

Impact of Training Effectiveness and Employee Competence on Quality Compliance Behavior in the Pharmaceutical Industry of Pakistan

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Abstract

Quality compliance remains an issue of great importance within the pharmaceutical industry where employee competence, knowledge, and skills play a direct role in the company's performance and quality of the product. In this research, Training Effectiveness on Quality Compliance Behavior was studied in relation to the pharmaceutical industry of Pakistan while taking into consideration the mediating effect of Employee Competence and the moderating effect of Management Support. Quantitative research design has been used and a total of 190 participants from the pharmaceutical industry of Pakistan were surveyed using a structured questionnaire. The data was analyzed using reliability analysis, descriptive statistics, Pearson correlation, regression analysis, bootstrap mediation and moderation analysis. It has been found that Training Effectiveness positively affected both Quality Compliance Behavior and Employee Competence. Employee Competence also positively impacted Quality Compliance Behavior. In addition, it has been observed that Employee Competence partially mediated the relationship between Training Effectiveness and Quality Compliance Behavior with an indirect effect of 0.256 and 95% confidence interval of (0.075, 0.463). The total impact of Training Effectiveness and Employee Competence accounted for 65.9% of the variance in Quality Compliance Behavior. However, the hypothesized moderation effect of Management Support on the relationship between Employee Competence and Quality Compliance Behavior was not significant. From the results of this study, it can be seen that effective and relevant training, together with the development of employee competence, has an important part to play in enhancing quality compliance behavior in the pharmaceutical industry.

Keywords: Training Effectiveness, Employee Competence, Quality Compliance Behavior, Management Support, Pharmaceutical Industry, Moderated Mediation.

Introduction

It is necessary for the pharmaceutical industry to maintain public health through manufacturing, storing, and distributing safe and effective medicines. Due to the sensitive nature of pharmaceutical products, regulatory bodies enforce stringent quality systems in the organization, including GMP, cGMP, GDP, and others. It ensures the safety of medicines through their production, storage and distribution, hence it operates within strict quality standards like GMP, cGMP, and GDP. In Pakistan, the pharmaceutical industry has been under the regulation of Drug Regulatory Authority of Pakistan (DRAP), which has been growing in the last decade (Bernasconi et al.,

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2025)but organizations still have to experience problems of non-compliance, audit findings, documentation issues, and deviation from processes (Mohini Tawade1, 2023). Training has been widely considered as one of the ways of ensuring compliance, as it increases workers' knowledge of quality processes and standards (Muhammad et al., 2025) nevertheless, training will lead to compliance only when it results in workers' competence (Astarina et al., 2022), and management influence will decide whether competent workers apply their competence. Quality improvement in the Pakistani pharmaceutical industry will need an examination of all these factors combined rather than individually.

Even with substantial training efforts of employees, instances of non-conformity, errors in documentation, and audit observations continue to be reported in pharmaceutical companies, suggesting that employee training may not ensure compliance. The impact of training on performance has been clearly documented (Obeng-Tuaah, 2025), but there has not yet been much investigation into the mechanisms through which training impacts compliance behaviors, specifically the mediating role of employee competence and the moderating role of management support in this relationship(Wang et al., 2022). Furthermore, most of the existing studies have focused more on investigating the impact of training on employee performance than on compliance behavior as an outcome variable, as well as they have limited their investigations to developed countries, while Pakistan's pharmaceutical industry, which is highly regulated, has remained largely unexplored.

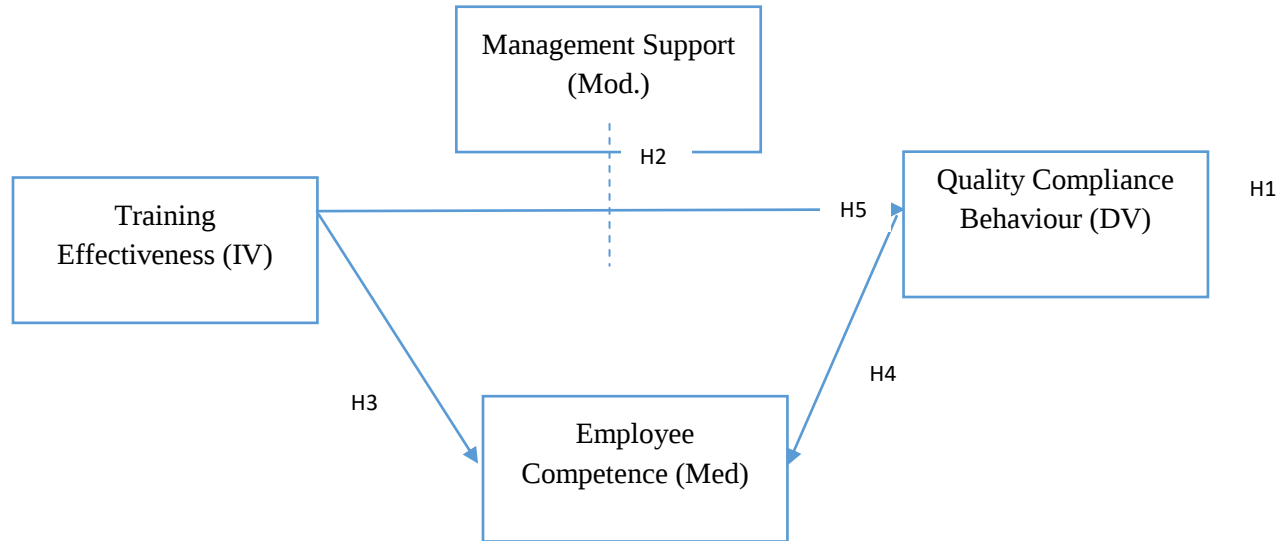
Theoretical Framework

Two well-known theories have been used in the research as a basis for explaining how the impact of training effectiveness is related to employee competence, and how organizational factors affect competence in compliance behavior.

Training Transfer Theory (Baldwin & Ford, 1988) The Training Transfer Theory is the belief that for training to be successful, it is not only dependent on the quality of the training but on whether the knowledge and skills gained are used in actual job performance through individual characteristics such as ability and motivation; training program characteristics such as the content and the sequencing of events; and environmental factors such as the transfer climate and supervisor support. This theory forms the basis of the belief that the competency of employees will lead to quality compliance due to management support (Mdhlalose, 2022).

Social Learning Theory (Bandura, 1986) The Social Learning Theory postulates that learning results from observation, imitation, and reinforcement and not personality and experience. This theoretical framework can help us understand the impact of management support on the current research, where the management support that observes, reinforces, and rewards compliance behavior makes it more probable that employees engage in such behavior. The Social Learning Theory also explains how the self-efficacy concept helps us understand the mediating effect of the competence of the employees because when employees become more competent through training, they feel more confident to perform compliance actions(Virginia Koutroubas & Michael Galanakis, 2022).

Theoretical Framework



Literature Review

Quality Compliance Behavior

Quality compliance behavior (QCB) is defined by the degree of adherence to regulation requirements, standard operating procedures (SOPs) and quality management systems, which include documentation, deviation reporting, audit activities and hygiene/safety practices (Nawawi et al., 2022). The theory behind QCB is social cognitive theory, under which QCB is based not only on cognitive factors (knowledge and skills), but also on environmental factors (organizational factors) and behavioral factors (self-efficacy)(Virginia Koutroubas & Michael Galanakis, 2022). Even though there are over 750 manufacturers registered in Pakistan, and significant domestic sales, there are still many compliance deficiencies, including poor documentation, and relaxed attitudes towards quality (Mubarak et al., 2024), which require proper compliance management system for companies wishing to enter export markets (Mohini Tawade1, 2023).

Factors Affecting Quality Compliance Behavior and Related Hypotheses

There are three variables that are considered to be the most determinant of QCB in Pakistan's pharmaceutical companies: Training Effectiveness (Independent Variable), Employee Competence (Mediator), and Management Support (Moderator).

Training Effectiveness and Quality Compliance Behavior

Training effectiveness refers to how well a training program accomplishes its learning goals and positively affects employee performance and behavior. In the pharmaceutical industry, training effectiveness is assessed using training need assessment, training design, and trainer competence. According to research in the pharmaceutical industry in Pakistan, the three mentioned aspects positively affect the cGMP compliance behavior of 412 employees(Muhammad et al., 2025). Moreover, in quasi-experimental studies conducted in Bangladesh, it was revealed that trained

drug dispensers showed significantly higher compliance level than their counterparts who did not receive any training(Sultana Samapti et al., 2026). Additionally, the link between sophistication of training and compliance-task efficiency was confirmed in a study conducted in Karachi. According to Kirkpatrick, effective training should result in behavior change (Pane et al., 2022).

H1a: There is a significant positive relationship between Training Effectiveness and Quality Compliance Behavior in the pharmaceutical industry of Pakistan.

H1o: There is no significant relationship between Training Effectiveness and Quality Compliance Behavior in the pharmaceutical industry of Pakistan.

Employee Competence and Quality Compliance Behavior (Mediation)

Employee competence refers to the combination of knowledge, skills, and abilities required for GMP-related activities like analysis, record keeping, and equipment qualification. Previous studies indicate that employee competence partly mediates the relationship between participation in training and behavioral compliance $VAF = 31.7\%$ (Wang et al., 2022) and that training and development significantly predicts employee competence that further leads to organizational effectiveness (Supriya, 2023), which forms the basis of the mediation framework, namely the Training Effectiveness $\rightarrow$ Employee Competence $\rightarrow$ Quality Compliance Behavior. Similar results have been reported by(Muhammad et al., 2025) where perceived usefulness of training partially mediates the relationship between training and compliance, and according to human capital theory (Becker, 1964), it is only the competence developed through training that brings about compliance behavior.

H2a: Employee Competence mediates the relationship between Training Effectiveness and Quality Compliance Behavior in the pharmaceutical industry of Pakistan.

H2o: Employee Competence does not mediate the relationship between Training Effectiveness and Quality Compliance Behavior.

Management Support and Quality Compliance Behavior (Moderation)

The management support is defined as the resources, motivation, and reinforcement provided by supervisors and executives for promoting compliance which includes the quality commitment of leaders and strict implementation of quality standards(Pane et al., 2022). Organizations with quality commitment from managers have higher performance as compared to cost saving organizations (Zhao et al., 2023), and according to the social exchange theory employees also respond to the organizational support in return with their positive behavior like adherence to SOPs (Otoo, 2023)therefore, the impact of training effectiveness on the quality compliance behavior is dependent on the extent of the management support(Pane et al., 2022).

H3a: Management Support significantly moderates the relationship between Training Effectiveness and Quality Compliance Behavior in the pharmaceutical industry of Pakistan.

H3o: Management Support does not moderate the relationship between Training Effectiveness and Quality Compliance Behavior.

H4a: Management Support significantly moderates the mediated relationship between Training Effectiveness and Quality Compliance Behavior through Employee Competence.

H4o: Management Support does not moderate the mediated relationship between Training Effectiveness and Quality Compliance Behavior through Employee Competence.

Research Gap and Need for the Study

This paper addresses three main gaps in the literature. One gap is that the majority of training effectiveness studies are conducted within the banking, hospitality or general service industries, whereas there is very limited work carried out within the pharmaceutical industry which requires more regulation, where any lapses in compliance pose serious safety risks to patients. The second gap in literature is that the few existing studies about training in pharmaceutical firm address issues related to training, competence, and compliance independently, instead of competence as a mediator of the relationship between training and compliance. Finally, there is no empirical work done on management support as a moderator of competence and compliance behavior within the context of pharmaceutical firms of Pakistan.

Methodology

Research Approach and Design

The research uses the quantitative research method involving cross-sectional surveys. The study utilized an instrument in the form of a self-administered structured questionnaire that was administered to the workers of pharmaceutical manufacturing companies located in Pakistan, resulting in the collection of data from 190 respondents after the screening of data. Constructs were assessed using five-point Likert scales ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Measures and Analysis

Training Effectiveness (IV, 8 items) reflected if training enhanced GMP knowledge, relevancy to the job, skill gap reduction, quality of delivery, its frequency, and evaluation afterwards, following Kirkpatrick model evaluation criteria (Ambu-Saidi et al., 2024). Employee Competence (mediator, 7 items) included technical knowledge, competence in deviation identification, independent problem solving skills, knowledge of regulations, and documentation accuracy (Pineda-Herrero et al., 2011). Quality Compliance Behavior (DV, 9 items) was designed by me and corresponded to cGMP/FDA requirements (FDA, 2025): SOP compliance, deviations reporting, documentation accuracy, and CAPA audits' participation. Management Support (moderator, 6 items) included resources, no-blame atmosphere, feedback and commitment to quality of leadership.

For missing data, spread sparsely across variables, series means were used to fill the gaps and keep all participants (N = 190). Next, composite (mean) scores were calculated for each variable. For internal consistency, Cronbach's alpha was used (>.70 is satisfactory, Nunnally, 1978). For testing hypotheses, Pearson correlation, hierarchical regression, and bootstrap-based mediation/moderation analysis (5,000 resamples, 95% CI) according to Hayes' (2018) PROCESS methodology was employed. Model 4 was used to test for mediating effect of competence and

Model 1 was used to test the moderating effect of management support. The predictors were first mean-centered prior to calculating the interaction effect.

Results

Reliability Analysis

Inferential analyses were performed after assessing internal consistency for each of the constructs via Cronbach's alpha.

Table 1: Reliability Analysis

Variable	No. of Items	Cronbach's Alpha (α)	Interpretation
Training Effectiveness (TE)	8	.921	Excellent
Employee Competence (EC)	7	.927	Excellent
Quality Compliance Behavior (QCB)	9	.937	Excellent
Management Support (MS)	6	.883	Good

The constructs all met the benchmark for internal consistency of .70, with values ranging from .927 (Employee Competence) to .921 (Training Effectiveness).

Demographic Profile of Respondents

Demographic and screening characteristics of the 190 participants are provided in Table 2.

Table 2: Demographic and Screening Profile of Respondents (N = 190)

Variable	Category	N	%
Age	20 or below	24	12.6%
	21–30	116	61.1%
	31–40	45	23.7%
	41–50	5	2.6%
Gender	Female	116	61.1%
	Male	71	37.4%
	Prefer not to say	3	1.6%
Qualification	Intermediate	26	13.7%
	Bachelor's	117	61.1%
	Master's	44	23.2%
	Other / missing	3	1.6%
Work Experience	Less than 1 year	86	45.3%
	1–3 years	47	24.7%
	4–7 years	29	15.3%
	8 or more years	28	14.7%
Training Related to Job	Yes	142	74.7%
	Partially	29	15.3%
	No	19	10.0%
Training Frequency	Monthly	79	41.6%
	Quarterly	32	16.8%
	Twice a year	20	10.5%

Once a year	16	8.4%
Only when required	43	22.6%

Table: 3 Descriptive Statistics and Normality

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
Training Effectiveness	190	1.00	5.00	3.8351	.70625	-1.502	3.753
Employee Competence	190	1.00	5.00	3.8519	.70114	-1.194	2.739
Quality Compliance	190	1.00	5.00	4.0015	.72823	-1.534	3.020
Management Support	190	1.00	5.00	3.8123	.70866	-1.721	4.219

Correlation Analysis

Pearson correlation analysis was done to study the relationships between variables and to conduct a preliminary multicollinearity test.

Table 4: Pearson Correlation Matrix

Variable	M	SD	1	2	3	4
1 Training Effectiveness	3.8351	0.706	1.000			
2 Employee Competence	3.8519	0.701	.736**	1.000		
3 Quality Compliance Behavior	4.0015	0.728	.779**	.728**	1.000	
4 Management Support	3.8123	0.708	.647**	.580**	.735**	1.000

The Pearson correlation analysis was carried out to determine the relationships between the constructs of Training Effectiveness, Employee Competence, Quality Compliance, and Management Support. According to Table 4, there is positive and significant correlation at the 0.01 level ($p < .01$) between all the four constructs being examined. This includes a very strong positive correlation between Training Effectiveness and Quality Compliance ($r = .779$, $p < .01$), Training Effectiveness and Employee Competence ($r = .736$, $p < .01$), and a moderate positive correlation between Training Effectiveness and Management Support ($r = .647$, $p < .01$). Employee Competence has very strong positive correlation with Quality Compliance ($r = .728$, $p < .01$) and a moderate correlation with Management Support ($r = .580$, $p < .01$). In addition, Quality Compliance has a very strong positive correlation with Management Support ($r = .735$, $p < .01$).

Regression Assumption Checks

Assumption	Statistic	Result
Multicollinearity Training Effectiveness	VIF = 2.179; Tolerance = 0.459	No problematic multicollinearity
Multicollinearity Employee Competence	VIF = 2.179; Tolerance = 0.459	No problematic multicollinearity
Independence of residuals	Durbin-Watson = 1.858	Acceptable; close to 2

als		
Homoscedasticity	Breusch–Pagan $p = 1.015e-07$	Significant evidence of heteroscedasticity

Multicollinearity was not an issue in the regression model with VIF values of 2.179 for both predictors and tolerance at 0.459. The Durbin-Watson statistic is 1.858 and suggests that there is no problem with independence of residuals. However, the Breusch-Pagan test resulted in a p -value $< .001$ and indicates heteroscedasticity in the data. It means that the analysis cannot conclude that homoscedasticity has been proved with the help of statistics.

Table 5: Regression Analysis: Direct Relationships

Training Effectiveness → Quality Compliance Behavior

Predictor	B	SE	B	T	p	R ²	F
Training Effectiveness	0.803	0.047	0.779	17.032	$< .001$	0.607	290.080

Training Effectiveness was a significant positive predictor of Quality Compliance Behavior ($B = 0.803$, $t = 17.032$, $p < .001$; $R^2 = 0.607$), supporting H1.

Training Effectiveness → Employee Competence

Predictor	B	SE	B	T	p	R ²	F
Training Effectiveness	0.730	0.049	0.736	14.886	$< .001$	0.541	221.581

The variable Training Effectiveness was found to be a positive predictor of Quality Compliance Behavior ($B = 0.803$, $t = 17.032$, $p < .001$; $R^2 = 0.607$), which supported the hypothesis H1.

Table 6: Regression Coefficients

Training Effectiveness and Employee Competence on Quality Compliance Behavior

Predictor	B	SE	B	t	P
Training Effectiveness	0.547	0.065	0.531	8.419	$< .001$
Employee Competence	0.351	0.065	0.338	5.359	$< .001$

$R^2 = 0.659$, $F(2, 187) = 180.778$, $p < .001$. Training Effectiveness and Employee Competence were both significant positive predictors of Quality Compliance Behavior

Mediation Analysis (H4)

Bootstrap mediation analysis was done using the data at the respondent level, where the variables were Training Effectiveness as X, Employee Competence as the mediator, and Quality Compliance Behavior as Y. The estimation of the indirect effect was done through 10,000 bootstrap samples.

Table 7

Effect	Coefficient	SE	95% Lower	CI	95% Upper	CI	Significant?
Total effect TE → QCB	0.803	0.047	0.710		0.896		Yes
Direct effect TE → QCB controlling for EC	0.547	0.065	0.419		0.675		Yes
Indirect effect (a×b): TE → EC → QCB	0.256	Bootstrap	0.075		0.463		Yes

The indirect effect was significant since the 95% confidence interval using bootstrap technique [0.075 to 0.463] does not contain zero value. However, the direct effect was also significant ($c' = 0.547$, $p < .001$), meaning that there was partial mediation. 31.9 percent of the total effect was mediated by Employee Competence. Thus, H4 is partially confirmed.

Moderation Analysis (H5)

The moderating effect of Management Support on the relationship between Employee Competence and Quality Compliance Behavior was investigated. Mean-centering was done for both Employee Competence and Management Support, and their product ($EC \times MS$) was entered in the regression analysis.

Table 8

Predictor	B	SE	T	p
Employee Competence (mean-centered)	0.474	0.057	8.347	< .001
Management Support (mean-centered)	0.485	0.053	9.142	< .001
Interaction: $EC \times MS$	0.004	0.041	0.098	0.922

Interaction effect proved to be insignificant ($B = 0.004$, $t = 0.098$, $p = 0.922$). Interaction effect made only 0.000 contribution to R^2 . Thus, there is no support for the moderating role of Management Support in the link between Employee Competence and Quality Compliance Behavior. H5 is rejected.

Table 9: Model Summary

Incremental Variance by Interaction

Model	R^2	R^2 Change	F Change	p
EC + MS	0.677	—	—	—
EC + MS + $EC \times MS$	0.677	0.000	-0.010	1.000

Hypothesis Testing Summary Results

Hypothesis	Result	Statistical Evidence
H1: Training Effectiveness → Quality Compliance Behavior (positive)	Supported	$B = 0.803, t = 17.03, p < .001$
H2: Training Effectiveness → Employee Competence (positive)	Supported	$B = 0.730, t = 14.89, p < .001$
H3: Employee Competence → Quality Compliance Behavior (positive)	Supported	$B = 0.351, t = 5.36, p < .001$
H4: Employee Competence mediates TE → QCB	Supported (partial mediation)	Indirect effect = 0.256, 95% CI [0.075, 0.463]
H5: Management Support moderates EC → QCB	Not supported	Interaction $B = 0.004, p = 0.922, \Delta R^2 = 0.000$

The results revealed that Training Effectiveness positively impacted both Quality Compliance Behavior and Employee Competence. The effect of Training Effectiveness was able to explain 60.7% and 54.1% of the variance in Quality Compliance Behavior and Employee Competence respectively. By adding both Training Effectiveness and Employee Competence, the model explained 65.9% of the variance in Quality Compliance Behavior, with all the predictors being statistically significant. The results from the Bootstrap mediation analysis showed that there was a statistically significant indirect effect of Training Effectiveness on Quality Compliance Behavior via Employee Competence ($ab = 0.256, 95\% \text{ CI } [0.075, 0.463]$). Nevertheless, the effect of Training Effectiveness on Quality Compliance Behavior remained statistically significant and thus partial mediation occurred. In the case of Employee Competence and Management Support interaction, the interaction was not statistically significant ($p = 0.922$).

Discussion

In this study training effectiveness on quality Compliance Behavior has been investigated in the pharmaceutical industry of Pakistan, where Employee Competence is the mediating variable and Management Support is the moderating variable. The results show significant and positive relationships of Training Effectiveness, Employee Competence, and Quality Compliance Behavior. Training Effectiveness significantly predicts Quality Compliance Behavior ($\beta = .779, p < .001$) and Employee Competence ($\beta = .736, p < .001$), which shows that an effective and relevant training can enhance the competence of employees and facilitate compliance with quality compliance behaviors.

The mediation analysis reveals that Employee Competence partially mediates the association between Training Effectiveness and Quality Compliance Behavior. Indirect effect ($ab = .256, 95\% \text{ CI } [.075, .463]$) is significant and there is also a significant direct effect ($c' = .547, p < .001$). It means that training has both a direct and an indirect effect on compliance behavior because it improves employee competence. Therefore, it has been proved that pharmaceutical organizations should pay attention to the competence development of employees in addition to training.

However, the moderating role of Management Support was not supported. Even though Management Support and Quality Compliance Behavior were positively correlated, the interaction of Management Support and Employee Competence was not significant ($B = .004, p = .922$). In

summary, the findings show that Training Effectiveness and Employee Competence have an influence on Quality Compliance Behavior, but Management Support was not a significant moderator of the association of Employee Competence and compliance behavior in the current study.

Conclusion, Limitations, and Future Research

According to the study, Training Effectiveness and Employee Competence have significant effects on the Quality Compliance Behavior of workers in the pharmaceutical sector. Employee Competence partly mediates the impact of Training Effectiveness on Quality Compliance Behavior, whereas Management Support does not have any moderating effect on the relationship. The research involved 190 respondents and depended on self-reports and cross-sectional data, which could reduce the generalization of the results. The study only focused on examining the stated relationships between the chosen variables. Further research can be conducted using larger and diverse samples and by adopting longitudinal designs. Researchers can also consider other variables such as organizational culture, motivation, leadership, and organizational support.

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