Chapter II
Review of Relevant Literature
CHAPTER-II

REVIEW OF RELEVANT LITERATURE

INTRODUCTION

The review of related literature is a very essential and significant aspect of any scientifically sound research project. The importance of this aspect may be realized from the fact that the relevant literature, if properly reviewed, helps the researcher not only in broadening his outlook by providing him up-to-date knowledge of result established, the method adopted and the relevance of the use of particular types of tools used by earlier researchers but it also helps him to decide and choose his own directions. One place to seek problems in education is in the research literature. The perusal of research literature enables new researchers to acquaint themselves with the research strategies that have proved efficacious in executing research carried out by earlier investigators.

According to Koul (2001) review of related literature, besides allowing the researcher to acquaint himself with current knowledge in the field or area in which he is going to conduct his research, enables the researcher to define the limits of his field.

Hence keeping in view the importance of review of related literature, an attempt has been made to trace and obtain the relevant material through direct and indirect sources of information on achievement and its relationship with web based instruction, learning style and intelligence. The studies on effect of web based instruction on achievement in relation to different variables are mostly carried out in foreign countries. As web based instruction is relatively new area in the field of education in India so the number of these studies carried out in India is very nominal. Hence the studies are not divided into different categories.

The review of a reasonable number of studies related directly or indirectly to the problem undertaken by the investigator is detailed below in chronological order:
2.1 STUDIES RELATED TO WEB BASED INSTRUCTION

Davies and Mendenhall (1998) compared online (Web-based) and classroom instructional delivery methods for the Health Education/Physical Education course, “Fitness and Lifestyle Management”, at Brigham Young University. Students in the traditional course were required to attend eighteen lectures and took six examinations. Students in the online course were required to access course materials online. These materials included lecture notes, video clips, animations, sound clips, graphics and Web links. The Web site also included lesson tests called “Speedback” exercises and provided students with immediate feedback concerning their performance. The results indicate that the students participating in the traditional class scored slightly higher than those studying the material online.

Schulman and Sims (1999) evaluated the achievement of students in five different undergraduate online courses. The achievement of students in the online courses was compared to that of students enrolled in the traditional version of the same courses. The results indicated that there was no significant difference between the post-test scores of the two groups and concluded that the learning of online students is equal to the learning of in-class students.

Smith (1999) studied the effectiveness of traditional methods in an On-line learning environment and found that there were no significant differences between experimental and control groups. Student performance was the same whether instruction was delivered in a traditional classroom or through On-line learning environment. Similar academic outcomes were produced with traditional instructional methods and On-line learning environments.

Thiele, Allen and Stucky (1999) studied the effects of web-based instruction on learning behaviors of undergraduate and graduate students. Students' responses to Web-based education were considered. The sample comprised of 58 undergraduate and 13 graduate students. The findings showed that the web based format increased collaborative learning and improved computer skills. Graduate students were more confident that the course helped them to understand concepts and ideas.

Wideman and Owston (1999) compared web based versus traditional instruction. The study included 14 different classes, each of which was offered in a web-based
format and in a corresponding face to face or traditional correspondence (paper) format. The study included 1099 students in webbased courses, 2467 students in correspondence courses, and 2318 students in face to face classes. An initial analysis of course grades found that students in the correspondence courses scored significantly lower than the other two modalities, which did not significantly differ. A second analysis was conducted and it was 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.

Mantei (2000) analyzed the effect of the use of internet based class notes and PowerPoint slides in Physical Geology. The researcher compared course grades of students that accessed these online materials to those of students who did not. The data revealed that the students who accessed the online materials scored significantly higher on all examination included in the study. Survey responses also indicate that students felt that the online materials helped them to learn the material better and made the course more interesting.

Stith (2000) found that a web-enhanced course was more than well received by students. In his study, many web-based tools- practice quizzes, animations, videos, a bulletin board, chat groups and a place for posting grade results were used with the course. The number of times students logged into the website was also compared to their final grades in the course. The correlation between students who did grade level A work and the number of times they logged onto the site was significant. A similar correlation existed between the number of articles posted on the site that were read and the grades those students received.

Wang (2000) developed a web site named STATICS ON-LINE for an engineering course to supplement the regular lecture and help the students to better understand the lecture. Multi-media, Virtual Reality Makeup Language (VRML) models and other format contents presented on the Web made the course more interesting and attractive. Hence learning became more active and efficient. Students reworked the problem until they solved it correctly and it was understood. Visualization of results helped students to check their answers and led them to the correct ones. Students posted their questions to the chat board. Other students and instructors could answer
questions on-line. The instructors posted frequently asked questions to the Web site topic-by-topic and the students reviewed them when needed.

**Woo and Kimmick (2000)** compared test scores and student satisfaction scores of graduate nursing students who took a nursing research course via the Internet with those of students who took the same course via traditional lecture instruction. A total of 97 students (Internet-44 and Lectures-53) participated. It was found that there were no significant differences in test scores and overall course student satisfaction.

**Daniel and Rohaida (2001)** used a specially designed WBI Module on *Elements of Life* (ELF) for students to learn about carbon, hydrogen and oxygen as the three basic elements of life. Sulphur was later introduced as a cognitive conflict. Many resources on these four basic elements were linked to this module. Pre and post quizzes were administered to students who participated in the study. They were also interviewed at the end of the study and the results indicated that they students had a better understanding of the basic elements of life found in living tissue. They were now able to visualize science as a whole entity rather than as separate disciplines of Biology, chemistry and physics.

**Sankaran and Bui (2001)** investigated the impact of learning strategies and motivation on performance in Web and lecture settings of a business information systems course. The purpose of this research was to study how learning strategies—deep, surface, undirected—and motivation affect learning performance in Web-based instruction as compared to a traditional lecture setting. There were 116 students in the sample, of which 60 were women and 56 men. Forty-six chose to take the course in the Web format and 70 chose the lecture format. The subjects for this study were students enrolled in an accelerated 4-week undergraduate business computer course. The course was offered in two alternative formats, lecture and Web. The instructor covered the same course content in both formats. The students were given a pre-test to measure their baseline knowledge of course content. At the end of the course, all students were administered the same test. Findings suggest that students with similar learning strategy and motivation performed equally well irrespective of web or lecture format. The study indicated that the achievement and satisfaction of students in asynchronous learning and synchronous learning environment is not
significantly different than the achievement and satisfaction of students in traditional classrooms.

Suthida (2002) undertook a comparative study of academic achievement in numerical methods between students studying by web based instruction and in a normal classroom. The objectives of this research were (i) to compare student’s academic achievement between learning with the web based instruction and in a normal classroom and (ii) to examine the satisfaction of the students who learnt with the WBI. The sample group comprised of 40 students. They were divided equally into two groups. The first group was the experimental group and the second group was the controlled group. The experimental group was assigned to learn with WBI and the controlled group learnt in the normal classroom. After finishing the lesson, they had to do a post-test. The result of the study reveals that the experimental group had higher academic achievement than the control group. In addition, the level of satisfaction of students on the learning was good in experimental group.

Suwanbenjakul (2002) developed a Web Based Instruction in the subject of English on the topics of relatives clauses for class V. The objectives of the study were to (i) develop the web-based instruction entitled relative clauses (ii) compare students’ English learning achievement of both experimental and control group and (iii) explore students’ attitude towards learning through web based instruction.

Eighty students were randomly selected and were divided into the experimental and control group. After giving a pre-test the experimental group was taught by web-based instruction whereas controlled group was taught by teacher’s manual. After the conduct of experiment, both groups were given a post test and it was found that English learning achievement of students in the experimental group was higher than those of students in the controlled group and the students who learnt with WBI showed good attitudes towards WBI.

Lebec (2003) examined learning in an online Biology course designed to help teachers to prepare for science certification examinations. Quantitative and qualitative methodologies were employed. Concept maps, tests and online discussion transcripts were compared as measures of assimilated knowledge, while interviews reflected participants' views on the course. Findings indicated that
participants experienced gains in declarative knowledge, but improvement with respect to conditional knowledge. Qualitative e:
concept maps demonstrated gaps in participants' understandings of key
Engagement in the use of online resources varied according to partici-
towards online learning.

Rattanavijai and Sharma (2003) indicated that the achievement and students in asynchronous learning and synchronous learning envir-
significantly different from the achievement and satisfaction of
traditional classrooms. There was no significant difference in perfor-
students who used learning strategy in either web format or lecture fo-
with similar learning strategy and motivation performed equally well in web or lecture format. However, students prefer asynchronous over learning environment, since they do not have to be online at a specific showed more concern about their convenience. Their learning is no asynchronous environment because they feel they have more time to rethink carefully about assignments. In synchronous learning environ have to response to given questions.

Bata-Jones and Avery (2004) evaluated online graduate pharmacolo
compared the students' outcomes with those in the face-to-face simultaneou
Eighteen students chose to participate in the Web-bas
52 chose to participate in the face-to-face course. The same instruct-
courses and the same examinations were administered. Students in th
were not different in age or in number of years of nursing practice pric
course. There was no association between the course chosen and the nursing preparation or if the student had taken pharmacology course
program. The study shows that there was no significant diffe:
the mean examination scores of students enrolled in the two cou
students in the online course were positive about their experience.

Kearns, Shoaf and Summey (2004) evaluated the performance of bachelor of science in nursing students enrolled in two course delivery Web-based and traditional classroom with Web enhancements) by co
aggregate final course grades and composite examination scores. Factors that contributed to student satisfaction with the method of course delivery were also identified. Students in the Web-based course scored significantly higher on both performance measures, whereas students in the traditional course were more satisfied.

Loh (2004) investigated the effects of Web-based pitch discrimination training on college music students’ achievement. A Web-based learning module (Mona Listen) for pitch discrimination was developed as a training and data collection tool for the study. Practice records, participants’ feedback and achievement scores of pre test, post test and follow-up post test served as the data for a repeated measure design study. Data analyses were conducted using t-test and analysis of variance. A focus-group interview provided additional data which was not collected with the online instrument. The findings of the study indicated that: (a) Web-based pitch discrimination training had an overall positive effect on achievement in melodic interval discrimination, and (b) the amount of time spent was not a good predictor of achievement due to other possible underlying factors.

Uzunboylu (2004) studied the effectiveness of Web Assisted English Language Instruction on the Achievement and Attitude of the Students. The experimental group of the study used a web site that was developed by the investigator. The control group subjects had similar learning activities through traditional learning methods. It was found that the English language grammar achievement of the experimental group’s subjects who made the English grammar exercises using Web assisted instruction was higher than the control group’s subjects who made them using traditional method.

Zittle, Zittle, Lesher, Bitsi Largie, Fischer, Short, Southerland, Roessel, Rivera and Johnson (2004) revealed after conducting a research that web based multimedia mathematics, science and reading lessons for 3rd, 4th, 5th and 8th grade students appear to enhance learning in low English proficiency and low income native American learners. The results of the study showed that there was a significant increase from the pre test (M= 57%) to the post test (M= 79%) of about 22%.
Gallagher, Dobrosielski-Vergona, Wingard and Williams (2005) examined the effectiveness of alternative methods of course delivery by comparing student profiles and instructional outcomes from a dental hygiene gerontology course offered both on the Web and in a traditional classroom setting. Questionnaires were sent to both groups of students completing the course. The data collected included familiarity with Web-based instruction, extent of prior computer training and student evaluations of course effectiveness. A comparison of student characteristics participating in the two course formats revealed statistically significant differences in instructional outcomes. Student retention of course material six months after completion of the course was greater in the Web-based format. Students selecting a Web-based course format demonstrated greater motivation and learning success based on final course grades, completion of assignments and knowledge retention over time.

Lodree (2005) investigated the effect of animated agents with verbal audio in WBI on mathematics achievement and attitudes toward mathematics and computer using a pre test-post test control group. Sample comprised of 81 college students who enrolled in Pre-Calculus courses at doctoral/research-extensive university. Findings of the study reveal that the presence of animated agents with verbal audio in WBI can improve students’ mathematics achievement and attitudes toward mathematics, but not their attitudes toward computer.

Noisri (2005) developed a web-based instruction programme for an information technology course in an upper secondary level school to evaluate and compare the learning achievements of an experimental group (which used the web-based instruction course) and a control group (which used traditional teaching method); and to determine the experimental group opinions toward the web-based instruction course. For this 70 students in grade 10 at Kanjanapisekwittayalai Nakomprathom school were divided into an experimental group and control group. All subjects took pretest and posttest examinations. Only the opinions of students in the experimental group were assessed by questionnaire regarding the web-based instruction course. The scores of the test and the questionnaires were analyzed using statistical methods. The result of the study indicated that the learning achievement of students with the web-based instruction course was significantly higher than that of the students with
normal teaching. As shown by questionnaire evaluation, students possessed positive opinions and satisfactions in learning with the web based instruction course.

**Saat and Bakar (2005)** explored the use of specifically designed web-based instructional materials in teaching science process skills. This qualitative case study attempted to uncover the factors that influence learning in a web-based learning environment. The participants comprised of 19 fifth grade students-11 girls and 8 boys of middle class socioeconomic background. They were chosen based on purposive sampling. The study was conducted in the school's computer laboratory. The students were divided into groups of two's and three's. There were a total of seven groups. Three of these groups had a computer each, while the other four groups had to share computers. Audio recorders were placed at each of the groups' computer terminals to capture the groups' conversation as well as conversations between the teacher and the students. The study utilized a specially designed WBI material, Science Process Skills in Scientific Exploration (SPicE). Analysis of verbal and non-verbal data revealed the four factors influencing students' acquisition of science process skills- (1) the web-based instructional materials, (2) the physical setting, (3) the role of the teacher, and (4) the students readiness.

**Sengel (2005)** explored the effects of the Web-based learning in a science course on students’ achievement and attitudes toward science learning. The subjects of study were 51 Ozel Bilim Okullari students in secondary school (6th, 7th, and 8th grades). The experiment was conducted throughout the academic year of 2004-2005. The Science Achievement Test and attitude scales for science learning were given as pre-tests at the beginning of academic year. They were given post-tests and the students were interviewed in groups of five at the end of the academic year. The total time for using the web site of the course was kept by Web log-system. The quantitative findings of the study indicated that there were significant differences between the pre-tests and post-tests of the science achievement test and attitude scale. In addition, there was a positive relationship between the site usage time and achievement and attitude of the students towards science learning. The qualitative findings of this study showed that the amount of information supplied in the web site of the course, access to the Internet, doing assignments and taking online exams played important roles in students’ science learning.
Topcu (2005) explored the effects of instructional methods in the asynchronous web-based “Science and Math Teaching Methods Course” on pre-service teachers’ achievement, metacognition, and attitudes towards computer, www and the web-based course. It was conducted with two groups, total of 63 third grade pre-service teachers. The general metacognition questionnaire, attitude scales for the computer and www were given as pretests, and after a fourteen-week treatment period they were given as post tests to both the groups. In the middle of the semester a midterm examination and at the end of the semester a final examination and attitudes towards web-based course scale were administered. The data obtained were analyzed by statistical techniques of multivariate analyses of covariance. Results of the statistical analyses indicated that the group exposed to the web-based indirect instruction had significantly higher achievement on the final examination than the one exposed to the web based direct instruction. On the other hand, the group exposed to the web based direct instruction had significantly higher attitude towards web-based course than the one exposed to the web-based indirect instruction. However, the statistical analyses failed to show any significant difference between the groups in the midterm examination metacognition, and, attitudes towards computer and www.

Potomkova, Mihal and Cihalik (2006) aimed to review the impact of web-based tutorials on increasing the effectiveness of medical instruction and motivation of students towards self-directed learning. Most of the studies selected for the review comprised of evaluation of the web-tutorials in view of practical implementation, strengths, weaknesses, and main preferences in comparison with traditional lecture-based education. The review reveals that students preferred Web tutorials to traditional lecture-based classes for accessibility, ease of use, freedom of navigation, high medical image quality and advantage of repeated practice.

Sitzmann, Kraiger, Stewart and Wisher (2006) effectiveness of Web-Based instruction and Classroom Instruction. Meta-analytic techniques were used to examine the effectiveness of Web-based instruction (WBI) relative to classroom instruction (CI) and to examine moderators of the comparative effectiveness of the two delivery media. Overall the results indicated WBI was 6% more effective than CI for teaching declarative knowledge, the two delivery media were equally
effective for teaching procedural knowledge, and trainees were equally satisfied with WBI and CI.

Graff and Lebens (2007) developed EFit web based tutoring system for lower secondary school mathematics in Germany which met the individual demands of different students. In contrast to the more traditional Computer Assisted Instruction programs, the web-based eFit program is characterized by a high degree of adaptability. Results of the study indicated that students in the treatment group improved significantly compared to students who received traditional, constructivist-inspired instruction.

Apichatibutarapong, Worrachittanon, Tenissara, Vongsirjgul and Petsuwan (2008) examined the effectiveness of web-based instruction on Thai students' achievement. A meta-analysis technique was employed to synthesize 56 research works of King Mongkut's Institute of Technology Ladkrabang, North Bangkok and King Mongkut's University of Technology, Thonburi during the academic year 2001 and 2006. The findings of the study indicated that web-based instruction was effective in teaching Information Technology, Mathematics and Statistics, and Sciences. The result of this research also proves that WBI is an appropriate medium in learning and teaching various subjects in Thailand.

Bayram, Deniz and Erdogan (2008) investigated the relationships between personality traits and learners’ academic achievement in a web based environment and attitudes towards web based education. It was revealed that the students were successful in the web based education environment. The average of students’ attitudes towards web based education was 97.212 out of 135. Significant relationships were also found between learners’ personality traits, academic achievement and attitudes towards web based education.

Erdogan, Bayram and Deniz (2008) investigated the factors that affect learners’academic achievement and attitudes in web based education. For this 127 students enrolled in the e-MBA Masters Degree of Bilgi University constituted the study group of the research. A survey method was used for the study and the data were collected by a Demographic Information Questionnaire and Web Based Education Attitudes Scale. Demographic Information Questionnaire and Web Based
Education Attitudes Scale were administered to the e-MBA students. The e-MBA Degree average course grades (GPA) were obtained from the department to determine academic achievement of the student. The findings of the study reveal that web based education have positive effects on the improvement of academic achievement. The effect of web based education on attitude toward learning suggests that web use has positive effects mainly on motivation for learning and interests in the lessons.

Morgil, Seyhan, Alsan and Temel (2008) studied the effect of web based project applications on students’ attitudes towards chemistry and the relationship between attitudes and students’ performance. Results of the study show that the web based project applications increased students’ attitudes towards chemistry. The results showed that students’ attitudes towards chemistry was a significant predictor of their performance.

Mugan (2008) studied the effect of intensively use of web-based resources on the performance and attitude of high school Biology students. The subjects were 69 high school students from the Midwest United States, 58% of which were female. A causal-comparative research study was performed in order to determine the effect of immersing students in an environment rich in web-based materials. Web-based classroom was compared with a control group that received similar instruction through traditional text book materials. A pre-test and post-test design assessed student performance and an attitude survey evaluated student opinions of the instructional methods. Findings of the study showed that web intensive instruction did improve scores from pre-test to post-test.

Uparimpanich (2008) evaluated a web based instruction in “Introduction tutorial to French Phonetics” for Thai students who study French and other people who are interested in French and to compare this tutorial with foreign websites teaching French Phonetics. The sample group consisted of 30 10th grade students from Boscopitak School at Nakhonpathom, Thailand. The first 20 students study were in a French program; they were divided into 2 subgroups: the control group (learning by traditional method) and the experimental group (learning with the WBI to supplement traditional teaching). The last 10 students were not in the French
program. They were in the Science-Mathematics program. However, they were assigned to learn French with WBI. For students in the French program, the learning effectiveness was evaluated by comparing the scores of the experimental group with the traditional method. Students’ pronunciation in the experimental group increasingly improved in comparison with the control group. The result of the writing test between the two groups was not highly different. Students in the Science-Mathematics program were also able to pronounce French vocabularies and write the phonetic alphabet.

Berger, Topp, Davis, Jones and Stewart (2009) compared web-based and face-to-face training concerning patient education in a hospital system. In 1,661 nurses from four affiliated hospitals attended either a 1-hr face-to-face instructor-led training program, an instructor-facilitated Web-based training program, or an independent Web-based training program to fulfill a training requirement concerning patient education. Post-test results, course evaluation and costs were compared for both methods and it was found that there was no significant difference in course effectiveness or satisfaction between the training methods studied.

Hsu, Lin, Ching and Dwyer (2009) studied the effects of web-based instruction navigation modes on undergraduates’ learning outcomes. Sixty-eight undergraduate students were randomly assigned to treatments (linear vs. nonlinear navigation mode) and received four criterion tests designed to measure different educational objectives immediately after interacting with the instructional material about human heart. The results suggested that matching or mismatching navigation mode of the learning environment with learners’ preference did not lead to significant differences in learning outcomes. However, there were significant differences in achievement between groups with different navigation mode preferences. Findings indicated that students preferring nonlinear navigation had significantly higher achievement scores on higher levels of learning outcomes.

Khatony, Nayery, Ahmadi, Haghani and Vehvilainen-Julkunen (2009) compared the effectiveness of web-based and face-to-face continuing education methods on nurses’ knowledge about AIDS. A quasi-experimental method was used with a pre-test and post-test design. In this study 140 nurses with BSc degrees were
chosen through a random sampling method and divided into a web-based to-face group by random allocation. For the former group the interval of a web-based course on AIDS; the latter received a 3-hour lecture on the same subject. At the beginning and end of the course in both groups knowledge was measured by a questionnaire. Pre- and post-test scores were compared within and between the groups. The results showed no significant difference between the groups in either the pre-test or the post-test scores in the knowledge test. However, there was a significant difference in post-test scores within each group.

**Pillala (2010)** used web-based lessons of statistical concepts with animations to enhance the effectiveness of learning statistical concepts. Experimental results indicated that compared to traditional teaching methods, designed web-based lessons significantly improved the effectiveness of learning statistical concepts (by 29.8%) and enhanced students' performance in the learning process (by 19.2%).

**Masri (2011)** investigated the effect of using web-based curriculums on students' achievement in English language. To achieve the aim of the study, a pre/post-test was constructed to measure students' achievement in English language. The test consisted of twenty-five items on English language. The sample of this study consisted of 321 eighth-grade students; 156 males and 165 female students from four governmental schools in Amman. The study was distributed into four groups (a female experimental group, a male experimental group, and a control group). The experimental group was taught using web-based curricula while the control groups were taught using traditional curricula. The subjects were 79 male students for the experimental group and 77 male students for the control group, while the female experimental and control groups were 84 and 81 respectively. Descriptive analyses were used (means and standard deviation) for the pre-test and post-test scores of the students' English grammar test to compare the effectiveness of experimental and control groups. Statistical methods were used (Two Way ANOVA) analysis of variance to compare the control and the experimental groups and between the male and female groups. The findings of the study indicated that there were significant differences in post-test scores within each group.
significant differences in the posttest between the control and the experimental groups and the result was in favor of the experimental group and there was no statistically significant difference in the students' achievement due to gender. There was no statistically significant difference due to the interaction between gender and group.

Saldivar (2012) investigated teachers' adoption of a new Web-based instructional planning system, the Curriculum Customization Service (CCS) and found that teachers reported three major reasons for adopting the CCS: to increase their efficiency in utilizing digital resources, to offer alternative representations of key concepts and to differentiate instruction according to student differences such as reading ability and language proficiency. The CCS also impacted both teachers' instructional planning and classroom teaching: teachers reported that the CCS helped them integrate digital resources into their teaching practices with greater confidence, frequency, and effectiveness.

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based instruction. In many studies, web based instruction enhanced students towards WWW, computer, mathematics and science learning. Studies reveal that web based instruction is found to be an effective strategy in teaching of French phonetics, Mathematics and Statistics, English, Music, nursing research course, business information systems, pharmacology course to students. This strategy has not only been proved good in training computer nurses. Rattanavijai and Sharma (2003) concluded that students prefer over synchronous learning environment, since they do not have to specify specific time. Bayram, Deniz and Erdogan (2008) found significant between learners’ personality traits, academic achievement and attitude towards web based education. Apichatibutarapong, Worrachittanon, Tenissa and Petsuwan (2008) proved that web based instruction is an appropriate learning and teaching various subjects.

Saat and Bakar (2005) revealed that four factors influence the acquisition of science process skills in web based instruction i.e. (1) instructional materials, (2) the physical setting, (3) the role of the teacher, and (4) students readiness.


2.2 STUDIES RELATED TO WEB BASED INSTRUCTION AND LEARNING STYLE

Rourke and Lysynchuk (2000) investigated the influence of learner achievement in hypertext. The learning styles of 21 female and 20 enrolled in an Introduction to Psychology class were assessed using
Style Inventory (LSI). Students were divided into two groups and placed in two different learning environments. Subjects in the first group were presented with a hypertext module from a Web-based Introduction to Psychology course and a printed version of the same module was presented to the other group. Achievement was assessed with four 20-question multiple choice quizzes, each composed of 10 factual and 10 conceptual questions. A significant difference was found between Divergers, who scored highest, and Accommodators, who scored lowest. These results indicate that web-based learning environments affect the success of learners having different learning styles.

Terrell and Dringus (2000) investigated the effects of learning styles on student success in an online learning environment. The Kolb Learning Style Inventory was given to 98 information science students. Results showed that a majority of students can succeed in an online learning environment regardless of learning styles.

Grayson, MacDonald and Saindon (2001) studied the efficacy of Web-Based Instruction at York University. Results showed that grades of in-class students on every form of evaluation were higher than those of web students. Learning styles had a minimal effect on grades.

Shih and Gamon (2001) analyzed the relationships between student achievement and the variables - attitude, motivation, learning styles and selected demographics. The study included 99 students who took two web-based courses offered by the college of agriculture at a land grant university. Seventy-four (75%) students completed a learning style test, an on-line questionnaire and received a grade by the end of the semester. The learning style test was the Group Embedded Figures Test (GEFT), which classified students as either field-dependent or field-independent. The on-line questionnaire consisted of two scales (motivation and attitude). Over two-thirds of the students taking the web-based courses were field-independent learners; however, there were no significant differences in achievement between field-dependent and field-independent students. Also, students with different learning styles and backgrounds learned equally well in web-based courses. The students enjoyed the convenience and self-controlled learning pace and were motivated by competition and high expectations in web-based learning.
Aragon, Johnson and Shaik (2002) concluded that there are no significant differences in learning styles and learning performance between online and traditional graduate students.

Shih and Gamon (2002) analyzed the relationships among student achievement, learning strategies, learning patterns, learning styles and student characteristics. The population of this study included 99 students taking two Web-based courses offered by a land grant university in the United States. Seventy-four students completed a learning style test, an on-line questionnaire, and received grades by the end of the semester. The learning style test was the Group Embedded Figures Test (GEFT), which classified students as either field-dependent or field-independent. Findings of the study reveal that student’ learning styles, patterns of learning and characteristics did not have an effect on achievement measured in the Web-based courses. Additionally, field-independent students did not differ significantly from field-dependent students in their use of learning strategies and patterns of learning, leading to conclude that students with different learning styles and backgrounds learned equally well and did not differ in their use of learning strategies and patterns of learning in the Web-based courses.

Terrell (2002) found that in a web-based learning environment, students whose learning styles belonged to Convergers and Assimilators were likely to succeed than students whose learning styles belonged to Divergers and Accommodators.

Comeaux (2003) undertook a study including 62 college students who took a 20 minute web-based session. Each student completed a background questionnaire, video assessment questionnaire, working memory test, work load test, a comprehension test and a learning style test. The learning style test was the Group Embedded Figures Test (GEFT), which classified participants as either field independent or dependent. There was no significance difference in user performance levels between procedural / non-procedural tasks and segmented / non-segmented video types. However, when comparing the means for each task type and technology type then procedural / segmented seemed to perform much higher than the other groups. There was marginal significance difference for performance level depending on individual learning styles.
Harris, Dwyer and Leeming (2003) investigated the impact of learning style on performance in a Web-based learning environment. Students with different learning styles, as measured by Kolb's Learning Styles Inventory were randomly assigned to one of two Web-based training modules that differed only in terms of their number of multimedia enhancements and user interaction options. Outcome measures included an online final test over the material presented in the modules and an online survey measuring participants' reactions to the modules. The potential impact of learning style was also assessed with respect to the students' final grade in the lecture course. Results indicated that neither student learning style nor online course module version had any impact on mean test score or on reaction to the online module. Furthermore, learning style was not related to the students' overall performance in the lecture course.

Morte and Pettis (2004) examined the impact of a web-based instructional tool for all learning styles in mathematics on the academic improvement in the students’ scores and motivation. This study was done in a third grade classroom of twenty students. Students were given their user name and passwords before going to the computer. Students accessed OnlineIntervention.com site. Students navigated this site in a self paced session. After each chapter was taught, students were then assigned the quiz management of OnlineIntervention.com. After taking a quiz, students were given a list of Learning Tools based on their scores. 71% of the students stated the program had made them learn. 29% of the students stated that OnlineIntervention.com had made them think. 100% of the students stated that they wanted to use the computer to access OnlineIntervention.com over using a mathematics worksheet.

Wang, Wang, Wang and Huang (2006) investigated the effects of formative assessment and learning style on student achievement in a Web-based learning environment. A quasi-experimental research design was used. Participants were 455 grade VII students from 12 classes of 6 junior high schools. A Web-based course, named BioCAL, combining three different formative assessment strategies was developed. Subjects were tested on Kolb's learning style inventory and assigned randomly by class into three groups. Each group took Web-based courses using formative assessment strategies. Pre and post achievement testing was carried out. A
one-way ANCOVA analysis showed that both learning style and formative assessment strategy are significant factors affecting student achievement in a Web-based learning environment. However, there is no interaction between these two factors. Learners with a diverger learning style performed best followed by assimilator, accommodator and converger respectively.

Lu, Jia, Gong and Clark (2007) studied the relationship between Kolb learning styles and learning outcomes and the relationship between learning outcomes and the enduring time of a variety of different online learning behaviours. Prior to the experiment, 104 students majoring in Educational Technology completed Kolb's Learning Style Inventory (KLSI). Forty students were chosen to be subjects in an online learning experiment. Results indicated that there was a significant effect of Kolb learning style on the total reading time and total discussion time of the subjects. Although there was no significant effect between Kolb learning styles and learning outcomes, data from the experiment showed that the mean of learning outcomes of Convergers and Assimilators was higher than that of Divergers and Accommodators.

Brittan-Powell, Legum and Taylor (2008) investigated the role of student learning styles on student selection and performance within academic coursework which was delivered in either a fully online or in a traditionally face to face format. Kolb’s (2005) theory of individual learning styles was used to designate participants’ preferred cognitive strategy for incorporating new knowledge and experiences. Results show that no unique relationship exists between student learning style and their selection of a traditional face to face course compared to a fully online course. Furthermore, student performance both within and across each course delivery type was not influenced by learning style.

Sun, Lin and Yu (2008) explored the learning effect related to different learning styles in a web based virtual science laboratory for elementary school students. The online virtual lab allowed teachers to integrate information and communication technology (ICT) into science lessons. The results of this experimental teaching method demonstrated that students in the experimental group using the online virtual lab achieved better grades than those in the control group under traditional
class instruction. In the experimental group, grade achievements of students having different learning styles were not significantly different from each other leading to the conclusion that the web based virtual learning environment is suitable for various learning styles. Students with the accommodator learning style made the most significant achievements in this study, the scores obtained by the experimental group being remarkably better than those in the control group.

Hsieh and Dwyer (2009) examined the instructional effectiveness of different online reading strategies for students with different learning styles. Participants were 169 undergraduate students, randomly assigned to four online reading treatments: none, rereading strategy, keyword strategy and question and answer strategy. Immediately after interacting with their respective instructions, students received four individual criterion measures. Analyses indicated an insignificant interaction between learning style and treatment type. However, comprehension tests reflect a significant main effect for students receiving the online rereading treatment.

Bousbia, Rebai, Labat and Balla (2010) analysed the relationship between Learning Styles and Navigation Behaviour in Web-Based Educational System on 27 students of computer science at the engineering school (ESI-Algeria). The students used a hypermedia course on an e-learning platform. The learners navigation behaviour was evaluated using a navigation type indicator. The study shows that significant relationships exist between learning styles and learners’ navigation behaviour in Web-based environment. Although the chi-square dependency test shows the existence of such dependence only for the sensing/intuitive dimension over the sample, the distribution of the collected observations, in terms of navigation type affirms this dependence for all FSLSM (Felder and Silverman Learning Style Model) dimensions.

Rakap (2010) investigated the influences of learning styles/preferences, prior computer skills and experience with online courses on adult learners’ knowledge acquisition in a web-based special education course. Forty-six adult learners who enrolled in a web-based special education course participated in the study. The results of the study showed that (a) learning styles/preferences had significant effects on adult students’ knowledge acquisition, and (b) there is a moderate positive
correlation between computer skills and students' success. Data showed that there is no relationship between prior experiences with and success in a web-based course.

Zacharis (2010) investigated the relationship between students’ learners achievement in two different learning environments: online and traditional instruction. The results indicated that a) students in the online learning group had higher, but not significantly higher, levels of achievement than students in the traditional instruction group b) a student’s learning style had significant effect on their course grades in any of the two instruction methods c) there was no significant interaction between the learning style and instruction method.

Aral and Cataltepe (2012) analyzed learning styles for K-12 education and showed that applying different teaching methods for different styles could actually help a K-12 student understand a mathematics subject.

THE REVIEW

The perusal of results of related studies quoted in this chapter reveals that in a few studies, learning styles have impact on the achievement of students. Studies such as Lysynchuk 2000, Terrell 2002, Morte and Pettis 2004, Wang, Wei, Huang 2006 and Bousbia, Rebai, Labat and Balla 2010) reveal that web-based instruction has positive effect on the achievement of students having various learning styles.

However, studies of (Terrell and Dringus 2000, Shih and Aragon, Johnson, and Shaik 2002, Shih and Gamon 2002, Harr Leeming 2003, Lu, Jia, Gong, Clark 2007, Brittan-Powell, Legt 2008 and Hsieh and Dwyer 2009 and Zacharis 2010) conclude that there is no interaction between learning style and treatment type. It means that neither the learning style nor web-based instruction has significant effect on achievement, thus, leading to the conclusion that web-based instruction is effective for students with different learning styles.
Terrell and Dringus (2000) and Sun, Lin and Yu (2008) found that students achieved better grades in a web based learning environment than those in traditional class instruction regardless of learning styles.

Studies of Grayson, MacDonald and Saindon (2001) and Comeaux (2003) show that learning styles have minimal effect on achievement of learners.

2.3 STUDIES RELATED To WEB BASED INSTRUCTION AND INTELLIGENCE

Intelligence is considered as one of the most important factors in determining academic achievement. Therefore, the investigator tried to find out the effect of web based instruction on achievement in relation to intelligence. But the investigator could not trace a single study related with web based instruction and intelligence rather few studies related with web based instruction and multiple intelligence have been found to have significant effect on learning.

Nelson (1998) studied Internet/Web based instruction and multiple intelligences and found that internet-based tools provide multiple avenues for learning as well as the overall design of effective Web-based instruction i.e. catering to learners having different types of intelligences. The use of e-mail in Web-based training, however, appeals to learners who have heightened intelligences in linguistic, interpersonal, and intrapersonal areas. Linked assignments, additional articles and multimedia videos or graphics supplement and reinforce the topic of study for students with linguistic intelligence and intrapersonal intelligence. Listservs appeal to learners who have heightened intelligences in the areas of linguistics, intrapersonal, and interpersonal. Videoconferencing appeals to learners, who are linguistic, interpersonal, intrapersonal, bodily kinesthetic, and visual spatial.

Cantu (1999) developed and analysed an Internet Based Multiple Intelligences Model for Teaching High School History. The result shows that marrying of the traditional MI model with the Internet and World Wide Web, provides an engaging pedagogical approach that seems almost tailor-made for secondary history education and the model provides history teachers with powerful means for unlocking student understanding.
Osciak and Milheim (2001) evaluated web-based instruction by implementing MI strategies. Results indicate that by utilizing the principles of multiple intelligences, web-based instruction becomes a very flexible type of instruction which adheres to all intelligences and creates course content which is more engaging to the learner and leads to educational success.

Dara-Abrams (2002) evaluated application of Multi-Intelligent Adaptive Hypermedia to Online Learning by combining adaptive hypermedia and asynchronous Web communication technologies with the cognitive Theory of Multiple Intelligences. The study was conducted in three stages i.e. user characterization and understanding goals, development of prototype adaptive hypermedia framework and learning modules, and formative evaluation of prototype. The entire study was conducted online via a Web-based framework developed for the purposes of the study. The formative evaluation indicates that application of the Theory of Multiple Intelligences, the Entry Point Framework, multiple representations and the Teaching for Understanding Framework will improve the prototype, offering rich multi-intelligent adaptive hypermedia content presentations and moving toward an implementation of “anytime, anywhere, anyone, anyhow” online learning.

Arroyo, Beal, Murray, Walles and Woof (2004) designed and evaluated Web-based Intelligent Multimedia Tutoring System (Wayang Outpost) for High Stakes Achievement Tests. It is an adaptive tutor for maths. An evaluation was conducted with two groups of 95 students. Spatial and computational abilities were diagnosed with pretests before starting to use the system. Students were assigned to one of two versions of the system, spatial or computational. The student began a session by logging into the site and receiving a problem. Each math problem is presented as a flash movie. The findings of the study are: (i) Students with low spatial and high-retrieval profiles learn more with computational help (using arithmetic, formulas and equations) and students with high-spatial and low-retrieval profiles, learn more with spatial explanations (spatial tricks and visual estimations of angles and lengths). (ii) A significant gender differences in spatial ability, specifically in the number of correct responses is found i.e females having significantly less correct answers than males. Girls of low math fact retrieval do not improve their score when exposed to
computational hints, while they do improve when exposed to spatial hints. Boys gave no significant interaction effect between hint type and math fact retrieval.

Ashmore (2004) undertook qualitative field study and investigated Website Usability and the Theory of Multiple Intelligence. The sample comprised of 12 children with age 3-6 years. Results reveal that the highest intelligence types for children in the study were kinesthetic (M = 4.67, SD = 0.78), spatial (M = 4.67, SD = 1.61) and intrapersonal (M = 4.50, SD = 1.38). The medium intelligence types were musical (M = 3.92, SD = 1.38), interpersonal (M = 3.83, SD = 1.75) and logical (M = 3.42, SD = 1.98). The lowest was linguistic (M = 3.0, SD = 1.28). Children with high logical intelligence had the greatest success, while children with high linguistic intelligence had the greatest satisfaction. Analysis of the comments of children and their usage patterns reveal that the biggest navigation obstacles were inability to read, poor mouse control and problems with the interface design. Age, gender, previous Internet experience, siblings, computer configurations and poor ergonomics affected usability. Results suggest that simpler navigation schemes, interface designs that engage spatial rather than linguistic intelligence and features that positively engage a variety of intelligence types will make Web sites easier for children to use.

Own and Li (2004) integrated the Theory of Multiple Intelligences in the Chemical Equilibrium Course to Improve Student's Learning Achievements. A learning environment was set up which was based on the multiple intelligences (MI) theory applied to the internet. Students of this experiment were divided into two groups of learning environments, i.e. the Multiple Intelligences learning web title and general learning web title. The students’ cognitive style and Multiple Intelligences were identified by the questionnaires. The ACS test and SPSS were used to analyse the data obtained respectively. After analyzed all the factors, it was found that MI web-based learning has a very positive effect on overall students especially on field-independence students and who only have the Naturalist, or not only have one more intelligences simultaneously shown better achievements in the MI learning environment.
Atan, Noor, Majid, Leong, Luan and Fook (2007) investigated the effectiveness of the Multiple Intelligence Web-based Learning (MIWBL) approach in terms of the students’ academic performances as compared to the commonly used Web Content-based Learning (WCBL) approach. The sample of this study consisted of 103 students randomly chosen from a total of 456 students enrolled in the first year ZCT-104 Modern Physics course offered by the School of Physics, Universiti Sains Malaysia. The students were randomly divided into two separate groups (Group A and Group B), each treated with either the WCBL or the MIWBL approach. To determine the learning outcomes from the treatments, the students were given the pre-test before the treatments and a similar post-test after the treatments. A comparative analysis of their scores was conducted by means of a student t-test using a standard statistical package. The results indicate that the MIWBL approach yielded better students’ academic performance as compared to WCBL. This implies that the students perform better, after having acquired significantly enhanced understanding of the concepts they are supposed to learn. The MIWBL approach, which is designed to conform to the multiple intelligences inclinations and preferences of the students with high level thinking skills activities, creates an engaging learning environment through social interaction, acquisition of skills in meta-cognitive reasoning and proficiency in problem solving skills.

Berenson, Boyles and Weaver (2008) studied emotional intelligence as a predictor for success in online learning. This study examined the intrinsic factors of emotional intelligence (EI) and personality to determine the extent to which they predict grade point average (GPA), a measure of academic success, among students attending community college. Stepwise multiple regression revealed that EI was the primary predictor of academic success in online courses, but the combination of EI and personality served as a stronger predictor of online student academic success. EI was directly associated with GPA among online students. Higher grades corresponded to greater levels of EI. The implication is that soft skills like EI and certain predominant personality characteristics may be closely related to students’ academic success in online courses.

Andrioti (2010) studied the use of multiple Intelligence, humour, and technology for teaching composition in the college classroom and found success rate increased by nearly 17% in case of online course incorporating multiple intelligence and
humour. Most students (98%) strongly agreed that the MI assessment assisted them in becoming more effective learners.

Lopez and Patron (2011) examined multiple intelligences in online, hybrid and traditional business statistics courses. The sample comprised of a group of 128 students from four different courses in Business Statistics. The results obtained from the study showed that individuals possess all the seven intelligences and most students can develop each intelligence to an adequate level of competency if given the appropriate encouragement, enrichment and instruction. The findings of the study show that interpersonal is the most dominant type of intelligence and the two least dominant types of intelligence are spatial and linguistic, which are the ones that instructors typically appeal to as they emphasize lectures, memorization of names, words, concepts, and use powerpoint slides and charts. Further, results indicate that instructors should assign students more group work and encourage peer teaching. New teaching tools, like the clickers, should not be used for solving problems individually, but to create cooperation and interaction among the students. Furthermore, instructors of online Statistics courses need to use interpersonal techniques in their classes. These include online discussion groups, wikis, blogs, and online “live” activities

THE REVIEW

Although the investigator could not trace a single study related with web based instruction and intelligence, but all the above quoted studies show that utilizing the principles of multiple intelligences in web based instruction may make the instruction flexible adhering to all intelligences and create course content which is more engaging to the learner and leads to better achievement. Study of Berenson, Boyles and Weaver (2008) reveals academic success can be enhanced by implementing emotional intelligence in online learning.

THE OVERVIEW

It is concluded from the review of above studies that majority of those on web based instruction were done to analyze the effectiveness of this technique as an instructional strategy. By and large, researchers have remained focussed more on web based instruction and achievement. The research studies quoted in this chapter
also reveal that there has been less work undertaken even in abroad aiming at the relationship between web based instruction and learning styles. As one goes through the research works already accomplished, one is surprised and even shocked to find that studies on relationship of web based instruction and achievement and intelligence have been woefully negligible. In regard to the relationship between learning style and intelligence in web based environment, the factual story is strongly the same. The perusal of the contents given in the earlier pages of the chapter reveals that investigator could not trace any study that explores the effect of web based instruction on achievement in relation to learning style and intelligence. Thus, it is clear that nothing even remotely adumbrates that the earlier investigators in our country ever seriously thought of undertaking empirical researches on an extensive scale for discovering the relationship of achievement and its relationship with the variables of the present study i.e. web based instruction, learning style and intelligence.

2.4 HYPOTHESES OF THE STUDY

On the basis of review of literature following hypotheses were framed:

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 difference in achievement of class IX students in Biology with high and low level of intelligence.

4. There will be no significant interactional effect of instructional strategies and learning styles on achievement of class IX students in Biology.

5. There will be no significant interactional effect of instructional strategies and intelligence on achievement of class IX students in Biology.

6. There will be no significant interactional effect of learning styles and intelligence on achievement of class IX students in Biology.

7. There will be no significant interactional effect of instructional strategies, learning styles and intelligence on achievement of class IX students in Biology.