Impact of Training Program Components on Perceived Training Utility and cGMP Compliance Behavior: An Evidence from Pharmaceutical Industry (Pakistan)

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Abstract

This study investigates the impact of training need assessment, training design, and trainer competence on cGMP compliance behavior, both directly and through the mediation of employee-perceived training utility, in the Pakistani pharmaceutical industry. Primary data were collected from a sample of 412 employees using Likert scale-based measures adapted from cGMP training parameters. The hypothesized relationships were tested using SPSS. The results show that training needs assessment, training design, and trainer competency have significant positive direct effects on perceived utility of training (PUOT) and cGMP compliance behavior. It was also found that PUOT partially mediates the relationships between all three training variables and cGMP compliance behavior, suggesting that the training program components play a vital role in fostering cGMP compliance behavior directly, and through perceived training usefulness. The research expands empirical work on training and compliance, asserting the need to ensure systematic training need assessment, well-structured and valid training design, and trainers' competencies to foster cGMP compliance behavior among pharma employees, thereby improving training utility perception and regulatory compliance outcomes.

Keywords: Training Design, Training Need Assessment, Trainer Competency, Perceived Utility of Training, cGMP Compliance, Pharmaceutical Industry.

Introduction

The pharmaceutical industry is one of the fastest-growing sectors, with a global market of approximately USD 1.64 trillion (Grand View Research, 2025). Pakistan's pharma industry has also observed notable value growth of around USD 3.2 billion, marking a 34% growth in exports, and highlighting the industry's rising global engagement (Business Recorder, 2025). Due to aging populations, increasing demand for chronic disease treatments, and the expansion of biologics and biosimilars in the global market, there is significant business potential for Pakistani pharma manufacturers to protect and enhance healthcare by producing high-quality medicines (Urias, 2017). But to avail the global opportunity, Pakistani manufacturers have to meet stringent quality expectations required for international competitiveness by complying with the regulatory

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standards charted by the World Health Organization's Current Good Manufacturing Practices (cGMP). cGMP plays an important role in producing high-quality, safe, and effective pharmaceutical products (Ahmed, 2024).

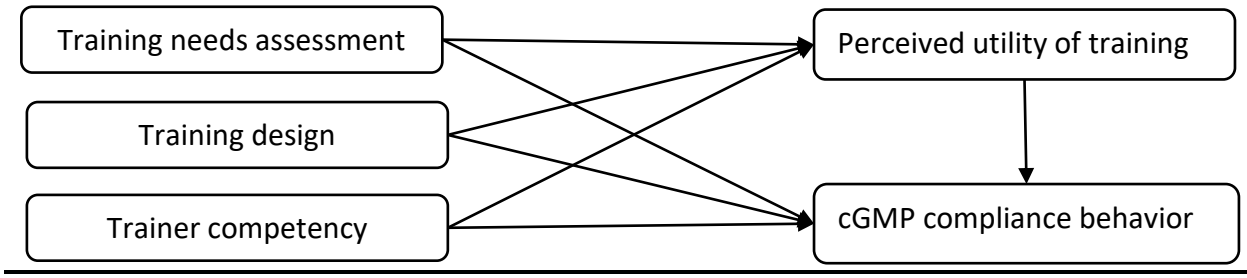
cGMP principles continue to evolve over time, in line with scientific developments and technological advancements (Weitzel et al., 2021; Betz et al., 2023; Tripathi & Shrivastava, 2019), as well as emerging risks, ensuring that the pharmaceutical industry remains aligned with the highest standards of product quality and patient safety. Moreover, cGMP compliance is a necessity, as it is a legal requirement in many countries, and non-compliance can lead to severe consequences, including product recalls, legal action, and loss of market authorizations. cGMP within the pharmaceutical manufacturing industry is established through careful planning and execution of production activities. These include a number of activities, which are qualified and calibrated equipment and systems to assure their proper functioning, validated processes, ensure that they operate within specified limits, and highly competent personnel to perform tasks competently, and this will be done through rigorous training (Ahmed, 2024)

As discussed above, training is a vital and mandatory part of cGMP. "Training of personnel involved in the manufacturing should be performed on a regular basis so that the personnel know about the cGMP maintaining requirement, thus they will understand their role in keeping product quality (Ahmed, 2024). The training should include topics such as hygiene, quality standards, proper equipment use, and safety measures. The training program should be done on an ongoing basis, and competency assessment should be conducted to ensure that employees are well aware of the latest regulations and procedures (Barratt et al., 2020; Chen et al., 2025).

However, despite its recognized importance, existing regulatory guidelines remain vague about how such training should be designed, assessed, and delivered. Regulatory agencies around the world have published certain guidelines for the training program which highlight the importance of training program and to be conducted on regular basis by competent trainer (Bobrowicz, 1994). However, they do not published the detail guidelines which specifically highlight that how training should be design, how training need assessment should be done and how will be deliver the training nor the guidelines are planned to published in future because of this many industry considered training as a simple process but for training to be an effective and efficient (John, 1999).

Due to a lack of specific guidelines on training, many pharmaceutical companies failed to recognize the importance and necessity of quality training programs for their employees, leading to a lack of employee skill development. They failed even in recognizing the exact training level of their technical personnel before assigning them specific tasks. Because of this, the company's skill level and final product quality decreased in compliance with the regulations it was required to follow (Krishnananda et al., 2016).

Figure 1: Theoretical framework



Theoretical Stance

The theoretical foundation of this study is drawn from two established theories; together, they explain why structured cGMP training can influence employee perceptions and, when thoughtfully planned and executed, eventually shape their cGMP compliance. Social Cognitive Theory (Bandura, 1986) proposes that individuals learn by observing others, by observing behavioral patterns, and through reinforcement and feedback. Transfer of training theory (Baldwin & Ford, 1988). Training transfer theory clarifies how knowledge and skills gained in training are transferred to behaviors and Performance. It suggests that training transfer is influenced by three core factors: training design, trainee characteristics, and work environment.

Literature Reviews

Concept of cGMP

In the pharmaceutical industry, Current Good Manufacturing Practices (cGMP) are regulations that ensure medicines are consistently produced and meet safety, quality, and efficacy standards. These standards cover all aspects of the drug manufacturing from raw materials to final distribution (Nally, 2016).

Training Need Assessment and Perceived Training Utility

Training Needs Assessment refers to the organizational process of collecting and analyzing data to support decision-making about when training is the best option (or not) to improve individuals' performance, who should be trained, and exactly what content should be taught (Clarke, 2003). It is not an administrative formality but a data-driven approach (Rossett, 1987). First described, Training Need Assessment TNA is a systematic study of a problem or innovation, incorporating data and opinion from varied sources in order to make an effective decision.

Among the most widely used approaches to assessing the effects of training are training reactions, i.e., perceived training utility and perceptions of the usefulness and applicability of the training (Holton, 1996). Previous studies have shown that training needs assessment has a positive effect on employee perceptions of the usefulness of training (Tabita & Gayatri, 2024)

H1: There is a relationship between training need assessment and perceived utility of the training.

Training design and perceived utility of training

The training design covers the structure, content, and delivery method of a training program, ensuring alignment with both organizational objectives and learner needs (Brown & Sitzmann, 2011). Empirical evidence indicates that training design has a significant influence on perceived effectiveness of training (Namasivayam et al., 2005). Quantitative research in the health sector in Pakistan revealed that both training content and learning style significantly influence employees' performance, highlighting the need for context-specific, appropriate training design elements; however, the impact of training design on employees' performance quality is often neglected (Bhatti et al., 2022).

H2: There is a relationship between training design and perceived utility of training.

Trainer competence and perceived utility of training

One of the most significant components of a training program is the trainer. And the most important quality of a trainer is their knowledge of the program's topic. Nonetheless, having knowledge alone is not enough; the trainer should be eloquent enough to engage participants with the ideas being discussed in the program (Ghosh et al., 2012). Empirical studies show that trainer

performance has a significant effect on both the perception of trainees as well as perceived usefulness of training (Giangreco et al., 2009)
H3: There is a relationship between trainer competency and perceived utility of training.

Perceived utility of training
Among the most widely used approaches to assessing the effects of training are training reactions, i.e., perceived training utility and perceptions of the usefulness and applicability of the training (Holton, 1996; E. A. Ruona et al., 2002). On the one hand, studies indicate that training may be viewed as useful and applicable, leading to the increased adoption or utilization of the trained method (Ford et al., 1992; Guthrie and Schwoerer, 1994).
Ho: There is no relationship between the perceived utility of training and CGMP compliance behavior.
H4: There is a relationship between the perceived utility of training and cGMP compliance behavior.

Training needs assessment and CGMP compliance behavior
Training Needs Assessment refers to the organizational process of collecting and analyzing data to support decision-making about when training is the best option (or not) to improve individuals' performance, who should be trained, and exactly what content should be taught (Clarke, 2003). In the pharmaceutical industry, Current Good Manufacturing Practices (cGMP) is a set of regulations that ensure that medicines are consistently produced and meet safety, quality, and efficacy standards. These standards cover all aspects of the drug manufacturing from raw materials to final distribution (Nally, 2016). For technical staff, a comprehensive training needs analysis should be conducted using both conventional and modern methods to improve employees' SOP adherence and cGMP compliance. (Krishnananda et al., 2016).
H5: There is a relationship between training need assessment and CGMP compliance behavior.

Training design and CGMP compliance behavior
Though few studies in the academic literature directly label the training design as impacting cGMP compliance behavior, some regional studies provide strong indirect evidence of the training design's structure and its relation to compliance-relevant outcomes. (Singh et al., 2018) In Malaysia, a standardized GMP training program was delivered through scheduled, role-based modules covering documentation, equipment, production practices, and QC. The participants demonstrated statistically significant improvements in knowledge (4-12%), indicating that job-specific training contributes to competencies and procedural awareness. Also, in Pharmaceutical Technology Europe, a case overview demonstrated that the use of systematic training to monitor KPI, refresh training, and job-specific content helped global operations become better at GMP compliance, implying that the deviations could be minimized by ensuring a clear instruction structure and continuous reinforcement (Monika Brunn, 2010). In Sudan, a qualitative assessment found that companies that used intermittent, lecture-based training lacked a long-term GMP application. Conversely, an operational compliance culture was found to be stronger, and fewer procedural failures were observed among those who embraced continuous, case-study-based approaches, namely the integration of real SOPs, interactive modules, and assessment (Gamal et al., 2015).
H6: There is a relationship between training design and cGMP compliance.

Trainer competence and CGMP compliance behavior

One of the most significant components of a training program is the trainer. And the most important quality of a trainer is the knowledge he or she has of the program's topic. Nonetheless, having knowledge alone is not enough; the trainer should be eloquent enough to engage participants with the ideas being discussed in the program (Ghosh et al., 2012). In the pharmaceutical industry, Current Good Manufacturing Practices (cGMP) is a set of regulations that ensure that medicines are consistently produced and meet safety, quality, and efficacy standards. These standards cover all aspects of the drug manufacturing from raw materials to final distribution (Nally, 2016). For compliance with cGMP standards, a qualified trainer is important, as highlighted by Krishnananda et al. (2016).

H7: There is a relationship between trainer competency and CGMP compliance behavior.

Perceived utility of training mediates between training need assessment, training design, trainer competency, and cGMPCB

Even though there is no direct study that tests Perceived Utility of Training (PUOT) as a mediator between training need assessment, training design, trainer competency, and CGMP compliance behavior. (Van Eerde et al., 2008) found that the perceived utility of training partially mediates the relationship between training need assessment and organizational effectiveness. Empirical findings support a reasonable role for PUOT. The characteristics of training design positively affect perceptions of utility, which, in turn, increase behavioral outcomes. An example is Kamran Iqbal et al. (2018), who found complete mediation of perceived training utility on transfer by motivation. According to Velada & Caetano (2007), the effect of utility reactions on transfer is partially mediated by perceptions of learning. Perceived usefulness enhances engagement and learning in virtual environments (Wong et al., 2023). and in the broader training literature, supporting the role of usefulness in transfer via motivational mechanisms (Grossman and Salas, 2011).

H8: PUOT mediates the relationship between training need assessment and cGMP compliance behavior.

H9: PUOT mediates the relationship between training design and cGMP compliance behavior.

H10: PUOT mediates the relationship between trainer competency and cGMP compliance behavior.

Research Gap and Need for Current Study

The overall literature synthesis reveals gaps in our knowledge of the effectiveness of training in stimulating cGMP compliance behavior, especially in the pharmaceutical sector in Pakistan. Although the regulatory environment in Pakistan aligns with international standards (WHO, USFDA, EMA), local companies, particularly small and medium-sized ones, face two problems: a lack of resources and a fragmented training system (Ahmed and Chandani, 2020; Tauqeer et al., 2019). These considerations underscore the urgent need for context-specific, holistic research on the efficacy of training.

To begin with, available literature tends to evaluate Training Needs Assessment (TNA), Training Design (TD), and Trainer Competency (TC) separately. But a successful cGMP compliance is probably a result of their combined effect. In fact, it is stated in the international literature that systematic, joint mechanisms, such as inclusive TNA and subsequent tailored training design and capable trainers, result in the achievement of better compliance outcomes (Rossett, 1987; Salas et

al., 2012; Ghosh et al., 2012); however, the empirical validations of this integration in Pakistan do not exist.

Second, research on the behavioral consequences, including the factual adherence to cGMP norms, is minimal in the Pakistani setting. Abroad, evidence suggests that well-organized training can lead to better regulatory conduct (Brunn, 2010; Elhassan & Alfadl, 2015). Nevertheless, the results are based on varied institutional contexts and may not be directly applicable to the Pakistani context, where regulations and operations differ, requiring local empirical research.

Methodology

Research Approach and Design

The study adopts a quantitative, cross-sectional survey design to examine the relationships among training need assessment, training design, trainer competency, and CGMP compliance behavior, with the mediating effect of perceived training utility within the pharmaceutical manufacturing industry of Pakistan. Cross-sectional surveys are particularly appropriate for measuring attitudes, perceptions, and self-reported behaviors among large numbers of participants with limited resources and time (Babbie, 2020). The positivist epistemology is also compatible with the survey design, which eases the operationalization of constructs into measurable variables and allows testing hypotheses through statistical analyses (Fowler, 2014). All constructs were operationalized based on the literature and adapted to pharmaceutical compliance contexts. The measurement of items was based on a five-point Likert scale. The TNA measure was modified by Holton et al. (2000) and Altarawneh (2009) to assess systematic identification of training gaps (e.g., training programs are developed after identifying specific employee needs).

Training Design: According to Raymond Noe (2019), evaluating the correspondence between content, delivery techniques, and learning goals, and the compliance requirements.

Trainer Competency: Based on Pineda-Herrero et al. (2011), assessing subject expertise, communication, and facilitation skills of the trainers.

Perceived Utility of Training (Mediator): It is based on Mathieu et al. (1992) and reflects employees' perceptions of how helpful training is for job performance and compliance. cGMP Compliance Behavior (Dependent Variable): It is self-designed in accordance with FDA (2025) guidelines and measures compliance with SOPs, documentation, and quality standards. A pilot study was conducted with 30 respondents at one pharmaceutical company to refine wording, structure, and clarity. The establishment of face and content validity was based on the review by qualified trainers and quality assurance professionals. Reliability was evaluated using Cronbach's alpha, and values above 0.70 were considered acceptable (Nunnally & Bernstein, 1994).

Results

Demographic Characteristic

Table 1: Demographic information of the participants

Characteristic	Category	N	Percentage	Characteristics	Category	N	Percentage
Age	20-30	114	27.7%	**functional Department**	Production	46	11.2%
	31-40	278	67.5%		QA	66	16.0%
	41-50	20	4.9%		Quality Control	264	64.1%
	50+	0	0%		R&D	24	5.8%
Gender	Male	306	74.3		Warehouse	8	1.9%
	Female	90	21.8%		Engineering	4	1.0%
	Prefer not to say	16	3.9%	**Type of company**	Local	142	34.5%
Highest Education Level	Bachelor's	166	40.3%		National	190	46.1%
	Master's	142	34.5%		Multinational	80	19.4%
	Pharm D	94	22.8%	**Size of Company**	<50	8	1.9%
	Doctorate	10	2.4%		50–100	60	14.6%
Year of experience in pharmaceutical industry	<1 year	46	11.2%		101–250	122	29.6%
	1–5 years	166	40.3%		251–500	136	33.0%
	6–10 years	112	27.2%		>500	86	20.9%
	>10 years	46	11.2%	***Years Since Establishment***	<5 years	30	7.3%
Position Level	Entry-Level	46	11.2%		5–10 years	116	28.2%
	Mid-Level	220	53.4%		11–20 years	102	24.8%
	Manager	126	30.6%		>20 years	164	39.8%
	Senior Management	20	4.9%	**Geographical Region**	Punjab	234	56.8%
					Sindh	60	14.6%
					Khyber Pakhtunkhwa	82	19.9%
					Islamabad	36	8.7%
					Balochistan	0	0%
				Export Activities	Yes	326	79.1%
					No	86	20.9%

Training Management Structure of the pharmaceutical industry

Table 2: Training Structure of Pharmaceutical Industry

Characteristic	Category	N	Percentage
Frequency of cGMP training	Monthly	162	39.3%
	Quarterly	72	17.5%
	Bi-Annually	34	8.3%
	Annually	60	14.6%
	Less than once a year	84	20.4%
Number of Training Sessions Attended Last Year	1–2	214	51.9%
	3–5	78	18.9%
	6–10	54	13.1%
	>10	66	16.0%
Training Management Structure	Dedicated Training Unit	94	22.8%
	Managed by HR	44	10.7%
	Managed by Dept. Heads	230	55.8%
	No Formal Structure	44	10.7%

Table 3: Reliability analysis

Inter-item Consistency

Variables	*Cronbach's Alpha*	*N of Items*
Training need assessment	.956	5
Training design	.974	5
Trainer competency	.982	5
Perceived utility of training	.973	6
cGMP compliance behavior	.985	8

Before proceeding with the inferential analysis of all variables. Using Cronbach's alpha, the reliability of the measurement scale was evaluated to ensure internal consistency. As shown in the above table, all the variables revealed excellent reliability, with Coefficients exceeding the recommended threshold of 0.70. All the variables yield alpha value above 0.95, showing a very high level of internal consistency among the questions measuring each variable.

Descriptive Statistics

Table 4: Descriptive Statistics

Variables	*n*	*M*	*SD*
Training need assessment	412	3.4476	1.35979
Training design	412	3.5864	1.38824
Trainer competency	412	3.6544	1.38612
Perceived utility of training	412	3.7201	1.26897
cGMP compliance behavior	412	3.7002	1.33698

The table above shows the descriptive statistics of the key variable of the research study. Training needs assessment training design, trainer competency, perceived utility of training and cGMP compliance. Among the above variables the perceived utility of training has the highest mean score

(M =3.72, SD = 1.27) followed by cGMP compliance behavior (M = 3.70, SD = 1.34), training competence (M = 3.65, SD = 1.39) and training design (M = 3.5, SD = 1.3). among the all variables training need assessment received the lowest score (M = 3.45, SD = 1.36). indicating that the training program is overall viewed positively, but somehow there is less emphasis on the systematic training need assessment. Importantly, all variables show considerable standard deviation (ranging from 1.27 to 1.39), indicating considerable variability in respondents' perceptions. It shows that the level of satisfaction about the training program differed among the employees, although most viewed the training program positively.

Correlation

Table 5: Correlation Analysis

S. #.	Variables	*n*	*M*	*SD*	1	2	3	4	5
1	TNA Scale	412	3.4476	1.35979	1				
2	TD Scale	412	3.5864	1.38824	.933**	1			
3	TC Scale	412	3.6544	1.38612	.912**	.970**	1		
4	PUOT Scale	412	3.7201	1.26897	.859**	.904**	.907**	1	
6	cGMPCB Scale	412	3.7002	1.33698	.895**	.938**	.938**	.891**	1

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

The above table shows the Pearson correlation Coefficients among the variables under study. The results indicate a strong linear association between the concepts as all the variables are positively and statistically correlated significantly at the 0.01 level (2-tailed). Between the independent variables training needs assessment, trainer competency, and training design display very high inter correlations (r = .912 to .970, p < .01). This indicates that the pharmaceutical organization arranging systematic training needs assessment also inclines to design structure training programs and deploy competent trainers.

The mediating variable, perceived utility of training, (r = .859 to .907, < .01) are strongly correlated with all three independent variables. Suggesting that if training programs are designed on the basis of actual gaps an employee has and delivered by competent trainers the employees' perception of usefulness of training increases.

Moreover, cGMP compliance behavior dependent variable shows strong positive correlation with all independent variables training design (r = .938 p < .01) training need assessment (r = .895 p < .01), trainer competency (r = .938 p < .01), and with mediator perceived utility of training also have a positive correlation (r = .891 p < .01). The correlation value suggests that a training program with effective training practices and positive perception of training utility led to improved compliance with cGMP standard.

Simple Regression

Table 6: Regression Coefficients of Training need assessment on PUOT

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.957		0.80	10.939	0.000
Training need assessment	0.801	0.859	0.24	33.936	0.000
R^2 = .737, F = 1151.644, N=412, P<0.05					

The model suggest that a well-conducted training need assessment significantly enhances the employee's perceived utility of training as explained by model for training need assessment 73.7% of variance in PUOT (Adj.R^2 = 0.737; F = 1151.644; p < .001) the Coefficients (B = 0.801; t = 33.936; p < .001).

Table 7: Regression Coefficients of Training design on PUOT

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.758		0.74	10.192	0.000
Training design	0.826	0.904	0.19	42.734	0.000
R^2 = .817, F = 1826.208, N=412, P<0.05					

In the same way training design represents 81.7% of the variance (Adj. R^2 = 0.817; F = 1826.208; p < .001), with a strong positive coefficient (B = 0.826; t = 42.734; p < .001), indicating that well-structured and engaging training design considerably improve the employee's perception of training utility.

Table 8: Regression Coefficients of Trainer competency on PUOT

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.684		0.74	9.216	0.000
Trainer competency	0.831	0.907	0.19	43.727	0.000
R^2 = .832, F = 1219.062, N=412, P<0.05					

In the same way trainer competency represents 83.2% of the variance (Adj. R^2 = 0.832; F = 1219.062; p < .001), with a strong positive coefficient (B = 0.831; t = 43.727; p < .001), indicating that well-aware and engaging trainer considerably improve the employee's perception of training utility.

Table 9: Regression Coefficients of PUOT on cGMPCB

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.207		0.093	2.236	0.000
Perceived utility of training	0.939	0.891	0.024	39.768	0.000
R^2 = .794, F = 1581.506, N=412, P<0.05					

The table shows the simple regression analysis results measuring the effect of perceived utility of training (PUOT) on cGMP compliance behavior. A strong and statistically significant relationship was observed between the two variables as revealed by the finding of the results (F = 1581.506; < .001). The variance explained by the model is 79.4% in compliance behavior (Adj.R^2 = 0.794), suggesting that in shaping the cGMP compliance behavior of the employees the perceived utility of training plays a significant role.

Multiple Regression

Table 10: Regression Coefficients of training need assessment, training design, trainer competency, on PUOT

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.658		0.073	9.056	0.000
Training need assessment	0.087	0.093	0.053	1.655	0.099
Training design	0.292	0.320	0.087	3.353	0.001
Trainer competency	0.469	0.512	0.076	6.149	0.000
R^2 = .883, F = 682.572, N=412, P<0.05					

Above table demonstrates the regression Coefficients examining the combined influence of training need assessment, training design, trainer competency, on perceived utility of training (PUOT). The overall regression model was found to be highly significant (R^2 = 0.883; F = 682.572; p < 0.5), explaining that together these three predictors are responsible for approximately 88.3% of the variance in the perceived utility of training (PUOT).

Constant value (B = 0.658; t = 9.056; p < .001 suggest that, even when the factor training needs assessment, training design, trainer competency is not considered the employees still perceive some basic level of training usefulness. If we look it the independent variables among the three independent variables two independent variables training design (B = 0.292; β = 0.320; t = 3.353; p < .001) and trainer competency, (B = 0.469; β = 0.512; t = 6.149; p < .001) the results show statistically a positive and significant effects on perceived utility of training.

However, training need assessment (B = 0.087; β = 0.093; t = 1.655; p = .009) at the level of 0.05 was not found to be a significant predictor among the two other predictor training design and trainer competency, the fact suggesting that while identifying training need is an important part of every training program, its direct impact on perceived utility may be relatively weaker.

Table 11: Regression Coefficients of training need assessment, training design, trainer competency, perceived utility of training on cGMPCB

Variable	*B*	β	*SE*	*t*	*p*
Constant	0.244		0.065	3.742	0.000
Training need assessment	0.116	0.118	0.043	2.675	0.008
Training design	0.296	0.307	0.072	4.093	0.000
Trainer competency	0.371	0.385	0.065	5.686	0.000
Perceived utility of training	0.172	0.164	0.041	4.252	0.000
R^2 = .889, F = 915.632, N=412, P<0.05					

Above table summarizes the multiple regression showing the effects of training need assessment, training design, trainer competency, and perceived utility of training on cGMPCB. The results indicate that model is statistically significant (R^2 = 0.889; F = 915.632; p < .05), which mean that the four predictors are responsible for the 88.9% of the variance in the cGMPCB of the employees working in the pharmaceutical manufacturing industry.

As suggested by the constant value (B = 0.244; t = 3.742; p < .001), it shows that even without the influence of the independent variables still a small baseline level of compliance exists.

All four independent variables have a positive and statistically significant effect on the dependent variable's cGMP compliance behavior. Training need assessment (β = 0.118; p = .008), Training

Design (β = 0.307; p < .001), and Trainer Competency (β = 0.385; p < .001), all the predictor contributes significantly, suggesting that employees will more likely to follow cGMP standard who have receives well-planned, well-designed training program delivered by competent trainer. Moreover, the perceived utility of training (β = 0.164; p < .001) also found to be have a positive and significant impact, suggesting that the employees are more motivated to apply cGMP complaint practices in their daily work when they found the training program useful and relevant to their daily cGMP task.

Mediation Analysis

Table 12: Mediation Analysis of the Effect of Training need assessment (X) on cGMP compliance behavior (Y) through Perceived utility of training (M)

	Estimate	*SE*	*t*	*p*	*95% CI Lower*	*95% Cl Upper*
Total Effect of TNA on cGMPCB	0.8804	0.0216	40.7284	<.001	0.8379	0.9229
Direct Effect of TNA on cGMPCB	0.4875	0.0357	13.6671	<.001	0.4174	0.5576
Indirect Effect of TNA on cGMPCB through PUOT	0.3929	0.0699			0.2668	0.5407

The above table shows that training need assessment has a significant total effect on cGMP compliance behavior (β = 0.88, p < .001). The direct effect remains significant after including perceived utility of training (β = 0.49, p < .001). The indirect effect through perceived utility of training is also significant (β = 0.39), as the 95% confidence interval excludes zero (CI = [0.27, 0.54]) the overall model indicates that PUOT partially mediates the relationship between training need assessment and cGMP compliance behavior.

Table 13: Mediation Analysis of the Effect of Training design (X) on cGMP compliance behavior (Y) through Perceived utility of training (M)

	Estimate	*SE*	*t*	*p*	*95% CI Lower*	*95% Cl Upper*
Total Effect of TD on cGMPCB	0.9032	0.0165	54.7172	<.001	0. 8708	0.9357
Direct Effect of TD on cGMPCB	0.6962	0.0369	18.8675	<.001	0.6236	0.7687
Indirect Effect of TD on cGMPCB through PUOT	0.2070	0.0637			0.1115	0.3604

The mediation analysis table shows that training design has a significant total effect on cGMP compliance behavior (β = 0.90, p < .001). The direct effect remains significant after including perceived utility of training (β = 0.70, p < .001). The indirect effect through perceived utility of training is also significant (β = 0.21), as the 95% confidence interval excludes zero (CI = [0.11, 0.36]) the overall model indicates that PUOT partially mediates the relationship between training design and cGMP compliance behavior.

Table 14: Mediation Analysis of the Effect of Trainer competency (X) on cGMP compliance behavior (Y) through Perceived utility of training (M)

	Estimate	*SE*	*T*	*p*	*95% CI Lower*	*95% Cl Upper*
Total Effect of TC on cGMPCB	0.9050	0.0165	54.9010	<.001	0. 8726	0.9374
Direct Effect of TC on cGMPCB	0.7078	0.0378	18.7367	<.001	0.6336	0.7821
Indirect Effect of TC on cGMPCB through PUOT	0.1971	0.0625			0.1016	0.3501

The above Table shows that trainer competency has a significant total effect on cGMP compliance behavior ($\beta = 0.91$, $p < .001$). The direct effect remains significant after including perceived utility of training ($\beta = 0.71$, $p < .001$). The indirect effect through perceived utility of training is also significant ($\beta = 0.20$), as the 95% confidence interval excludes zero (CI = [0.10, 0.35]) the overall model indicates that PUOT partially mediates the relationship between trainer competency and cGMP compliance behavior.

Discussion

This research paper examined the direct and indirect impacts of training need assessment, training design, and trainers' competency on cGMP compliance behavior, while accounting for the perceived utility of training (PUOT) as a mediator of these relationships in the pharmaceutical manufacturing sector of Pakistan. The results show that a systematic training needs assessment, a well-structured training design, and trainers knowledgeable in cGMP principles are vital to ensuring adherence to cGMP standards.

In line with the previous literature (Tabita & Gayatri, 2024; Giangreco et al., 2009), (Ghosh et al., 2012), the research revealed that there were significant direct correlations between training variables and PUOT. The strongest predictors of PUOT were training design and the trainer's competency, demonstrating that the alignment of content, training delivery modes, and the trainer's skills directly affects how an employee evaluates the usefulness of training. In the same manner, PUOT had a positive predictive effect on cGMP compliance behavior, suggesting that perceptions of training relevance and effectiveness stimulate employees to implement the learned practices in the workplace.

Mediation analyses indicated that PUOT partially mediates the association between training and compliance behavior. This means that, though training needs assessment, design, and trainers' competency directly influence cGMP compliance behavior, these factors are improved when employees perceive training as valuable to their tasks. These results are consistent with the existing literature that has focused on the mediation of learning perceptions on translation of training into behavioral outcomes (Van Eerde et al., 2008). In practice, the findings demonstrate the significance of creating training programs that are based on identified needs, designed efficiently, and delivered by well-qualified trainers. It can be assumed that organizations that allocate effort to increasing the perceived utility of training will achieve better compliance with regulatory requirements, thereby helping maintain quality assurance and operational excellence in pharmaceutical manufacturing. Finally, the paper has shown that both direct and mediated processes are significant in explaining how training interventions affect compliance behavior. Although the roles of training design and trainer competency in PUOT are the most significant, all three training variables have direct and indirect effects on compliance behavior. Future studies

should incorporate longitudinal designs and objective compliance studies to better confirm these results and examine additional mediators, such as motivation and organizational support.

Conclusion

The study leads to the following conclusions based on the results and discussion. The training factors (TNA, TD, TC) have a significant impact on cGMP compliance behavior, and trainers' competency has the greatest impact. The relationship between training and knowledge application is partly mediated by perceived training utility, suggesting that employee perceptions are a key factor in knowledge application. Structured, job-specific training has been proven to be highly beneficial for behavioral compliance with regulatory requirements. The companies should not focus solely on content but also emphasize the quality of delivery, i.e., the perceived relevance of the training to employees' work. On the whole, the analysis underscores that attendance or hours alone do not make good training; it is about relevance, quality, and employee perception that enhance regulatory compliance behavior.

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