

EFFECT OF WEB BASED INSTRUCTION ON ACHIEVEMENT IN BIOLOGY IN RELATION TO LEARNING STYLE

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Abstract

This study analyzes the effect of web based instruction on achievement in Biology in relation to learning style. The study investigated 320 Class IX students from Amritsar city. Achievement test in Biology of 60 items and Kolb Learning Style Inventory were used to collect the data. Experimental group was taught with the help of website named Webzbio.com and control group was taught by conventional mode of instruction. The results revealed that students achieved higher when taught through web based instruction as compared to conventional mode of instruction. Learning styles of students did not effect their achievement in experimental and control group. No interaction effect of instructional strategies and learning style was found.

Keywords: Web based instruction, Achievement in Biology, Learning style

1. Introduction and Theoretical Framework

Learning is a biological process involving horizontal and vertical synapse formations in the brain resulting in established neuronal pathways. Each learner has a unique biological makeup resulting in individual approaches to acquire, understand, and perceive information, which constitutes their learning styles. Learners have a dominant and several subdominant learning styles which they use to explore new material. Some students tend to focus on facts, data and algorithms while others are more comfortable with theories and mathematical models. Some respond strongly to visual form of information like pictures, diagrams and schematics while others get more from verbal form-written and spoken explanation. Some prefer to learn actively and interactively, others function more introspectively and individually (Felder, 1996).

Many educational theorists and researchers consider learning style as an important factor in the learning process and agree that incorporating them in education will make learning easier for students and enhance their achievement and help to improve the teaching-learning process. According to Zapalska and Dabb (2002), an understanding of the way students learn improves the selection of teaching strategies best suited to student learning. For the effectiveness of teaching environments, it is important to take account of group or individual learners' characteristics, competences and experiences (pre-learning) throughout the process of planning learning environments (Kemp, Morrison and Ross, 1998).

Learners with a strong preference for a specific learning style might have difficulties in learning if their learning style is not supported by the teaching environment (Felder and Silverman, 1988; Felder and Soloman, 1997).

Understanding students' unique learning style preferences and instructional needs can assist teachers in developing a more favourable view of all students' abilities and thereby stimulate the development and implementation of differentiated instructional practices and the provision of intentional and personalized intervention (Evans and Waring, 2006; Honigsfeld and Schiering, 2004; Rosenfeld and Rosenfeld, 2008). Often, the resulting increased success of all students serves as further incentive for continued attention to individual learners' needs (Rosenfeld and Rosenfeld, 2008). Thus, teachers must become proficient in differentiating instruction to accommodate those needs, make learning more meaningful, and enhance student success (Honigsfeld and Schiering, 2004; Noble, 2004).

Educational settings that give value to learners' learning styles are part of individualized instruction. One of these educational settings is web-based instruction (Roh and So, 2005). Web based instruction addresses students' diverse individual differences and provides adaptivity according to learning styles. By integrating technology, learners can be taken through different learning styles so that they can be benefited by learning through preferred styles and at the same time learn to adjust and function in styles that make them more balanced learners. Technology and computers easily combine various media formats and can provide a variety of different learning opportunities. Technology based lessons lend themselves to teaching students of various learning styles (Lamb, 2001).

Web based instruction not only appeals to learners' learning styles but also improves academic grades. Different students' learning styles may influence student learning outcomes

and satisfaction within a web-based course in different disciplines (Kanuka and Nocente, 2003). In addition, Hallock, Satava and LeSage (2003) stress that student learning outcomes will improve when a student learning style was matched to the learning environment. For instance, students who are classified as visual learners may have higher performance when information is offered using pictures or design methods (Hallock, Satava and LeSage, 2003). Understanding the differences of student learning styles may facilitate instructors to create educational approaches to suit students' needs and increase learning achievements. For instance, Neuhauser (2002) pointed out that visual learners may benefit from text, charts, and graphs; auditory learners may favour traditional face-to-face instruction. Judy Serwatka (2005) claims that the key ingredient in improving student retention and increasing motivation in online courses lies in addressing student learning styles.

Both web based instruction and learning styles are based on constructivist learning theory which emphasizes the learner's experiences in the learning process. WBI allows the teachers to consider the learning style of each learner individually, by adapting the content, in terms of form, structure, presentation order of learning activities and choices of these activities, which is a difficult or impossible task for the teacher in a traditional classroom setting. Learners in web-based courses are given opportunities for collaborative learning and learning communities, to access information via Internet in the Web-based courses in anytime and anywhere (Miller, 2001; Roblyer, 2003). Many adaptive educational hypermedia systems such as CS383, Multimedia Asynchronous Networked Individualized Courseware (MANIC), Intelligent Distributed Environment for Active Learning (IDEAL) etc. has incorporated Felder-Silverman learning style model.

The perusal of results of related studies makes it clear that in a few studies, learning styles have impact on the achievement of students in the web based instruction while in some studies web based instruction is equally effective for students with different types of learning styles.

Based on this literature review, students' learning styles seem to be associated with achievement. Research is needed to understand the relationship between students' achievement having different learning styles in web-based learning environment. This type of research will assist educators in planning, organizing, and delivering quality web-based instruction in a manner that will improve student achievement and accommodate different learning styles.

2. OBJECTIVES OF THE STUDY

1. To study the effect of different instructional strategies i.e. web based instruction and conventional mode of instruction on achievement of class IX students in Biology.
2. To study the difference in achievement of class IX students in Biology with different learning styles.
3. To study interaction effect of instructional strategies and learning styles on achievement of class IX students in Biology.

3. HYPOTHESES OF THE STUDY

1. There will be no significant difference in achievement of class IX students in Biology taught through different instructional strategies i.e. web based instruction and conventional mode of instruction.
2. There will be no significant difference in achievement of class IX students in Biology with different learning styles.
3. There will be no significant interaction effect of instructional strategies and learning styles on achievement of class IX students in Biology.

4. RESEARCH METHOD

4.1 Research Design

In the present study, 2 X 4 factorial experimental design was employed.

4.2 Sample for the Study

Class IX student sample (N=330) was drawn randomly from the three schools of Amritsar city. The sample comprising of 330 students was administered two tests-test of achievement in Biology and test of intelligence. Out of 330 students, six students did not respond to all the items of achievement and four students did not respond to some items of intelligence test i.e. total of 10 students were dropped from the sample of 330 students. The scores of these students were not considered at the time of analysis. Hence sample comprising of 320 students were randomly divided into two groups- the experimental group and the control group. In order to make equivalent groups, matching was done at the pre-test

stage for two variables- variable of achievement in Biology (pre-test) and intelligence. t-test was employed to compare mean scores on the variable of achievement in Biology and Intelligence. Insignificant t-ratio showed that both the groups were matched and equivalent. The experimental group was taught with web based instruction and the control group was taught with conventional mode of instruction.

4.2.1 Sample Distribution on the basis of Instructional Strategy and Learning Style

As the present study involved two instructional strategies (web based instruction and conventional mode of instruction) and four learning styles (diverging, converging, accommodating and assimilating), hence the students (N=320) were distributed at two stages- on the basis of instructional strategies and on the basis of learning styles.

Stage I: Sample Distribution on the basis of Instructional Strategy

The sample was distributed on the basis of instructional strategies into two types i.e. web based instruction and conventional mode of instruction. The distribution of the sample on the basis of these strategies is presented in table 1.

Table 1: Distribution of Sample on the basis of Instructional Strategies

S. No.	Groups		Total No. of Students
	Experimental (Group taught with WBI)	Control (Group taught with CMI)	
	No. of Students	No. of Students	
1.	63	62	125
2.	49	49	98
3.	48	49	97
Total	160	160	320

Stage II Sample Distribution on the basis of Learning Style

To distribute the sample on the basis of learning style, Kolb Learning Style Inventory was employed. On the basis of scores the students obtained on the inventory (as per manual), they were

identified with different learning styles. Out of these 83 students had diverging style, 76 students had converging style, 80 students had accommodating style and 81 students had assimilating style. As the number of students with different learning styles varied and ranged from 76 to 83, only 76 students were retained randomly for every learning style. This was necessary to ensure that experimental group and control group had equal number of students with different learning styles. At this stage the sample comprised of 304 students divided into four learning styles of 76 students each. Further these 76 students were randomly assigned to two groups of 38 each- experimental and the control. The distribution of sample on the basis of learning styles is shown in table 2.

Table 2: Distribution of the Sample on the basis of Learning Style (N=304)

Sr. No.	Treatment Groups	Learning Style				Total No. of Students
		Diverging	Converging	Assimilating	Accommodating	
1.	WBI	38	38	38	38	152
2.	CMI	38	38	38	38	152
Total		76	76	76	76	304

5. Tools Used

In the present study the following tools were used:

1. An achievement test in Biology for class IX was constructed and standardized to measure the performance of students before and after the treatment.
2. The Kolb Learning Style Inventory by Kolb (2007).
3. General Group Test of Intelligence (GGTI) by Ahuja (2005).
4. Web based instructional package in Biology for class IX was developed and validated (content wise).

6. PROCEDURE

Conducting the Experiment

The present study was conducted in four phases:

Phase I: Development of Web Based Instructional Package (WebBio) and an Achievement Test

Phase II (a): Matching the Groups

Phase II (b): Administration of an Achievement Test (pre-test), Learning Style Inventory

Phase III: Implementation of Web Based Instructional Package

Phase IV: Administration of the Achievement Test (post-test)

7. RESULT AND DISCUSSION

F values were calculated to study the main effect and interaction effects of two factors viz. instructional strategy and learning style with regard to gain scores of class IX students on the variable of achievement in Biology. The F values calculated by using two way ANOVA test is presented in table 3.

Table 3: Showing summary of 2 X 4 Analysis of Variance on gain scores on variable of achievement in Biology in relation to instructional strategy and learning style

Source of Variation	SS	df	MSS	F-ratio
Main Effects				
A: Instructional Strategy	4252.53	1	4252.53	76.50*
B: Learning Style	198.37	3	66.12	1.19
First Order Interaction				
A X B (Instructional Strategy x Learning Style)	226.85	3	75.61	1.36

*Significant at 0.01 level of Confidence.

7.1 COMPARISON OF MEANS

Hypothesis I

F-ratio (vide table-3) for the difference between mean gain score on the variable of achievement in Biology of the groups taught through web based instruction and conventional mode of instruction came out to be 76.50 which is significant at the 0.01 level of confidence leading to rejection of hypothesis to be stated. Hence, the null **Hypothesis Ho 1** stating “There will be no significant difference in achievement of class IX students taught through different instructional strategies (web based instruction and conventional mode of instruction” stands rejected.

To further analyse the results, mean gain score of students taught through web based instruction were compared with mean gain score of students taught through conventional

mode of instruction on the variable of achievement in Biology. Results are given in table 4 and figure 1.

Table 4 Comparison of students taught by Web Based Instruction (WBI) with students taught by Conventional Method (CM) on the variable of Achievement in Biology (N=304)

Groups	N	Mean Gain Score	S.D	t-value
WBI	152	25.61	7.346	8.723*
CM	152	18.13	7.603	

*Significant at 0.01 level of Confidence.

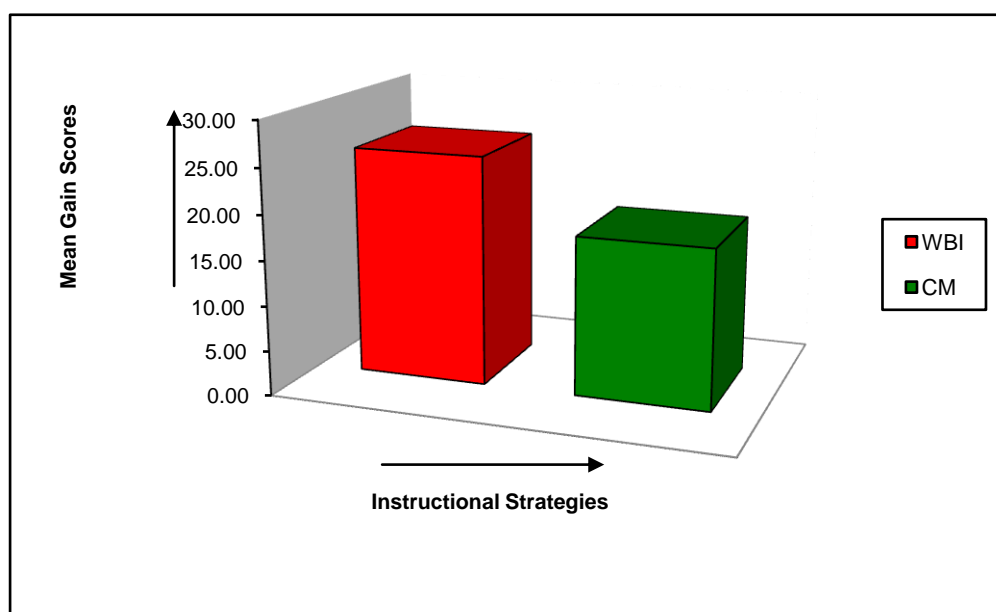


Figure 1: Showing comparison of students taught by Web Based Instruction with students taught by Conventional Method on the variable of Achievement in Biology (N=304)

The mean scores of the groups taught through web based instruction and conventional mode of instruction on the variable of achievement in Biology were found to be 25.61 and 18.13 respectively and the mean gain is in favour of group taught through web based instruction meaning thereby that the students taught by web based instruction achieved more as compared to those who were taught by conventional mode of instruction.

DISCUSSION OF RESULTS

An examination of F-ratio and means of two groups reveals that both the groups are significantly different on the mean gain score on the variable of Achievement in Biology. The result of the study shows that web based instruction is better than the conventional mode of instruction as an instructional strategy and has a noticeable impact on students' achievement. The significantly higher performance of web based instruction group can be attributed to the fact that teaching through web based instruction is able to draw the attention of learners and keep them involved in learning process. Study materials in the form of video, animations, interactions through the facilitative questions, e-links helps in stimulation of the senses of the learners leading to effective learning. . The animation enables students to visualize the information in a better way, particularly in acquiring the science process skills. These animations, which are dynamic and interactive, may activate the students' imaginal codes. This activation facilitates encoding and memory storage of information (Driscoll, 2000).The significant difference between web based instruction and conventional mode of instruction in achievement is also attributable to constructivist view of learning of web based instruction as learning becomes more interesting and effective when students have a control over learning environment. They can learn at their own pace and answer questions without constraint of time and place

The findings of the present study go in line with studies conducted by Sengel (2005), Morgil, Seyhan, Alsan and Temel (2008), Mungan (2008) who found significant effect of teaching through web based instruction on achievement of students in the science subject.

7.2 Hypothesis II

F-ratio (vide table 4) for the difference between mean gain score on the achievement in Biology of students with diverging style, converging style, accommodating style and assimilating style came out to be 1.19 which is insignificant leading to acceptance of hypothesis to be stated. Hence, the null **Hypothesis Ho II** stating "There will be no significant difference in achievement of class IX students in Biology with different learning styles" stands accepted. It may be inferred that the mean gain score on the variable of achievement in Biology of students with varying learning style i.e. diverging, converging, accommodating and assimilating may be considered equal and difference may be due to chance factor.

DISCUSSION OF RESULTS

F-ratio for the difference between the mean gain score on the achievement in Biology of students with diverging style, converging style, accommodating style and assimilating style is insignificant. It means that students with varying learning styles were not significantly different from each other on the mean gain score on the variable of achievement in Biology. The probable reason for this result is that students with different learning styles have same ability to organize and use the information they acquire.

This finding of the present study is also supported by findings conducted by (Gakhar 2006; Soyulu and Akkoyunlu 2009 and Rahmat 2010) who found that learning styles do not contribute to achievement.

7.3 INTERACTION EFFECT

Hypothesis III

Table 4 reveals that the F-ratio for the difference in mean gain score on the variable of achievement in Biology of students due to interaction between two types of instructional strategies and four learning styles came out to be 1.36 which is insignificant. It means that mean gain scores due to interaction of instructional strategy with varying learning styles i.e. diverging, converging, accommodating and assimilating did not yield different mean gain score for students. Hence, the null **hypothesis Ho III** stating “There will be no significant interaction effect of instructional strategies and learning styles on achievement in Biology of students” is accepted.

DISCUSSION OF RESULTS

The above findings explore that students with different learning styles (diverging, converging, accommodating and assimilating) perform equally when taught through different instructional strategies (web based instruction and conventional mode of instruction). The probable reason for this is that students with different learning styles gain the information in a similar way i.e. in classroom settings as well as in web based instruction. The results indicate that two instructional strategies are equally effective for learners with varying learning styles.

The findings of earlier studies (Terrell and Dringus 2000; Brittan- Powell, Legum and Taylor

2008; and Zacharis 2010) support this result that there is no significant interaction effect of instructional strategies and learning styles on mean achievement scores of students.

8. CONCLUSIONS

In the light of the analysis and interpretation of the data, the following conclusions are drawn:

1. Students taught through web based instruction are found to have achieved significantly high in Biology than taught through conventional mode of instruction. Thus, web based instruction proves to be better instructional strategy over conventional mode of instruction.
2. Learning style proves an insignificant factor in achievement in Biology.
3. No significant interaction effect of instructional strategies and learning styles is found on achievement of class IX students in Biology. It means that instructional strategies and learning styles do not enhance achievement of students in Biology.

9. EDUCATIONAL IMPLICATIONS

Web based instruction was found to be an effective strategy in increasing students' achievement as compared to conventional mode of instruction. Videos, animations and pictures available in web based instructional package provides a new learning environment for learners. Animations and videos are capable of attracting learners' attention and facilitating their understanding of abstract concepts of Biology. Therefore, Biology teachers should develop interesting web based instructional package for enhancing the understanding of abstract concepts and integrate web based instruction in their teaching learning process.

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