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Effect of Web Based Instructional Strategy on Achievement in Computer Science in Relation to Internet Self-Efficacy

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Abstract

The present study investigates the effect of web based instruction on achievement in computer science in relation to internet self-efficacy. The data was collected from 300 XI class students of four private schools of Amritsar City affiliated to Central Board of Secondary Education, New Delhi. The Achievement Test in computer science consisting of 60 items and Internet Self-Efficacy Scale was developed and standardized by investigator to categorise students into high, average and low internet self-efficacy students, were used to collect the data. Experimental group was taught using web based instructional strategy and the control group was taught by conventional mode of instruction. Statistical techniques such as Mean and S.D were used in the analysis of data. F-ratio and t-test were employed to find significance of difference between means related to different groups and variables. The data was analysed using Analysis of Variance (2×3) and following conclusions were drawn: (i) The achievement of group taught through web based instructional strategy was significantly higher than that of conventional method of teaching. (ii) The performance of high internet self-efficacy group was significantly higher than that of average and low internet self-efficacy group on achievement in computer science. (iii)There was significant interaction effect of instructional strategies and internet self-efficacy on achievement in computer science.

Keywords: Web-based instructions, achievement, internet self-efficacy.

Introduction

The advancements in technology have created a possibility for new ways of teaching and learning. The contributions of web in the teaching-learning process are the best among other computer innovations. The great potential of web can be fully utilized and taken advantage of if teachers think about teaching and learning in new ways and master the use of new technology skills along with their students. The students of 21st century need to be fully engaged which requires the use of new constructive methods of teaching and learning with the help of technology tools and resources and providing them appropriate learning environment. The technology based instructional programmes help students continue learning outside the classroom by providing study questions, activities, and even tests and quizzes for a class. The use of World Wide Web (www) as an instructional tool is gaining importance as many teachers and trainers have started incorporating it into their daily instructions. In mid of 1990s, the use of web for educational purposes was explored. Today, the web is on the way of being an important learning environment which provides students with a new and rich style of learning. Education delivered with the help of internet is referred to by many names such as web-based instruction, web based learning, web-based teaching, e-learning and online-learning. Web based instruction is the application of a repertoire of cognitively oriented instructional strategies within a constructivist and collaborative learning environment, utilizing the attributes and resources of the World Wide Web (Relan & Gillani, 1997). Khan (1997) defines web based instruction as a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported.

Web-based instruction is facilitated by network-based technologies that afford collaborative learning experiences and can provide learners with flexible access to materials at various times and/or locations. Although web-based instruction is primarily associated with a traditional view of distance education depicting only situations when learners are geographically dispersed, this form of instructional delivery may also be

effectively used as a supplement to traditional, face-to-face, classroom, based activities. Specific features of web-based instruction provide multiple opportunities for student-to-content, student-to-student, and student-to-instructor interaction (Moore & Kearsley, 1996).

According to Khan (1997) various components of web based instruction are as follows:

(i) *Content Development:* Content is developed on the basis of learning and instructional theories, Instructional Design (ID) and curriculum.

(ii) *Multimedia Component:* It includes text and graphics, audio streaming, video streaming, Graphical User Interface (GUI) and compression technology.

(iii) *Internet Tools:* Communications tools, remote access tools (telnet, file transfer protocol (ftp) etc.), internet navigation tools (gopher, lynx etc.) and search and other tools (search engines and counter tool) are internet tools.

(iv) *Computers and Storage Devices:* Computer platforms running unix, DOS, windows etc. and servers, hard drives, CD ROMS etc.

(v) *Connections and Service Providers:* Modems, internet service providers, gateway service provider etc. may be connections and service providers.

(vi) *Authoring Programmes:* These may be any programming languages such as Hyper Text Mark up Language (HTML), *Virtual Reality Modeling Language* (VRML), java etc. converters and editors etc.

(vii) *Servers:* HTTP servers, web site, Uniform Resource Locator (URL), Common Gateway Interface (CGI) etc.

(viii) *Browsers and Other Applications:* Text-based browser, graphical browser etc. Links (e. g. hypertext links, hypermedia links etc.) and applications that can be added to web browsers such as plug-ins.

The rising popularity and importance of web-based instruction in the field of education requires checking the effectiveness of web-based instruction by comparing it to other classroom instructional techniques and find out what factors influence the use of it for making the teaching and learning process effective.

Web-based instruction offers multiple dimensions of use in education and training environments. As with computer-based instruction, it is capable of providing direct instruction to meet individual learning objectives. Due to its networking capability, the web can play additional roles. These include promoting and facilitating enrolment into courses, availing the syllabus or program of instruction, posting and submitting assignments, interacting with instructors and fellow students, collaboration on assignments, and building learning communities. The web has become a powerful tool for learning and teaching at a distance. Its inherent flexibility allows application in a variety of ways within an educational context, ranging from simple course administration and student management to teaching entire courses online. Each of these types of use works towards a different goal. These goals should be recognized when evaluating the use of the web. For example, an instructor may hold face-to-face lectures in a classroom but post the class syllabus, assignments, and grades on the web. In this case, it may not be appropriate to evaluate the use of the web with respect to learning outcomes since the web was not used in a direct instructional role (Olson & Wisher, 2002).

The theory of self-efficacy was first conceptualized and brought to life by Bandura (1977). Bandura (1995) defines self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations". It is an important concept to help individuals understand how quickly they are capable of adopting new tools and develop new skills utilizing those tools. Self-efficacy relates to one's own perception or belief about his capability to perform a certain task (Bandura, 1977). When extended to World Wide Web domain, the term internet self-efficacy is considered. Internet self-efficacy is not concerned only with the computer skill but also the internet skill such as using e-mail, browsing the www, etc. Internet self-efficacy is defined as the belief that one can successfully perform a distinct set of behaviours

required to establish, maintain and utilize effectively the internet over basic personal computer skills. Internet self-efficacy is a potentially important factor in efforts to use the e-services.

In order to examine the role of students' internet self efficacy in their information searching strategies in an internet-based learning setting, Tsai and Tsai (2003) conducted 8 in-depth case studies and concluded that high internet self efficacy students had better information searching strategies and learned better than those with low internet self efficacy in the Internet-based condition. Web based courses have opened a way to the students who cannot attend the school or need to supplement their classroom instructions. For the success of web based courses which are accessed through internet, the students need to possess internet-related ability or skills. Therefore, this study will focus on internet self-efficacy instead of computer self-efficacy, which involves basic skills of using computer.

Need and Significance

India is a country of large and diverse population. People belong to varied social differences like cultures, socio-economic status, live at varied geographical locations and many more. When we think of educating such a diverse population and achieving the best results in education, we cannot simply rely upon old and traditional methods of teaching and learning. Also, in India we have many such students who are unable to attend schools regularly on health grounds or due to certain family or financial problems. Web based instructional strategy can be used either for students who prefer online courses, distance education or for assisting classroom instruction. This strategy requires ability of using computers and assessing internet resources. The ability of assessing internet resources efficiently is called internet self-efficacy. The rising popularity and importance of web-based instruction in the field of education requires checking the effectiveness of web-based instruction by comparing it to other classroom instructional techniques and find out what factors influence the use of it for making the teaching and learning process effective. In the present study the effectiveness of web based instructional strategy is studied on achievement in computer science relation to internet self-efficacy as the investigator felt that there is a need that web based instruction as an instructional strategy should be incorporated in schools because it has the potential to develop the various skills and abilities among students and make them better informed and high achievers.

Objectives

The study was conducted to achieve the following objectives:

1. To compare the achievement of groups of students taught through web based instructional strategy and conventional teaching strategy in computer science.
2. To compare the achievement of high, average and low groups of students on internet self-efficacy.
3. To examine the interaction effects between instructional strategies and internet self-efficacy on achievement in computer science.

Hypotheses

The study was designed to test the following hypotheses:

1. There will be no significant difference in the achievement of group taught through web based instructional strategy and conventional teaching strategy in computer science.
2. There will be no significant difference in the achievement of group having high internet self-efficacy than that of average and low internet self-efficacy group of students in computer science.
3. There will be no significant interaction effect of instructional strategies and internet self-efficacy on achievement in computer science.

Sample

In the present study, purposive sampling was initially employed to select those schools which have LAN facility and had opted for computer science subject in XI class and then random sampling technique was used to select five schools from amongst them. The sample in the present study was drawn

at the school and student level. After selecting the schools, the General Mental Ability Test was administered to assess intelligence and matching of the students was done to form equivalent experimental and control groups from the four schools.

The present study was conducted on initial sample of 300 students of class XI who had opted for computer science subject from English medium schools of Amritsar, affiliated to Central Board of Secondary Education, New Delhi. The school-wise distribution of the sample is as shown the table-1.

Table-1: The school wise distribution of the sample

S. No.	Name of the Schools	Experimental Group	Control Group	Total
1	Shri Guru Harkrishan International School, Amritsar	25	25	50
2	The Millenium School, Amritsar	25	25	50
3	Khalsa Public School, G.T. Road, Amritsar	50	50	100
4	The Senior Study II, Amritsar	50	50	100
	Total	**150**	**150**	**300**

Design

For the purpose of present investigation a pre and post-test factorial design was employed. In order to analyze the data analysis of variance (2×3) was used for the two independent variables viz. instructional strategy and internet self-efficacy. The impact of instructional strategy was examined at two levels, namely web based instructional strategy and conventional teaching strategy. The classification of internet self-efficacy group was done at three levels viz. high, average and low internet self-efficacy. The main dependent variable was the achievement in computer science, which was calculated as the difference in post- test and pre-test scores for computer science subject.

Tools Used

The following tools were used for data collection:

1. General Mental Ability Test (1972) by Jalota was used to access the intelligence of the students for matching the group.
2. Internet Self-efficacy Scale developed by the investigators.
3. An Achievement Test in computer science developed by the investigators.
4. Instructional Material for Web Based Instructional Strategy and Conventional Teaching Strategy on five topics such as introduction to database concepts, data types, keys and their types, classification of SQL commands and creating and using a database using MYSQL of XIth class computer science subject were developed by investigators.

Procedure

After the selection of the sample and allocation of students to the two instructional strategies, the experiment was conducted in six phases. Firstly, the investigator made necessary arrangements with the Principal of the school selected for the experiment. Secondly, General Mental Ability Test to assess intelligence was administered for matching of the students. Thirdly, the test of internet self-efficacy was administered in each school in order to identify the internet self-efficacy levels of the students. Fourthly, an achievement test in computer science as pre-test was administered to the students of experimental and control groups. The answer-sheets were scored to obtain information regarding the previous knowledge of the students. Fifthly, the experimental group was taught through web based instructional strategy and control group was taught through conventional teaching strategy by the investigators. Sixthly, after the completion of the course, the achievement test in computer science as post-test was administered to the students of both the groups. The answer-sheets were scored with the help of scoring key.

Analysis and Interpretation of the Results

1. Analysis of Descriptive Statistics

The data were analyzed to determine the nature of the distribution of scores by employing mean and standard deviation. The Analysis of Variance (2×3) was used to test the hypotheses related to web based instructional strategy, conventional teaching strategy and internet self-efficacy levels. The mean and standard deviation of different sub groups have been presented in table- 2, 3, 4, 5 & 6. The obtained mean gain scores on achievement in computer science for experimental and control group has been given in table-2.

Table-2: A summary of descriptive statistics of mean gain achievement scores of experimental and control group

Variables	Experimental Group			Control Group			Total		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
High Internet Self-Efficacy	40	25.43	6.86	40	17.87	3.46	80	21.65	7.23
Average Internet Self-Efficacy	70	20.87	6.75	70	14.76	3.40	140	17.81	6.88
Low Internet Self-Efficacy	40	13.05	4.96	40	15.05	3.42	80	14.05	5.86
Total Internet Self-Efficacy	150	20.00	7.82	150	15.67	5.92	300	17.83	7.25

Source: Field Study, 2016

To substantiate the data presented in table-2, a bar diagram was drawn to depict mean gain achievement scores for high, average, low and total internet self-efficacy groups of experimental and control group has been given in fig-1.

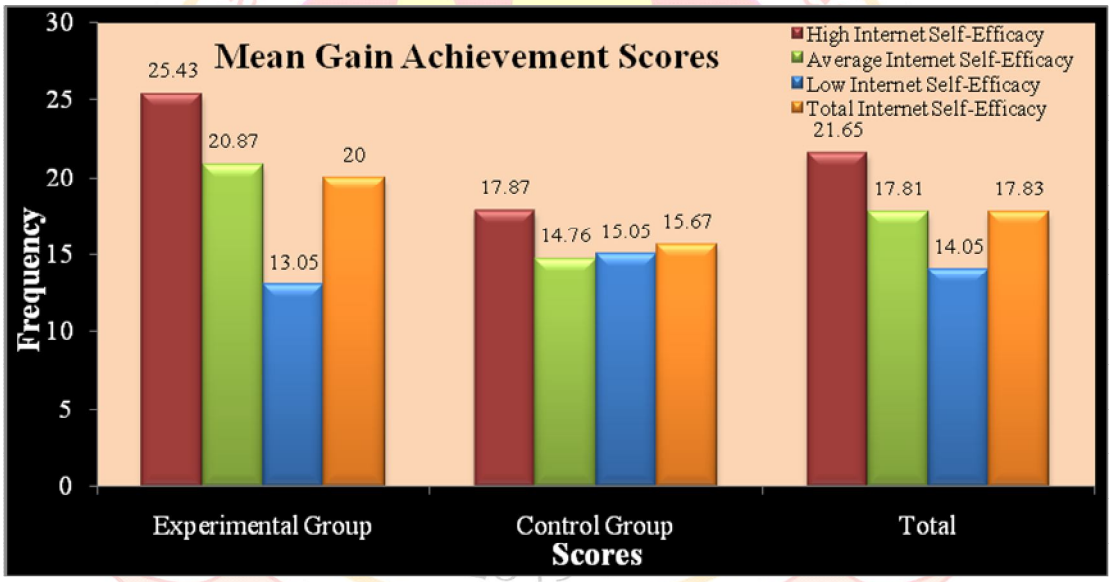

Fig-1: Bar diagram showing comparison of mean gain achievement scores of experimental and control group

The table-2 and fig-1 shows that the mean gain achievement score of total internet self-efficacy of experimental group is 20 and of control group is 15.67. This shows that the mean gain achievement score in computer science is high for the experimental group than that of control group with respect to internet self-efficacy. Further the above table reveals that the mean gain achievement score of high internet self-efficacy group of experimental group is 25.43 and of control group is 17.87. This shows that the mean gain achievement scores of high internet self-efficacy is high for the experimental group than that of control group. And for average internet self-efficacy, it is observed that mean gain of experimental group is 20.87 and of control group is 14.76. This shows that the mean gain achievement scores of average internet self-efficacy is high for the experimental group than the control group. Further for low internet self-efficacy, it is observed that mean gain of experimental group is 13.05 and of control group is 15.05. This shows that the mean gain

achievement score in computer science of low internet self-efficacy group is low for experimental group than that of the control group.

Analysis of Variance on Gain Achievement Scores

The mean of different sub-groups, sum of squares, degree of freedom, mean sum of squares and the F - ratio have been presented in table-3.

Table-3: Summary of Analysis of Variance (2×3) factorial design

Source of Variation	Sum of Squares	df	Mean of Sum of Squares	F-ratio
Instructional Strategy (A)	958.99	1	958.99	**28.47****
Internet Self-Efficacy (B)	2209.48	2	1104.74	**32.80****
A × B	1107.32	2	553.66	**16.44****
Error Terms	**9901.11**	**294**	**33.68**	

***Significant at 0.01 level*
(Critical Value 3.87 at 0.05 and 6.72 at 0.01 level, df 1/294)
(Critical Value 3.03 at 0.05 and 4.68 at 0.01 level, df 2/294)

Instructional Strategy (A)

It is observed from the table-3 that the F-ratio for difference in gain achievement scores of web based instructional strategy and conventional teaching strategy is 28.47, which in comparison to the table value was found significant at 0.01 levels of significance. It shows that the groups are different beyond the contribution of chance. Hence, the hypothesis H_1: There will be no significant difference in the achievement of group taught through web based instructional strategy and conventional teaching strategy in computer science, is rejected. The result indicates that achievement of group taught through web based instructional strategy is much higher than that of conventional teaching strategy.

In order to probe deeper, F-ratio is followed by t-test. The values of the t-ratio for different combinations have been given in the table-4.

Table-4: t-ratios for mean gain achievement scores of experimental and control group

Variable	Experimental Group			Control Group			SE_D	t-value
	N	Mean	SD	N	Mean	SD		
Gain Scores	**150**	**20.00**	**7.82**	**150**	**15.67**	**5.92**	**0.80**	**5.41****

***Significant at 0.01 level*
(Critical Value 1.97 at 0.05 and 2.59 at 0.01 level, df =298)

A bar diagram has drawn to depict the mean gain achievement scores in computer science has been presented in fig- 2.

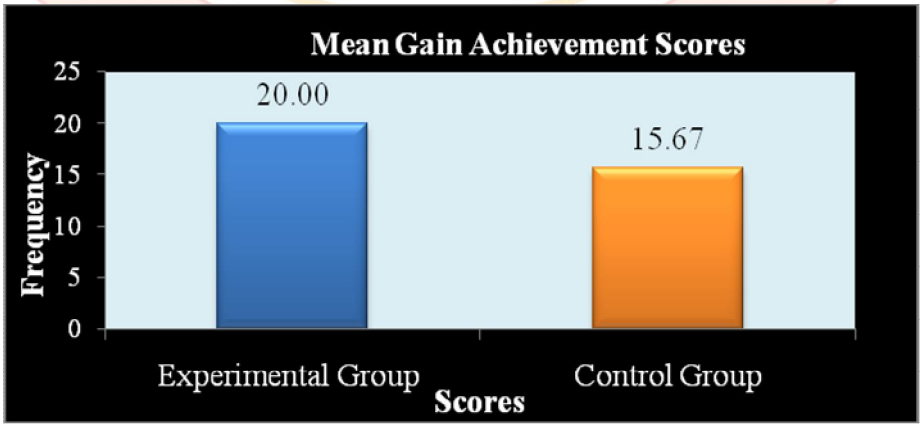

Fig-2: Bar diagram showing comparison of mean gain achievement scores of experimental and control group

It is observed from the table-4 and fig-2 that the mean gain achievement scores of experimental group taught through web based instructional strategy is 20.00, which is higher than the corresponding mean gain scores of 15.67 for the control group taught through conventional teaching strategy. The t-value testing the significance of mean gain difference on achievement in computer science of experimental and control group is 5.41, which in comparison to the table value was found significant at 0.01 levels of significance. Hence, the hypothesis$H_1$of significant difference is accepted in case of web based instructional strategy and conventional teaching strategy irrespective of grouping across other variables. The result indicates that the students taught through web based instructional strategy perform significantly better than that of students taught through conventional teaching strategy.

Internet Self-Efficacy (B)

It has been seen from the table-3 that the F-ratio for difference of mean gain achievement scores of the three groups for internet self-efficacy is 32.80, which in comparison to the table value was found significant at 0.01 levels of significance. Hence, the hypothesis H_2: There will be no significant difference in the achievement of group having high internet self-efficacy than that of average and low internet self-efficacy group of students in computer science, is rejected. The result indicates that high, average and low internet self-efficacy groups do not yield equal level of achievement in computer science.

To investigate further, F-ratio was followed by t-test. The values of the t-ratio for different combination have been given in table-5.

Table-5: t-ratio for different combinations of different internet self-efficacy groups

Variables	High Internet Self-Efficacy N Mean SD 80 21.65 7.23	Average Internet Self-Efficacy N Mean SD 140 17.81 6.88	Low Internet Self-Efficacy N Mean SD 80 14.05 5.86
High Internet Self-Efficacy N Mean SD 80 21.65 7.23	--	3.84**	**7.31****
Average Internet Self-Efficacy N Mean SD 140 17.81 6.88	--	--	**4.27****
Low Internet Self-Efficacy N Mean SD 80 14.05 5.86	--	--	--

*** Significant at 0.01 level*

A bar diagram has been drawn to depict the mean gain scores of high, average and low internet self-efficacy group on achievement in computer science presented in fig -3.

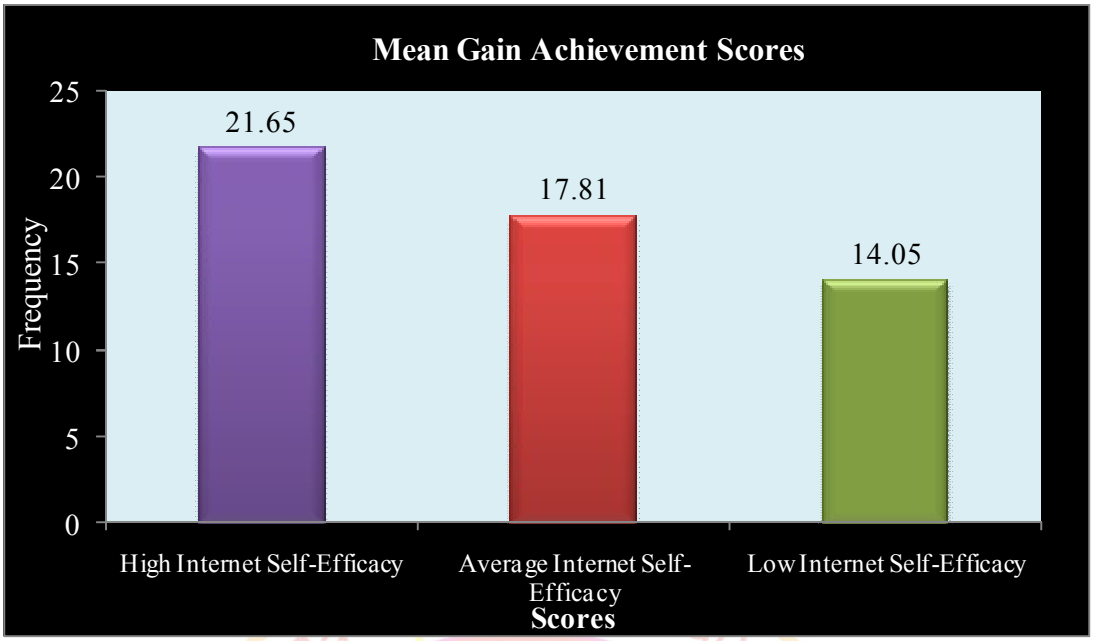

Fig-3: Bar diagram showing comparison of mean gain achievement scores of high, average and low internet self-efficacy groups

It is observed from the table-5 and fig.-3 that the mean gain achievement scores of high internet self-efficacy group is 21.65, which is higher than the corresponding mean gain achievement score of 17.81 for average internet self-efficacy group. The t-ratio for difference in gain achievement scores of high and average internet self-efficacy is 3.84, which in comparison to the table value ($t_{0.01}$=2.60, df 218) was found significant 0.01 level of significance. Hence, the hypothesis of significant difference is rejected in case of high and average internet self-efficacy irrespective of grouping across other variables. The result indicates that high internet self-efficacy group of students perform significantly better than that of average internet self-efficacy group of students.

It is evident from the table-5 and fig.-3 that the mean gain achievement score of high internet self efficacy group is 21.65, which is higher than the mean gain achievement score of 14.05 for low internet self-efficacy group. The t-ratio for difference in gain achievement scores of high and low internet self-efficacy group is 7.31, which in comparison to the table value ($t_{0.01}$=2.61, df 158) was found significant at 0.01 level of significance. Hence, the hypothesis of significant difference is rejected in case of high and low internet self-efficacy irrespective of grouping across other variables. The result indicates that high internet self-efficacy group of students perform significantly better than that of low internet self-efficacy group of students.

It is clear from the table-5 and fig.-3 that the mean gain achievement scores of average internet self-efficacy group is 17.81, which is higher than the corresponding mean gain achievement score of 14.05 for low internet self-efficacy group. The t-ratio for difference in gain achievement scores of average and low internet self-efficacy group is 4.27, which in comparison to the table value ($t_{0.01}$=2.60, df 218) was found significant at 0.01 level of significance. Hence, the hypothesis of significant difference is rejected in case of average and low internet self-efficacy irrespective of grouping across other variables. The result indicates that the achievement of average internet self-efficacy group is significantly better in respect of gain achievement scores than that of low internet self-efficacy group of students.

Interaction Effect (A×B)

Table-3 shows that the F-ratio for interaction between web based instructional strategy and internet self-efficacy group is 16.44, which in comparison to the table value was found significant at 0.01 levels of significance. It indicates that instructional teaching strategies interact with internet self-efficacy group to yield

significant difference in respect of gain achievement scores. Hence, the null hypothesis H_3: There will be no significant interaction effect of instructional strategies and internet self-efficacy on achievement in computer science, is rejected. The result indicates that there is a significant difference in gain scores on achievement in computer science due to interaction effect of instructional strategies and internet self-efficacy. To ascertain significance of difference among means of various combination groups, t-ratios are calculated which have been shown in table-6.

Table-6: t-ratio for difference in mean gain achievement scores of instructional strategies and different levels of internet self-efficacy

Variables		Experimental Group			Control Group		
		B_1 N 40 Mean 25.43 SD 6.86	B_2 N 70 Mean 20.87 SD 6.75	B_3 N 40 Mean 13.05 SD 4.96	B_1 N 40 Mean 17.87 SD 5.45	B_2 N 70 Mean 14.76 SD 5.54	B_3 N 40 Mean 15.05 SD 6.55
Experimental Group	B_1 N 40 Mean 25.43 SD 6.86	---	3.38**	9.24**	5.44**	8.40**	6.92**
	B_2 N 70 Mean 20.87 SD 6.75	---	---	6.92**	2.54*	5.88**	4.44**
	B_3 N 40 Mean 13.05 SD 4.96	---	---	---	4.12**	1.66	1.54
Control Group	B_1 N 40 Mean 17.87 SD 5.45	---	---	---	---	2.85**	2.09*
	B_2 N 70 Mean 14.76 SD 5.54	---	---	---	---	---	0.24
	B_3 N 40 Mean 15.05 SD 6.55	---	---	---	---	---	---

**Significant at 0.05level* ***Significant at 0.01 level*

Note: Here B_1 stands for High Internet Self-Efficacy, B_2 for Average Internet Self-Efficacy and B_3 for Low Internet Self-Efficacy

A bar diagram has been drawn to substantiate the results has been given in fig- 4.

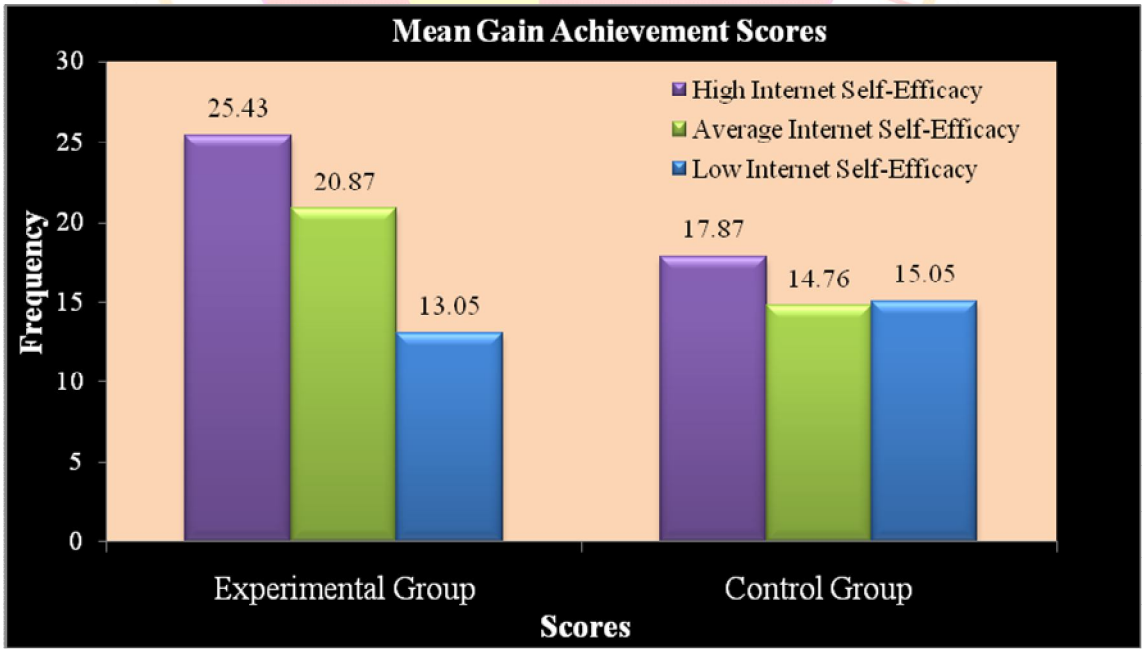

Fig-4: Bar diagram showing mean gain achievement scores for interaction effect of instructional strategies and internet self-efficacy

Table-6 and fig-4 indicates that high internet self-efficacy group with mean of 25.43 of experimental group exhibits higher mean gain scores than average internet self-efficacy group with mean 20.87 of experimental group. The t-ratio for difference in mean gain scores of high and average internet self-efficacy of experimental group is 3.38, which in comparison to the table value ($t_{0.01}$=2.63, df 108) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of experimental group possesses higher mean gain scores than that of average internet self-efficacy of experimental group.

Table-6 and fig-4 reveals that high internet self-efficacy group with mean of 25.43 of experimental group shows higher mean gain scores than low internet self-efficacy group with mean 13.05 of experimental group. The t-ratio for difference in mean gain scores of high and low internet self-efficacy of experimental group is 9.24, which in comparison to the table value ($t_{0.01}$=2.64, df 78) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of experimental group exhibits higher mean gain scores than that of low internet self-efficacy of experimental group.

Table-6 and fig-4 shows that high internet self-efficacy group with mean of 25.43 of experimental group exhibits higher mean gain scores than that of high internet self-efficacy group with mean 17.87 of control group. The t-ratio for difference in mean gain scores of high internet self-efficacy of experimental group and high internet self-efficacy of control group is 5.44, which in comparison to the table value ($t_{0.01}$=2.64, df 78) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of experimental group possesses higher mean gain scores than that of high internet self-efficacy of control group.

Table-6 and fig-4 indicates that high internet self-efficacy group with mean of 25.43 of experimental group exhibits higher mean gain scores than that of average internet self-efficacy group with mean 14.76 of control group. The t-ratio for difference in mean gain scores of high internet self-efficacy of experimental group and average internet self-efficacy of control group is 8.40, which in comparison to the table value ($t_{0.01}$=2.63, df 108) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of experimental group possesses higher mean gain scores than that of average internet self-efficacy of control group.

Table-6 and fig-4 reveals that high internet self-efficacy group with mean of 25.43 of experimental group possesses higher mean gain scores than that of low internet self-efficacy group with mean 15.05 of control group. The t-ratio for difference in mean gain scores of high internet self-efficacy of experimental group and low internet self-efficacy of control group is 6.92, which in comparison to the table value ($t_{0.01}$=2.64, df 78) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of experimental group exhibits higher mean gain scores than that of low internet self-efficacy of control group.

Table-6 and fig-4 shows that average internet self-efficacy group with mean of 20.87 of experimental group exhibits higher mean gain scores than that of low internet self-efficacy group with mean 13.05 of experimental group. The t-ratio for difference in mean gain scores of average internet self-efficacy of experimental group and low internet self-efficacy of experimental group is 6.92, which in comparison to the table value ($t_{0.01}$=2.63, df 108) was found significant at 0.01 level of significance. Hence, the average internet self-efficacy of experimental group possesses higher mean gain scores than that of low internet self-efficacy of experimental group.

Table-6 and fig-4 indicates that average internet self-efficacy group with mean of 20.87 of experimental group exhibits higher mean gain scores than that of high internet self-efficacy group with mean 17.87 of control group. The t-ratio for difference in mean gain scores of average internet self-efficacy of experimental group and high internet self-efficacy of control group is 2.54, which in comparison to the table value ($t_{0.05}$=1.98 and $t_{0.01}$=2.6, df 108) was found significant at 0.05 level of significance. Hence, the average internet self-efficacy of experimental group exhibits higher mean gain scores than that of high internet self-efficacy of control group.

Table-6 and fig-4 reveals that average internet self-efficacy group with mean of 20.87 of experimental group exhibits higher mean gain scores than that of average internet self-efficacy group with mean 14.76 of control group. The t-ratio for difference in mean gain scores of average internet self-efficacy of experimental group and average internet self-efficacy of control group is 5.88, which in comparison to the table value ($t_{0.01}$=2.61, df 138) was found significant at 0.01 level of significance. Hence, the average internet self-efficacy group of experimental group possesses higher mean gain scores than that of average internet self-efficacy of control group.

Table-6 and fig-4 reveals that average internet self-efficacy group with mean of 20.87 of experimental group exhibits higher mean gain scores than that of low internet self-efficacy group with mean 15.05 of control group. The t-ratio for difference in mean gain scores of average internet self-efficacy of experimental group and low internet self-efficacy of control group is 4.44, which in comparison to the table value ($t_{0.01}$=2.63, df 108) was found significant at 0.01 level of significance. Hence, the average internet self-efficacy of experimental group possesses higher mean gain scores than that of low internet self-efficacy of control group.

Table-6 and fig-4 reveals that low internet self-efficacy with mean of 13.05 of experimental group exhibits lower mean gain scores than that of high internet self-efficacy with mean 17.87 of control group. The t-ratio for difference in mean gain scores of low internet self-efficacy of experimental group and high internet self-efficacy of control group is 4.12, which in comparison to the table value ($t_{0.01}$=2.64, df 78) was found significant at 0.01 level of significance. Hence, the low internet self-efficacy of experimental group possesses lower mean gain scores than that of high internet self-efficacy of control group.

Table-6 and fig-4 reveals that high internet self-efficacy with mean of 17.87 of control group exhibits higher mean gain scores than that of average internet self-efficacy with mean 14.76 of control group. The t-ratio for difference in mean gain scores of high and average internet self-efficacy of control group 2.85, which in comparison to the table value ($t_{0.01}$=2.63, df 108) was found significant at 0.01 level of significance. Hence, the high internet self-efficacy of control group possesses higher mean gain scores than that of average internet self-efficacy of control group.

Table-6 and fig-4 reveals that high internet self-efficacy with mean of 17.87 of control group exhibits higher mean gain scores than that of low internet self-efficacy with mean 15.05 of control group. The t-ratio for difference in mean gain scores of high and low internet self-efficacy of control group 2.09, which in comparison to the table value ($t_{0.05}$=1.99 and $t_{0.01}$=2.64, df78) was found significant at 0.05 level of significance. Hence, the high internet self-efficacy of control group possesses higher mean gain scores than that of low internet self-efficacy of control group.

Table-6 and fig-4 indicates that the rest of combination groups i.e. low internet self-efficacy of experimental group with average and low internet self-efficacy of control group and average with low internet self-efficacy of control group, do not yield significant difference in achievement in computer science even at 0.05 levels of significance.

Discussion of the Results

The finding of present study reveals that web based instructional strategy was more effective than that of conventional teaching strategy on achievement in computer science. Hence, the hypothesis $H_{1:}$ There will be no significant difference in the achievement of group taught through web based instructional strategy and conventional teaching strategy in computer science, is rejected. The results are supported by the findings of Schutte (1997), who found that students taught through virtual class on World Wide Web scored an average of 20% higher than the traditional class on both examinations. Thiele, Allen and Stucky (1999) found that the web based format increased collaborative learning and improved computer skills. Owston and Wideman (1999) found that grades were significantly higher for the web-based classes than for the face-to-face classes, which were significantly higher than for the correspondence classes.

Daniel and Rohaida (2001) indicated that the students had a better understanding of the topics taught using web based instructions. Suwanbenjakul (2002) found that English learning achievement of students in the experimental group was higher than those of students in the control group. Kearns, Shoaf and Summey (2004) found that students in the web-based course scored significantly higher than those taught using traditional methods. Uzunboylu (2004) found that the English language grammar achievement of the experimental group's subjects was higher than the control group's subjects. Noisri (2005) found that the learning achievement of students with the web based instruction course was significantly higher than that of the students with normal teaching. Sengel (2005) found that there were significant differences between the pre-tests and post-tests of the science achievement test and attitude scale. Apichatibutarapong, Worrachittanon, Tenissara, Vongsirojgul and Petsuwan (2008) **found** that web-based instruction was effective in teaching Information Technology, Mathematics and Statistics, and Sciences. Mugan (2008) found that web intensive instruction improved scores from pre-test to post-test on achievement in Biology. Kaur (2012) found that students achieved higher when taught through web based instruction as compared to conventional mode of instruction. Sudha and Amutha (2015) found that higher secondary learners of control group and experimental group differ significantly in the pre-test and post-test on achievement in Chemistry.

The results are contradicted by the findings of Davies and Mendenhall (1998), Rattanavijai and Sharma (2003) who reported no difference in the achievement of students taught through web based instruction and traditional method of instruction. Kearns, Shoaf and Summey (2004) found that the satisfaction level of students in traditional classrooms was still more than those of web based course. Khatony, Nayery, Ahmadi, Haghani and **Vehvilainen-Julkunen** (2009) found that there was no significant difference between the groups in either the pre-test or the post-test scores in the knowledge test. Kuo (2016) reported that synchronous web-based instruction affects thinking styles and creativity of teachers and students.

The finding of the present study indicates that high, average and low internet self-efficacy groups differ in the level of achievement in computer science. Hence, the hypothesis $\mathbf{H_2}$: There will be no significant difference in the achievement of group having high internet self-efficacy than that of average and low internet self-efficacy group of students in computer science, is rejected. The results are supported by the findings of Wang and Newlin (2002), who found that students' perceived internet-based learning self-efficacy was predictive of their final exam scores. Moreover, students showing curiosity about the internet-based program revealed higher internet-based learning self-efficacy and had better class performance than those taking part in the course solely due to availability. Tsai and Tsai (2003) in their study found evidence that high internet self-efficacy students had better information searching strategies and learned better than those with low internet self-efficacy in a web-based learning task. Chang, Liu, Sung, Lin, Chen and Cheng (2013) in their study found that students with high internet self-efficacy outperformed those with low internet self-efficacy on the final exam and were more confident in their ability to complete an online course. Significant gender differences were noted in degree of internet self-efficacy, confidence, online discussion participation, learning motivation etc. Kuo and Kuo (2013) found that student performance was significantly associated with internet self-efficacy.

For the interaction effect of instructional strategies and internet self-efficacy, it was concluded that gain in achievement was higher for high internet self-efficacy group followed by average and low internet self-efficacy group taught by web based instructional strategy. Hence, the hypothesis $\mathbf{H_3}$: There exists significant interaction effect of instructional strategies and internet self-efficacy on achievement in computer science, is accepted. The finding lies in line with the researches done by Tsai and Tsai (2003) who in their study found evidence that high internet self-efficacy students had better information searching strategies and learned better than those with low internet self-efficacy in a web-based learning task than their counterparts. Wangpipatwong and Papasratorn (2007) found that students who learn using e-learning systems, showed significant improvement in their computer self-efficacy, internet self-efficacy, and computer attitude. Chu and

Tsai (2009) found that internet self-efficacy plays a mediating role in the relationships between internet usage and the participants' preference for internet based learning. Chang, Liu, Sung, Lin, Chen and Cheng (2013) found that students with high internet self-efficacy out performed those with low internet self-efficacy on the final exam and were more confident in their ability to complete an online course.

Findings

1.The achievement of group taught through web based instructional strategy was found significantly higher than that of conventional method of teaching.

2.The performance of high internet self-efficacy group was significantly higher than that of average and low internet self-efficacy group on achievement in computer science. The further analysis revealed that:

(i) The mean gain score of high internet self-efficacy group was significantly higher than that of average internet self-efficacy group.

(ii) The mean gain score of high internet self efficacy group was significantly higher than that of low internet self-efficacy group.

(iii) The mean gain score of average internet self-efficacy group was significantly higher than that of low internet self-efficacy group.

3. There was significant interaction effect of instructional strategies and internet self-efficacy on achievement in computer science. Further analysis revealed that:

(i) The high internet self-efficacy of experimental group possesses higher mean gain scores than that of average and low internet self-efficacy of experimental group.

(ii) The high internet self-efficacy of experimental group possesses higher mean gain scores than that of high, average and low internet self-efficacy of control group.

(iii) The average internet self-efficacy of experimental group exhibits higher mean gain scores than that of low internet self-efficacy of experimental group.

(iv) The average internet self-efficacy of experimental group exhibits higher mean gain scores than that of high, average and low internet self-efficacy of control group.

(v) The low internet self-efficacy of experimental group possesses lower mean gain scores than that of high internet self-efficacy of control group.

(vi) The high internet self-efficacy of control group possesses higher mean gain scores than that of average and low internet self-efficacy of control group.

(vii) The rest of the combinations of instructional strategy and internet self-efficacy group did not yield significant difference in mean gain achievement scores.

Conclusion

The present study reveals that web based instructional strategy gives better results than conventional teaching strategy for secondary school students. This could be because the students are able to access the web-based course from anywhere and at any time and at their own pace. Further, the internet self-efficacy affects the achievement of computer science students in web based teaching-learning environment. The instructional strategies and internet self-efficacy produced significant interactional effect on achievement scores. The study recommends the use of web based instructional strategy for better achievement of secondary school students in computer science. Internet self-efficacy seems to be a good predictor of achievement of students in computer science in web based learning environments. Hence, appropriate training to use computer and internet must be given to achieve good results using web based instructional strategy.

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