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EFFECTIVENESS OF WEB BASED INSTRUCTIONAL STRATEGY ON ACHIEVEMENT OF STUDENTS IN EDUCATIONAL TECHNOLOGY AT UNDER GRADUATE LEVEL

Goutam Mondal

RESEARCH ARTICLE

Author Details: Seth Anandram Jaipuria College, West Bengal, India

Corresponding Author:
Goutam Mondal

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Abstract

This study aimed to find out the effectiveness of Web Based Instructional Strategy on Achievement of Students in Educational Technology at Under Graduate Level under University of Calcutta. The study focused on development of Web-Based Instructional strategy to teach Educational Technology at UG level to find out the effectiveness of the Web-Based Instructional strategy in terms of students' achievement in Educational Technology at different levels of cognition viz. Knowledge, Understanding and Application. The researcher also pointed out the impact of Web-Based Instructional strategy in terms of students' achievement in Educational Technology with respect to different demographical variables viz. gender, and location. A Web-based instructional strategy was developed by designing a website incorporating selected Units from the syllabus of Educational Technology prescribed by the University of Calcutta for the Second Year of Under Graduate Programme and the students in Education Honours from four undergraduate degree colleges were enrolled for the said courses. An experimental design, namely, "Pre-test Post-test single group Design" was adopted to conduct the study. A website was also designed for the purpose of teaching Educational technology to students. The teaching-learning process was followed as a self-learning technique (Online Tutorial) which integrates Texts, Slides, and Multimedia resources including animated videos and audio files to explain the concepts. Appropriate statistical procedures like t-test were used for analysis and findings of the study.

Keywords: *Web-based Instructional strategy, effectiveness, educational technology*

Introduction

In the recent years, the unprecedented growth and development of Information and Communication Technology (ICT) has almost impacted all forms of human activities, including teaching-learning activities at all levels of education. Although the use of ICT in the teaching and learning process has been there for quite some time, the scale of its use has expanded during 2020 in the wake of outbreak of Corona Pandemic. Online learning platforms using various ICT tools are being used by teachers and educational institutions to provide learners learning experiences in different subject areas, and several teaching-learning interventions through webinars, symposia, etc. Online learning not only encourages, among learners, individualised learning, but also enhances their learning competence. ICT based instructional system develops in the learners the skills of observation, exploration, learning and doing by themselves, thereby making their learning more effective and meaningful. Further, the software packages make the learning more accessible and user friendly. Online learning platforms help the learners to learn at their own pace, without any restricted standard. The current society is witnessing growth in every arena with the everyday expansion of science and technology. Predominantly, the development of information and communication technology has made specific and general impacts on the society. Web-based instruction not only facilitates synchronous communication between learners and teacher but also asynchronous communication beyond time. Above all, it has the benefit of obliging many students at the same time without any boundary or physical space. Web-Based Instruction (WBI) is a hypermedia based teaching method that utilizes the characteristics of the web and the materials provided through the web (Kahn, 1997). Web Based Technology (WBT) is considered to be more idealistic than other instructional technologies in learner-centred teaching.

Web-based instruction has changed from any number of computer-based instructional methods, often mentioned as Computer-Assisted Instruction (CAI), Internet-Based Instruction (IBI), Computer-Aided Instruction (CAI), Computer Managed Instruction (CMI), or Web-Based Instruction (WBI). The World Wide Web is used to provide instruction and instructional support. Web-based instruction offers learners unparalleled access to instructional resources, far surpassing the reach of the traditional classroom. It also makes possible learning experiences that are open, flexible, and distributed, providing opportunities for

engaging, interactive, and efficient instruction (Kahn, 2001). Web-based instruction is defined as "an innovative approach to delivering instruction to a remote audience, using the Web as the medium" (Khan, 1997).

Web-based instruction provides learners diverse opportunities in education and training. It helps a teacher to achieve the learning outcomes. The Web has become a powerful tool for teaching learners in remote areas. Its intrinsic agility lets applications in different ways in an educational setting, ranging from course management to teaching the whole contents online. Each of these types works close to a dissimilar goal. These goals are documented while assessing the use of the Web. For example, an instructor may hold face-to-face talks in a classroom but posts the class program, projects and marks on the Web. In this case, it may not be fitting to appraise the use of the Web with reference to learning products, since the Web is not used with an instructional role. There are many aspects that determine educational setting. In an effort to improve the methodical acceptance of these factors, Kahn (1997) has developed a framework for Web-based learning, consisting of eight dimensions, as follows: 1) Pedagogical 2) Technological 3) Interface Design 4) Evaluation 5) Management 6) Resource Support 7) Ethical 8) Institutional. As the use of Web-based Instruction upsurges in the instructional and training areas, many persons have documented the level of assessing its impact on the learners through parameters, such as learning, presentation, and gratification. Often, these outcomes are equivalent to those of regular classroom instruction, while investigating which method is better. However, major changes in technology and performance rather than instructional content can distort the factual association between web-based instruction and these conclusions.

Web-based learning is a modern way to learn, using web-based technologies or tools in the learning process. In this approach, the learner uses mainly computers to interact with the teacher and other students and also the learning material. Web-based learning consists of technology that can collaborate well with the traditional classroom and online learning environments as well. There are pure web-based courses which are wholly based on computer and online technology, in which all the communication and learning activities are done online. Contrary to this, web-based courses may have some face-to-face sessions and also the distance learning courses. Web-based learning can also be formal or informal**.** Formal web-based learning happens through learning activities that are organized by teachers. Informal web-based learning takes place while you are searching material on the Internet. It is self-paced, depending on learner's goals and motivation to learn.

Literature Review

There are quite a number of researches and studies that have been carried out to study the effectiveness of web-based instruction in the learning process. These studies substantiate that with right kind of freedom to learn, web-based instruction paves a platform for learner autonomy. This self-directed learning method makes the learners more responsible and they become more interested and enthused towards the learning process.

According to Bousbia, Labat, Rebai and Balia (2010), who have analysed the connection between Learning Styles and Navigation Behaviour in Web-Based instruction, in a web-based environment and web-based learning, there are significant relationships between learning styles and the navigation behaviour. From the analysis and interpretation of the data, it is observed that learners of different learning styles follow different navigation behaviour and the chi-square dependency test exhibits the prevalence of the same in the sample learners. This study also has made use of Felder and Silverman Learning Style Model (FSLSM) for studying the connection between the two variables.

Kaur (2012) studied the effect of web based instruction on achievement in Biology in relation to learning style and intelligence and found that the group of students with high level of intelligence with diverging and converging styles did not achieve equal mean gain score on the variable of achievement in Biology.

Prasad (2014) studied effectiveness of web based instruction on mathematics in terms of achievement and reaction towards WBI of class Ninth students and found that adjusted mean score of achievement in Mathematics of WBI Group is significantly higher than that of Traditional method when the groups were matched with respect to pre-achievement in Mathematics.

According to the study conducted by Yadav P (2015), Development and validation of web integrated instructional package for learning disabled elementary students in English language, it is observed that Web integrated instructional package changes the role of a teacher in a way that teacher is no longer only the dispenser of education, but rather plays the role of a facilitator. Teacher actively encourages students to participate in classroom dialogue and activities, provide constant feedback and continuous motivation.

Sudha (2016) studied the impact of web based instruction as guided design tool on attainment of mastery learning in chemistry at tertiary level among Heterogeneous groups and found that the gain score of students in the post-test of CG and EG in the achievement of chemistry, attitude towards WBI in Chemistry, information seeking behaviour and metacognitive awareness is higher than the CG.

Divakaran V. (2018) in his experimental research has observed the effectiveness of web based Instruction in Cognitive Learning of Mathematics Parabola. From the results of the study, it is observed that the improvement is more significant in the web-based instruction than the conventional teaching.

Research Questions

1. Does Web based Instructional Strategy enhance the achievement of students in Educational Technology at Undergraduate level?
2. Does Web based Instructional Strategy enhance the achievement of students in Educational Technology in terms different levels of cognition: knowledge, understanding and application?
3. Is there any difference in the achievement between male and female students due to Web based Instructional Strategy?
4. Is there any difference in the achievement between urban and rural students due to Web based Instructional Strategy?

Objectives of the Study

1. To develop Web-Based Instructional strategy to teach Educational Technology at UG level.
2. To test the effectiveness of Web-Based Instructional strategy in terms of students' achievement in Educational Technology
3. To find out the effectiveness of the Web-Based Instructional strategy in terms of students' achievement in Educational Technology at different levels of cognition viz. Knowledge, Understanding and Application.
4. To find out the effectiveness of the Web-Based Instructional strategy in terms of students' achievement in Educational Technology with respect to different demographical variables viz. gender, and location.

Hypotheses of the Study

H1: There is no significant difference between the pre -test and post test scores of learners' in Educational Technology taught through Web-based Instructional strategy.
H2: There is no significant difference between the pre -test and post test scores of learners' in Educational Technology taught through Web-based Instructional strategy with respect to different levels of cognitions. namely, Knowledge, Understanding and Application.
H3: There is no significant difference between the pre-test and post test scores of learners' in Educational Technology taught through Web-based instructional strategy with respect to gender (male and female) of the learners.
H4 There is no significant difference between Unit test scores of male and female learners' in Educational Technology taught through Web-based instructional strategy
H5: There is no significant difference between the pre-test and post test scores of learners' in Educational Technology taught through Web-based instructional strategy with respect to location (urban and rural) of the learners.

Variables of the Study

There are two variables in the above study shown by the researcher firstly dependent variable that is the achievement of students in the subject of Educational technology and the other one is independent variable that is Web Based Instructional Strategy developed by the researcher.

Methodology of the Study

An experimental design, namely, "Pre-test Post-test single group Design" was adopted to conduct the study. A web-based multimedia modules of Educational Technology viz. Understanding of educational technology and System approach, Computer in education and communication**,** instructional techniques and different models of teaching, understanding of ICT & e-learning was developed and Pre-test and Post-test for each content area were developed.

Population & Sample

The population of the study represented all second year undergraduate students of Education Honours under University of Calcutta. Since a pre-test post-test single group design experimental study was adopted, all second year students of different colleges under University of Calcutta in West Bengal were taken in consideration. There were 66 students who opt for Educational Technology paper. Sample students, both male and female, represent both urban and rural Kolkata. Since all students opting for Educational Technology were chosen for experimental study, there was no need of randomization. While choosing students for the experimentation, it is to be ensured that students have access to ICT and Internet.

Tools

The study adopted an Achievement Test covering the contents in the four Units namely: Understanding of educational technology and System approach, Computer in education and communication**,** instructional techniques and different models of teaching, understanding of ICT & e-learning. The Achievement Test was administered to the sample as a Pre Test as well as Post-test. Four Unit Tests was developed by the investigator to assess the terminal behaviour of the respondents at the end of each Chapter. An online testing software was used by the researcher to administer the Pre-test and Post-tests to the respondents of the experimental group as well as Unit tests at the end of all the four units. Researcher also developed a Five-point Scale to study the reactions of students to the Web-based Instructional strategy.

Development of the Web-Based Instructional Strategy

A website was designed for the purpose of teaching Educational technology to students. The teaching-learning process along with the self-learning technique (Online Tutorial) was applied which integrates Texts, Slides, and Multimedia resources including animated videos and audio files to explain the concepts. The learner can analyze the quantum of knowledge gained from each module by taking up the Unit-test at the end of each module and can re-learn the concept over and again, in case required.

The website was designed in such a way as to satisfy the different needs of the learner as a self-learning procedure. It includes the following steps to access the contents.

1. Home page
2. About us
3. Registration for new user
4. Sign in for existing user
5. Online strategy
6. References for further clarification
7. Contact details
8. Glossary used in the package
9. Providing the learners with marks scored and time taken
10. Acknowledgements

Apart from the above, the Web based Instructional Strategy will also include

- Course information, notice board, timetable
- Teaching materials such as slides, handouts, articles
- Communication via email and discussion boards
- Formative and summative assessments
- Student management tools (records, statistics, student tracking)
- Links to useful internal and external websites—for example, library, online databases, and journals.

The Web based Instructional Strategy was tested among a small group of Under Graduate students. The researcher conducted discussions with the students at length on the problems that they will confront during the learning process. The researcher also obtained feedback from them.

Process of the Web Based Instructional Strategy

The learner followed a linear way to complete the course after taking the pre-test for all five units. In each Unit, the learner was asked questions on the concept learnt and they answered them correctly, in order to move to the next concept. Some learner attempted incorrect answer, they have been directed to the same concept again to make himself/herself understand that concept. Also the learner can go through the lessons as many number of times using the pause-play buttons attached or by choosing the option to learn again the concept. Those who became the master each concept, only then they had been allowed to go to the next concept. At the end of completing a unit, the students were administered unit test for that unit. Online testing software will be used by the investigator for conducting the Pre test and Post test and unit test for each module.

Before the experimentation, the researcher sought the permission of the College to carry out the experimental study. Students with Educational Technology were taken as sample for the experimentation. The students were explained the purpose of the experiment and the constraints, if any during the period of experimentation. Their consents to participate in the study was obtained along with general information like gender, locality will be obtained.

After initial briefing about the Web based Instructional strategy, students were administered Pre-test. This was followed by teaching the first unit. During the course of teaching the unit, the investigator ensured that all requirements of Web based Instructional Strategy such as attending to the technical difficulties faced by the students, holding discussions with them, guiding them to attempt the quizzes, etc. After the end of the transaction of the first unit, the Unit test for the first unit was administered. This process was followed for all the units. At the end of the experimentation, Post-test was administered to students. Researcher also administered reaction scale at the end of the experimentation.

Data Analysis and Discussion of Result

The total size of the sample was 66 which was drawn from male and female students of the Under Graduate College, affiliated to University of Calcutta. The college that were chosen for selection of the sample were located both in urban, semi- urban and rural areas. The background information of the sample has been tabulated and presented in Table A.

TABLE A. BACKGROUND INFORMATION

Sl. No.	Attributes	Nos.	Percentage (%)
1	Urban Rural	31 35	47 53
2	Female Male	60 06	90 10

Table A shows the background information of the sample with respect to different attributes namely, age, location and gender. Percentage of students from rural area is highest but urban students were also equal as like rural students. The percentage of female students was higher than that of male students.

Testing and Validating Hypotheses

In an attempt to test the formulated hypotheses, paired 't' tests and chi-square test. Analysis were attempted to test the hypotheses. The testing of the hypotheses is given below:

Hypothesis 1

There is no significant difference between the pre- test and post -test scores of learners in Educational Technology taught through Web-based Instructional strategy.

To test the hypothesis, paired 't' test was computed for the pre-test and post-test achievement scores obtained as a result of instruction through questionnaires. The results are given in Table 1.

TABLE 1.

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF PRE-TEST AND POST TEST SCORES WITH REGARD TO ACHIEVEMENT SCORES

Test	N	Mean	SD	t-value	df	t critical value
Experimental Group Pre-Test	66	26.78	8.16	13.16	64	1.99
Experimental Group Post-Test	66	37.94	4.76			

From the above table 1., it is noted that the calculate t-value 13.16 is greater than the t-critical value 1.99 at 0.05 level of significance for 64 degree of freedom. Hence, the hypothesis "*There is no significant difference between the pre- test and post -test scores of learners in Educational Technology taught through Web-based Instructional strategy."* is rejected.

Therefore, it is concluded that there is a significant difference between the pre- test and post -test scores of learners in Educational Technology taught through Web-based Instructional strategy.

Hypothesis 2

"There is no significant difference between the pre test and post test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to different levels of cognitions. namely, Knowledge, Understanding and Application."

To test the hypothesis, paired 't' test was computed for the pretest and post-test achievement scores obtained as a result of instruction through questionnaires. The results are given in Table 2.

TABLE 2.

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF PRE-TEST AND POST TEST SCORES WITH RESPECT TO DIFFERENT LEVELS OF COGNITIONS. NAMELY, KNOWLEDGE, UNDERSTANDING AND APPLICATION

Cognitive domain	N	Pre-test		Post-test		t-value	df	Result sig. (2 tailed)
		Mean	SD	Mean	SD			
Knowledge	18	42.16	12.00	53.66	11.50	4.02	17	0.05
Understanding	16	40.93	8.08	52.43	9.27	3.25	15	0.05
Application	12	35.50	10.86	44.66	13.49	2.02	11	0.05
Total	46							

From the above table 6., it is noted that in Knowledge level the calculate t value 4.02 is greater than the table value 2.10 at 0.05 level of significance for 17 degree of freedom. Hence, the hypothesis *"There is no significant difference between the pre test and post test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to levels of cognitions namely Knowledge"* is rejected.

It is also observed that in Understanding level of cognition the calculate t value 3.25 is greater than the table value 2.131 at 0.05 level of significance for 15 degree of freedom. Hence, the hypothesis *"There is no significant difference between the pre test and post test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to levels of cognitions namely Understanding"* is rejected.

It is further calculated that in application level of cognition the calculate t value 2.02 is smaller than the table value 2.201 at 0.05 level of significance for 11 degree of freedom. Hence, the hypothesis *"There is no significant difference between the pre test*

and post test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to levels of cognitions namely Application" is failed to be rejected.

Therefore, it is concluded that there is a significance of difference between means of pre-test and post test scores with respect to different levels of cognitions namely, knowledge, understanding but not in application level.

Hypothesis 3

H3: There is no significant difference between the pre-test and post-test scores of learners in Educational Technology taught through Web-based instructional strategy with respect to gender (male and female) of the learners.

To test the hypothesis, paired 't' test was computed for the pretest and post-test achievement scores obtained as a result of instruction through questionnaires. The results are given in Table 3.

TABLE 3.
SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF PRE-TEST AND POST TEST SCORES WITH REGARD TO GENDER

Gender	N	Pre-test		Post-test		t-value	df	Sign. level
		Mean	SD	Mean	SD			
Female	60	27.33	8.29	38.22	4.86	12.33	58	Result sig. (2 tailed)
Male	06	22.33	5.35	36.83	3.81	6.67	4	

From the above table 8., it is noted that the calculate t value between means of pre-test and post-test scores with regard to female is12.33 that is greater than the table value 2.00 at 0.05 level of significance for 58 degree of freedom.

It is also calculated that the calculated t value of pre-test and post-test with regard to male is 6.67 which is greater than the table value 2.776 at 0.05 level of significance for 4 degree of freedom Hence, the hypothesis "*There is no significant difference between the pre- test and post -test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to gender (male and female) of the learners."* is rejected.

Hypothesis 4

H4 There is no significant difference between Unit test scores of male and female learners in Educational Technology taught through Web-based instructional strategy

To test the hypothesis, paired 't' test was computed for the pretest and post-test achievement scores obtained as a result of instruction through questionnaires. The results are given in Table 4.

TABLE 4.
SIGNIFICANT DIFFERENCE BETWEEN UNIT TEST SCORES OF MALE AND FEMALE LEARNERS' IN EDUCATIONAL TECHNOLOGY TAUGHT THROUGH WEB-BASED INSTRUCTIONAL STRATEGY

Units	N	Female		Male		t-value	df	Sign level
		Mean	SD	Mean	SD			
Unit 1	20	12.71	11.02	10.66	1.82	14.80	19	Two tailed at 0.05 level of sign.
Unit 2	15	8.06	10.20	6.33	1.50	12.26	14	
Unit 3	20	12.85	6.32	14	1.43	27.23	19	
Unit 4	10	6.98	5.17	4.5	1.08	24.34	9	

In case of UNIT 1, it is showed that the calculate t value 14.80 is more than the table value 2.021 at 0.05 level of significance for 19 degree of freedom in unit test scores of Unit- 1 of male and female learners in educational technology taught through web – based instructional strategy. So the null hypothesis *"there is no significant difference between Unit test 1 scores of male and female learners in Educational Technology taught through Web-based instructional strategy"* is rejected.

In case of UNIT 2, It is also showed that the calculate t value 12.26 is more than the table value 2.160 at 0.05 level of significance for 14 degree of freedom in unit test scores of Unit- 3 of male and female learners in educational technology taught through web – based instructional strategy. Here the p value is greater than the calculated value. Hence, the hypothesis *"There is no significant difference between the pre- test and post test scores in unit test: 2 of learners in Educational Technology taught through Web-based Instructional strategy with respect to levels of cognitions namely Knowledge"* is rejected.

In case of UNIT 3, it is calculated that the calculate t value 27.23 is more than the table value 2.09 at 0.05 level of significance for 19 degree of freedom in unit test scores of Unit- 3 of male and female learners in educational technology taught through web – based instructional strategy. So the null hypothesis *"there is no significant difference between Unit test 1 scores of male and female learners in Educational Technology taught through Web-based instructional strategy"* is rejected.

In case of UNIT 4, it is showed that the calculate t value 24.34 is more than the table value 2.26 at 0.05 level of significance for 9 degree of freedom in unit test scores of Unit- 4 of male and female learners in educational technology taught through web – based instructional strategy. So the null hypothesis *"there is no significant difference between Unit test - 4 scores of male and female learners in Educational Technology taught through Web-based instructional strategy"* is rejected.

TABLE 5.
SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF PRE-TEST AND POST TEST SCORES WITH REGARD TO LOCATION (URBAN AND RURAL) OF THE LEARNERS.

H5: There is no significant difference between the pretest and post test scores of learners in Educational Technology taught through Web-based instructional strategy with respect to location (urban and rural) of the learners.

To test the hypothesis, paired 't' test was computed for the pretest and post-test achievement scores obtained as a result of instruction through questionnaires. The results are given in Table 5.

TABLE 5.

Area	N	Pre-test		Post-test		t-value	df
		Mean	SD	Mean	SD		
Urban	**31**	**23.64**	**7.25**	**37.12**	**5.25**	**8.84**	**29**
Rural	**35**	**29.57**	**7.99**	**38.65**	**4.23**	**11.16**	**33**

From the above table 11., it is observed that the calculate t value between means of pre-test and post-test scores with regard to Urban students is 8.84 that is greater than to t-critical value 2.045 at 0.05 level of significance for 29 degree of freedom.

It is also calculated that the calculated t value of pre-test and post-test with regard to rural students is 11.16 which is greater than the table value 2.042 at 0.05 level of significance for 33 degree of freedom. Hence, the hypothesis "*There is no significant difference between the pre- test and post -test scores of learners in Educational Technology taught through Web-based Instructional strategy with respect to location (urban and rural) of the learners."* is rejected.

Conclusion

The results of the study indicated that availing web based instructional strategies is effective in enhancing the learning of the participants to teach Educational Technology in undergraduate level. These instructional strategies are also effective to gain the knowledge in different cognitive level namely knowledge level, understanding level and application level. Even we have found that both male and female students improve the learning through this instructional strategy and a sharp change has been observed both rural and urban students. Further, it is observed that the traditional classroom environment does not encourage students to explore alternative teaching platforms which can possibly reinforce their classroom learning and paves way for lifelong learning. Therefore, it is imperative to develop and implement different web based instructional strategies in order to motivate students for self-learning and self-evaluation which are helpful for lifelong learning. So we may develop such kind of web based instructional strategies for self-pace learning and it provides flexibility to the students for learning that is very cost effective. We may also develop different types of course for easy access of the students to develop career advancement opportunities.

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