



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

EFFECT OF WEB BASED INSTRUCTION ON ACHIEVEMENT IN MATHEMATICS IN RELATION TO PROBLEM SOLVING ABILITY

Ms.Harleen Kaur
Research Scholar
Department of Education
Guru Nanak Dev University
Amritsar.

Dr.Navdeep Kaur
Assistant Professor
Department of Education
Guru Nanak Dev University
Amritsar

ABSTRACT

The present study investigates the effect of web based instruction on achievement in mathematics of IX class students in relation to problem solving ability. The Quasi – experimental design was employed where pre-test and post- test scores were used for further statistical analysis such as t-test and 2*2 ANOVA was used for this purpose. A sample of 340 secondary school students from Amritsar, Punjab (India) was taken for present study. The results of the study revealed that the performance on account of WBI group is significantly higher than that of conventional group and in case of problem solving ability group the performance of high problem solving ability is significantly higher than that of low problem solving ability group of students in mathematics. Therefore, the study reveals that high and low problem solving ability groups were different on mean gain scores achievement in mathematics that is high problem solving ability group gained in their achievement in mathematics scores than low problem solving ability.

Keywords-

Web based instruction, academic achievement, problem solving ability.

INTRODUCTION

We are living in the age of 21st century and this is the age of information. In this age information may be in the form of science and technology, social systems and educational systems. Rapid growth and development in ICT has conducted to the diffusion of technology in education (Corbett and Willms, 2002); therefore, ICT is nowadays indispensable for educational studies, such as surveys, presentations, project work or research, online and distant web based learning. Not only ICT is the basis of learning environment, but also it provides individuals to have lifelong learning, to improve educational outcomes, to learn new occupational skills, and to decrease inequalities between groups (Cavas, Kisla, R Twinig, 2004).

Khan(1997) defines web based instruction (WBI) as: "... a hypothesis- based instructional programme which utilizes the attributes and resources of the world wide web to create a meaningful environment where learning is fostered and supported".

Components of Web based Instruction

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



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

1. Content Development: Content is developed on the basis of learning and instructional theories, instructional design (ID) and curriculum
2. Multimedia Component: It includes text and graphs, audio streaming, video streaming, graphical user interface (GUI) and compression technology.
3. Internet Tools: Communication Tools, Remote Access Tools, (Telenet, File Transfer Protocol (ftp) etc., Internet Navigation Tools (Gopher, Lynx etc.) and search and other Tools (Search Engines and Counter Tool) are internet tools.
4. Computer and Storage devices: Computer platforms running Unix, DOS, Windows etc. and servers, hard drives, CD ROMS etc.
5. Connections and Service providers: Modems, Internet Service Providers, Gateway Service Provider etc. may be connections and service providers.
6. Authoring Programmes: These may be any programming languages such as HTML, VRML, Java etc. and HTML Converters and Editors etc.
7. Servers: HTTP servers, Web Site, Uniform Resource Locator (URL) etc. Common Gateway Interface (CGI)
8. Browsers and Other Applications: Text-Based browser, graphical browser etc. Links (eg. Hypertext Links, hypermedia links etc.) and application that can be added to Web browsers such as plug-ins.

Emergence of the Problem

Today's era has become so technology oriented that it generates in the mind of investigator to come up with something new and innovative learning strategy for the learners and the core weapon nowadays to learn is to have knowledge that helps to develop the scientific attitude among the youth and that also helps them in teaching- learning process. Mathematics is one of the subjects that students really want to learn and grasp the spirit of its content. The two key factors that help them to learn its content are practice and repetition.

In bygone years, online learning has become a main mode of restructuring educational settings. According to (Sabry and Baldwin, 2003), increasingly, web technology is used for learning interaction and is becoming common place in education institutions (Nielson Net Raings2002; Mc Graw-Hill,2002; Whittingon and Campbell,1998;Collis , Peters and Pals, 2000).In order to fulfil the deficiencies like high dropout rate , wastage and stagnation there is a need to shift our conventional mode of teaching to the innovative mode that comprises of technology.

Collins , Deck & Mc Crickard (2008),” The need for students to be actively engaged in the learning process which can create a pedagogical dilemma. Instructions recognise that completing chapter readings and homework assignments significantly increases the student's ability to retain what is being taught, recognise alternative situations to which the concepts can be applied, and see the connection between topics throughout the course. Yet many students may not understand the amount of effort required to learn the subject matter at this cognitive level and may not have the time management skills needed to achieve the disciplined study required by more rigorous courses. To address this dilemma and to ensure that students are actively engaged in the learning process, instructors have typically given written homework assignments and/or frequent quizzes. Such methods are not necessarily optimal, for either instructors or students, because developing, distributing and grading assignments and quizzes in often very time intensive, particularly for large classes. This implies an information lag between the learning process and instructor's knowledge of what students are learning.”



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

So to overcome the difficulties and to achieve the objectives, there is a need of online learning strategy that can be retrieved through web based instruction. Web technology is only one alternative among the wide range of media for helping people learn (Boisvert,2000). In view of Patrick, L.T. (2003), many schools have incorporated interactive computer assisted instruction into their programme to provide students opportunities to master specific educational objectives or standards. Therefore, a need was felt by the investigator that schools should incorporate web based instruction as an instructional strategy as it has the potential to develop the various skills and abilities among students and make them better informed and higher achievers. Gahala (2001) suggested that rather than using technology's sake, the school can develop a vision of how technology can improve teaching and learning.

Web based instruction engages the students in meaningful interactive dialogue, employs graphics, sound and simulations in learning facts of science and enhancing concept clarity. It helps the teacher to address the differences as the students in the class are with mixed abilities. Some students take long time to learn and some learn more quickly. And web based instruction is the one that make students to learn at their own pace. Many experimental studies in differential psychology have shown that individual differences play an important role in learning and instruction. The results suggest that matching instruction to learning style allows the student to retain information longer and apply it more effectively. When mismatches prevail between learning styles of most students in a class and the teaching style of the instructor, the students may become bored and inattentive in class, do poorly on tests, get discouraged about the courses, and that directly affects their grades and later on their careers. The web is able to offer a world-wide democratic learning context to students, who are from different cultures, speak different languages without gender discrimination (Kurubacak, 1999)

Thus the study was being done as the investigator feels that schools should develop a vision of how technology can improve teaching-learning process and make the pupils more informative and develop the various skills and abilities. The investigator tried to develop web based instruction package for teaching of mathematics to adolescents and also taken into the consideration of different problem solving abilities and learning styles. Technology nowadays is used with wide variety of formats that makes teaching –learning process more desirable and leads to have different learning styles. To make more balanced learners it is necessary to integrate the technology in the teaching learning so that preferred styles of learning can be taken into account. The review of studies related to web based instruction on achievement in mathematics reveals that negligible work has been done on the effect of web based instruction on achievement in mathematics in relation to learning style and problem solving ability as variable. The investigator in the present research studied the effect of web based instruction on achievement in Mathematics in relation their learning style and problem solving ability and developed web based instructional package supported by visualisation and animations which can facilitate effective learning of mathematical concepts.

STATEMENT OF THE PROBLEM

EFFECT OF WEB BASED INSTRUCTION ON ACHIEVEMENT OF CLASS IX STUDENTS IN MATHEMATICS IN RELATION TO PROBLEM SOLVING ABILITY

OBJECTIVES

1. To develop an achievement test in Mathematics for class IX students.
2. To develop WBI package for selected units of Mathematics.
3. 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 Mathematics.
4. To study the difference in achievement of class IX students in Mathematics with high and low level of problem solving ability.



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

HYPOTHESES

1. The performance on Mathematics WBI group is significantly higher than that of conventional group.
2. The performance of high problem solving ability group is significantly higher than that of low problem solving ability group of students in mathematics.

Delimitation of the study

The Study was conducted on class IX students (N=170) from three schools of Amritsar city affiliated to Central board of Secondary Education (CBSE)

The study was delimited to the variables in Mathematics, instructional strategy, learning style and problem solving ability

Operational Definitions

Web Based Instruction: It is a self-learning interactive instructional strategy and to present information in Mathematics and monitor the learning that takes place.

Academic Achievement: Achievement means performance in a subject or in a test. The achievement test is an investigator made test. It involves the set of questions from different lessons chosen for study. This helps to measure high and low achievement of students under study.

Problem Solving Ability: The problem solving ability is a process of overcoming difficulties that appear to interfere with the attainment of a goal. It is an ability to choose among various responses in order to accomplish a task successfully.

Methodology

In the present study, in order to satisfy the real effort in experimental research, the logical statistical inference of purposive sampling was initially employed to select those schools which have LAN facility and then random sampling technique was used.

Tools used

The following tools were used for collecting the data

1. An achievement in Mathematics for class IX was constructed and standardised by the investigator to measure the performance of students before and after the treatment.
2. Problem Solving Ability test by LN Dubey (2012)
3. Web Based Instruction package in Mathematics for class IX was developed and validated (content wise) by the investigator . Lesson plans on the same chapters for delivering lectures by conventional mode of instruction were also delivered by the investigator.

Results and Discussions

Comparison of students taught by WBI with students taught by CMI on the variable of achievement in Maths (N=170)

Groups	N	Mean gain score	SD	t-value	t-ratio
WBI	85	25.41	8.36	7.98	5.89*
CMI	85	19.32	8.49	7.98	

*Significant at 0. 01 level of significance

Table 1 shows that F-ratio for the difference between the mean gain score on the variable of achievement in mathematics of the groups taught through web based instruction and conventional method of instruction significant at 0.0 level of significance. It means that both the groups are significantly different on the gain score on the variable of achievement in mathematics and the difference in the favour of group taught through web



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

based instruction. Hence, the null hypothesis stating “There will be no significant difference in achievement of class IX students through different instructional strategies is not accepted”.

Comparison of students with high level of problem solving ability with students with low level problem solving ability on the variable achievement in Mathematics (N=170)

Problem Solving Ability	N	Mean Gain Score	SD	T	t-ratio
High Problem Solving Ability	85	25.93	9.63	4.91	3.03*
Low Problem Solving	85	20.64	8.75	4.91	

***Significant at 0.01 level of significance**

Table 2 reveals that the F-ratio for the difference between mean gain score on the variable of achievement in Mathematics of the group with high level of problem solving ability and group with low level of problem solving ability is significant at 0.01 level of significance. It means that both the groups were significantly different on the gain score on the variable of achievement in Mathematics. Hence, the null hypothesis stating “There will be no significant difference in the achievement of class IX students in Mathematics with high and low level of problem solving ability”.

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 provide a new learning environment for learners. Animations and videos are capable of attracting learners attention and facilitating their understanding of abstract concepts of Mathematics. Therefore, Mathematics teachers should develop interesting web based instructional package for enhancing the understanding of abstract concepts and integrate web based instruction in their teacher learning process.
- Most of the school teachers are not computer literate. Further, those who are computer literate are not equipped or trained to develop and use web based instructional package in teaching learning process. Therefore, in service computer literate teachers can be given an opportunity to enhance their skills and competencies required for the development and use of web based instructional package. For this schools should organise refresher courses, workshops and seminars.
- Development of web based instructional package is not an expensive affair because once the package is developed; it can be used for many years with the required updations. So schools should make one time investment in the development of the package.
- India, today aspires to remain ahead as front-runners among knowledge based societies. Appropriate education and training are the key components in the process. Education is a powerful tool towards empowerment of society and its people. So education must reach the unreached people where human resources are reluctant to provide education. This is possible only through the use of technology web based instruction which is revolutionizing the paradigm of dissemination of knowledge. The challenge of quality of education, reaching the unreached, learning while working or working while learning, lifelong education and providing a ‘safety net’ to school drop-outs so that they do not remain undereducated can be met with web based instruction. Therefore, educational bodies should allow to make maximum use of web based instruction in remote areas also.
- Today, education based software are available on internet and in market. Teachers should be guided and trained to select the relevant software from various websites and open sources. The teachers can further help the students to select the software to assist them in effective learning, for these parents should be made aware of meaningful use of educational software. This will also help them in removing their misconceptions regarding the misuse of internet.



INNOVATIVE RESEARCH ORGANISATION

International Journal of Advance Research in Education, Technology & Management

(Scholarly Peer Review Publishing System)

REFERENCES

1. Altun, I. (2003). The perceived problem solving ability and values of student nurses and midwives. *Nurse Education Today*, 23 (8), 575-584.
2. Akinoglu, O. & Ruhan, O. T. (2007). The Effect of Problem- Based active Learning in Science Education on Students' Academic Achievement, Attitude and Concept Learning *Eurasia Journal of Mathematics, Science & Technology Education*, 3(1), 71-81.
3. Apichatibutarapong, S., Worrachittanon, W., Tenissara, R., Vongsirojgul, N., & Petsuwan, S. (2008). Effects of Web-based instruction on Thai students achievement: A meta analysis (Abstract). Retrieved May 15, 2010, from <http://www.actapress.com/abstract.aspx?paperID=32839>
4. Baki, A., & Güveli, E. (2007). Evaluation of a web based mathematics teaching material on the subject of fractions. *Computers & Education*, 51, 854-863.
5. Ballow, J., & Cunningham, J.W. (1982), Diagnosing Strength and Weaknesses of 6th Grade Students in Solving Word Problems, *Journal for Research in Mathematics Education*, 13(3), 202-210.
6. Corbett, B.A., & Willms, J.D. (2002). Canadian students' access to and use of information and communication technology. Paper presented at 2002 Pan-Canadian Education Research Agenda Symposium Information Technology and Learning, 30 April - 2 May, Montreal, Quebec. Retrieved March 21, 2016 from [www.cesc.ca/pceradocs/2002/papers/BCorbett_OEN.pdf].
7. Çavaş, B., Kışla, T., & Twining, P. (2005). Eğitimde bilgi ve iletişim teknolojilerinin kullanımına yönelik bir araştırma: dICTatEd yaklaşımı [A study on the use of information and communication technologies in education: dICTatEd approach]. Retrieved March 11, 2016 from <http://kn.open.ac.uk/public/getfile.cfm?documentfileid=4551>.
8. Caldwell, J.H., & Goldin, G.A. (1979), Variables Affecting Word Problem Difficulty in Elementary School Mathematics, *Journal for Research in Mathematics Education*, 10(5), 323-336.
9. Chang, E.C. (1998). Hope, problem solving ability and coping in a college student population: some implications for theory and practice. *Journal of Clinical psychology*, 54 (7), 953-962.
10. Charan, S.R. (1992). Comparative study of scientific creativity, problem solving and risk taking in tribal and urban students, fifth survey of educational research, 2, 1074. New Delhi: National Council of Educational Research and Training.
11. Dubey, L.N. (2011). Problem solving ability test. Agra: National Psychological Corporation.
12. Dutt, S. (1989). The effect of problem solving strategies on the problem solving ability in science of high school students in relation to anxiety, level, cognitive styles and intelligence. Unpublished Ph.D.Thesis, Chandigarh: Panjab University.
13. Frederiksen, N. (1984). Implications of cognition theory for instruction in problem solving. *Review of educational Research*, 54(3), 363-407.
14. Fuchs, L.S., Fuchs, D., Prentics, K., Hamlett, C.L., Finelli, R., & Coursey, S.J. (2004). Strategies to enhance young children's mathematical development. *Journal of educational psychology*, 96 (4), 635-647.
15. Gill, T.K. (1990). Effect of Training strategies on creative problem solving skills and central dominance in relation to int'ce, personality and cognitive style. Fifth survey of Educational Research, 2, 1372. New Delhi: National Council of Educational Research and Training.
16. Hansen, C.W. (1944), Factors Associated with Successful Achievement in Problem Solving in 6th Grade Arithmetic, *Journal of Educational Research*, 38, 111-117.
17. Ma, L. (1999), Knowing and Teaching Elementary Mathematics Teachers Understanding of Fundamental Mathematics in China and the United States, Mahwah, NJ : Erlbaum.
18. Morgan, C. & O'Reilly, M. (2001). Innovations in online assessment, in: F. Lockwood & A. Gooley (Eds) *Innovations in open and distance learning*, Kogan Page, London. Nguyen, D. M., & Kulm, G. (2005). Using web-based practice to enhance mathematics learning and achievement. *Journal of Interactive Online Learning (JIOL)*, 3(3),1-16.
19. Salami, S.O., & Aremu, A.D. (2002). Relationship between problem solving ability and study behavior among school-going adolescents in south-western Nigeria. *Electronic Journal of research in Educational Psychology*, 2 (1), 139-154.

**INNOVATIVE RESEARCH ORGANISATION****International Journal of Advance Research in Education, Technology & Management***(Scholarly Peer Review Publishing System)*

20. Sanchis, G. R. (2001). Using web forms for online assessment. *Mathematics and Computer Education*, 35(2), 105-114.
21. Schoenfeld, A. (1985) *Mathematical Problem solving*. Orlando, FL: Academic Press.
22. Skinner, A.J. (2001). Problem solving and computer assisted instruction in science education: An analysis of research findings and the research process. Unpublished Master of Education Thesis. Ontario, Canada: Brock University. Retrieved August 5, 2011 <http://infibeam.com/Books/info/jennifer-anastasia-skinner/problem-solving-computer-assisted-instruction-science-education-analysis/9781153531740.html>
23. Serin, O. (2011). The Effects of the Computer-based Instruction on the Achievement and Problem Solving Skills of the Science and Technology students. Retrieved June 10, 2016, from <http://www.tojet.net/articles/v1oi1/10119.pdf>.
24. Simon, D.P. (1978). Information processing theory of human problem solving. In D. Estes (Ed.), *Handbook of learning and cognitive process*. Hillsdale, NJ: Lawrence Erlbaum Associates.
25. Stanly, L.S. (2014). A study on achievement motivation and problem solving ability in mathematics of IX standard students in relation to their sex and type of school. *Indian Journal of Applied Research* 4(12).
26. Stuart, V. (2000). Mathematics curse or mathematics anxiety? *Teaching Children Mathematics*, 6, 330-335.
27. Taplin, M. (2010). Mathematics through problem solving. Retrieved 11/06/2016, from <http://www.mathletics.com>
28. Tuma, D., and Reif, F. (1980). *Problem solving and education: Issues in teaching and research*. Hillsdale, NJ: Lawrence Erlbaum Associates.