather than practical capabilities. This skill gap stems from the mistaken belief that theoretically taught total quality management (TQM) practices alone improve competencies. The objective is to examine the relationship between three total quality management practices and students' practical competence based on instructors' perceptions by analyzing the mediating role of instructors' self-efficacy. A quantitative research design was used, and data were collected via a questionnaire from a random sample of 380 instructors across 12 technical institutions in north Lebanon. Instructor self-efficacy was positively associated with students' practical competency as perceived by instructors ($\beta = 0.570$; $p < 0.001$). Among TQM factors, process standardization was most influential ($\beta = 0.540$), followed by TQM training adequacy ($\beta = 0.511$) and Kaizen commitment ($\beta = 0.482$). TQM factors predicted instructor self-efficacy, with process standardization ($\beta = 0.823$) and Kaizen ($\beta = 0.703$) showing the highest associations. All indirect effects were significant, with process standardization ($\beta = 0.560$) and TQM training adequacy ($\beta = 0.409$) confirming self-efficacy's mediating role. This study supports instructors' self-efficacy as a mediator of technical education competency building, offering a differentiated, human-centered perspective. This study can serve as a guide for technical schools by proposing actionable strategies to support practical competencies and promote graduates' readiness in a resource-constrained context like Lebanon.

Keywords

process standardization, training, Kaizen commitment, empowerment, technical institutions, north Lebanon

JEL Classification

L15, M53, I25

INTRODUCTION

In today's economy, with rapidly accelerating technological cycles, shifting production paradigms, and intensifying global competition, the importance of practical skills as a strategic resource has grown significantly for organizations. The latter requires experienced personnel with operational competencies that can be implemented immediately, the ability to undertake complex technical work, and the capacity to function effectively in standardized settings (Khamiliyah et al., 2025). In this scenario, the technical and vocational education sector is at the forefront, as it links education and production, and its performance is assessed by its ability to translate training programs into skills that can be applied immediately in the workplace (Mayombe, 2024). The need for operational efficiency has led many institutions to adopt the principles of Total Quality Management (TQM), which are often per-



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ceived as tools for process management, closing performance gaps, and fostering a culture of continuous improvement. In the education sector, Quality Management in Training is implemented through three key drivers: training alignment with quality planning and control, Kaizen commitment, and standardization of teaching processes. These three aspects, including ISO, are meant to shape the learning context and improve the reliability of training outcomes (Korir et al., 2020; Barcos Redin et al., 2025). However, while TQM practices aim to establish a culture of continuous improvement and reliable processes, their effectiveness crucially depends on instructors' beliefs in their own pedagogical and technical abilities, which can either amplify or inhibit them (Khurniawan et al., 2021).

In the technical education domain, the interplay between these organizational practices and students' actual development of practical skills is anything but linear. The lack of standardization increases uncertainties and goal ambiguity, as it is viewed as a constraint on trainers' self-efficacy (Ochwo et al., 2023). Likewise, the implementation of quality tools may be seen as both an enabler of trainers' professionalism and a source of additional bureaucracy. The spirit of Kaizen assumes a culture of trust and accountability; otherwise, it may become empty formalism with no real-world effect on learning (Elihami et al., 2024). Although TQM is widely marketed in vocational education, the psychological processes linking it to objective student success remain a "black box." Therefore, it appears that leadership self-efficacy is not merely a secondary mindset but a central explanatory mechanism within the institution's excellence (Azha & Mislam, 2025).

In Lebanon, vocational training institutes play a key role in preparing youth to be proficient in a competitive and technology-driven world. The Directorate General of Vocational and Technical Education (DGVTE) under the Lebanese Ministry of Education and Higher Education (MEHE) oversees the technical and vocational education (TVE) sector. Both private and public institutions manage this sector. Within Lebanon's technical and vocational higher education framework, the system offers 170 specializations across various educational levels, including intermediate career education and professional employment supervision (Nasser et al., 2022). The TVE provides students with the acquisition of competencies and skills and prepares them for careers. However, the effectiveness of technical education depends on instructors' expertise, and advanced technical education emphasizes not just learning but applying knowledge, which is critical for adapting to changes in employers' expectations. In north Lebanon, the TVE sector faces challenges including skills mismatches, limited industry engagement, and the ongoing escalating effects of the country's crises (Elhassan et al., 2026). While multiple factors may influence the development of students' practical competence, institutional quality management practices have increasingly attracted attention as a potential mechanism for supporting educational effectiveness. However, limited evidence exists regarding the extent to which TQM practices are associated with perceived student practical competence in Lebanese technical institutes. This article has practical significance for managers. Quality management practices are intended to develop performance. Training is related to mastery, Kaizen can foster appreciation for contributions, and standardization can reduce goal uncertainty. This study could provide guidance to the leadership of Lebanese technical institutes in developing strategies to predict instructors' self-efficacy, the effectiveness of TQM practices in students' skills, and foster professional integration. It will also enrich the TQM model by incorporating Instructor Self-Efficacy as a psychological mediator.

1. LITERATURE REVIEW AND HYPOTHESES

Originally developed in industrial settings, Total Quality Management (TQM) has been adopted in educational institutions. This management philosophy targets continuous improvement, process

effectiveness, and stakeholders' satisfaction. TQM practices have been associated with improvements in institutional performance and workforce preparation (Zefaj, 2025). This quality management approach requires producing individuals who are immediately employable. TQM in education extends beyond statistical control to encompass organiza-

tional and behavioral issues. In this service organization, the system is considered a socio-technical system with a human focus, underscoring the need for a cross-functional approach that integrates all organizational elements (Zohriah et al., 2025). The application of TQM entails modifying practical approaches that require co-production between teachers and students. Transferring quality management principles entails creative adaptation rather than simple transfer (Talaie et al., 2025).

TQM implementation in vocational education predicts student readiness through a customer-focused approach, continuous professional development, and participatory improvement, thereby generating a competitive advantage (Wismayanti et al., 2025). Similarly, Total Quality Management programs train experts to apply specialized skills to manage projects and processes effectively. The literature emphasizes the crucial role of PDCA cycle in the success of quality initiatives. TQM program views training as a core part of quality systems, alongside resource and knowledge management. This systemic approach shows that appropriate TQM training is a fundamental component. Instructors' professional development through a cyclical TQM process: plan, do, check, act, with tailored training essential for improving teaching quality (Hermadi et al., 2025).

Previous studies consistently emphasize that training constitutes a core facet of TQM implementation. Adequate training endorses instructors' professional development, improves quality awareness, and facilitates the alignment of educational practices with technical sector requirements. Training through practical exercises, case studies, and group activities aligns with technical education needs for developing operational skills (Kravchenko & Saienko, 2020). The concept of continuous improvement, or Kaizen, is central to TQM. Quality management training emphasizes continuous improvement, the use of statistical tools, benchmarking, and Lean Six Sigma, underscoring the importance of organizational learning (Parumasur & Govender, 2013; Sunder, 2016). Personal skills and professional development are linked to teaching quality, underscoring the need for institutional support and a commitment to improvement. Research on standardization reveals how standards are embedded in educational prac-

tices and transform operations. Analyzing TQM obstacles indicates that a lack of a culture of continuous improvement hinders quality, as teachers often meet only minimal obligations rather than engage in proactive professional development (Barcos Redin et al., 2025). A commitment to Kaizen promotes continuous improvement in educational environments. Kaizen tools, such as 5S and daily boards, help learners become agents of change, boosting motivation and academic performance. The Kaizen model is associated with the professional skills of future computer science teachers through iterative problem-solving (Suzuki & Sakamaki, 2020).

Process standardization is considered a key dimension of TQM. It promotes consistency, reduces unnecessary variability, and establishes instructional and evaluation practices. Standardized processes in technical education may facilitate alignment between training activities and occupational standards. Structured frameworks, such as Quality Matters, influence pedagogical choices and technology use, suggesting that standardization can support creativity by providing a secure foundation. The TQM program emphasizes ISO 9001, indicating that proper standardization promotes professionalism (Randa, 2019). Other studies, based on Maslow and McGregor's theories, emphasize that standardization is effective when it addresses individuals' psychological needs. Process standardization unifies teaching practices for consistent results. In technical institutes, this standardization coordinates work processes, skills, and results (Rafi et al., 2023).

Instructors' self-efficacy, their belief in teaching abilities, amplifies the effect of quality practices on professional development (Scott et al., 2023). It shapes classroom organization, influencing emotional responses when facing challenges (Beniga, 2025). Previous research indicates that instructors with high self-efficacy demonstrate instructional effectiveness, greater persistence, classroom management capability, and willingness to adopt innovative teaching practices. Teachers' experiences foresee self-efficacy. Bandura's theory underscores the significance of self-efficacy in teaching (Mulyono et al., 2023). It mediates how TQM practices influence teacher performance, shedding light on psychological factors shaping educational results (Chen & Wu, 2025).

The relationship between trainers' self-efficacy beliefs and student learning outcomes is a well-documented area of research. Teachers' professional self-efficacy significantly mediates the transmission of skills to learners. Students' technical, problem-solving, and interpersonal skills are influenced by their trainers' confidence in their own efficacy (Eakman et al., 2019). Trainers' self-efficacy predicts learners' capabilities only through a high-quality pedagogical relationship, in which attentiveness to the other party is crucial (Eren et al., 2025). Although TQM practices focus on organizational processes, their effectiveness ultimately relies on human factors. Quality-oriented environments may improve instructors' confidence in their professional capabilities (Farah et al., 2025). It provides them with training opportunities, supportive leadership, continuous feedback, and clear procedures. Consequently, instructors' self-efficacy may represent a crucial mechanism through which TQM practices influence educational outcomes (Istiqomah et al., 2024). However, empirical evidence examining this mediating role remains limited, particularly within technical and vocational education settings.

TQM practices may contribute to educational effectiveness by supporting instructor development and continuous improvement. It promotes educational performance by emphasizing stakeholder involvement and process control (Geresom & Hazarika, 2024). The literature emphasizes the role of training quality in TQM, with Crosby noting that quality results from meeting requirements aligned with labor-market needs (Amoozad Mahdiraji et al., 2024). Bandura's self-efficacy theory explains that belief in one's ability influences motivation, with high self-efficacy leading trainers to engage in more interactive teaching, provide more feedback, and create positive environments (Schunk & DiBenedetto, 2023). Hence, self-efficacy theory proposes that instructors' beliefs regarding their professional capabilities affect their teaching behavior and educational outcomes (Kalinowski et al., 2024). The integration of these points of view indicates that TQM practices may be associated with students' perceived practical competence, both directly and indirectly through instructors' self-efficacy. Nevertheless, empirical evidence examining these relationships in Lebanese technical institu-

tions remains scarce, and the literature converges on the idea that TQM practices do not automatically yield educational outcomes.

Although there is increasing research on TQM in education, most studies focus on universities or general education, with less attention to technical and vocational institutions. Additionally, there is limited evidence on how TQM practices relate to students' perceived practical competence, specifically in Lebanon. The possible mediating effect of instructor self-efficacy has also been underexplored. These gaps justify the need for the current study.

This research aims to analyze the relationship between TQM practices (TQM training adequacy, commitment to Kaizen, process standardization) and students' practical competence, by examining the mediating role of instructors' self-efficacy. This theoretical framework justifies the formulation of the following hypotheses:

- H1: *TQM adequacy is positively associated with the perceived students' practical competence.*
- H2: *Commitment to kaizen positively predicts instructors' perception of students' practical competence.*
- H3: *Process standardization is positively associated with instructors' perception of students' practical competence.*
- H4: *Adequate TQM training positively predicts the instructor's self-efficacy.*
- H5: *A commitment to Kaizen is positively associated with instructors' self-efficacy.*
- H6: *Process standardization has a significant positive association with the instructor's self-efficacy.*
- H7: *The instructor's self-efficacy is positively associated with their perception of students' practical competence.*
- H8: *The instructor's self-efficacy plays a mediating role between TQM training adequacy and the perceived students' practical competence.*

H9: The instructor's self-efficacy mediates the relationship between commitment to Kaizen and the perceived students' practical competence.

H10: The instructor's self-efficacy plays a mediating role between process standardization and perceived students' practical competence.

2. METHODS

This explanatory study is based on a positivist philosophy. It perceives TQM reality in organizational settings as an objective phenomenon that can be observed, measured, and analyzed in terms of relationships among variables in a cross-sectional time horizon. This study is descriptive, as it observes and describes the practices of total quality management and their relationship to perceived students' practical competence (Parveen et al., 2024). It is explanatory because it aims to exam-

ine associations between variables, in accordance with a positivist philosophy that emphasizes objective analysis and the pursuit of general laws. Based on this philosophy, the nature of phenomena can be understood through empirical evidence, thereby facilitating hypothesis testing. In this context, the study adopts a deductive research methodology, which facilitates the development of research hypotheses based on theoretical concepts and prior research.

The study employs a quantitative method, chosen for its ability to measure instructors' perceptions of TQM practices. The primary data collection tool is a structured questionnaire. This choice is justified by its capacity to reach a significant number of Lebanese instructors as respondents and standardize responses. To ensure this measurement tool is clear, relevant, and scientific, a two-step validation process was conducted. First, it was reviewed and revised by experts and research professors in educational science and quality

Table 1. Operational definition

Variables	Operational definition	References
TQM Training Adequacy	This dimension assesses the alignment of training programs with Total Quality Management principles. Six items evaluate whether the training content, objectives, methods, and tools align with TQM, consider professional opinions, and adapt to labor market changes, aiding student competencies	Items were adapted to reflect the TQM training dimensions discussed by Naqvi and Naz (2025), Wei and Yin (2024) and Aid et al. (2024). These authors provide a TQM-in-education basis for assessing the adequacy and alignment of training with quality requirements
Commitment to Kaizen	It evaluates institutional and individual commitment to continuous improvement through six items that assess involvement in proposing, examining, valuing mistakes, and organizing meetings to improve teaching	The items were adapted with reference to the Kaizen/TQM framework discussed by Alsmairat et al. (2024), Barcos Redin et al. 2025), Oropesa-Vento et al. (2015), and Abu-Backer and Alshatnawy (2022). They support the operationalization of Kaizen as continuous improvement and institutional commitment to improvement
Process Standardization	It measures the formalization and standardization of teaching, using six items to assess methods, assessment, instructions, activities, and objectives, ensuring consistency. Items were developed to capture the formalization and consistency of instructional procedures	Items were adapted the TQM standardization literature, particularly Zubair (2013), Schäfermeyer and Rosenkranz (2011), and Othman Abahussain et al. (2020) They provide the TQM basis for formalized and consistent educational processes
Instructor Self-Efficacy	This scale measures instructors' beliefs in their ability to achieve teaching goals. Six items assess confidence in helping students master skills, adapt methods, improve performance, include underperforming students, and keep interest through suitable strategies. It establishes teacher/instructor self-efficacy dimensions relevant to teaching effectiveness and instructors' confidence in supporting learners	The six items were adapted to the technical/vocational teaching context from established teacher/instructor self-efficacy literature, particularly Scott et al. (2023) and Mulyono et al. (2023)
Perceived Students' Practical Competence	From the instructors' perception, this variable assesses students' practical competence through six items assessing mastery of basic skills like applying procedures, working independently, valuing quality and safety, solving problems, progressing, and transferring skills to real or simulated situations	The items were developed to capture instructors' perceptions of students' practical skills acquisition, drawing on the TVET skills-acquisition literature, particularly Beniga (2025) and Mayombe (2024)

management. It also underwent a pilot study with 20 teachers to improve the wording of the items and the overall structure of the questionnaire. The questionnaire consists of closed-ended items measured on 5-point Likert scales. In this study, a questionnaire was used as a data collection instrument. To assess instructors' self-efficacy, an attitude scale adapted from a valid model was used. They were asked to respond to several items on a five-point Likert-type ordinal scale of agreement. The scale was designed to capture teachers' beliefs and judgments about their classroom abilities. The questionnaire consisted of 30 items. Once the scale has been constructed, it is recommended to pretest the items (Naqvi & Naz, 2025).

The study is being conducted in vocational and technical training institutions in the city of Tripoli. The questionnaires were distributed to instructors at the institutions, as they are directly involved in teaching and administrative activities and can therefore judge the current state of management practices. The target population comprises 12 vocational and technical education institutes in Tripoli. The vocational and technical institutes are situated in North Tripoli. Table 2 lists the official institutes and technical schools in Tripoli. Data collection complies with the Declaration of Helsinki principles for the study of humans. The anonymity and confidentiality of the data are ensured. The data provided by the participants is anonymous, and no personal information was requested, such as names, surnames, email addresses, or IP addresses. The data were processed under the umbrella of confidentiality, were used for statistical purposes, and were analyzed aca-

demically. No personal results will be revealed to anyone. Participants were provided with a consent form, and at any time, they could withdraw their consent without consequences. The study is voluntary, and by completing the survey, participants consent to the regulations. The data will be safely stored, accessible to the research team, and anonymous.

The target population for this study comprises tenured and contracted teachers in vocational and technical education institutions in Tripoli, totaling about 1,970 teachers. Because the study population comprises tenured and contracted teachers in vocational and technical education institutions in Tripoli, the sample size was calculated using Steven Thompson's formula. This formula was selected because it yields a highly accurate estimate of the size of a representative sample when the total population size is known, and it allows precise control over the confidence level and the maximum margin of error (López-Garrido, 2023). Using a 95% confidence level and a maximum margin of error of 5%, the sample size was calculated to be 325. This was selected because it provides a fair representation of the study population and yields generalizable results with a reasonable degree of scientific accuracy. Although according to Steven Thompson's formula, the minimum sample size was 325, the number of questionnaires distributed reached 550. This larger number was distributed to account for any non-response or invalid responses. After data screening, 380 valid questionnaires were kept for analysis, indicating a response rate of around 70%.

Table 2. Population description

No.	Names of Official Technical Institutes and Schools	Number of Instructors
1	Akram Awida Technical School – Mina	113
2	Al-Badawi Technical Institute – Al-Badawi	95
3	Al-Fayhaa Technical Institute – Al-Mina	182
4	Al-Maharat Technical Institute – Jabal Mohsen	27
5	Technical Institute – Al-Qalamoun	127
6	Al-Saada Technical Institute – Abi Samra	142
7	Hospitality Institute of Tripoli – Mina	52
8	Jabal Mohsen Technical Institute	73
9	Technical School of Hospitality, Tripoli – Mina	57
10	The Educational Institute of Abi Samra	232
11	Tripoli Technical Institute – Abi Samra	155
12	Tripoli Technical Institute – Al-Qubba	715
Total		1,970

Table 3. Demographics

Demographics	Measures	Frequency	Valid Percent
Gender	Male	164	43.2
	Female	216	56.8
Age	Under 30	18	4.7
	30-39	148	39
	40-49	152	40.0
	50-59	62	16.3
	60-69	0	0.0
Qualification obtained	Bachelor's Degree	160	42.1
	Master's Degree	161	42.4
	Doctorate	59	15.5
Experience	Less than 5 years	60	15.8
	5-9 years	102	26.8
	10-14 years	214	56.3
	15-19 years	4	1.1
	20+ years	0	0.0
Participation in quality management training	None	63	16.6
	1 to 2 training courses	109	28.7
	3 to 5 training courses	146	38.4
	More than 5 training courses	62	16.3
	Total	380	100.0

The total sample comprises 380 respondents. Women predominate at 56.8% (216 cases) compared to 43.2% (164 cases) for men. 40% of instructors are aged 40-49 years (152 respondents), closely followed by those aged 30-39 years (39%, 148). Younger respondents (< 30) were underrepresented (only 4.7%). 56.3% are over 40. As for education level, responses are nearly balanced between Bachelor's (42.1%, 160) and Master's (42.4%, 161), with PhD holders the minority (15.5%, 59). The table shows a high concentration of 56.3% among instructors with 10-14 years of experience (214 cases). 83.4% have at least one training course. These profiles are trained in Total Quality Management (TQM).

The proposed model was pretested using principal component analysis (PCA) with Varimax rotation, conducted in SPSS. Before conducting a principal components analysis, it is appropriate to assess the adequacy of the sampling using the Kaiser-Meyer-Olkin (KMO) index to determine whether correlations among items are sufficient ($KMO > 0.70$) and to justify the analysis. It is also recommended to conduct a Bartlett's test of sphericity to assess whether the correlation matrix is an identity matrix. For this test, a significant result is expected ($p < 0.05$). Reliability is measured using Cronbach's alpha. The value is considered satisfactory from .70 (Moussa & Massoud, 2025).

Validity is checked through factor analysis. A confirmatory factor analysis is therefore conducted

using AMOS. Two criteria for evaluating construct validity are proposed: convergent and discriminant validity. Convergent validity is assessed by examining whether all elements of a measurement model are statistically significant. The indicator used is: Average Variance Extracted (AVE) > 0.5 . Since reliability is also an index of convergent validity, Cronbach's alpha is calculated. The value is considered satisfactory from .70. Divergent validity assesses whether the latent variables are distinct; this test is particularly indicated when construct intercorrelations are high. The indicators selected are, first, comparing the Average Variance Extracted (AVE) to the Maximum Shared Variance (MSV) and to the Average Shared Variance (ASV): $MSV < AVE$; $ASV < AVE$. The last retained indicator involves comparing the square root of a variable's AVE with its correlation coefficient with the other variables. The square root of the AVE must be greater than the correlation coefficient (Leatemia et al., 2022).

3. RESULTS

As Table 4 reveals, the dominant aspect is "Standardization of Processes," with a high average of 3.84. This is because there is a strong perception of standardization despite a high standard deviation of 0.936. This indicates a certain degree of heterogeneity. The distribution is negatively skewed (-1.157) and leptokurtic (+1.162). "Commitment

Table 4. Descriptive statistics

Variables	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
TA TQM Training Adequacy	1.00	5.00	3.44	0.832	0.522	0.125	0.155	0.250
CK Commitment to Kaizen	1.00	5.00	3.72	0.791	0.768	0.125	0.753	0.250
SP Standardization of Processes	1.00	5.00	3.84	0.936	-1.157	0.125	1.162	0.250
ISE Instructor Self-Efficacy	1.00	5.00	3.78	0.852	0.926	0.125	0.861	0.250
ASP Perceived Students' Practical Competence	1.50	5.00	3.74	0.634	0.742	0.125	0.748	0.250

Table 5. Correlation matrix

Variables	TA	CK	SP	ISE	ASP	Collinearity	
						Tolerance	VIF
TA TQM Training Adequacy	1					0.607	1.647
CK Commitment to Kaizen	0.357**	1				0.760	1.315
SP Standardization of Processes	0.454**	0.511**	1			0.600	1.166
ISE Instructor Self-Efficacy	0.452**	0.462**	0.895**	1		0.523	1.912
ASP Perceived Students' Practical Competence	0.294**	0.368**	0.578**	0.647**	1	—	—

Note: ** Correlation is significant at the 0.01 level (2-tailed).

to Kaizen” and “Training Adequacy” have relatively high averages at 3.72-3.78. However, there is a strong positive skew, ranging from +0.768 to +0.926. This suggests a “tail” of low values.

Practical Skills Acquisition” has an average of 3.74. This suggests a strong foundation in practical skills. This has the lowest standard deviation at 0.634. This is an unusual phenomenon, given the degree of consensus. This suggests a degree of skill transferability, a key lever for graduate employability. All averages are over 3. This suggests a positive assessment of TQM training. The average rank is approximately 3.70.

Table 5 shows moderate-to-strong correlations (0.35-0.89); the most strongly correlated pairs are SP-ISE (0.895) and SP-CK (0.511). Positively interconnected TQM constructs, validating a unified model (e.g., “training efficiency” factor). All had low VIFs ($1.16-1.64 < 5$) and high tolerances ($0.52-0.76 > 0.2$). Therefore, multicollinearity is not a major issue according to commonly accepted thresholds (Kim, 2019). However, discriminant validity between Standardization of Processes and Instructor Self-Efficacy was weaker than desired. Findings indicate substantial overlap between these two constructs, and results should be considered in the interpretation of results. Principal component analysis (PCA) after item purifica-

tion shows a stable factor structure. The rotation component matrix shows that the variables cluster around five latent dimensions. This confirms the instrument’s validity. The major findings include factor loadings, extraction estimates, total variance explained, and reliability and sampling adequacy.

The standardization process factor has a strong form, with high loadings above 0.75, accounting for over two-thirds of the variance. Furthermore, the loadings total 71%, which demonstrates a strong level of explanatory power. A high KMO index indicates that the data are appropriate. The Cronbach’s alpha value of 0.90 indicates strong internal consistency. TQM training adequacy has a strong form with loadings above 0.50. This demonstrates that quality-oriented teaching processes form a cohesive construct that reflects the alignment of learning objectives with labor market needs. Commitment to continuous improvement (Kaizen) has a good but limited structure, with all values above the threshold and an explained variance of 75%, indicating good power despite the low number of indicators. In the teacher self-efficacy dimension, the structure shows high values and communalities, accounting for 77% of the explained variance. A Cronbach’s alpha above 0.80 indicates reliability. Students’ practical skills results are very satisfactory, with high values and

Table 6. Convergent validity

Rotated items	Component			TVE/AVE	MSV
	Factor loadings	Extraction	Estimate		
Standardization of Processes					
Alpha Cronbach = 0.901; KMO = 0.870; C.R. = 8.58					
SP4.	0.842	0.726	0.757	71% 0.649	0.801
SP5.	0.837	0.800	0.865		
SP6.	0.803	0.693	0.738		
SP3.	0.786	0.720	0.845		
SP2.	0.758	0.707	0.811		
TQM Training Adequacy					
Alpha Cronbach = 0.805; KMO = 0.812; C.R. = 6.33					
TA2.	0.796	0.647	0.694	70% 0.520	0.206
TA3.	0.768	0.598	0.637		
TA1.	0.746	0.628	0.748		
TA5.	0.683	0.511	0.645		
TA4.	0.596	0.534	0.641		
Commitment to Kaizen					
Alpha Cronbach = 0.722; KMO = 0.790; C.R. = 3.08					
CK1.	0.810	0.656	0.551	75% 0.513	0.261
CK6.	0.693	0.605	0.697		
CK5.	0.635	0.513	0.745		
Instructor Self-Efficacy					
Alpha Cronbach = 0.808; KMO = 0.797; C.R. = 9.10					
ISE4.	0.826	0.683	0.785	77% 0.635	0.801
ISE3.	0.806	0.649	0.722		
ISE5.	0.799	0.638	0.692		
ISE6.	0.755	0.569	0.663		
Perceived Students’ Practical Competence					
Alpha Cronbach = 0.847; KMO = 0.843; C.R. = 8.14					
ASP1.	0.815	0.664	0.784	73% 0.621	0.419
ASP5.	0.794	0.631	0.754		
ASP3.	0.778	0.606	0.686		
ASP2.	0.776	0.602	0.691		
ASP6.	0.775	0.601	0.703		

communalities above the threshold in most cases, yielding an explained variance of 73%. A high Cronbach's alpha and a satisfactory KMO index confirm reliability and validity. The PCA validated a strong factor structure.

The HTMT ratios used to assess discriminant validity are provided in Table 7. The majority of con-

struct pairs showed HTMT ratios below the recommended threshold, hence showing satisfactory discriminant validity. Nonetheless, the HTMT ratio between Standardization of Processes and Instructor Self-Efficacy exceeded the recommended threshold (HTMT = 1.048), indicating considerable conceptual overlap between the two constructs. This finding corresponds to the

Table 7. HTMT ratios

Constructs	TA	CK	SP	ISE	ASP
TA. TQM Training Adequacy					
CK. Commitment to Kaizen	0.514				
SP. Standardization of Processes	0.538	0.681			
ISE. Instructor Self-Efficacy	0.565	0.649	1.048		
ASP. Perceived Students' Practical Competence	0.358	0.501	0.663	0.785	

Note: HTMT values below 0.85 indicate adequate discriminant validity. Values above the threshold suggest potential construct overlap.

Table 8. Direct effects on practical skills acquisition

Variable	→	Variable	Estimate	S.E.	C.R.	P	Results
Standardization of Processes	→	Perceived Students' Practical Competence	0.540	0.032	15.259	$p < 0.001$	H3 supported
TQM Training Adequacy	→	Perceived Students' Practical Competence	0.511	0.035	14.318	$p < 0.001$	H1 supported
Commitment to Kaizen	→	Perceived Students' Practical Competence	0.482	0.035	12.310	$p < 0.001$	H2 supported
Instructor Self-Efficacy	→	Perceived Students' Practical Competence	0.570	0.034	16.803	$p < 0.001$	H7 supported

Fornell-Larcker criterion, in which the correlation between the two constructs is greater than the square root of their AVE. Although the HTMT results indicate limited discriminant validity between the two constructs, they were retained because they represent theoretically different dimensions within the proposed framework. Therefore, interpretations were treated carefully.

These results confirm the robustness of the structural model and the theoretical consistency of the hypotheses formulated. All relationships exhibit High C.R. values (from 12.310 to 16.803), well above the critical threshold of 1.96. The standardization of processes showed a significant positive association with instructors' perception of practical competence ($\beta = 0.540$; CR = 15.259; $p < 0.001$). The high coefficient and critical value confirm H3. H1 is supported ($\beta = 0.511$; $p < 0.001$). Commitment to kaizen is associated with instructors' perception of practical competence ($\beta = 0.482$; C.R. = 12.310; $p < 0.001$). This effect is the smallest among the organizational variables; it remains statistically very significant, supporting H2. Instructors' self-efficacy has a direct statistical effect on instructors' perception of students' practical

competence ($\beta = 0.570$; $p < 0.001$). The highest critical value confirms H7. Trainer self-efficacy is the most influential element of students' practical competence.

Process standardization was positively associated with instructor self-efficacy ($\beta = 0.823$; C.R. = 38.279; $p < 0.001$). The coefficient indicates that a one-standard-deviation improvement in process standardization is associated with a substantial increase in perceived self-efficacy. Hence, the model's strongest effect supports H6. Commitment to a continuous improvement approach positively predicts instructor self-efficacy ($\beta = 0.703$; CR = 34.148; $p < 0.001$). This statistical effect supports H5. Conversely, while statistically significant, TQM training adequacy has a marginal effect. TQM training adequacy is related to trainer self-efficacy ($\beta = 0.059$; CR = 2.553; $p = 0.011$). Statistical support for H4 is statistically significant.

All relationships are statistically significant ($p = 0.000$). The estimated value confirms this mediating role and supports H10. Instructors' self-efficacy mediates the relationship between process standardization and the instructors' perception

Table 9. TQM practices and instructor self-efficacy

Variable	→	Variable	Estimate	S.E.	C.R.	P	Results
Standardization of Processes	→	Instructor Self-Efficacy	0.823	0.022	38.279	$p < 0.001$	H6 supported
TQM Training Adequacy	→	Instructor Self-Efficacy	0.059	0.023	2.553	0.011	H4 supported
Commitment to Kaizen	→	Instructor Self-Efficacy	0.703	0.024	34.148	$p < 0.001$	H5 supported

Table 10. Mediating role of instructor self-efficacy

Variable	→	Variable	Estimate	S.E.	C.R.	P	Results
Standardization of Processes → Instructor Self-Efficacy	→	Perceived Students' Practical Competence	0.560	0.005	10.770	$p < 0.001$	H10 supported
TQM Training Adequacy → Instructor Self-Efficacy	→	Perceived Students' Practical Competence	0.409	0.006	9.389	$p < 0.001$	H8 supported
Commitment to Kaizen → Instructor Self-Efficacy	→	Perceived Students' Practical Competence	0.023	0.006	3.895	$p < 0.001$	H9 supported

of practical competence ($\beta = 0.560$; $CR = 10.770$; $p < 0.001$). Standardization of processes positively predicts skill acquisition by improving trainers' self-efficacy.

Instructors' self-efficacy mediates the relationship between TQM Training Adequacy and instructors' perception of practical competence ($\beta = 0.409$; $CR = 9.389$; $p < 0.001$). This indirect significant effect supports H8. Instructors' self-efficacy mediates the relationship between Commitment to Kaizen and instructors' perception of practical competence ($\beta = 0.023$; $CR = 3.895$; $p < 0.001$). The critical value confirms the existence of a mediating effect and supports H9.

4. DISCUSSION

The statistical analysis shows that TQM practices are associated with students' practical competence, as perceived by instructors, and have direct and indirect effects. The results show a relational architecture in which total quality management practices are positively associated with practical competence and indirectly influence it through instructors' self-efficacy. Process standardization, TQM training adequacy, and commitment to Kaizen demonstrate that a structured, coherent framework directly promotes students' acquisition of practical competence and skills. The present study confirms these findings in the education context (Temirkhanov et al., 2024). The standardization of processes and the adequacy of TQM training are structuring levers that can stabilize teaching methods and reduce implementation discrepancies. It creates an environment conducive to applied learning. A commitment to continuous improvement introduces a dynamic of progressive adjustment that supports practical competencies. These results align with previous work in quality management, which emphasizes that formalizing processes improves organizational coherence and operational performance (Dinata & Andriani, 2025).

The results regarding direct effects indicate that improvements in practical competencies depend on both organizational and human factors. Instructors' self-efficacy emerges as a central lever in acquiring pedagogical skills (Alamri, 2023). The results show that instructors' self-

efficacy is shaped by the organizational environment. Process standardization and commitment to Kaizen have a particularly strong influence on self-efficacy. When rules are clear, procedures consistent, and objectives shared, the sense of self-efficacy and teaching mastery intensifies (Chen & Wu, 2025).

The analysis of indirect effects confirms that self-efficacy functions as a transformative mechanism. Quality practices influence instructors' perceptions of self-efficacy, which then translate into concrete competencies (Peng et al., 2024). Mediation is particularly substantial for process standardization and the adequacy of TQM training; consequently, these dimensions improve practical skills largely by consolidating pedagogical self-confidence (Setiawati & Martdianty, 2024). Comparing direct and indirect effects reveals complementarity rather than substitution. Certain practices, notably standardization, simultaneously have a significant direct effect on skills and a substantial indirect effect through self-efficacy. Institutions seeking to sustainably improve students' competencies must consider instructors' professional confidence as a strategic asset, built through rigorous management practices and supported by a coherent organizational culture. Results imply a dual pathway of influence: structural and psychological (Zhang & Tseng, 2023).

Studies highlight that Total Quality Management (TQM) through internships improves technical competence and skills. These studies converge on the potential of Total Quality Management practices to lever trainers' self-efficacy, thereby promoting practical competencies among students in technical training (Talaie et al., 2025). However, few studies have examined the mediating effect of instructor self-efficacy in Lebanese institutions, underscoring the need for targeted empirical investigation.

Practical competencies depend on a coherent articulation between the organizational framework, a culture of continuous improvement, and learning capital. The results underscore that investing in training instructors and clarifying processes constitutes a strategic priority (Ravaghi et al., 2021). Comparison with previous studies also reveals an important distinction. While some

studies primarily emphasize a culture of continuous improvement as the central driver of performance, current findings show that its indirect effect through self-efficacy remains more moderate than that of process standardization. This relative divergence can be explained by the operational nature of technical training, where the clarity of procedures and the precision of reference frameworks play a particularly critical role.

This study underscores that the impact of quality practices extends beyond mechanical procedural improvements; it also depends on trainers' perceptions of their ability to effectively transmit know-how. From a strategic perspective, this article adopts an integrated approach to instructional management. It supports that investing in TQM practices without supporting instructors' confidence would limit its potential contribution (Yusuf, 2023). Optimal skills acquisition results from the alignment between the institutional framework, a culture of continuous improvement, and a sense of personal efficacy. From a managerial perspective, the discussion highlights the need for integrated governance. Technical school administrators should adopt a systemic approach that combines standardizing practices, supporting professional development, and implementing continuous evaluation mechanisms. Educational performance appears to result from a balance between organizational discipline and instructor empowerment.

This study did not escape limitations. The first limitation is that the perceived practical competence of the students was evaluated by instructors' perception only, without assessing the actual performance of the students or their practical examination or tests, due to a request for grade confidentiality. Future studies will need to include multiple sources of evaluation to provide a complete picture of students' competence levels. While the majority of constructs demonstrated acceptable discriminant validity, Standardization of Processes and Instructor Self-Efficacy exhibited substantial conceptual overlap, as evidenced by both the correlation matrix and the discriminant validity. The reason is that instructors who perceive the educational process as highly standardized have high teaching self-efficacy. As such, results related to these variables were carefully interpreted. Future studies could examine the moderating effects of contextual variables, such as organizational culture, instructors' professional experience, and the level of institutional resources. A comparative approach across different types of institutions would also allow an assessment of the model's robustness across diverse environments. Finally, longitudinal research would be relevant for analyzing the stability of the observed effects over time and for better understanding the dynamics of changes in self-efficacy and teaching performance.

CONCLUSION

The objective of this study was to examine the relationship between TQM practices and instructors' perceptions of students' practical competence, and to analyze the mediating role of instructors' self-efficacy in this relationship. The empirical results corroborated positive associations between constructs. The study identified significant positive associations of TQM practices, particularly process standardization, TQM training adequacy, and commitment to kaizen as continuous improvement, on students' practical competence and indirect effects through instructors' self-efficacy. Instructors' self-efficacy emerged as a key explanatory mechanism linking educational quality to students' abilities and their learning outcomes. This study confirms that the structured integration of quality management principles, combined with the trainers' self-efficacy, may contribute to the sustainable development of practical skills in technical education. The model demonstrated that the combined TQM practices (structural) and self-efficacy (psychological) is associated with skills acquisition in technical and vocational education.

Educational organizations cannot limit themselves to procedural changes alone but must improve teachers' self-efficacy through training, support, and consistent organizational structures. Process standardization exhibited the strongest association and may represent a critical consideration in TQM implementation strategies. It highlights the relevance of the application of social cognitive theory to

understand the effect of organizational context on learning outcomes. Yet, the strong overlap between process standardization and self-efficacy suggests the need for clearer construct differentiation in future research. Leaders in education would adopt an integrated quality framework that combines standardized procedures, targeted instructors' development, and a continuous improvement culture.

AUTHOR CONTRIBUTIONS

Conceptualization: Fadi Dandachli, Mazen Massoud.

Data curation: Fadi Dandachli, Mazen Massoud.

Formal analysis: Fadi Dandachli, Mazen Massoud, Ali Sankari.

Investigation: Fadi Dandachli.

Methodology: Fadi Dandachli, Mazen Massoud, Ali Sankari.

Project administration: Fadi Dandachli, Ali Sankari.

Resources: Fadi Dandachli, Ali Sankari.

Software: Fadi Dandachli, Mazen Massoud.

Supervision: Fadi Dandachli, Ali Sankari.

Validation: Fadi Dandachli, Mazen Massoud, Ali Sankari.

Visualization: Ali Sankari.

Writing – original draft: Fadi Dandachli, Mazen Massoud.

Writing – review & editing: Fadi Dandachli, Mazen Massoud, Ali Sankari.

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APPENDIX A. Questionnaire

This questionnaire is part of doctoral research on “The influence of Total Quality Management (TQM) practices on the acquisition of practical skills, through the mediating role of teachers’ self-efficacy.” Its purpose is to investigate the impact of quality management practices in educational centers on students’ practical skills, both directly and through teachers’ self-efficacy. This questionnaire is conducted ethically in accordance with the Declaration of Helsinki and ensures the anonymity and confidentiality of the data, with the data used solely for research purposes. Your participation is voluntary and can be stopped at any time without explanation. Your contribution to this research is crucial to its progress and is estimated to take 15 to 20 minutes of your time. Your answers will be kept confidential and anonymous, and you will not be identified in any way. There is no right or wrong answer to the questions in the questionnaire; what matters is your experience and perception.

For each of the following statements, please indicate the extent to which you agree by selecting one of the responses below:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Table A1. Questionnaire items

Items	TQM Training Adequacy (TA)					
TA1	The training content is regularly updated in accordance with the principles of Total Quality Management.	1	2	3	4	5
TA2	The training objectives are clearly aligned with the quality standards of the professional sector.	1	2	3	4	5
TA3	The teaching methods used promote the continuous improvement of student performance.	1	2	3	4	5
TA4	The programs incorporate systematic feedback from the professional field.	1	2	3	4	5
TA5	The institution ensures that training is adapted to the evolving demands of the job market.	1	2	3	4	5
TA6	The teaching tools are designed to guarantee mastery of the expected practical skills.	1	2	3	4	5
Items	Commitment to Kaizen (CK)					
CK1	The institution encourages the continuous improvement of teaching practices.	1	2	3	4	5
CK2	I am encouraged to suggest improvements to my teaching methods.	1	2	3	4	5
CK3	Instructors’ suggestions for improvement are considered by management.	1	2	3	4	5
CK4	Mistakes are considered opportunities for learning and improvement.	1	2	3	4	5
CK5	Regular meetings are organized to analyze and improve teaching processes.	1	2	3	4	5
CK6	The progressive improvement of student performance is an institutional priority.	1	2	3	4	5
Items	Standardization of Processes (SP)					
SP1	Teaching procedures are clearly defined and documented.	1	2	3	4	5
SP2	The criteria for evaluating practical skills are standardized.	1	2	3	4	5
SP3	Instructions given to students follow established protocols.	1	2	3	4	5
SP4	Practical activities are organized according to structured procedures.	1	2	3	4	5
SP5	Learning objectives are clearly specified for each practical module.	1	2	3	4	5
SP6	Standardization facilitates consistency among different instructors.	1	2	3	4	5
Items	Instructor Self-Efficacy					
ISE1	Instructors can help students acquire complex technical skills.	1	2	3	4	5
ISE2	Instructors can modify their methods to accommodate students’ different needs.	1	2	3	4	5
ISE3	Instructors believe they can improve students’ practical skills.	1	2	3	4	5
ISE4	Even when working with struggling students, instructors play a vital role in addressing issues.	1	2	3	4	5
ISE5	Instructors have mastered the teaching methods needed to develop professional skills.	1	2	3	4	5
ISE6	Instructors can keep students highly engaged during hands-on activities.	1	2	3	4	5
Items	ASP Perceived Student Competencies					
ASP1	Students master the fundamental technical skills of their specialization.	1	2	3	4	5
ASP2	Students correctly apply the professional procedures taught.	1	2	3	4	5
ASP3	Students can perform practical tasks independently.	1	2	3	4	5
ASP4	Students adhere to quality standards in their practical work.	1	2	3	4	5
ASP5	Students effectively resolve technical problems encountered in the workshop.	1	2	3	4	5
ASP6	Students demonstrate tangible progress in their practical skills throughout the semester.	1	2	3	4	5
ASP7	Students effectively transfer their acquired knowledge to real or simulated situations.	1	2	3	4	5
ASP8	Students adhere to safety and quality standards in their practical work.	1	2	3	4	5

Table A2. Demographics

Demographics	Category	Choice
Gender	Male	
	Female	
Age	Under 30	
	30-39	
	40-49	
	50-59	
	60-64	
qualification obtained	Bachelor's Degree	
	Master's Degree	
	Doctorate	
experience	Less than 5 years	
	5-9 years	
	10-14 years	
	15-19 years	
Participation in quality management training	None	
	1 to 2 training courses	
	3 to 5 training courses	
	More than 5 training courses	