

# Analysis of Effectiveness of Web based E-Learning Through Information Technology

Anand Tamrakar, Kamal K. Mehta

**Abstract**-Advancements of technology help in providing effective decision-making and problem solving in many aspects of life. Amongst the available technologies, Information Technology (IT) is one of the leading technologies in effectively utilizing the scarce resources to encounter the gap between solutions provided by existing methodologies and demands of society. Effectiveness of education system depends on the degree of quality it exhibits. Traditional learning models like classroom teaching and distance learning have their own limitations. It is increasingly becoming hard to maintain the standards of education due to limitations of infrastructure, finance and other resources including skilled manpower. Learning empowered through Information Technology (IT), to some extent ensures high quality learning by providing necessary information. This project, study the effectiveness of e-learning as it relates to the level of e-learning experience. It is clearly observed that, e-Learning systems emphasise on quality and effective presentation of information. This paper has a hypothesis (regarding effectiveness of web based e-learning and other learning methods) using a varying statistics and statistical methods performed on data. It includes a hypothesis statement and details for the performance of the hypothesis test on the data. The paper also includes an analysis of variance (ANOVA) computation for the data and an interpretation of the results.

*Index Terms*—ANOVA, e-learning, semantic web, ontologies

## I. INTRODUCTION

E-Learning is just-in-time education integrated with high velocity value chains. It is the delivery of individualized, comprehensive, dynamic learning content in real time, aiding the development of communities of knowledge, linking learners and practitioners with experts" The study of the use of e-learning in these different contexts should help us to better understand the dynamics of e-learning, and would also improve the generalizability of the results. Our objective is to better understand the interrelationship among learning presage variables (preconceptions, prior e-learning experience, ability and interest) of students on their perceptions regarding the process of e-learning and furthermore on the effectiveness of e-learning [1].

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## II. REVIEW OF LITERATURE

The purpose of this section is to report the findings of a research conducted to evaluate the effect of learning preconceptions, prior e-learning experience, ability and interest of students on their perceptions regarding the process of e-learning. We study the effectiveness of e-learning as it relates to the level of e-learning experience.

### A. Effectiveness of e-learning

The traditional educational delivery system in universities and colleges has for a relatively long period of time been a classroom with a professor giving lectures to students and the students listening and taking notes. Interaction between the professor and students has been perceived to be a crucial learning ingredient in this delivery platform. Innovations in educational delivery mechanisms such as interactive and reflective schools of thought [2] have, however, challenged the traditional approaches to education. Progress in information technology has enabled new educational delivery methods such as distance learning and e-learning. As an outcome of this, many universities and colleges have entered this new e-learning world in a major way. For this reason the need for pedagogical and technical knowledge to teach using the Internet has emerged, and this knowledge is slowly becoming a core competence for many teachers. Given the proliferation of electronic mediated teaching, the essential question here is that how and to what extent e-learning and the information technology is changing the dynamics of teaching and learning. Some researchers have predicted that the traditional classrooms will appear [3, 4]. E-learning has entered the education as well as the corporate world in a major way and it also complements the traditional delivery methods. It has facilitated the traditionally difficult educational paradigms such as adult learning or distance learning. E-learning can be viewed as an alternative to the face-to-face teaching method or as a complement to it. E-learning usually allows the student a greater choice as well as responsibility for their own learning [2,5]. E-learning can change the methods of learning and has the promise to overcome the barriers of time, distance, and economics [6, 7].

### B. e-Learning and semantic web

The great success of the current WWW leads to a new challenge: a huge amount of data is interpretable by humans only; machine support is limited. Berners-Lee suggests enriching the Web by machine-process able information, which supports the user in his tasks. For instance, today's search engines are already quite powerful, but still return too often too large or inadequate lists of hits. Machine-process able information can point the search engine to the relevant pages and can thus improve both precision and recall. To reach this goal the semantic web will be built up in different levels: Unicode/Unified Resource Identifiers, XML, RDF, ontologies, logic, proof, and trust (The important property of the Semantic

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Web architecture i.e. (common-shared-meaning and machine-process able metadata), enabled by a set of suitable agents, establishes a powerful approach to satisfy the e-Learning requirements. The process is based on semantic querying and navigation through learning materials, enabled by the ontological background. In Semantic Web can be exploited as a very suitable platform for implementing an e-Learning system, because it provides all means for (e-Learning): ontology development, ontology-based annotation of learning materials, their composition in learning courses and (pro) active delivery of the learning materials through e-Learning portals. Table I shows the suggested advantages to the possibility of using the Semantic Web for realizing the e- Learning requirements [5, 8].

Table I: Advantages of using Semantic Web as a technology for e-Learning

Requirements	Web eLearning Semantic Web
Delivery	Knowledge items (learning materials) are distributed on the web, but they are linked to commonly agreed ontologie(s). This enables construction of a user-specific course, by semantic querying for topics of interest.
Responsiveness	The vision is that each user has his own personalised agent that communicates with other agents.
Access	User can perform semantic querying for the suitable learning material. The user profile is also accounted for. Access to knowledge can be expanded by semantically defined navigation.
Symmetry	The Semantic Web (semantic intranet) offers the potential to become an integration platform for all business processes in an organization, including learning activities.
Authority	The Semantic Web will be as decentralized as possible. This enables an effective co-operative content management.
Adaptively	The Semantic Web enables the use of distributed knowledge provided in various forms, enabled by semantically annotation of content. Distributed nature of the Semantic Web enables continuous improvement of learning materials.

### III. PROBLEM IDENTIFICATION

This section describes the working process of the present work. The rapid growth and integration of e-learning programs has prompted experts, authors, and researchers to question how best to evaluate the effectiveness of such programs. Many questions regarding the effectiveness of e-learning have surfaced. One of the most common questions raised is simply "How effective is it?", and make sure to the learners' level of satisfaction with the media and processes used to create the learning environment plays upon the learners' desire to participate in future e-learning courses. Because learner

satisfaction is a major component of successful training and particularly important to e-learning courses, careful analysis of the different aspects of learner satisfaction is an important component of evaluating e-learning courses. Positive reactions help to gain or maintain organizational support for training. When selecting a multimedia environment, Norton and Wilburg (1998) suggested that instructors should ask the following questions [9]: What is the theoretical approach to learning that guides the design of the learning environment? Does the learning environment support opportunities for student groups to discuss and work with the material? Are a variety of perspectives presented for the concepts taught? Are students encouraged to critically evaluate information regardless of whether that information is presented as images, sounds, or text? Within the structure of the learning environment, are opportunities provided for student to build their own links between different types of information [9, 10]?

### IV. HYPOTHESIS

The purpose of this study was to determine the effects of four instructional methods on the achievement test scores of 100 students. The following research question was designed to address the problem according to their pretest and posttest results: Do e-learning tools help students in effective learning as compared to traditional/conventional learning methods? To test the Null Hypothesis (H<sub>0</sub>) that there is no difference between achievement test scores of the four groups: X<sub>1</sub> (treatment with Internet based e-learning), X<sub>2</sub> (treatment with non-internet based e-learning), X<sub>3</sub> (treatment with Chart), X<sub>4</sub> (treatment with Chalk Talk) at the alpha .05 level.

### V. METHODOLOGY

#### *A. Understanding of Analysis of ANOVA*

The acronym, ANOVA (pronounced "a nova"), is the popular name for the statistical procedure whose full name is "analysis of variance." ANOVA carries out tests of hypotheses that say that some variable has the same mean value in two or more populations, i.e., in two or more situations. The procedure gets its name from the fact that it makes use of an elegant chain of reasoning about variances in order to reach a conclusion about whether the mean values of the variable are the same or not. The ANOVA technique was invented by a British mathematician, Sir Ronald Aylmer Fisher, in the 1920s. In discussing the ANOVA procedure, we shall first take a look at the reasoning that underlies the procedure. After that, we shall explain how the arithmetic details are handled in terms of manual calculations[11]. These calculation techniques were developed and polished in the 1920s and 1930s, when the only aids to calculation were mechanical and electromechanical calculating machines. What is known as the ANOVA table was devised in that period, as a way of aiding the calculations through the display of intermediate steps along with the final results. Though no one would think of doing ANOVA these days except via a computer, the ANOVA table remains popular as a way of displaying the results of an ANOVA analysis[11,12]. Web Based e-learning and Non-web based e-learning were considered as e-learning tools in this study. Non-randomized quasi-pretest and posttest experimental design was used in conducting the study. This design involves administering an achievement test to the pupils before and after teaching the topics. The study was conducted in Durg district Chattisgarh state India. The college Shri Shankaracharya Mahavidyalaya, College were purposively selected and stratified random sampling technique was used to select the 100 pupils involved in the experiment. The pupils were stratified

along BCA (Ist, IInd & IIIrd) Year. In each class, 25 pupils were placed in each of the treatment groups: Web based e-learning, Chart, Non-web based e-learning and Chalk Talk Method group. This means that 25 pupils each were taught with web based e-learning, Chart, Non-web based e-learning and the control group (Chalk Talk Method).

The achievement test used to determine the performance of the pupils consists of multiple choice questions with 4 options on the various topics like Fundamental of Computer System, Concept of Operating System, and Database Management System. The topics were taken from the BCA (Ist, IInd & IIIrd) year college curriculum. The Web based e-learning clip on the above topics were produced locally and edited for its suitability for teaching student. The socio-cultural status of the student was put into consideration in producing the Web based e-learning. The Web based e-learning group was taught with the internet based desktop alone with the intervention of the teacher. The Non-web based e-learning group was taught by the teacher demonstration of the practice with desktop. The teacher taught the Chart group with Chart containing diagrams, drawing and pictures of the concept taught. The Chalk Talk Method group was taught using lecture method without any instructional material. An interval of three hours was given between pretest and posttest.

Analysis of variance was used in comparing the performance of all four groups. Scores of each pupil before instruction and after instruction were computed. Difference between pre and posttest (the average gain) was calculated.

## VI. DATA ANALYSIS & RESULTS

Here X1 is treatment with Web based e-learning, X2 is treatment with Non-web based e-learning, X3 is treatment with Chart, X4 is treatment with Chalk Talk.

Table II: Data for Calculating Average gain and Analysis of Variance (ANOVA)

Ist group X1	(X1)2	2nd group X2	(X2)2	3rd group X3	(X3)2	4th group X4	(X4)2
65	4225	61	3721	52	2704	19	361
37	1369	37	1369	28	784	41	1681
63	3969	59	3481	50	2500	20	400
41	1681	43	1849	26	676	42	1764
64	4096	58	3364	50	2500	21	441
48	2304	41	1681	25	625	40	1600
64	4096	61	3721	53	2809	21	441
41	1681	38	1444	24	576	41	1681
65	4225	62	3844	48	2304	20	400
39	1521	41	1681	28	784	42	1764
64	4096	60	3600	29	841	20	400
38	1444	48	2304	37	1369	42	1764
67	4489	60	3600	49	2401	23	529
47	2209	36	1296	38	1444	39	1521
65	4225	62	3844	49	2401	24	576
49	2401	42	1764	27	729	37	1369
68	4624	41	1681	51	2601	22	484
40	1600	39	1521	29	841	36	1296
50	2500	66	4356	52	2704	22	484
53	2809	33	1089	34	1156	34	1156
67	4489	60	3600	51	2601	26	676
39	1521	37	1369	36	1296	33	1089
66	4356	58	3364	53	2809	21	441
37	1369	49	2401	31	961	39	1521
65	4225	57	3249	50	2500	23	529
$\sum X1=1342$		$\sum X2=1249$		$\sum X3=1000$		$\sum X4=748$	

$\sum(X1)^2 = 75524$	$\sum(X2)^2 = 65193$	$\sum(X3)^2 = 40000$	$\sum(X4)^2 = 24368$
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$$\begin{aligned} \sum X &= \sum X1 + \sum X2 + \sum X3 + \sum X4 \\ \sum X &= 1342 + 1249 + 1000 + 748 \\ \sum X &= 4339 \\ \sum(X)^2 &= \sum(X1)^2 + \sum(X2)^2 + \sum(X3)^2 + \sum(X4)^2 \\ \sum(X)^2 &= 75524 + 65193 + 40000 + 24368 \\ \sum(X)^2 &= 205085 \end{aligned}$$

### Impact Factor

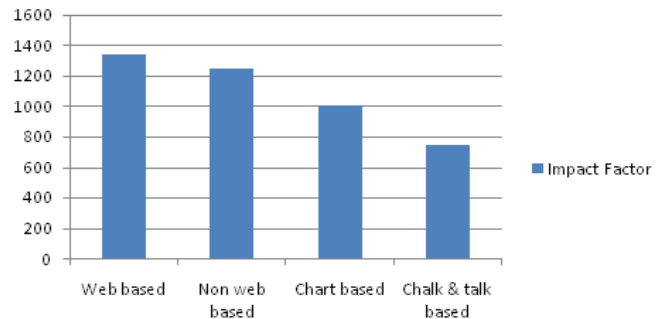


Fig 1. Impact Factor of Various Learning Methods

Table III: Average Gain Score of ThePupils'Performance In The Test

Instructional media	Pretest score in %	Posttest score in %	Average gain score	Ranking
Web based e-learning	23.37	79.05	55.68	1st
Non-Web based e-learning	22.94	74.9	51.96	2 <sup>nd</sup>
Chart	22.2	64.2	42	3 <sup>rd</sup>
Chalk Talk Method	22.53	54.45	31.92	4 <sup>th</sup>

The mean average gain score, which is the difference between the pretest and the posttest, was computed for the four treatment groups. The web based e-learning group is slightly higher than the Non-web based e-learning group (55.68 % and 51.96 % respectively). The chart group scored 42 % while the Chalk Talk Method group scored 31.92%. This result in table IV confirms that web based e-learning can be effective in teaching student varying subject matter.

Table IV: Test of Significance Using Analysis of Variance (ANOVA) of The Average Gain Scores of The Four Groups

Source of variance	Sum of Square (SSx)	Degree of freedom Dfx	Variance estimate MSx	F cal	F tab (p < 0.5)	Remarks
Between Group (x=b)	8549.55	3	2849.85	24.47	2.76	There is significant difference
Within Group (x=w)	11182.24	96	116.48167			
Total(x=t)	19731.79					

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Table IV shows that the F cal of 24.47 is greater than the F tab of 2.76 at alpha 0.05. Hence, the Null Hypothesis (H<sub>0</sub>) may be rejected. This implies that there is a significant difference amongst the four mean average gain scores of the pupils taught with varying methods.

In this paper we have design a Web Site/Portal([www.elearnweb.net](http://www.elearnweb.net)), in this portal consist of user who has access to services ,repositories and database through an interface. in e-learning scenario and specifies details of services in the e-learning domain. In this web based portal ,the first step would be registering each user, and the service provider allows communication between service provider and requesters. Services interact resources and ,in particular, subscribe to relevant ontologies. Other resources include database and documents published in the web site. Portal might be include services such as answer –questioning ,lessons, subject materials, feed back system and a services to help students improve their knowledge. The semantic web comes with new emerging standards based on evolving Web technologies, that allow the reuse of material in different contexts, flexible solution, as well as robust and scalable handling. Through the Web technology we are providing following features ,that shows the effectiveness of the web based e-learning system:-

1. Creation of new user account.
2. Providing user rights.
3. Making the content visible for all user .
4. Providing SMS facility for acknowledgement of messages receiving/sending .
5. Providing upload/download facility of the notes/lessons.
6. Providing answer to learners' question
7. Promoting discussion through messages or forum
8. Providing feed back and survey facility.



Fig 2.Front page of the Web Site.



Fig 3.Admin page.

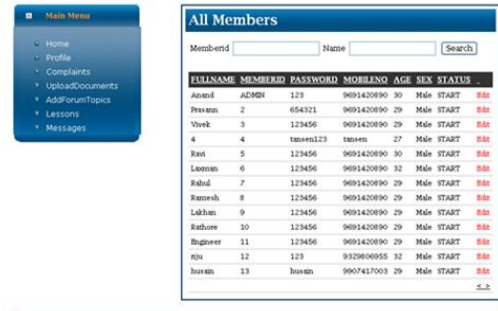


Fig 4. For viewing or restricting the members.

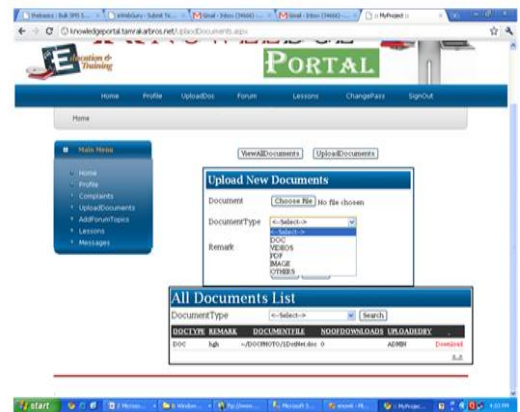


Fig 5. For Upload/Download page.

## VII. CONCLUSION

IT is one of the effective tools to accelerate the learning process in highly customized manner. The surveys will be conducted here indicate that the base technology and infrastructure to provide effective functionality are critical for successful implementation of the adopted e-Learning model. Various institutions maintain a variety of training resources to ensure a basic level of proficiency. The result of the surveys highlights the need of knowledge-based approach to achieve the advantages like effective retrieval and presentation, identifying users need, evaluation of users responses, and explanation and justification of the systems own decisions made to achieve high degree of quality. Based on the findings of this study, it is concluded that e-learning tools/models help teachers in effective teaching as compared to traditional/conventional teaching methods. It is further clarified that the use of Web Based e-learning in teaching college pupils is as effective as when the teacher uses the Non-Web Based e-learning system in teaching. The use of e-learning tools is more effective as compared to traditional learning system. And it will be proved by taking some parameters like availability of material, availability of teacher and evaluation data analysis we find out the performance will be increasing in the web based e-learning system up to 24.47 percent.

## VIII. REFERENCES

- [1] Welsh, E.T., C.R. Wanberg; K.G. Brawn and M.J. Simering, 2003. E-learning emerging uses, empirical results and future direction. International J. Training and Develop. 7(4): 245-288.
- [2] Janicki, T., Steinberg, G. (2003). Evaluation of a computer-Supported Learning System, Decision Sciences the Journal of Innovative Education, 1, 2 (Sept.), 203-223.

[3] Drucker, P. (2005), "Need to Know: Integrating e-Learning with High Velocity Value Chains", A Delphi Group White Paper, <http://www.delphigroup.com/pubs/whitepapers/20001213-e-learning-wp.pdf>

[4] European Journal of Open, Distance and e-Learning EURODL, Date of publication: 28.05.2009. <http://www.eurodl.org/article=359> The Influence of Experience, Ability and Interest on e-learning Effectiveness

[5] Vrasidas, C., & McIsaac, M. (2000). Principles of pedagogy and evaluation of Web- based learning, Educational Media International, 37(2), 105-111.

[6] Collis, B (1998). New didactics for university instruction: why and how? Computers & Education, 31 pp. 373-393, Collis, B and Moonen, J (2001).

[7] Collis, B.. (1998) New didactics for university instruction: why and how? Computers and Education, 31, 373-393. Collis, B. & Anderson, R.E. (1994).

[8] Barker, Ph. (2000),"Designing Teaching Webs: Advantages, Problems and Pitfalls. Educational Multimedia,

[9] e-learning - A Review of Literature Barron, Tom (2000a) "The future of digital learning." e-learning May/June 2000. Vol. 1, No.2, pp. 46-7. Barron, Tom (2000b)

[10] 5 Jun 2010, Abernathy, D. J. (1998). The WWW of distance learning: Who does what and where? Training and Development 52 (9) p. 29-30.

[11] Research in Education ,Ninth Edition by John W.Best,James V.Kahn,second impression 2006.

[12] Testing Group Differences using T-tests, ANOVA, and Nonparametric Measures, Department of psychology University of Alabama348 Gordon Palmer Hall,jan 2003 .



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