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Effectiveness of Synchronous Training Programs

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Abstract:

Purpose – The purpose of the research paper is to find out the effectiveness of Virtual Training Programs of Indian Society for Quality using approaches based on Quality Management, Learning outcomes or Cowan approach and European Federation of Quality Management Model.

Design /Methodology/Approach - Descriptive research design was used as data is captured using a Questionnaire .The Pre-Experimental Research Design one group pretest post test was used with a slight difference that the pretest perception of participants was also taken after the training .Another difference was that the perception of participants was recorded and not the test scores.

Findings - Effectiveness as described by (Cowan) is the ratio of actual outcome to the possible ideal outcome. The output shows that the level of students has definitely improved and for 90% the expectations were fulfilled after the training but all were not at the same level .Participants have shared their opinion about the effectiveness of inputs like teacher , teaching methodology, instruction material and virtual platform and effectiveness of outputs such as learning .The difference in the final level of different participants may be because of difference in the level of the participants at the beginning of the training with respect to the topic taught ,different cognition with different teaching styles & difference in expectations etc.

Practical implications – The paper lists three ways to assess effectiveness and some important inputs, outputs and process parameters to find out the effectiveness of the program.

Originality/Value – Majority of the existing literature measures effectiveness of training programs based on accomplishment of learning outcomes and the focus on the inputs is rare .The desired outcomes are different with respect to different training programs hence the questionnaires were designed focusing on inputs ,process as well as outputs. The topics taught were of Engineering and Management and were application oriented.

Keywords: Effectiveness, Diagnostic, Formative and Summative Assessment, Memory, Understanding, Reflective levels of teaching, Virtual Training

1. Introduction:

During the pandemic many positive and negative outcomes were there across the globe. According to (NDTV) (Sriram, 2020) (Chris Watkins, 2002) various positive outcomes included the following -

- a) The Personnel Protective Equipments industry has emerged
- b) Fuel consumption reduced because of lockdown implementation
- c) Technology Giants like Amazon , Apple, Alphabet ,Microsoft and Facebook sustained performance and their revenue increased
- d) Work from home culture increased and many organizations experimented to find whether they can run using “Work from Home” mode.
- e) Fixed term employment contracts increased
- f) The Governments of various countries came forward and supported the citizens through relief packages
- g) There was a shift to online education which acted as a backbone in ensuring continuity of education
- h) Learning Management Systems emerged during the pandemic providing variety of facilities such as grading, assignment submission, uploading of lectures etc.

According to (NDTV) (Sriram, 2020) (Chris Watkins, 2002) various negative outcomes included the following -

- a) Many organizations became bankrupt
- b) There was a dip in Indian Gross Domestic Product forecasts
- c) Sector-wise huge losses were there in Tourism , Real estate, Aviation , Automobiles and Hospitality especially in restaurants
- d) Informal employment reduced everywhere
- e) Sudden closure of schools forced people to think about education using Non-Traditional modes and lack of internet access was a hindrance for some
- f) The period witnessed fluctuating unemployment rates in India

According to the Indian Human Development Report 2011 (UNDP, 2011) development is about removing obstacles like ill health , lack of access to productive resources , lack of civil and political freedom from possible achievements .So in order to ensure that education continues, online teaching emerged using various platforms like Googlemeet , Zoom , Cisco Webex etc. .Learning which happens simultaneously when the teacher teaches and student learns using online platform live is called learning through **Synchronous Training Programs**. As synchronous teaching uses online platforms, the comparison of various emerging platforms is shown below in Table I .

Table I Comparison of various online platforms (Google Meet, 2021) (Zoom Join Meeting, 2021) (Cisco Webex, 2021) (Bharadwaj, 2021) (Helpcenter, 2019) (Ansari, 2020)

Feature	Google Meet	Cisco Webex	Zoom
Chat with everyone	Yes	Yes	Yes
Chat with individual	No	Yes	No
Cost	Free	Free	Free
Duration	60 minutes initially but 24 hours till June 2021	50 minutes	40 minutes with 3 or more participants
Hand raising during session	Yes	Yes	Yes
Video Off facility	Yes	Yes	Yes
Audio off facility	Yes	Yes	Yes
Multiple Presenters possible	No	No	No
Attachment sharing possible in chat section	No	No	No
Maximum number of participants	100	100	100
Recording Possible	Host has rights	Yes for free users but with desktop app only else web host only has rights	Host has rights

2. Literature Review:

The major aim of the Literature Review was to study the following-

1. To find out the training programs for which effectiveness was measured in the written papers.
2. To find out the diversified participants of the training programs for which effectiveness was studied.
3. To find out the inputs, process parameters and outputs which were considered for finding the effectiveness of the training programs.
4. To find out what is considered & not considered in existing papers with respect to finding the effectiveness.

The training programs for which effectiveness was measured in the selected literature included Entrepreneurship Development Program, Life Skills Program, Drug Abuse Prevention Program as evident from (R.Krishnan, Effectiveness of Entrepreneurship Development Programmes

among S and T graduates, 2019) (S.Poornima & T, 2013) (T, 2012) (BYadav & S.Pingle, 2016) (Chhadva & Kacker, 2013) (GJ Botvin E. B.-J.).

The participants in the existing literature in which training effectiveness was measured included village students, adolescents, graduates, school students and State Bank of India employees as evident from (T, 2012) (BYadav & S.Pingle, 2016) (Trakru & Jha, 2019) (R.Krishnan) (S.Poornima & T, 2013).

The inputs considered while measuring the effectiveness as per (S.Poornima & T, 2013) included –a) The duration of the program which means that the duration at a time should not be more than the attention span of the participants. b) The effectiveness of the resource person. c) Topics covered were within the scheduled timeframe. d) The module was developed as per the needs. e) Feedbacks of previous training programs were considered while designing the module again .

The output measures as per (S.Poornima & T, 2013) (T, 2012) (R.Krishnan) (Trakru & Jha, 2019) (Chhadva & Kacker, 2013) (BYadav & S.Pingle, 2016) (GJ Botvin E. B.-J.) were- a) The participant perception about application of skills , speed of decision making , improvement in technical and interpersonal skills , possibility of exchange of experience & information and reduction in difficulties at work . b) The improvement in work efficiency is also a measure of effectiveness which consists of timely completion of work, return on investment on employee which means whether the learnings during the trainings are applied at work. c) The other output measures specified as learning outcomes in different training programs are launch of a startup within 6 months of training program, improvement in job satisfaction , self esteem, hygiene ,quality of life ,exam score ,communication , stress management , systematic way of doing work and saying no to drugs and alcohol .

The process parameters included exchange of experience and information during the training programs as highlighted in (S.Poornima & T, 2013).

The training programs for which effectiveness was measured in the reviewed literature (Trakru & Jha, 2019), (R.Krishnan), (Anand, 2019), (Worku, 2019) used different modes like e-learning, classroom based programs and Information and Communication Technology (ICT) enabled classroom based programs like Flipped Classroom Method where students present what they have learned in class.

The research gaps which emerged out of reviewing (S.Poornima & T, 2013) (T, 2012) (Chris Watkins, 2002) (BYadav & S.Pingle, 2016) (Chhadva & Kacker, 2013) (R.Krishnan) (Cowan) (Trakru & Jha, 2019) (Tahir) are –1. Effectiveness models considered did not focus on Quality Management approach and EFQM approach simultaneously. 2. Learning outcomes were considered but outcomes in form of inputs, process and outputs were not considered thoroughly. eg: A trained and qualified faculty who is fit to take the lecture is an effective outcome while arranging resources or inputs . Similarly adherence to Psychological and General principles of teaching while designing

instruction material and taking lecture include process and output related outcomes .

3. Objectives:

1. The purpose of the research paper is to find the effectiveness of synchronous (live) training programs using 1) European Federation of Quality Management(EFQM) Approach 2) John Cowan’s Approach 3) Quality Management Approach .

The EFQM approach states that if inputs are effective then outputs are effective ,the John Cowan’s approach assesses what is achieved with respect to outcomes and the Quality Management approach assesses whether customers are satisfied or not.

4. Research Methodology:

Sampling Frame – The sampling frame consisted of registered participants of all Indian Society for Quality (ISQ) e-learning programs. The members were Life Time and Annual Members of ISQ.

Sample Selection – The samples were self selected when feedback questionnaire was sent to all the participants and only a few filled the questionnaire .It can’t be found out whether sample was representative of the population or not as all participant details training wise were not available .The sample is free from response error as uninterested people did not attempt to fill the questionnaire. The number of respondents in 14 training programs were 124 as shown in Figure 1 and 94 sub-topics were taught during the training .The Table II shows the sampling strategy .

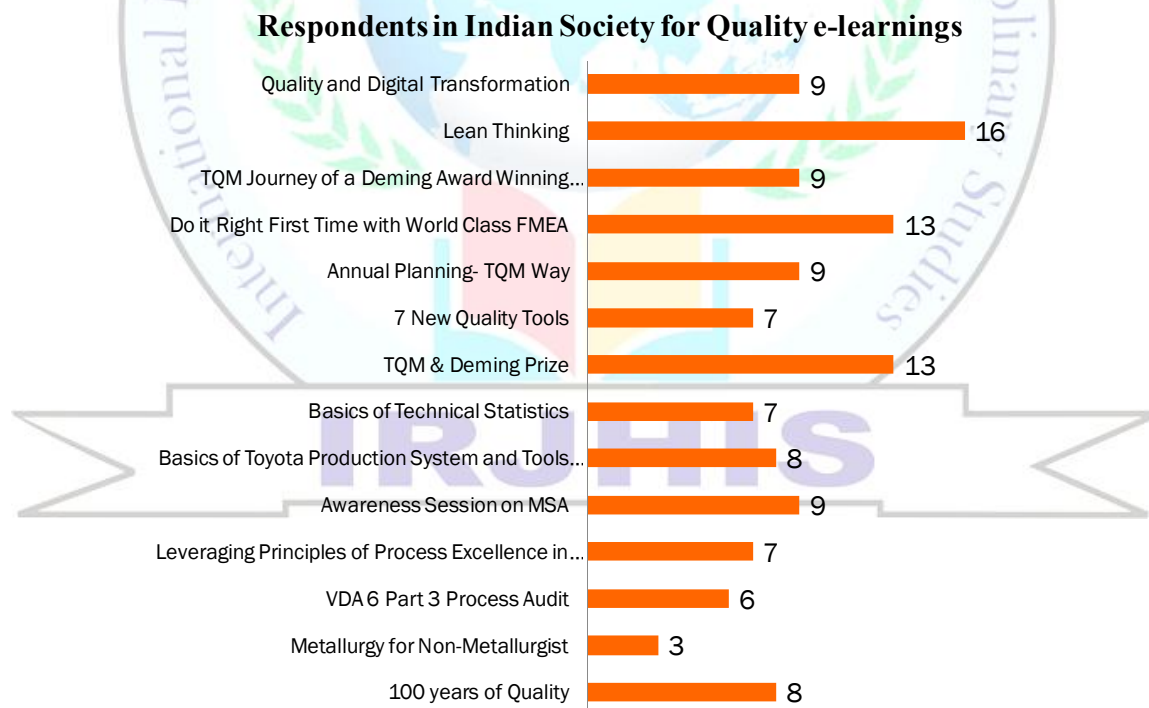


Figure 1 Number of respondents in various training programs (Shettigar, 2021)

Table II Sampling Strategy Elaboration (Black, 2011) (Shettigar, 2021)

Indian Society for Quality E-Learnings							
TR:Trainer , P:Participants , IM:Instruction Material , VP: Virtual Platform , R:Respondents							
Training 1		Training 2		Training 3		Training 4	
TR1	P1 (R1)	TR2	P2(R2)	TR3	P3(R3)	TR4	P4(R4)
IM1	VP1	IM2	VP2	IM3	VP4	IM4	VP4
Training 5		Training 6		Training 7		Training 8	
TR5	P5(R5)	TR6	P6(R6)	TR7	P7(R7)	TR8	P8(R8)
IM5	VP5	IM6	VP6	IM7	VP7	IM8	VP8
Training 9:Guest Talk		Training 10		Training 11		Training 12	
TR9	P9(R9)	TR2	P10(R10)	TR11	P11(R11)	TR12	P12(R12)
IM9	VP9	IM10	VP10	IM11	VP11	IM12	VP12
Training 13:Guest Talk		Training 14		Training 15		Training 16	
TR13	P13(R13)	TR14	P14(R14)	TR15	P15(R15)	TR16	P16(R16)
IM13	VP13	IM14	VP14	IM15	VP15	IM16	VP16
Training 17		Training 18		Training 19		Training 20	
TR17	P17(R17)	TR18	P18(R18)	TR19	P19(R19)	TR20	P20(R20)
IM17	VP17	IM18	VP18	IM19	VP19	IM20	VP20
Training 21		Training 22		Training 23			
TR21	P21(R21)	TR22	P22(R22)	TR23	P23(R23)		
IM21	VP21	IM22	VP22	IM23	VP23		
Respondents are the subset of group of participants in each training .							
Legend	Trainings Selected in Sample			Trainings not in sample			

Population–Error! Reference source not found.The population represents all registered participants (Life time (Team, www.isqnet.org>Membership>Click on for list of Life Members, 2021) and Annual members (no data available)) for ISQ E-learning’s shown at (Team, isqnet.org>events>national>ISQ eLearning Programs, 2020) .Out of the 23 training programs for 14 data was taken for study and R6-R8,R10-R12 ,R14-R21 represent respondents of the numbered training program which sum upto 124 which is considered as a single sample and Shapiro-Wilk test to check normality was applied and null hypothesis was rejected as p value was 1.15×10^{-10} which was less than 0.05 and $W(124)=0.83$ (Kingdom, 2022) , hence it is concluded that the data didnot follow normal distribution .

Sample Size Adequacy – According to Morgan’s table at 95 % confidence or when 5% are the chances of errors 124 is an adequate sample size when 158 is the population size .In reality the population size is not known but in every training it varied from 15 to 40 participants and variation

was at every instant. All participants did not attend the training program thoroughly so some of those who did not fill the questionnaire might not have been able to attend the training for the entire duration .The sector wise distribution of respondents is shown Figure 2 below .

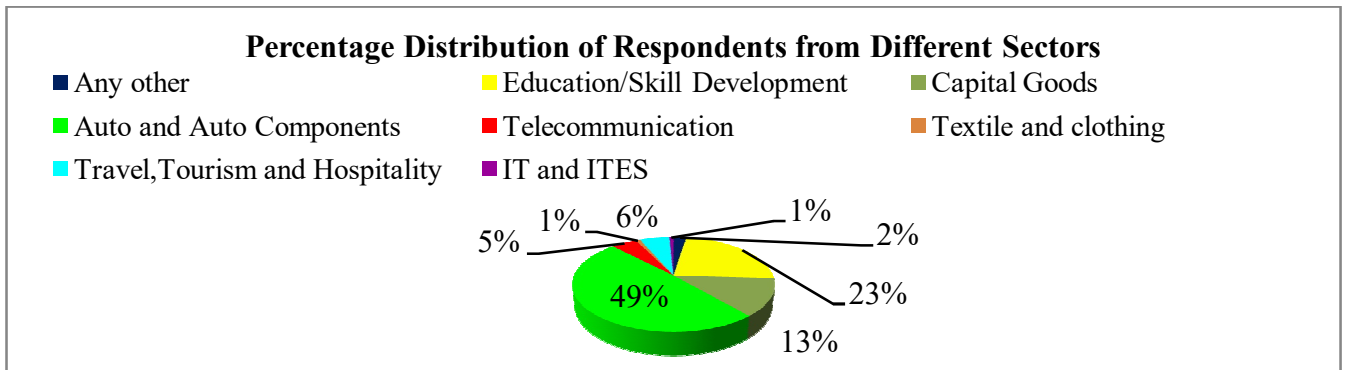


Figure 2 Percentage distribution of respondents from different sectors

Research Design – Descriptive Research Design was used as a questionnaire was designed and participant’s perception was recorded on inputs , process and outputs. 94 topics were covered which were related to Quality Management in 14 trainings .The Input ,Process, Output parameters on which questions were formulated are shown in Figure 3 below .

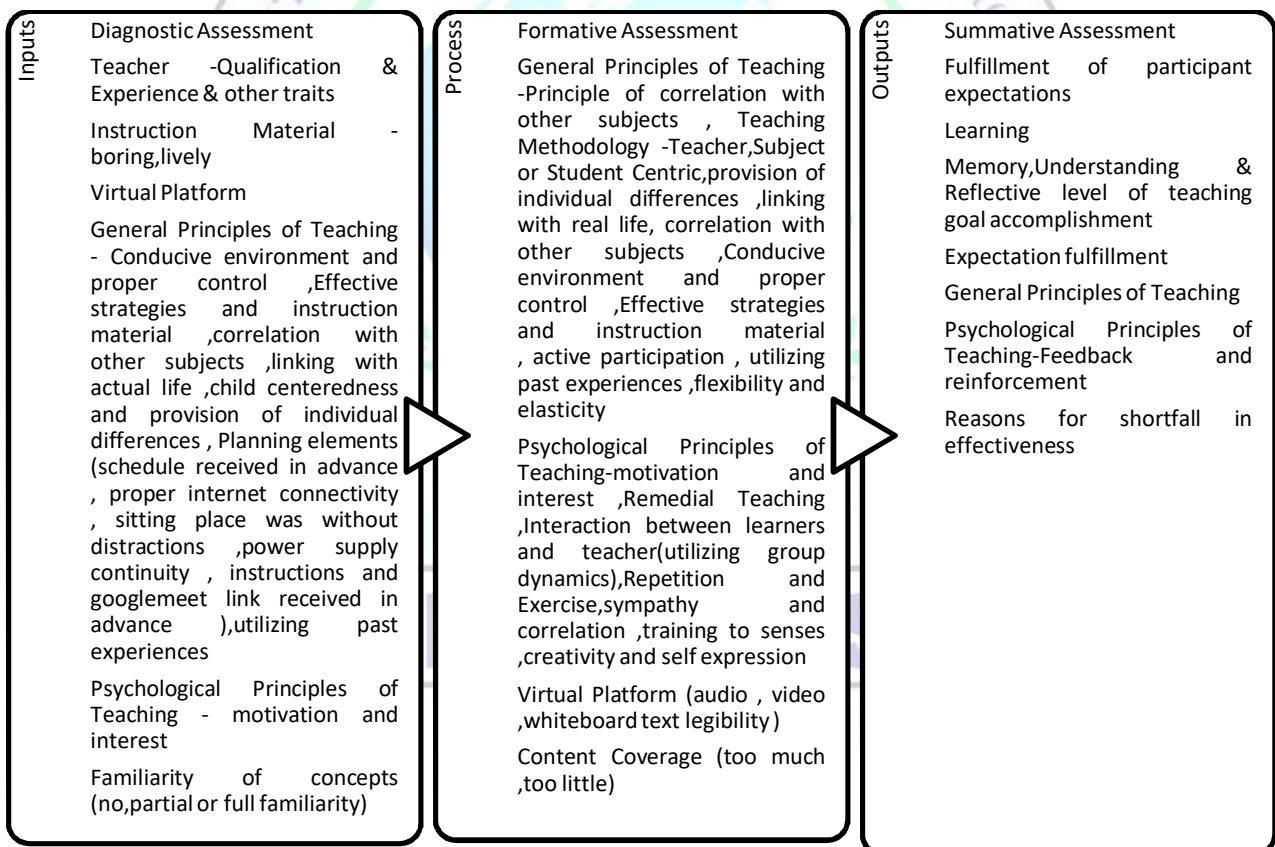


Figure 3 Inputs, Process & Output parameters considered during questionnaire design (S.K.Mangal & Mangal, 2018)

The used design differed from the conventional Pre-Experimental one group Pretest and Post test Design. In Pre-Experimental designs there is no randomization and the extraneous factors are not

controlled as written in (Nayak J. u., 2022).The existing Pre-Experimental design was different from the conventional pre-experimental design because the pre-training and post-training feedback both were taken after the training .In conventional Pre-Experimental design the pre-training feedback is taken prior to training .The internal reliability of the questionnaire was checked using **Chronbach Alpha Test** for the different training programs and the Chronbach Alpha Values are shown in the Table III below.

Table III Reliability of questionnaires used in different training programs

Training Number	Training Program Name	Chronbach Alpha Value
6	7 New QC Tools	0.878
7	Annual Planning- TQM Way	0.706
8	Do it Right First Time with World Class FMEA	0.672
10	TQM Journey of a Deming Award winning organization	0.731
11	Lean Thinking	0.635
12	Quality and Digital Transformation	0.822
14	TQM and Deming Prize	0.842
15	Basics of Technical Statistics	0.823
16	Basic concept of TPS and introduction of various TPS Tools & methods	0.841
17	Awareness Session on MSA	0.893
18	Leveraging Principles of Process Excellence in Software Context	0.659
19	VDA 6 Part 3 Process Audit	0.760
20	Metallurgy for Non-Metallurgist	0.808
21	100 years of Quality	0.719

Scale Used - The basis of the levels for mapping participant perception was Bloom's Taxonomy but instead of the levels "remember", "understand", "apply", "analyze", "evaluate" and "create" the levels considered were "not familiar" to "reflect" and the pyramid showing levels considered is shown in Figure 4.The scale used was ordinal.

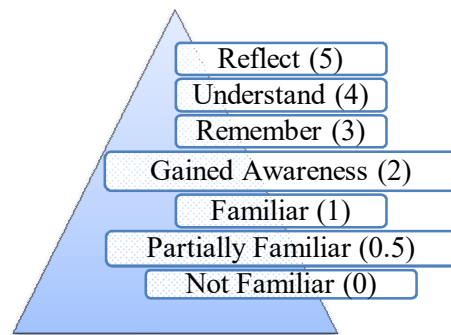


Figure 4 Pyramid showing levels considered with scores given in brackets while mapping of participant perception

5. Hypotheses:

All hypotheses which were tested to find out the effectiveness levels based on different approaches are shown in Table IV .

Table IV Formulated hypotheses and tests used to measure effectiveness of ISQ training programs

S.No	Approach	Hypotheses	Description	Test Used	Assumptions met
1	Learning Outcomes Approach	H ₀₁ H _{01a}	It is believed that there is no significant difference in the before and after test scores based on participant perception which means that the participant level of learning is same before and after training . It is believed that there is a significant difference in the before and after test scores based on participant perception which means that the participant level of learning improved after training.	Wilcoxon Sign Rank Test was used	Shapiro Wilk Test proved that the participant feedback about teaching level accomplishment did not follow a normal distribution .
2	Quality Management principle of Customer Satisfaction Approach	H ₀₂ H _{02a}	It is believed that for 90% of the participants expectations are fulfilled. It is believed that participant expectations were fulfilled for less than 90% of participants.	Z Test for proportion	N _p ≥0.5,N _q ≥0.5
3	European Federation of Quality Management Approach (Effective inputs lead to effective outputs)	H _{03,04,05,06} H _{03a,04a,05a,06a}	It is believed that all inputs (Teacher/Teaching Methodology/Virtual Platform/Instruction Material) are 90% effective in the training programs. It is believed that all inputs (Teacher/ Teaching Methodology/ Virtual	Z Test for proportion	N _p ≥0.5,N _q ≥0.5

			Platform/ Instruction Material) are greater than or less than 90% effective in the training programs.		
4	Learning Outcomes Approach	H ₀₇ H _{07a}	It is believed that learning output is 90% effective in the training programs. It is believed that learning output is less than 90% effective in the training programs.	Z Test for proportion	Np≥0.5,Nq≥0.5

6. Data Analysis and Findings:

6.1. The success of the training was evident from the fact that 89.5 % of the respondents felt that their expectations from the trainings were met as shown in Figure 5 below.

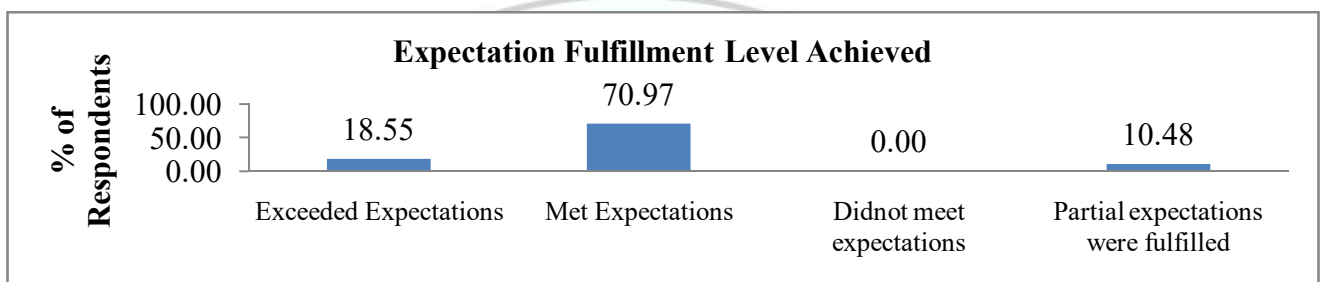


Figure 5 Respondent expectation fulfillment in percentage

6.2. Among the input teaching components the “Teachers” were found to be most effective followed by “Virtual Platform”, “Teaching Methodology” and “Instruction Material”. “Learning” was the outcome of the trainings and it had almost 75% accomplishment as shown in Figure 6 below.

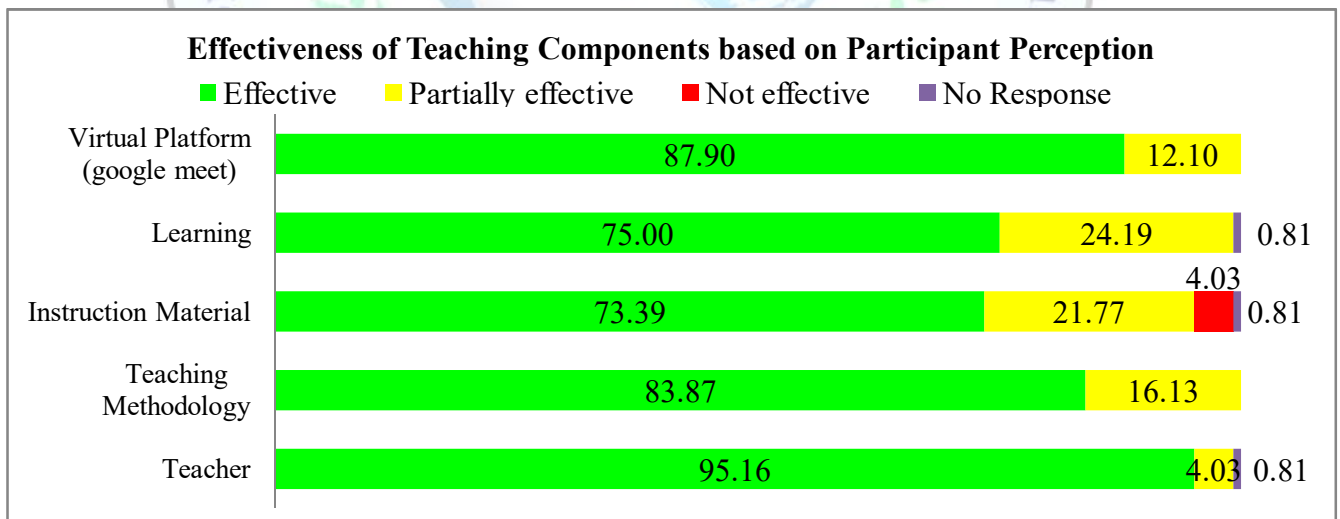


Figure 6 Effectiveness of Teaching Components

6.3 Hypothesis Testing Results:

a) As the improvement in the participants after the training program was evident from the level of learning they accomplished on the formulated scale inspired from Bloom’s Taxonomy, the difference of before and after accomplishment was checked after the training based on their

perception. The distribution was checked for normality using Shapiro Wilk Test and it showed a significant departure from normality. So, instead of paired t test it's non-parametric alternative Wilcoxon Signed Rank Test was applied .The sum of the positive ranks came out to be 7755, mean 3875 and standard deviation 401.014 .So, as n is greater than equal to 10 the discrete probability of ranks was approximated by normal distribution as shown in (Nayak J. u., 2022) and z value comes out to be 9.675 which is greater than 1.96 so null hypothesis is rejected and this means that there was a significant improvement in the learning level of participants after the training program .The p value is less than 0.01 as well as 0.05 as shown in (Joohi, 2022).

b) Further moving to next level the level accomplished in memory ,understanding and reflective level of teaching goals was found and the attainment and the results are shown in **Figure 7** below. It is evident that more than 91.60-93.42 % participants gained awareness but memory, understanding and reflective level of understanding was gained by 73.41-76.41%, 45.41-48.86% and 14.87-17.41% participants respectively.

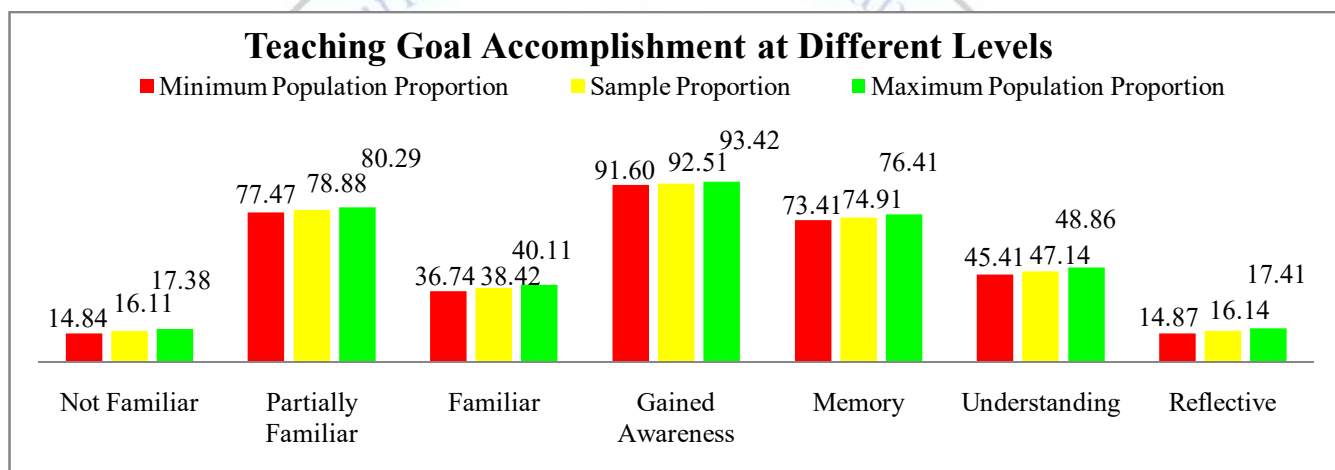


Figure 7 Teaching goal accomplishment at different levels

c) For null hypothesis 2 “H₀₂” stating that it is believed for 90% of the population expectations were fulfilled, it is the case of failure to reject the null hypothesis as Z statistic was -0.18 and Z critical was -1.645 .As Z statistic was less than Z critical at 5% level of significance it is concluded that for 90% of participants expectations were fulfilled at p value 0.5707 which is much greater than 0.05 .

d) Two teaching components “Teaching Methodology”, “Instruction Material” were less than 90 percent effective and “Teacher” and “Virtual Platform” effectiveness was greater than 90% as shown in Table V.

Table VI shows that Teaching Methodology is 80 percent and Instruction Material is 70 percent effective .

Table V Computation of Teacher, Teaching Methodology, Instruction Material and Virtual Platform effectiveness level

S. No	Null Hypothesis	Alternate Hypothesis	Z Calculated, p value	Z Tabulated at 0.05% significance (one tailed)	Result
1	Teacher effectiveness is 90%.	Teacher effectiveness is greater than 90%.	1.9176 , 0.0277	1.645	Alternate hypothesis is accepted .
2	Teaching Methodology effectiveness is 90%.	Teaching Methodology effectiveness is less than 90%.	-2.28 , 0.0115	-1.645	Alternate hypothesis is accepted .
3	Instruction Material effectiveness is 90%.	Instruction Material effectiveness is less than 90%.	-6.1665, 3.49*10 ⁻¹⁰	-1.645	Alternate hypothesis is accepted .
4	Virtual platform is 90% effective .	Virtual platform effectiveness is less than 90% .	-0.78 , 0.2182	-1.645	Fail to reject Null Hypothesis

Table VI Computation of Teaching Methodology and Instruction Material effectiveness level

S. No	Null Hypothesis	Alternate Hypothesis	Z Calculated ,p value	Z Tabulated at 5% significance (one tailed)	Result
1	Teaching Methodology effectiveness is 80%.	Teaching Methodology effectiveness is less than 80%.	1.08, 0.8594	1.645	Fail to reject Null Hypothesis
2	Instruction Material effectiveness is 80%.	Instruction Material effectiveness is less than 80%.	-1.8410 ,0.0328	-1.645	Alternate hypothesis is accepted .
3	Instruction Material effectiveness is 70%.	Instruction Material effectiveness is less than 70%.	0.82 , 0.7948	-1.645	Fail to reject Null Hypothesis

5. The learning effectiveness was also found to be lower than 90% but equal to 80% as shown in Table VII.

Table VII Computation of output (learning) effectiveness level

S.No	Null Hypothesis	Alternate Hypothesis	Z Calculated	Z Tabulated at 0.05% significance(one tailed)	Result
1	Learning effectiveness is 90%.	Learning effectiveness is less than 90%.	-5.57 , 1.29×10^{-08}	-1.645	Alternate hypothesis is accepted .
2	Learning effectiveness is 80%.	Learning effectiveness is less than 80%.	-1.39 , 0.0820	-1.645	Fail to reject null hypothesis

7. Conclusions:

1. The overall efficiency of inputs and outputs is shown in Table VIII .

Table VIII Overall Effectiveness of Inputs and Outputs

Input-Output	Effectiveness Percentage			
	>90 and <100	90	80	70
Teacher	Yes			
Virtual Platform		Yes		
Teaching Methodology			Yes	
Instruction Material				Yes
Learning			Yes	

2. The results of measured effectiveness using the 3 approaches are explained in

Figure 8. It shows what was achieved and not achieved in terms of goals/outcomes. It also shows what can be done in future to measure the effectiveness of training programs.



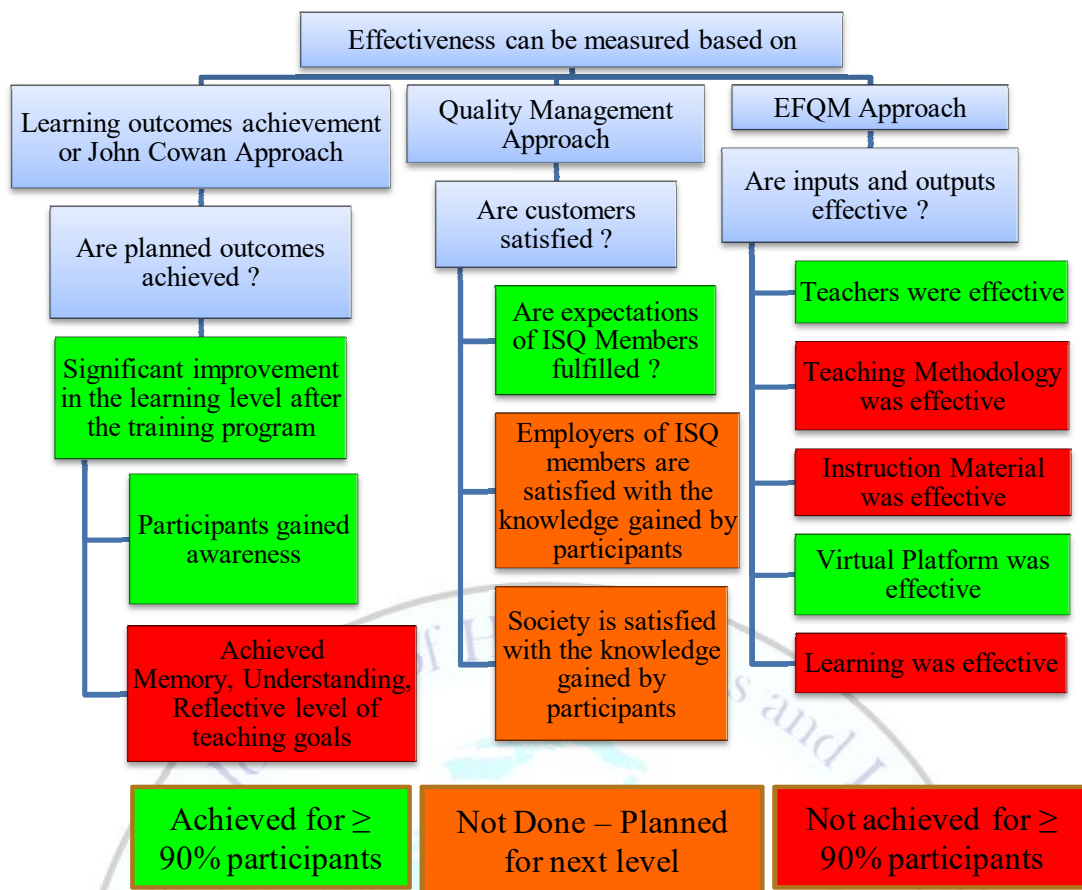


Figure 8 Results related to effectiveness measurement based on the three approaches

a) The training program was successful in achieving a significant improvement in knowledge as evident from Wilcoxon sign rank test and greater than 91.6% participants gained awareness on all topics as shown in **Error! Reference source not found.** Which is greater than 90%. Based on Cowan approach which states that actual outcome should be closer to the ideal outcome it can be said that the training program can be further improved to achieve memory, understanding and reflective level of teaching goals.

b) From the Quality Management perspective the outcome was that for 90% of the participants expectations were fulfilled .No employer and society survey was done to evaluate the performance of the participants at work and during their dealings with society which can be done at the next level.

c) From EFQM Model perspective Table VIII shows all results .It was found that among inputs Instruction Material and Teaching Methodology effectiveness was less than 90% .On further checking it was found that Instruction Material effectiveness was 70% and Teaching Methodology effectiveness was 80%. The learning effectiveness was 80%. Only “Teacher” and “Virtual Platform” were the effective inputs in the eyes of 90% of the participants.

Overall the ISQ trainings can be considered partially effective as there are improvements required in the Memory , Understanding and Reflective level of teaching goal attainment and overall Learning as output in the perception of participants .Instruction Material and Teaching methodology

also need further improved for 90% effectiveness accomplishment .Hence , out of the 11 parameters considered for measuring effectiveness, the ISQ training programs were successful in achieving \geq 90% accomplishment in 5 parameters and need improvement in 6 parameters.

8. Future Research Prospects:

1. Though 90% participant expectations were fulfilled but the level of accomplishment was not same in memory, understanding and reflective teaching level goals and hence, this means that the expectations might be different based on the participant level in organization(higher , middle, lower level employee), sector of the organization employee is serving in , employee experience in years, membership status of employee whether annual or life-time .So , training results can be optimized by further listing participant expectations and designing the program considering those expectations .

2. Extraneous variables like sector of trainee, trainer experience, topic relevance, participant experience can cause shortfall in effectiveness. Hence, their impact on training outcomes can be measured and analyzed at the next level.

3. Society and employer survey can be done to measure improvement in the participants after the training.

9. Acknowledgement:

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