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ELEI- METRIC FOR MEASURING ELEARNING EFFECTIVENESS

***Abstract:** Measurement of learning outcome is an essential quality metric. This paper proposes a framework for measuring eLearning effectiveness in quantitative terms. It also sets out the results of a research project carried out across thirty nine Indian organizations. In this empirical study, eLearning effectiveness measurement framework based on Kirkpatrick Model, was proposed. This model is an additive model, metric value of eLearning effectiveness for each course is derived from five critical metrics measured using different parameters. Pilot implementation was done. Evaluation of the framework was done using the learning records of the organizations under consideration. An online survey was conducted to capture feedback on usefulness, adequacy and value addition by this framework to overall learning process. This was followed by one sample proportion test for drawing inferences. The research concluded that well defined and structured approach play an important role in measurement of eLearning outcome. It also revealed the positive impact of the framework in taking the organizational learning and development activities to the next level. This study was limited to Indian scenario. More studies are required to generalize results. Data was collected through self-responses and focus group discussion. Hence, the "perception" of respondents has some influence on the overall outcome.*

***Keywords:** eLearning, Effectiveness, Kirkpatrick's Model, One Sample Proportion test, Learning & Development*

1. Introduction

In the age of rapid industrial and technological change, skill and competency of the employee play a vital role in the business success of an organization. Hence, day by day organizational learning is becoming very important as it plays a pivotal role in the skill and competency development of the employee. Indian organizations are also not an exception. Learning and Development functions are

organizing workshops, sending their employees to a different conference or in skill development programs. However, due to an increase in training cost, travel expenses this option is now very costly for the organizations. To address these challenges, most of the organizations are now moving towards eLearning to keep their learning process aligned with the digital age. Also, eLearning is cost-effective, flexible and can be scaled up easily. Once the eLearning framework is implemented in the organizations, learning, and development

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professionals are increasingly being asked to prove the effectiveness of the learning and development initiatives. Several indirect measures of learning effectiveness are available in the scattered form, however, compilation, analysis, and summarization make it challenging to interpret. Hence, there is a need for “Quantitative Value” as a measure of eLearning effectiveness. It will be measured on the basis of different attributes commonly used for measuring learning outcomes. This will help in:

- understanding the eLearning effectiveness in a better way
- comparing the learning effectiveness of different eLearning courses
- finding the eLearning effectiveness at an organizational level

2. Literature review

Aguinis and Kraiger (2009) revealed that most studies report the positive impact of training on individuals, teams, and organization as a whole.

In the present scenario, online learning is the most suitable option for employee training with high acceptance, flexibility, availability, and also it is cost-effective. (Rym et al., 2013).

Commlab India (2017) define effective eLearning as, ‘When eLearning helps organizations achieve the desired business results such as increasing the ramp rate of product revenue, reducing turnover and rework, increasing customer satisfaction and more, it can be termed effective.’ In the blog, some popular techniques for measuring the effectiveness of has also been discussed. The techniques include:

- learning outcome
- translation on knowledge into practice
- perceived learning- skill, competency and attitude
- learning retention, motivation, and

engagement

- cost-effectiveness and organizational result

Wranx (2015) suggested measuring eLearning effectiveness using multiple metrics, which include:

- learners’ feedback
- test evaluation record
- learners’ attitude towards learning
- some HR metrics like employee retention, employee feedback, competency

It also emphasized on the calculation of “Return on Investment (ROI)” to justify the initial investment of eLearning. The two elements, cost, and savings of ROI calculation include the following parameters:

- cost includes infrastructure, eLearning development or procurement cost, cost of maintenance of eLearning infrastructure.
- savings include higher flexibility and personalization, no travel expenses, no cost for the instructor, no loss of work time.

Brenner (2017) explains how “Kirkpatrick’s Four-Level Training Evaluation Model” can be used to measure eLearning effectiveness. The article well described the “How” part of the measurement process. This model also emphasized on the measurement of eLearning effectiveness using different metrics.

Chan et al. (2003) proposed a framework for measuring eLearning effectiveness based on the following four parameters;

- online courses
- learning effectiveness
- evaluation method
- evaluation result

The parameters are sub-parameters used for this framework are summarized in Table 1.

The authors also recommended measuring different metrics for measuring the effectiveness of eLearning.

Several systematic review and researches have been conducted on the effectiveness of eLearning with respect to higher education

(Moravec et al., 2015), language or learning management science (Bentley et al., 2012).

Table 1. Parameters of Chan’s Framework

<p>One- Online Courses</p> <ul style="list-style-type: none"> • Learning Environment • Learning Process • Supporting Technologies 	<p>Two- Learning Effectiveness</p> <ul style="list-style-type: none"> • Resource Repository • Progress Assessment • Knowledge Management
<p>Four-Evaluation Result</p> <ul style="list-style-type: none"> • Student Perception • Student Performance • Learning Style 	<p>Three- Evaluation Methods</p> <ul style="list-style-type: none"> • Questionnaire • Database • Weblogs

There are many shreds of evidence of the use of the Technology Acceptance Model (TAM) for measuring eLearning effectiveness and acceptance. Researches by Cheung et al. (2013) and Zanzan et al. (2012) concluded that the effectiveness of eLearning is as good as classroom training and it is well accepted by the learners. Also, many researchers have conducted a structured meta-analysis on the effectiveness of e-Learning. Some of the analysis is a comparative study of the effectiveness of eLearning with other learning modes. A detailed study on eLearning effectiveness by Neuhauser (2002) was also a comparative study of face to face learning and eLearning based on several parameters.

The summary of researches indicates a huge variety of findings, in most cases, eLearning was found to have equal or better effectiveness. Noesgaard et al. (2015) concluded that more than 70% effectiveness study are the quantitative and more than 50% of the study are comparative studies, which compare eLearning with traditional face-to-face and/or blended learning. This overall approach also helps in policymaking. Also, a majority of the researches are focused on

identifying the parameters for improving eLearning effectiveness.

It has been observed that almost all researches related to eLearning effectiveness are focused on learners perspective i.e. how learners are getting benefited using eLearning or how to improve the eLearning effectiveness further. However, no study is available with research objective “Quantification of Learning Effectiveness”, focusing on the measurement of the effectiveness of eLearning initiative. But then, this is indeed an important metric for learning and development professionals.

3. Proposed framework and measurement parameters

The summary of the literature review indicates that several approaches are available for measuring the effectiveness of eLearning. However considering our requirement of "Quantification of eLearning effectiveness" into a single value, approaches of Kirkpatrick’s Model can be followed with some modification.

To address our requirement, a new metric, “eLearning Effectiveness Index (eLEI)” is proposed for quantifying the learning outcomes. As discussed earlier, this metric is inspired by the Kirkpatrick four-level model for measuring training effectiveness, however, it is an integrated approach.

There are several challenges associated with the use of Kirkpatrick’s Model as a measurement framework for measuring training effectiveness. These challenges are:

- computation of training effectiveness is a long process which include several steps. Too many data points are required for this purpose and the data collection process is complicated. That makes the overall process time consuming and expensive.
- in the model, it is assumed that the importance of a level increase with the level number, which may not be

a practical case.

- another important part of the model is the measurement parameters and the weightage of all the parameters are not the same. Hence, a practical approach is required for assigning the weightage to the parameters.

Brenner (2017) has described some parameters as measurement metrics for different levels. An attempt has been made to include a possible method of data collection. The overall approach is available in Table 2.

Table 2. Summary of Measurement Process using Kirkpatrick’s Model by Brenner

Level	Metrics	Specific Measurement Parameters	Data collection process
1	Reaction	<ul style="list-style-type: none"> • The worthiness of training with respect to time • Representation of training content • Alignment with personal learning style • Overall Feedback 	Feedback from learners
2	Learning	<ul style="list-style-type: none"> • Evaluation of learning 	Online assessment result
3	Behavior	<ul style="list-style-type: none"> • Translation of learning into work • Sharing knowledge with peers 	Supervisor feedback
4	Results	<ul style="list-style-type: none"> • An increase in Productivity, sales, customer satisfaction, employee morale • Reduction in attrition rate, customer complains 	Using multiple channels

In order to simplify the learning outcome measurement, a single value metric eLearning Effectiveness Index (eLEI) is proposed in this paper. This metric is a framework based on five main parameters. Each main parameter has some sub-parameters within it. Sub-parameters are

included in the model to make the measurement outcome more realistic and accurate. The parameters, sub-parameters and the measurement objectives of the proposed framework are summarized in Table 3.

Table 3: Framework parameters, sub-parameters, and measurement objectives

Sl No	Parameter	Measurement Objective
1	Learner’s Feedback Index (LFI)	It is used to measure the overall satisfaction of learners
2	Leaner’s Performance (LP)	It is used to measure learners’ understanding and retention after attending an eLearning course or module
3	Application of learning (ApL)	It is used to measure the translation of learners' understanding of practical work after attending an eLearning course or module
4	Behavioral aspects of learners (BA)	It is used to measure learners’ psychology towards eLearning
5	Return on Investment (ROI)	It is used to measure the cost-effectiveness of eLearning

Hence, in the proposed model, the metric value of eLearning effectiveness for each course is derived from five metrics measured using different parameters:

- learners' feedback (content quality,

look & feel, interactivity, objective fulfillment, and learning experience)

- learners’ performance (performance in the assessment)

- application of learning (supervisor feedback)
- learners behavioral aspect (learners' attitude-attempt vs. not attempt analysis and acceptance of eLearning-considering multiple attempts)
- cost-effectiveness (savings through eLearning)

3.1. Parameters and Sub-parameters of the measurement framework

The parameters of the measurement framework are discussed below:

Learner's Feedback Index (LFI): This parameter indicates the learners' perspective of eLearning using the feedback about eLearning courses. There are four sub-parameters associated with these metrics. Based on the importance, some weightage has been assigned to each sub-parameter. The sub-parameters and corresponding weightages are discussed below.

- **Quality of content:** Content is the backbone of an eLearning course. It plays a vital role in the learning outcome of the learners. Correct, adequate, precise content is expected for an eLearning course. The content should be jargon-free, easy to understand and copyright free. The weightage assigned for it is 50%.
- **Look and feel:** Look and feel deals with the graphics used for the courses. This plays an important role in making the course attractive to the learners. The look and feel should be appropriate for the target audience and course type. All the image used in the course should be copyright free. The weightage assigned for Look and Feel is 10%.
- **Interactivity:** This deals with the activities present in an eLearning course. Presence of interactivity has

an impact on learner engagement. The weightage assigned for interactivity is 10%.

- **Objective fulfillment:** This indicates how the course meets the expectation of the learners. This is an important parameter for measuring the effectiveness of eLearning. The weightage of this parameter is 20%.
- **eLearning experience:** This indicates whether the overall eLearning process was hassle free, adequate support was there while required. The weightage assigned to this sub-parameter is 10%.

Hence, the Learners' Feedback Index (LFI) will be calculated as follows:

$$\begin{aligned} \text{Learner's Feedback Index (LFI)} &= 0.5 \times \text{Quality of Content} + 0.2 \\ &\times \text{eLearning Experience} + 0.2 \\ &\times \text{Objective Fulfillment} + 0.1 \\ &\times \text{Look \& Feel} + 0.1 \times \text{Interactivity} \end{aligned}$$

Learners' responses are collected for the above-mentioned parameters through the learner's feedback survey (mandatory) available at the end of the courses. The learners' rate each and every parameter on the scale of 1-10, where 10 is highest. The median value of the sub-parameters is used to measure LFI and expressed in percentage (%).

Learners Performance (LP)

This parameter indicate understanding and retention of learning immediately after completion of the course. Median of Assessment Scores of the learners is used as Learners' performance metric value. Assessment scores for a particular course are downloaded from the Learning Management System (LMS) and the median value is calculated as a measure of this metric value and expressed in percentage (%).

Application of learning (ApL)

This parameter indicates how the learner translating their learning into practice. Rating (in 1-10 scale, where 10 is highest) provided by the supervisor of the learner used as a measure of this metric.

Supervisor's feedback is collected through the post-training survey (using the learning management system) conducted by the learning and development team as per the pre-defined schedule (preferably after 3 months of completion of training). The median value of the rating is used as a measure of the metric and expressed in percentage (%).

Behavioral aspects of learners (BA)

This is comprised of the following two parameters.

- Learners Attitude(LAt) = (Number of participants attempted & Passed + 0.6 x Number of participants

attempted & failed + 0.4 x Number of participants attempted)/Expected number of Participants

- Learners Acceptance of eLearning (LAeL) = (Total number of attempt/Total number of unique attempt). More the number of repeat attempts by the learners more will be the "Learners Acceptance of eLearning(LAeL)"

Return on Investment (ROI)

(Cost would have been incurred if done in the classroom- eLearning cost)/eLearning Cost).

All costing data is available with the Learning and Development team.

Data requirement summary of the proposed measurement framework is represented in Table 4. The data requirement summary includes data types, sources, collection mode and requirement of manual effort.

Table 4. Data Collection Summary

Measurement Parameters	Required Data Type	Data Source	Data collection mode	Is manual effort required?
Learner's Feedback Index (LFI)	Participants' feedback	Learning Management System(LMS)	Online	No, only monitoring is required
Learning Performance (LP)	Performance data of learners	Learning Management System(LMS)	online	No, only monitoring is required
Application of Learning (ApL)	Implementation of learning into practice	Learning Management System(LMS)	Online	No, only follow-up is required
Behavioral Aspect (BA)	Learners' detail attempt, completion etc.	Learning Management System(LMS)	Online	No, can be downloaded from LMS
Return on Investment (ROI)	Cost-related data	Vendors	Offline	Training team maintain this data

As mentioned earlier, data collection is one of the major challenge associated with Kirkpatrick's Model. In the proposed framework, most of the data will be collected online using the facilities available in the Learning Management System (LMS). Hence, this challenge has been addressed.

Only monitoring and follow-up is required, which is generally done by the training team.

3.2. Learning outcome

The value of Learning Effectiveness Index (LEI) for a particular course (ith Course) is

calculated as follows;

$$LEI_i = ROI \times [0.3 \times LFI_i + 0.25 \times LPI_i + 0.25 \times ApLi + 0.2 \times BAI_i]$$

Using the normalized yield concept of Six-Sigma (Pyzdek et al., 2009), "Organizational Learning Effectiveness Index (LEI)" is calculated as;

$$LEI_{ORG} = (LEI_1 \times LEI_2 \times \dots \times LEI_N)^{1/N}$$

Where LEI_i is Learning Effectiveness Index for the i th course and $i = 1, 2, 3, \dots, N$

The main features of the proposed framework are:

- based on standard practice and approach
- easy to compute, compare and interpret
- system driven, less effort high accuracy

The metric can be interpreted as:

- poor (below 50%)
- average (between 51-79)
- good (80-100)
- excellent (above 100)

4. Framework validation study

4.1. Research Hypotheses

This study hypothesized:

- quantification of learning effectiveness is required
- framework parameters used are adequate
- the proposed framework is easy to implement and interpret
- the proposed framework will add value in the overall learning process

4.2. Sample and data collection

The population in the study consisted of professionals from thirty-nine Indian

organizations based in different sectors; consultancy, banking & financial, manufacturing, hospitality, information technology, and telecom. Each had implemented eLearning as part of their employee training strategy. As a part of the pilot study, the proposed measurement framework was implemented. Total of 5760 learning records was studied. One hundred twenty six learning and development professionals including senior leaders from these organizations (28.6% male and 71.4% female with length of service profiles ranging from less than 3 years at 26.1%; 3-5 years at 38% and 5 years + at 35.9%) were randomly identified to provide feedback on the newly implemented measurement framework. Lastly, feedback data was collected and was used for the analysis.

The survey instrument was designed with ten dichotomous questions from four broad categories:

- the requirement of measurement framework (2)
- adequacy of the framework (3)
- implementation, computation, and interpretation (3)
- value addition (2)

The number within the parenthesis represents the number of questions from that particular category. Also, there was an open-end question for providing qualitative feedback. Content validity was ensured by eLearning experts. Reliability was good (92%) after testing the instrument with 35 professionals.

4.3. Data Analysis and Result

The collected responses were summarized and one sample proportion test (at a 95% confidence level) was conducted. The objective was to understand the alignment of the thought process of the majority (>50%) of the respondents' with the null or alternative hypotheses (refer Table 5.).

Table 5. Analysis Summary

Sl. No	Parameters	Alternative hypotheses	Response Detail		Test Result (p-value)
			Yes	Total	
1.	Framework Requirement	there is a requirement of the effective measurement framework	163	228	0.00 (significant)*
2.	Framework Adequacy	all relevant parameters have been included in the model	221	352	0.00 (significant)*
3.	Framework Implementation	not very difficult to implement	204	347	0.001 (significant)*
4.	Value Addition	the model will add value	162	246	0.00 (significant)*
Test result significant implies, alternative hypothesis is correct					

The analysis outcomes of the proposed framework are summarized below.

- professionals strongly feel that quantification of learning effectiveness is essential and the parameters used in the framework for measuring the learning effectiveness are adequate
- analysis outcome also indicates that implementation of the framework won't be challenging as data collection, computation and interpretation of the metrics value is easy
- professionals strongly feel that the proposed framework will add value to overall learning and development activity by quantifying the learning outcome
- around 45% of the respondents feel that framework is great, however, it will be more helpful if the proposed framework can be automated.

5. Discussion and Future Scope of Work

The proposed framework is easy to implement, compute, interpret and compare.

It had a positive impact on the measurement of eLearning effectiveness; professionals, as well as stakeholders including senior management, appreciated it. The outcomes strongly recommend the use of "eLearning Effectiveness Index (eLEI)" as a measure of organizational learning effectiveness.

The proposed model bridges the gap between ongoing training and the measurement of learning outcome. This empirical research helps in the quantification of learning outcome, which eventually helps in the evaluation of learning and development activities at the organizational level. The outcomes suggest that L&D professionals need to work on customization of the framework as per their need and senior management on effective implementation of the framework. At the same time, organizations need to establish a proper maintenance/management process for using the outcome of this activity to take the organizational learning process to the next level.

Finally, future research needs to cover more dimensions of learning outcome and different computation methodology to assess the general applicability of the model.

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