

# The Mediating Effect of Training Infrastructure on Teaching Methodology and Effective Implementation

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**Abstract:** The study examines the effect of training infrastructure as a mediating variable in the relationship between teaching methodology as the predictor and effective implementation as the outcome in a virtual training environment. The Baron and Kenny model was adopted to test the hypotheses developed in the study. This is an exploratory study to know how the virtual training infrastructure affects effective implementation and, if so, by how much compared to teaching methodology. The study finds out that both the teaching methodology and training infrastructure affect effective implementation, with training infrastructure having a more significant effect. Since hybrid working condition is already acceptable in the business environment, companies should invest in virtual training infrastructure to ensure their training is effective.

**Key words:** methodology, training infrastructure, effective implementation, virtual training environment

**JEL code:** M530

## 1. Introduction

Training is about improving individual and group performance, thereby influencing the business' overall performance. It is, therefore, essential to evaluate the effective implementation of the knowledge gained from training and ensure that the original learning goals are achieved. The effectiveness of training is measured along the levels of reaction, learning, and results, which is the Kirkpatrick Evaluation Model for training.

In the Philippines, employee training is essential to an organization's productivity. Companies hire consultants who are good at designing teaching methodologies, hopefully resulting in an effective implementation of knowledge gained. During the transition to the new normal, virtual training also continues to become the new normal. Virtual training infrastructure becomes an indispensable part of the training. The question is how this infrastructure affects the virtual training environment.

This study determines how the training infrastructure mediates the effect of teaching methodology on effective implementation as perceived by the respondents and seeks answers to the following:

- 1) Does teaching methodology significantly affect effective implementation?
- 2) Does teaching methodology significantly affect the virtual training infrastructure?
- 3) Does training infrastructure significantly affect effective implementation?
- 4) How does training infrastructure mediate the effect of teaching methodology on effective

implementation?

The objective is to provide the possible effect of training infrastructure and, in so doing, determine reasons why virtual training may not result in higher productivity or effective implementation of the required skills. Other mediating/intervening variables may hinder achieving a training program's required goal or objective.

This is an empirical study of things that have been observed and measured as well as by theory or belief. The population of the study is the students of the writer who had undergone virtual training during the pandemic. The training should have been virtual so the training infrastructure could come into play. Simple linear regression was used for corresponding null hypotheses of subproblems 1, 2, and 3. On the other hand, multiple linear regression was used for the corresponding null hypothesis of subproblem 4. There are no sufficient studies about the role of virtual training infrastructure insofar as the relationship between the training methodology (as predictor), and the effective implementation (outcome) is concerned. Hence this study aims to fill in this gap.

## **2. Literature Review**

### **2.1 Mediating Factors Related to Training**

This section discusses the research conclusion of the team led by Hayton et al. (1996) that enterprise training (both in nature and extent) largely depended on three main elements: training drivers, environmental factors, and mediating factors. Training infrastructure is among the mediating factors, which include the size of the organization, the industry in which the training is conducted, the occupational structure of the organization, the level of training decision making and perhaps most important the top-level management commitment to the training program and even to the conduct of training.

### **2.2 Teaching Methodology**

In his book *Teaching in Digital Age: Guidelines for Designing Teaching and Learning*, Bates (2019) mentioned that the learning management system (LMS) software enables teachers and students to log in and work in a password-protected online learning environment. In the conference paper presented by Djenic and Mitic (2017) entitled *Teaching Strategies and Methods in Modern Environments for Learning of Programming*, they concluded that in the application and further development of teaching methods, teachers must investigate, prepare, and recommend web-based learning environments and tools; as much interactive multimedia content as possible, animations, and simulations. These are tried-and-true methods of communicating with students about the teaching material and tasks and the mechanisms required to evaluate employed teaching strategies.

### **2.3 Virtual Training Infrastructure**

When looking for virtual training infrastructure, several important factors should be “deal breakers”, according to Ravello Community (2016). They also considered technological fidelity, which should support all elements in the environment and calls for specific networking setups; that is, the environment's quality and commitment should not be compromised for training to be effective. In addition, the trainer should spend less time setting up the same environment repeatedly every time a session is scheduled. According to Ravello Community, this is called “repeatable deployment”. The training infrastructure should provide a quick and easy way to save and run the configuration whenever needed.

### **2.4 Effective Implementation of Training**

Authors Sandfort and Moulton (2015) wrote in their book *Effective Implementation in Practice* that it is

helpful to first consider the original aim of the program before digging into the core program specifics and the dynamics of the implementation system. The author of this research work defines effective implementation as the deliberate, institutionally sanctioned change motivated by a policy or program oriented toward creating value results on purpose. In the book *Factors Influencing the Implementation of Training and Learning in the Workplace* (Readout, 2002), it is stated that it is necessary to emphasize the variety of circumstances in which training activity occurs in enterprises and the significance of giving due consideration to those differences to maximize the volume of training activity and tailor its nature to enterprise requirements most economically and effectively.

Considering the recent pandemic, the exhaustive use of virtual training is relatively new in the Philippines. This is a country where the training infrastructure, in general, is considered below average. The infrastructure plays a vital role in training effectiveness, whether in corporate training or even in the academe. The knowledge of top management on this virtual training infrastructure is also wanting, considering that the resources were directed to a more priority objective rather than training which takes a backseat in the meantime, particularly during the pandemic. Moreover, the training infrastructure may be why, despite a suitable training methodology, it does not result from effective communication and ultimately affects effective implementation.

## 2.5 Research Framework

A four-step method was suggested by Baron and Kenny (1986), in which several regression analyses are carried out, and the significance of the coefficients is assessed at each stage, as shown in Figure 1. While there have been some comments on the method by Baron and Kenny, this is appropriate for my research work.

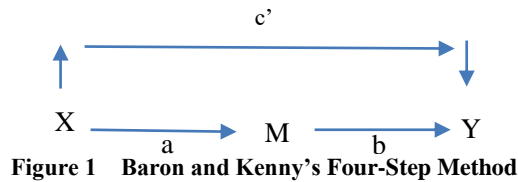


Figure 1 Baron and Kenny's Four-Step Method

The study conceptualizes the mediating influence of virtual training infrastructure on the effect of teaching methodology on effective implementation, as shown in Figure 2.

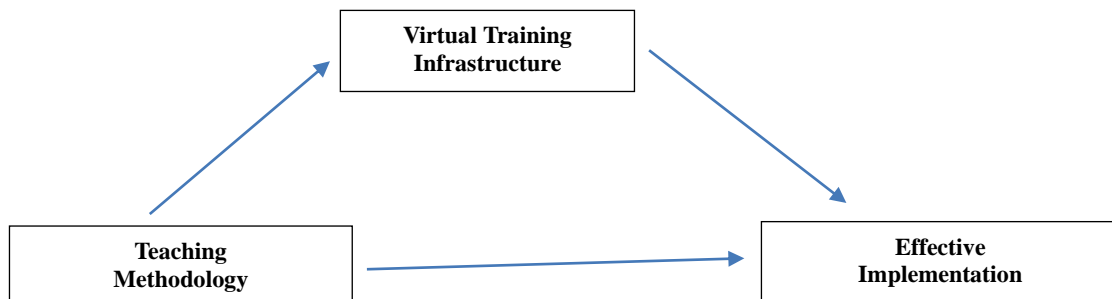


Figure 2 The Framework of the Study

The virtual training infrastructure includes three basic things: (1) Hardware, (2) Software, and (3) Support team. The hardware comprises the server type, user database, concurrent users, bandwidth, and other server configurations. The software is the learning management system and the platform to deliver the training; examples are Zoom, MS Teams, Google Meet, etc. Moreover, lastly, the support consists of team selection, administration training, team size, activities, and reports.

### 3. Data Results and Analysis

#### 3.1 Effects of Teaching Methodology on Effective Implementation

Table 1 shows the regression analysis result on the effect of teaching methodology on effective implementation.

**Table 1 Effect of Teaching Methodology on Effective Implementation**

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.871311				
R Square	0.759183				
Adjusted R <sup>2</sup>	0.756135				
Standard Error	0.283973				
Observations	81				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	20.08355	20.08355	249.0506	3.85925E-26
Residual	79	6.370595	0.08064		
Total	80	26.45414			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	0.667726	0.205485	3.249512	0.001699	
Module	0.860477	0.054525	15.78134	3.86E-26	

The author, who has been teaching advanced statistics for a long time, knows that R-squared is used as an evaluation metric in the linear regression model to assess the scatter of data points around the fitted regression line. It recognizes the dependent variable's percentage of variation. When the sample size and several variables are considered, the adjusted R-squared (0.756135) value is nearly the same as the R-squared (0.759183), an unbiased estimate of the fraction of variance explained. Because adjusted R-squared is only slightly smaller than R-squared, the equation has sufficient informative variables fitted on a large enough sample of data. The value of adjusted R-squared is a good value for this situation and can be measured and applied in the data transformation for the context of decision-making. Thus, training methodology highly influences the effective implementation of virtual training.

Based on the above results, the formula for the linear equation is:

$$\text{Effective Implementation} = 0.667726 + 0.860477 (\text{Training methodology})$$

As mentioned in the related literature, for the result to act on the effective implementation, the teaching methodologies must be suited for the virtual environment for the participants to appreciate the different methodologies, make things more exciting and thereby imprint in their minds the importance of the training activity as part of this research work. This training methodology has a significant effect on the implementation, which is the objective of the training.

#### 3.2 Effects of Teaching Methodologies on Virtual Training Infrastructure

Table 2 shows the regression analysis results on the effect of teaching methodology on virtual training infrastructure.

**Table 2** Effect of Teaching Methodology on Virtual Training Infrastructure

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.922356				
R Square	0.85074				
Adjusted R Square	0.848851				
Standard Error	0.218004				
Observations	81				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	21.39983	21.39983	450.2794	2.27317E-34
Residual	79	3.754528	0.047526		
Total	80	25.15436			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	0.484015	0.15775	3.068248	0.002949	
Module	0.888227	0.041858	21.21979	2.27E-34	

The value of the adjusted R-squared, which is 0.848851, is an excellent value for this situation and can be measured and applied in the data transformation for the context of decision-making. Thus, teaching methodology highly influences the infrastructure of virtual training.

The formula for the linear equation is:

$$\text{Virtual Training Infrastructure} = 0.484015 + 0.888227 (\text{Training methodology})$$

That is why the company's IT department must have access to and knowledge of implementing different training platforms, which should be suited to the required methodology. In our case, the training infrastructure highly predicts the methodologies used in training.

### 3.3 Effect of Training Infrastructure on Effective Implementation

Table 3 shows the results on the effect of training infrastructure on effective implementation.

**Table 3** Effect of Training Infrastructure on Effective Implementation

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.88300699				
R Square	0.77970135				
Adjusted R Square	0.77691276				
Standard Error	0.27160591				
Observations	81				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	20.62633124	20.62633	279.60411	1.13045E-27
Residual	79	5.827811967	0.07377		
Total	80	26.45414321			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	0.43856284	0.207544039	2.113107	0.0377486	
Infra	0.90553319	0.054154257	16.72137	1.13E-27	

R-squared (0.77970135) is used as an evaluation metric in the linear regression model to assess the scatter of data points around the fitted regression line. It recognizes the dependent variable's percentage of variation. When the sample size and several variables are considered, the adjusted R-squared value (0.77691276) is nearly the same as the R-squared, an unbiased estimate of the fraction of variance explained. Because adjusted R-squared is only slightly smaller than R-squared, the equation has sufficiently informative variables fitted on a large enough sample of data.

The formula for the linear equation is:

$$\text{Effective Implementation} = 0.438562 + 0.904433 (\text{Training infrastructure})$$

The participants in this research are pretty aware of how critical the virtual training infrastructure is regarding the effectiveness of the training implementation. The training can be useless, no matter how beautiful the training methodologies are, if they cannot properly reach the training participants. This is particularly true in the Philippine environment, where internet provision is unstable and the connection unreliable. The participants cannot prepare for the lesson because they are unsure if they can get a good and sustainable internet connection.

### 3.4 Effects of Teaching Methodology and Virtual Training Infrastructure on Effective Implementation

Table 4 shows the regression analysis results on the effect of teaching methodology and virtual training infrastructure on effective implementation.

**Table 4 Effect of Teaching Methodologies and Training Infrastructure on Effective Implementation**

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.89519022				
R Square	0.80136553				
Adjusted R Square	0.79627234				
Standard Error	0.25955348				
Observations	81				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	21.19943842	10.59972	157.34054	4.20853E-28
Residual	78	5.254704793	0.067368		
Total	80	26.45414321			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	0.40385546	0.198690986	2.032581	0.0454982	
Method	0.37624064	0.128995525	2.916695	0.0046181	
Infra	0.54517136	0.133951994	4.069901	0.0001118	

In regression analysis, P-values and coefficients work together to determine which relationships in the model are statistically significant and the nature of those relationships. The coefficients describe the mathematical relationship between the independent and dependent variables. The coefficient p-values indicate whether these relationships are statistically significant.

Based on the above results, the formula for the multivariate regression model is:

$$\text{Effective Implementation} = 0.403855 + 0.376240 \times (\text{Methodology}) + .545171 \times (\text{Infrastructure})$$

In this case, both the teaching methodologies and the virtual training infrastructure influence the effective implementation with p values of 0.0046 and 0.0001, respectively. Based on the p values, the training infrastructure affects the effective implementation more. This is validated by the coefficients of the methodologies and the infrastructure, whose values are 0.376240 and 0.545171, respectively. With the higher coefficient, the training infrastructure has a more significant influence on the effective implementation than the teaching methodology.

#### 4. Conclusions

I conclude that teaching methodology predicts effective implementation. Furthermore, considering that for this particular study, everything starts with teaching methodology, the preparation of teaching methodology should be thoroughly done. The course outline should be reviewed repeatedly because this is the basis for teaching methodology. The teaching methodology should consider methodologies recommended by experts in this field. Effective implementation is dependent on training methodologies to a great extent.

It is safe to conclude that teaching methodology directly affects the virtual training infrastructure. Given this and in preparation for teaching methodology, the available training infrastructure should be considered. The author noted that a complicated methodology, as seen by the respondents, may not be adequately delivered if there is a constraint in the virtual training infrastructure. On the other hand, the methodology should maximize the available virtual training infrastructure to optimize knowledge delivery.

Virtual training infrastructure highly influences effective implementation. Since the virtual training infrastructure is the medium for delivering knowledge and skills to the training participants, the infrastructure should include the equipment on the learners' end. Having an excellent virtual infrastructure from the trainers' end would be a waste of resources if the learners cannot receive the knowledge to be imparted due to their poor training equipment.

An organization should invest in having an excellent training infrastructure. The study's findings indicate that no matter how good the teaching methodology is, effective implementation is affected if the learnings cannot be delivered well to the participants. The investment should be considered both on the part of the training administrators and the subject matter experts and on the part of the training participants.

Should another study be made related to this matter, the research should cover the effect of the course outline on effective implementation, with the subject matter expert as the moderating variable.

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