EFFECT OF INTERACTIVE WHITEBOARD TECHNOLOGY ON ACHIEVEMENT IN ENGLISH OF SECONDARY SCHOOL STUDENTS IN RELATION TO LINGUISTIC APTITUDE AND SELF EFFICACY

A SUMMARY OF THE THESIS
Submitted to the
FACULTY OF EDUCATION
PANJAB UNIVERSITY CHANDIGARH
for the degree of
DOCTOR OF PHILOSOPHY
2015

SONIA RANI

DEPARTMENT OF EDUCATION
PANJAB UNIVERSITY
CHANDIGARH
INTRODUCTION Nowadays, just chalk and board is not enough to attract attention of the students who are intensely exposed to external stimulus like television and computer. In the presence of a changing society, the only way to provide more effective education is redesigning teaching and learning processes systematically and using human and technological resources mutually by integrating learning and communication (Reiser 1987, p.11). Thus, well educated individuals as the products of applied modern education system have the ability to represent societies in which they live in an international arena (Ozsoy 2003, p.24). The influence of sense organs on learning is indisputably tremendous. The learning is more effective and permanent, when the teaching is more appealing to the sense organs. Several theories of learning assert that technological tools have an influence, which words cannot achieve alone, on directing individuals, focusing their attention, and their capability to analyze and synthesize. Max Wertheimer from Gestalt school of psychology however asserts in his classic “Productive Thinking” that individuals should understand the inner structure of knowledge in order to learn. Visual learning is one of the techniques of learning the inner structure of knowledge (Lawrance 2007, p.1). Gagne indicates that the aim of teaching is the development of students’ problem solving skills that is parallel to Wertheimer. According to Gagne, learning depends on configuration of external stimulus with cognitive processes. (Akinoglu et al. 2007, p.131). Cognitive theorists further explain learning by means of internal processes. According to cognitive theory, some parts of the environmental stimulus have come to short-term memory via selective perception. Short-term memory is a memory that holds a small amount of information for a short period of time. Considering the capacity of the short-term memory despite all the stimuli competing for attention, attractive stimulus should be presented to ensure that learners focus on the objective (Yalın 2002, p.83). Long-term memory with a larger capacity on the other hand permanently holds the information in a complex mental organization. In view of technology use of students as a part of their daily life, classical education that has been in school- teacher-student triangle for thousand years has remained incapable and using new multi-channel alternatives has become a necessity (Oguz, Oktay & Ayhan 2004, p.21). In the presence of changing society, the only way to provide more effective education is systematically redesigning teaching and learning processes and also mutually using human and technological resources by integrating learning and communication (Reiser, 1987 p.11). One of the most advanced educational technologies, interactive white board technology is a technology that transmits computer screen to the whiteboard by means of a projector and that enables controlling the computer by only touching the whiteboard with a special pen (Becta 2003, p.1). Many studies indicate that the interactive white board technology facilitates and increases learning. They are used in a variety of settings, including classrooms at all levels of education, in corporate board rooms and work groups, in training rooms for professional sports
coaching, in broadcasting studios, and others. The first interactive whiteboards were designed and manufactured for use in the office. They were developed by Xerox Parc around 1990. This board was used in small group meetings and round-tables (Wikipedia, 2014). An interactive whiteboard is frequently used in educational settings. The interactive whiteboard forms a bridge between a teaching surface and a digital projector and computer. Only a single user could use interactive whiteboard in the past time. But now multiple users can interact with interactive whiteboards.  

This type of tool promotes creative teaching and motivates students into absorbing information. Teaching with an interactive whiteboard allows lecturers to accommodate all different learning styles: 

Tactile learners get to touch and move things around the board. They can also make notes and highlight elements, Visual learners benefit from a clear view of what is happening on the board, Audio learners can participate in a class discussion.

Interactive whiteboards promote group discussion and participation. They are an effective tool for brainstorming as notes made on the screen can be turned into text, and saved to be shared and distributed later. They are an ideal tool for small group work and collaborative learning, as students can huddle around the board developing ideas, and then save the work for sharing over a network or by email (Wikipedia, 2014).

Interactive whiteboards are an effective way to interact with digital
content and multimedia in a multi-person learning environment. Learning activities with an interactive whiteboard may include: Manipulating text and images, making notes in digital ink, saving notes for later review by using e-mail, the web or print, viewing websites as a group, demonstrating or using software at the front of a room without being tied to a computer, creating digital lesson activities with templates, images and multimedia, writing notes over educational video clips, using presentation tools that are included with the whiteboard software to enhance learning materials and showcasing student presentations (Wikipedia, 2014). Interactive Whiteboards can be classified as fixed and mobile boards. The different kinds of interactive whiteboards are as; many interactive whiteboards have a built-in projector with adjustable height, most interactive whiteboards are equipped with sound amplification and speakers and some contain an integral processor and can be operated without a computer. Interactive whiteboards can also be classified on the basis of size like smaller interactive whiteboards are about 40-50 inches in size and larger models are available up to 95 inches in size. Some interactive devices are also used to compliment the interactive whiteboards. For example, small wireless interactive tablets allow remote access to the board from anywhere in the class. A visualizer or document camera can also be invested to project a still or live video image onto the interactive whiteboard screen. However, different types of interactive whiteboards differ in their functions, design and the software used. Now interactive whiteboard curriculum materials that contain interactive lesson materials and activities are also available. On the websites that contain educational content that has been produced with the interactive whiteboard in mind; teachers simply repurpose existing web content and use it on the interactive whiteboard screen. Online user communities and groups are also created by schools and commercial suppliers to share and swap lesson materials they have created. Now, commercial suppliers
operate their own file formats for interactive whiteboard software; however, in 2007, British Educational Communications and Technology Agency of United Kingdom began to create a common file format to use material on an interactive whiteboard. Since computers entry into education environment, advances in technology used in classes increase without any slow down. One of these developments is “the interactive whiteboard technology” that becomes more and more prevalent in our country in recent years. Interactive white board technology that enables using white boards just like computers is first produced by Smart Technologies Company in the U.S.A. in 1991 (Shenton & Pagett 2007, p.129). Interactive white board technology is a technology that moves computer screen to the whiteboard by means of a projector and that enables controlling the computer by only touching the whiteboard with a special pen (Becta 2003, p.1).

5.2 NEED AND SIGNIFICANCE OF THE STUDY Today’s students are digital natives. They grow up immersed in technology long before they set foot in the classroom. They are connected to the entire world through television, the internet, and a myriad of personal devices in electronic and digital format. Classrooms equipped for the 21st Century demand curriculums that integrate technology resulting in high standards, high expectations, and high results. With this in mind, teachers must acknowledge how students learn today and find every possible way to teach children and improve learning (Lutz, 2010). Teachers are turning to technologies, specifically interactive whiteboard, which can provide a variety of tools and do multiple things. The more a student participates in classroom instruction, the more likely that student is to absorb and internalize the material being taught. When teachers teach in ways that students learn in today’s digital age, students are much more engaged in the lesson content and are more interested in the information. There is much excitement concerning interactive whiteboards and their ability to engage children. “Educators say it's important to incorporate technology into the lower grades because most children entering school today are "Internet natives" - they have always had technology at home and have come to expect it wherever they go. Schools need to and give students a multimedia experience” (Wikipedia, 2013). The importance of this study lies in its practical value and its contribution to the pedagogical body of knowledge. Technology utilization and proficiency are required of teachers and students as requisite 21st century skills. The interactive whiteboard is one type of technology that can be successfully integrated in
schools’ technology plans at low cost for the school. Currently, however, interactive whiteboards are not widely used for regular classroom instruction. To date, there have been few studies conducted regarding interactive whiteboard use and its effects on student engagement and behavior. Most of the research that has been done focuses on teacher use, perception, pedagogy, and training needs. Studies involving the student perspectives have examined learning styles, teaching styles, and application in particular academic disciplines. Those studies that have explored student engagement and motivation have looked primarily at teacher perceptions of student engagement and student self-perceptions through survey response regarding their own enjoyment and interest as the determinants. This study proposes that student engagement is also evidenced by student at-task behaviors during the lessons. The visual impact and interactive nature of whiteboards may involve students in ways that increase their at-task behaviors due to their engagement in instruction.
This has usefulness for teachers in the areas of maintaining student focus and attention, retention of course material, and for classroom management issues. Use of the interactive whiteboard in middle school classrooms also addresses the developmental needs of this age group. Literature on middle school student characteristics and performance indicate that student motivation and academic achievement decline during this maturational stage. Student focus shifts from academic performance to social relationships as the driving priority. Consequently, they respond well to teaching strategies that use collaboration, interactivity, and problem-solving. Whiteboard use can incorporate these strategies in ways that engage students more fully in lessons, foster greater enthusiasm for learning, and increase student motivation and ultimately to their academic achievement. Some researches have been conducted regarding the students’ perceptions of technology in general, but this often has been conducted at the college level. Specific research on high school students’ perceptions of the interactive whiteboard is lacking. Thorough research studies with the interactive whiteboard have been conducted at the primary level (Wall, Higgins & Smith, 2005). However, the view of secondary students may differ from primary level students and college students. Therefore, it is essential to explore secondary level students’ perceptions of the interactive whiteboard’s benefits. The idea for this research study began with the lived experience of the investigator as a Secondary school teacher using an interactive
whiteboard. The influence on children’s storytelling in the classroom when the investigator offered the students an opportunity to use an interactive whiteboard was illuminated one day as the investigator worked with a small group of four year old students. The school had just received some interactive whiteboards through a technology grant and she was offered a chance to use one in the classroom. The investigator immediately grasped the opportunity and was anxious to see the possibilities it would offer children as a new technological tool in my classroom. Though number of studies have been conducted abroad with students at high school and at primary level regarding mathematics achievement but fewer have focus in English subject and a very less number of researches have been done in India on individual differences like English self-efficacy and achievement in English. This also fascinated the investigator to explore this area to find out the relevance of interactive white board in relation to English self-efficacy and English linguistic aptitude. 5.3 STATEMENT OF THE PROBLEM EFFECT OF INTERACTIVE WHITEBOARD TECHNOLOGY ON ACHIEVEMENT IN ENGLISH OF SECONDARY SCHOOL STUDENTS IN RELATION TO LINGUISTIC APTITUDE AND SELF EFFICACY 5.4 OPERATIONAL DEFINITION OF THE VARIABLES i) Interactive Whiteboard Technology- An interactive whiteboard is a presentation system that connects a computer to a projector and screen. Through the use of either special pens or even fingertips, presenters can manipulate the images on the screen. ii) Conventional Method of Teaching- Conventional method of teaching is a method in which a teacher plays an active role and students are passive. This is also known as authoritative method of teaching. It is thought that everything taught by the teacher is understood by the learners. iii) Achievement - Something accomplished successfully, especially by means of exertion, skill, practice, or perseverance is known as achievement. Achievement in English is the outcome of education — the extent to which a student, teacher or institution has achieved their language achievement goals. iv) English Linguistic Aptitude- Language learning aptitude refers to the prediction of how well, relative to other individuals; an individual can learn a foreign language in a given amount of time and under given conditions. As with many measures of aptitude, language learning aptitude is thought to be relatively stable throughout an individual’s lifetime. v) English Self Efficacy- English Self efficacy is a person’s belief in his/her own competence, i.e., as the belief that one is capable of performing in a certain manner to attain a certain set of goals of English language. It is believed that our personalized ideas of self-efficacy affect our social interactions in almost every way. 5.5 DELIMITATIONS The study was delimited with respect to the following: (i) The present study was confined to Xth class English students of Senior Secondary Schools of Ambala Region affiliated to Central Board
School Education, New Delhi only. (ii) 20 lessons based on Interactive Whiteboard Technology were developed in English Grammar on topics such as Determiners, Tenses, Subject Verb Agreement, Active and Passive Voice, Reported Speech from the prescribed syllabus of Xth class. (iii) The experimental treatment was confined to about 40 working days of the academic session. (iv) The study was confined to classifying variables i.e. English linguistic aptitude and English self efficacy.

5.6 OBJECTIVES The study was conducted to achieve the following objectives: 1. To develop interactive whiteboard technology based instructional package for selected units of English grammar. 2. To develop and standardize criterion reference test for selected units of English grammar. 3. To develop and standardize achievement test in English for selected units of English grammar. 4. To develop lesson plan based on conventional method of teaching for selected units of English grammar. 5. To develop and standardize English linguistic aptitude scale. 6. To develop and standardize English self efficacy scale. 7. To compare the achievement of groups taught through interactive whiteboard technology and conventional method of teaching in English. 8. To compare the achievement of high and low groups of students in English linguistic aptitude. 9. To compare the achievement of different groups of students in English self-efficacy. 10. To examine the interaction effect of instructional strategies and English linguistic aptitude on achievement in English. 11. To examine the interaction effect of instructional strategies and English self-efficacy on achievement in English. 12. To find out the interaction effect of English linguistic aptitude and English self-efficacy on achievement in English. 13. To examine the interaction effect among instructional strategies, English linguistic aptitude and English self efficacy.

5.7 HYPOTHESES The study was designed to attain the
following hypotheses: H1: There exists no significant difference in gain achievement scores of group taught through interactive whiteboard technology and conventional teaching method in English. H2: There exists no significant difference in gain achievement scores of high and low group of students in English linguistic aptitude. H3: There exists no significant difference in gain achievement scores of high, average and low group of students in English self-efficacy. H4: There exists no significant interaction effect between instructional strategies and English linguistic aptitude on achievement in English. H5: There exists no significant interaction effect between instructional strategies and English self-efficacy on achievement in English. H6: There exists no significant interaction effect between English linguistic aptitude and English self-efficacy on achievement in English. H7: There exists no significant interaction effect among instructional strategies, English linguistic aptitude and English self-efficacy on achievement in English. 5.8 SAMPLE: A sample is a finite part of a statistical population whose properties are studied to gain information about the
When dealing with people, it can be defined as a set of respondents (people) selected from a larger population for the purpose of a survey. A population is a group of individual persons, objects, or items from which samples are taken for measurement. Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population. The sample of a study can have a profound impact on the outcome of a study. The sampling distribution can be thought of as the result of repeating a sampling operation many times with a fixed sample size, and calculating a statistic like from each sample. It provides a way of determining the significance level of a given result under the null hypothesis. The sample in the present study was drawn at the school and student level. The school sample was drawn from Senior Secondary Schools of Ambala region affiliated to Central Board of Secondary Education, New Delhi. These schools have same class climate, physical facilities, teacher taught ratio, sex ratio etc. The list of four schools taken for the study is given below: (i) Murlidhar D.A.V. Senior Secondary Public School, Ambala City. (ii) Anglo Sanskrit Senior Secondary School, Ambala City. (iii) Suman Bala Senior Secondary Public School, Ambala City. (iv) Surya Senior Secondary Public School, Ambala City. After selecting schools, the intact sections of each school were randomly taken for experimental and control group. The present study was conducted on an initial sample of 400 students of 10th class of Senior Secondary Schools of Ambala Region. Out of total schools of northern region, 5 schools were randomly selected on basis of availability of interactive white board technology, strength of students and approachability of schools. After selecting the schools, the student sample was drawn randomly. The 200 students were divided each into experimental and control group for the conduct of the experiment. In the sampling procedure of the study, multi stage sampling was done such as in the first stage, four schools were randomly selected out of the northern region. In the second stage, the intact sections were randomly selected out of the four schools. These sections were renamed as experimental and control group. In the third stage, the test of English linguistic aptitude was administered. High and low groups on this variable were formulated
according to Kelley (1939) criteria of taking up top 27% and bottom 27% student as constituting the high and low groups respectively. In the fourth stage, the test of English self-efficacy was given and high, average and low groups of students on this variable were formulated. 5.9 DESIGN The present study was experimental in nature. A pre-test and post-test factorial design was employed. In order to analyze the data, 2×2×3 factorial analysis of variance was used. One group was treated as experimental group and second group was treated as control group. The experimental group was taught through interactive whiteboard based instructions and control group was taught same topics with traditional method of teaching. The study covered three variables viz. (i) instructional treatment (ii) English linguistic aptitude and (iii) English self-efficacy. The variable of instructional treatment was studied at two levels, namely interactive whiteboard based instruction and traditional method of teaching.

The variable of English linguistic aptitude was studied at two levels i.e. high and low linguistic aptitude. The variable of English self-efficacy was studied at three levels high, average and low self-efficacy. The main dependent variable was achievement gain which was calculated as the difference in post-test and pre-test scores for the subject.

5.10 CONTROLS IN EXPERIMENTAL DESIGN The process of taking time and effort to organize the experiment properly to ensure that the right type of data, and enough of it, is available to answer the questions of interest as clearly and efficiently as possible is called experimental design. A scientific control is an experiment or observation designed to minimize the effects of variables other than the single independent variable. This increases the reliability of the results. There are many forms of controlled experiments. A relatively
simple one separates research subjects into two groups: an experimental group and a control group. No treatment was given to the control group, while the experimental group is changed according to some key variable of interest, and the two groups are otherwise kept under the same conditions.

Controls eliminate alternate explanations of experimental results, especially experimental errors and experimenter bias. In the present study, the investigator controlled the extraneous or situational variables through the following techniques: (i) Matching of the Groups: Matching of the groups was one of the control in which all the relevant variables were controlled. The matching of the groups was done on all the relevant variables like intelligence, age, entry behaviour of the learner etc. (ii) Randomization: In randomization, the groups that receive different experimental treatments are determined randomly. Using randomization is the most reliable method of creating homogeneous treatment groups, without involving any potential biases or judgements. It was another control which was exercised for the allocation of students to various treatment groups e.g. experimental group and control group. (iii) Method of Counter Balancing: This method was used by following same sequence in
administration of all the tools, by keeping up similar time limits for teaching in the experimental and control group. No time gaps were allowed for data collection in the experimental and control group. (iv) Method of Holding Situational Variables Constant: The investigator took equal number of subjects in both experimental and control group, taught them by investigator herself and in the same environmental conditions such as presence or absence of distracting noise etc. The investigator used the similar sequence and conditions to administer pre-tests, instructions and post-tests in similar conditions of classroom environment and instructions.

5.11 TOOLS USED The following tools were used for collecting data: 1. A Criterion Referenced Test in English grammar was developed by investigator herself. 2. An Achievement Test in English grammar was developed by investigator herself. 3. Instructional Material based on Interactive Whiteboard Technology and Conventional Method of Teaching was developed by investigator herself. 4. English Linguistic Aptitude Test by Misra and Dubey (2014) was used. 5. English Self-Efficacy Scale was developed by investigator herself. 5.12 PROCEDURE After the selection of sample and allocation of students in two groups for two instructional strategies, the experiment was conducted in five phases as following: Firstly, the investigator made necessary arrangements with the principals of schools selected for the experiment. An achievement test as a pre-test was administered on the total sample. Students were given 45 minutes to complete the test. The answer-sheets were scored to obtain the information regarding the previous knowledge of the students. Before implementing the interactive whiteboard technology based instructional strategy, the two groups i.e. experimental and control groups were randomly decided and matched on the basis of pre-test scores so that equivalent groups could be formed. Secondly, English linguistic aptitude test and English self-efficacy scale was administered for the classification of the students. Thirdly, treatment was given to the experimental group. The experimental group was taught through interactive whiteboard technology based instructional strategy. Twenty lessons based on interactive whiteboard technology with each session of 45 minutes on selected units of English grammar were taught to the students. The control group was taught the same topics through conventional method of teaching. The two groups were taught for about 40 working days. Fourthly, after the completion of the course, same achievement test was administered simultaneously as post-test to the students of
both the groups. Time limit for the test was 45 minutes. The answer-sheets were scored with the help of scoring key. Experimental and control group scores were compared according to their pre-test and post-test scores. The difference was the gain achievement scores. 5.13

| STATISTICAL TECHNIQUES USED | The following statistical techniques were used to test the hypotheses: (i) Descriptive statistical techniques like mean, standard deviation, skewness and kurtosis were used to see the nature of distribution of the scores. (ii) A three way Analysis of Variance (2x2x3) was employed on the gain achievement scores to test the hypotheses, related to the strategy of teaching, English linguistic aptitude test and English self-efficacy scale. (iii) For the significant F-ratio, the t-test was employed so as to find out the significance of difference between means related to different groups and different variables. (iv) Graphical techniques were used for descriptive analysis and visual perception of the data. |

5.14

FINDINGS The following conclusions were drawn which are described below such as: 1. The performance of group taught through interactive whiteboard technology was found to be significantly higher than that of conventional teaching strategy in English. 156 2. The performance of high English linguistic aptitude group was found to be significantly higher than that of low English linguistic aptitude group of students in English. 3. The performance of students with different self-efficacy group was found to be significantly different from one another in English. Further analysis revealed that: ? The mean gain achievement score was not found significant for high and average English self-efficacy group. ? The mean gain achievement score was significantly higher for high English self-efficacy group than that of low English self-efficacy group. ? The mean gain achievement score was not found significant for average and low English self-efficacy group. 4. There was significant interaction effect of instructional strategies and English linguistic aptitude on achievement in English. Further analysis revealed that: ? The high English linguistic aptitude of experimental group exhibits high mean gain scores than low English linguistic aptitude of experimental group. ? The high English linguistic
aptitude of experimental group possesses high mean gain scores than high English linguistic aptitude of control group. The high English linguistic aptitude of experimental group exhibits high mean gain scores than low English linguistic aptitude of control group. Rest of the combinations of instructional strategy and English linguistic aptitude group did not yield significant difference in mean gain achievement scores. 5. There was significant difference in the gain achievement scores in English due to interaction effect of instructional strategies and English self-efficacy. Further analysis revealed that: The high English self-efficacy of experimental group possesses high mean gain scores than that of average and low English self-efficacy of experimental group. The high English self-efficacy of experimental group possesses high mean gain scores than that of high, average and low English self-efficacy of control group. The low English self-efficacy of experimental group exhibits high mean gain scores than that of low English self-efficacy of control group. The high English self-efficacy of control group possesses high mean gain scores than that of low English self-efficacy of control group. The average English self-efficacy of control group possesses high mean gain scores than that of low English self-efficacy of control group. Rest of the combinations of instructional strategy and English self-efficacy group did not yield significant difference in mean gain achievement scores. 6. There was no difference in the gain achievement scores in English due to interaction effect of English linguistic aptitude and English self-efficacy. 7. The interaction effect among instructional strategies, English linguistic aptitude and English self-efficacy do not ascribe to significant difference in mean gain achievement scores in English.

5.15 EDUCATIONAL IMPLICATIONS OF THE FINDINGS

The findings of the present study revealed that interactive whiteboard based instructional strategy geared towards students’ needs, interests and expertise. It provided flexible learning environment and enhanced achievement in English grammar. In the present research, students taught through interactive whiteboard based instructional strategy exhibited better gain in achievement in English grammar as compared to students taught by conventional teaching strategy. Following are the educational implications of the present study: (i) Development of interactive
whiteboard based instructional material is not an expensive affair because once the package is developed; it can be used for many years with the required updating. So, schools should make one time investment in the development of the material. (ii) Potential of interactive whiteboard based instructional strategy should be utilized to enhance quality of education at school level. (iii) Parents should encourage their children to utilize educational packages available in the market. (iv) Interactive whiteboard based instructional material can be helpful to create positive teaching learning environment in classroom as it increases the concentration and interests of the learners towards learning process. (v) Most of the teachers are not computer literate. Further, those who are computer literate are not equipped or trained to develop and use interactive whiteboard based instructional material in teaching learning process. Therefore, computer should be the compulsory course in the pre-service teacher training programme. In-service computer literate teachers can be given an opportunity to enhance their skills and competencies required for the development and use of interactive whiteboard based instructional material. (vi) Students with low self efficacy in English should be identified and for alleviation of self efficacy special seminars, counseling programmes, additional classes, individual classes and group therapy should be organized. (vii) School administrations should utilize such programmes in their school. (viii) School administration should arrange for providing technical and software training to teachers so that they can create multimedia instructional material to support students’ learning. (ix) Students with high linguistic aptitude can be paired with students with low linguistic aptitude. This would enable students to learn from their peers and increase their confidence in the presence of a friend rather than an educator. (x) Schools should make provision for individual counseling as it can serve as an effective intervention to improve self-efficacy.

5.16 SUGGESTIONS FOR FURTHER RESEARCH In the light of the findings revealed and conclusions drawn from the study, the following suggestions may be considered for further studies: (i) The effectiveness of interactive whiteboard based instructional material may be studied on a sample of students from different ecological backgrounds. (ii) The present study may be replicated on a wider range of sample for more valid generalizations. (iii) Research studies may be undertaken to determine the effectiveness of different forms of interactive whiteboard based instructional strategy for various subject areas and at different grade levels. (iv) The present study was conducted to see the effect of interactive whiteboard based instructional strategy in teaching of English. Such studies are needed to be planned and conducted in other subject areas such as mathematics, sciences and social sciences. (v) In the present study, the effect of interactive whiteboard based instructional strategy was studied in relation to linguistic aptitude and self-efficacy only. Further studies can widen scope by incorporating other variables like gender, achievement motivation, study habits, problem solving ability, learning style, multiple intelligence and etc. (vi) The studies comparing the effectiveness of interactive whiteboard based instructional strategy with other instructional strategies i.e. computer assisted instruction, web based instruction and computer based cooperative learning etc. can be conducted. (vii) In the present study, interactive whiteboard based instructional material was developed only
on five topics of English grammar; the same may be replicated on the whole syllabus.

(viii) Diagnostic and remedial work can also be carried out in the field of education with the use of interactive whiteboard based instructional strategy. (ix) The present study was conducted in senior secondary private schools of Ambala city. The further study can be extended to government schools and comparisons can be made on the effect of interactive whiteboard based instructional strategy on achievement of students in private and government schools.