Every research shows its results after the data are analysed. The findings of the research will have to be implemented if they are very effective for the benefit of the students who pursue their studies in the future. The effectiveness of CAI and CL is marvellous. The students to whom the treatments were administered had a new experience in the way of their learning. Teaching by the dint of CAI and CL mitigated the burden of their studies. For them it was very easy, interesting and effective.

This chapter deals with a summary of the major findings, recommendations and suggestions. It deals with recommendations to different regulatory bodies such as National Council for Teacher Education (NCTE), National Assessment and Accreditation Council (NAAC), National Council of Educational Research and Training (NCERT), the Universities of B.Ed Programme, Department of School Education, Curriculum developers and Educational planners, managements of Schools and Government administrators. It also imparts suggestions to the researchers for further studies related to this particular field.

This study was conducted with a vision to find out the effect of Computer Assisted Instruction (CAI) and Co-operative Learning (CL) on the achievement of higher secondary students in chemical bonding in chemistry. In the study, there are only three variables namely Computer Assisted Instruction, Co-operative Learning and Achievement. Computer Assisted Instruction and Co-operative Learning are the independent variables whereas achievement is the dependent variable. This study adopted Pre-test – Post-test Equivalent Group Design (Best & Khan, 2006) with the sample of 50 students for each group. The control group was taught through the conventional method and the experimental groups-I & II were given treatments under Computer Assisted Instruction and Co-operative Learning Strategies. Both the sample groups underwent pre-test, post-test and delayed post-test.
The findings obtained from this experimental study employing statistical techniques such as SD, t-tests for independent and dependent means and analysis of covariance are stated below.

5.1 FINDINGS OF THE STUDY

Pre-test Analysis

1. There is no significant difference between the control group taught by traditional method and the experimental group-I by Computer Assisted Instruction in the overall pre-test scores of chemical bonding.

2. There is no significant difference between the control group taught by traditional method and the experimental group-II by Co-operative Learning in the overall pre-test scores of chemical bonding.

3. There is no significant difference between the pre-test scores of the control group taught by traditional method and the experimental group-I by Computer Assisted Instruction with regard to the level of intelligence.

4. There is no significant difference between the pre-test scores of the control group taught by traditional method and the experimental group-II by Co-operative Learning with regard to the level of intelligence.

Post-test Analysis

5. There is significant difference between the post-test scores of the control group and the experimental group-I. The mean scores show that the experimental group-I performed better than the control group in the post-test of chemical bonding.

6. There is significant difference between the post-test scores of the control group and the experimental group-II. The mean scores show that the experimental group-II performed better than the control group in the post-test of chemical bonding.
7. There is significant difference between the post-test scores of the control group and the experimental group-I with regard to the level of intelligence. The mean scores show that the experimental group-I performed better than the counterpart in the post-test of chemical bonding with regard to the level of intelligence.

8. There is significant difference between the post-test scores of the control group and the experimental group-II with regard to the level of intelligence. The mean scores show that the experimental group-II performed better than the control group in the post-test of chemical bonding with regard to the level of intelligence.

Pre-test – Post-test Analysis of Control and Experimental Groups

9. There is significant difference between the pre and post-test scores of the control group taught by traditional method. The mean scores show that the control group performed better in the post-test of chemical bonding.

11. There is significant difference between the pre and post-test scores of the experimental group-I by Computer Assisted Instruction. The mean scores show that the experimental group-I performed better in the post-test.

12. There is significant difference between the pre and post-test scores of the experimental group-II by Co-operative Learning strategy. The mean scores show that the experimental group-II performed better in the post-test.

Gain Score Analysis

12. There is significant difference between the gain scores of the control group and the experimental groups-I. The mean scores show that the experimental group-I performed better than the control group in chemical bonding.
13. There is significant difference between the gain scores of the control group and the experimental groups-II. The mean scores show that the experimental group-II performed better than the control group in chemical bonding.

14. There is significant difference between the gain scores of the control group and the experimental groups-I with regard to the level of intelligence. The mean scores show that the experimental group-I performed better than the control group with regard to the level of intelligence.

15. There is significant difference between the gain scores of the control group and the experimental groups-II in chemical bonding with regard to the level of intelligence. The mean scores show that the experimental group-II performed better than the control group with regard to the level of intelligence.

16. There is significant difference between the gain scores of the experimental groups-I & II. The mean scores show that the experimental group-I performed better than the experimental group-II.

**Delayed Post-test Analysis**

18. There is significant difference between the delayed post-test scores of the control group and the experimental group-I in chemical bonding. The mean scores show that the experimental group-I performed better than the control group in the delayed post-test.

19. There is significant difference between the delayed post-test scores of the control group and the experimental group-II. The mean scores show that the experimental group-II performed better than the control group in the delayed post-test.

19. There is significant difference between the delayed post-test scores of the control group and the experimental group-I with regard to the level of intelligence. The mean scores show that the delayed post-test score of the experimental group-I was more than the control group with regard to the level of intelligence.
20. There is significant difference between the delayed post-test scores of the control group and the experimental group-II with regard to the level of intelligence. The mean scores show that the delayed post-test scores of the experimental group-II was more than the control group with regard to the level of intelligence.

*Analysis of Covariance*

21. There is significant difference between the adjusted post-test scores of chemical bonding of the control group and the experimental group-I. The analysis of covariance shows that the experimental group-I performed better than the control group in the adjusted post-test.

22. There is significant difference between the adjusted post-test scores of the control group and the experimental group-II. The analysis of covariance shows that the experimental group-II performed better than the control group in the adjusted post-test.

24. There is significant difference between the adjusted post-test scores of the control group and the experimental group-I with regard to high, average and low levels of intelligence. The analysis of covariance shows that the experimental group-I performed better than their counterparts in the adjusted post-test with regard to high, average and low levels of intelligence.

25. There is significant difference between the adjusted post-test scores of the control group and the experimental group-II with regard to high and average levels of intelligence. The analysis of covariance shows that the experimental group-II performed better in chemical bonding than their counterparts in the adjusted post-test with regard to level of intelligence.

26. There is significant difference between the adjusted delayed post-test scores of the control group and the experimental group-I. The analysis of covariance shows that the experimental group-I performed better than the control group in the adjusted delayed post-test.
27. There is significant difference between the adjusted delayed post-test scores of the control group and the experimental group-II. The analysis of covariance shows that the experimental group-II performed better than the control group in the adjusted delayed post-test.

5.2 INTERPRETATION AND DISCUSSION

The interpretation of the findings along with the discussion in view of the outcome of the reviewed studies is presented below.

In the pre-test analysis of the data, the control group and the experimental groups-I & II have no significant difference between the overall pre-test scores of chemical bonding. Similarly, with regard to the level of intelligence of the sample groups as well there exists no significant difference. The same result is revealed in most of the experimental and quasi-experimental studies reviewed by the researcher.

In the post-test analysis of the data, the investigator finds significant difference between the overall post-test scores of chemical bonding of the control group and the experimental group-I (CAI). There is also significant difference between the post-test scores of chemical bonding of the control group and the experimental group-I with regard to the level of intelligence. It shows that the higher secondary first year students in the experimental group-I performed better in the post-test than their counterparts in the control group. This may be due to the reason that the experimental group under treatment of Computer Assisted Instruction was able to understand the lesson chemical bonding very easily and interestingly and the entire treatment administered by the investigator was enjoyable. This positive result might be due to the effectiveness of Computer Assisted Instruction which is the combination of music, audio and video, graphics, animation and colourful text. This innovative method of teaching chemical bonding to the students might have very much fascinated their attention in learning the lesson swiftly and effectively. This finding is in harmony with the reviewed studies of Hussain et al. (2014); Achor & Ukwuru (2014); Sharma & Jain
In the same way in the *post-test analysis* of the data, the investigator finds significant difference between the overall post-test scores of chemical bonding of the control group and the experimental group-II (CL). There is also significant difference between the post-test scores of chemical bonding of the control group and the experimental group-II with regard to the level of intelligence. It shows that the higher secondary first year students in the experimental group-II performed better in the post-test than their counterparts in the control group and hence the Co-operative Learning was effective to the students in the teaching learning-process. This may be due to the fact that the experimental group under Co-operative Learning treatment was able to interact with each other joyfully in small groups and the learning continued until all the students gain mastery over the lesson ‘chemical bonding’.

In Co-operative Learning (CL), learning takes place easily and enthrallingly and the entire treatment administered by the investigator was stimulating. This positive result might be due to the effectiveness of Co-operative Learning in which the peers help, support, encourage, and praise each other. This innovative method of teaching chemical bonding to the students might have promoted enriched, enjoyable and interactive learning experience and hence it might have fascinated their concentration in learning the lesson speedily and effectively. This finding is in agreement with the reviewed studies of Orora & Wachanga (2014); Simsek & Yilar (2013); James and Olumorin (2013); Mehar & Sekhri (2012); Jebson (2012); Sivaram & Ramar (2012); Baskaran (2011); Chianson & Kurumeh (2011); Keskin & Polat (2011); Ajaja (2010); Malarvizhi

In the pre-test - post-test analysis of the control group, significant difference is found between the pre-test and the post-test scores of chemical bonding. This may be the reason that the students are accustomed to the traditional teaching-learning process. The same is found in the reviewed study of Spradlin & Ackerman, (2010) and Stultz & Sherry, (2008).

In the pre-test - post-test analysis of the experimental group-I (CAI), there exists significant difference between the pre and post-treatment scores of chemical bonding of the experimental group-I by Computer Assisted Instruction. The mean scores show that the experimental group-I performed better than that of the control group in the post-test. Similarly, in the pre-test–post-test analysis of the experimental group-II (CL), there exist significant difference between the pre and post-treatment scores of chemical bonding of the experimental group-II. The mean scores show that the experimental group-II performed better than the control group in the post-test.

In the gain score analysis too, there exists significant difference between the gain scores of the experimental groups-I & II in chemical bonding. The mean scores show that the experimental group-I (CAI) gained more score than the experimental group-II (CL). It shows that the teaching of chemical bonding through Computer Assisted Instruction is more effective than the Co-operative Learning strategy. It implies that the chemical bonding can be better achieved through Computer Assisted Instruction as it has the exuberance in getting those abstract and dreary concepts effectively.

The delayed post-test (retention test) was administered ten days after the post-test to all the three groups. The scores of the delayed post-test indicate that the performance of the experimental groups-I & II is better than the control group with regard to the achievement of chemical bonding. The findings imply that the experimental groups-I & II have the power to make the students hold
higher retention than their counterparts. With regard to the level of intelligence also the experimental groups gained more scores than their counterparts of the control group. This result is in agreement with the studies of Akengin, (2010) and Chianson & Kurumeh, (2011). The performance of experimental groups is better than its counterparts because of the pedagogical strength of Computer Assisted Instruction and Co-operative Learning strategies which have the power of retaining the subject matter taught to the higher secondary students for a long time.

The Analysis of Covariance in the post-test scores of experimental groups-I & II shows that the experimental groups-I & II performed better than the control group in learning chemical bonding. It shows that the Computer Assisted Instruction and Co-operative Learning strategies are more effective than the traditional method for learning the lesson chemical bonding.

The findings of this experimental study made the investigator arrive at a conclusion that the Computer Assisted Instruction and the Co-operative Learning strategies are effective in teaching chemistry especially ‘Chemical Bonding’ and Computer Assisted Instruction is more effective than the Co-operative Learning strategy in the teaching learning process. Hence, the investigator recommends the educational authorities to take initial steps to make the learning of the students easy, effective and interesting.

5.3 RECOMMENDATIONS

The findings of the study show that the Computer Assisted Instruction and the Co-operative Learning are effective teaching strategies and they bestow significant contribution to the process of teaching and learning chemistry in the Indian classrooms. The results of the study reveal that the Computer Assisted Instruction and the Co-operative Learning strategies can be introduced to the educational institutions especially to the higher secondary schools for greater achievement in the examinations. It is apparent that Computer Assisted Instruction has the pedagogical strength and it fosters easy learning and better understating and helps to hold the power of retention for a long
period and hence, the investigator likes to recommend educational clients to introduce these innovative and effective Computer Assisted Instruction and Co-operative Learning strategies to all the higher secondary schools.

1. To Regulatory Bodies

The National Council for Teacher Education (NCTE) is a regulatory body which monitors teacher education curriculum and teacher education institutions over the years. It can instruct the Colleges of Teacher Education to foster their prospective teachers with the skill of technology. So that in future they can be expected to be the teachers of techno-based skills and thereby they may interweave their teaching materials with CAI. NCTE can insist the curriculum designers on framing the curriculum for teacher education which is incorporated with Computer Assisted Instruction and active learning in small groups for effective teaching-learning process. As a result, the teachers will be techno-savvy and facilitators of group learning.

National Assessment and Accreditation Council (NAAC) is the prime body which plays a significant role in the field of higher education. It has every right and responsibility to anticipate quality education from the colleges of education. Hence, this regulatory body as well enhances the quality of teachers insisting on their delivery of lesson inter-woven with technology and group activities. It may insist on the colleges of education to provide ample opportunity and adequate facility to the teachers for using computers and provide feasible environment for Co-operative Learning in their teaching-learning process.

National Council of Educational Research and Training (NCERT) has a lot of accountability in line with school education. It may provide technical advice regarding the improvement of the standard of school education as it performs an important function in
improving educational techniques; develop curriculum instructional materials, methods of teaching, teaching aids etc conforming to the present needs of digital era. The NCERT can offer in-service and pre-service training to teachers for effective utilization of innovative technology and insist the schools to create joyful co-operative learning climates.

2. To the Universities of B.Ed Programme

*The Universities* which offer Bachelor of Education have to promote excellence in Teacher Education. One of the major objectives of these Universities is to provide high quality education through innovative teaching methodologies. Hence, they may provide proper training to the teacher trainees to exploit different teaching strategies such as CAI and CL.

3. The Educational Planners and the Developers of Curriculum

*The Educational Planners and Curriculum Developers* of higher secondary schools may prepare techno-based resource materials which may invoke interest among the students. There may be a paradigm shift from conventional teaching strategies to innovative approaches like Computer Assisted Instruction and Co-operative Learning for teaching Chemistry. The utility of technopedia
gogical devices and learning in small groups enable the learners to acquire proficiency in chemistry. Hence, the educationists may raise their voice collectively to enforce this Computer Assisted Instruction and Co-operative Learning in order to achieve the goal in a relaxed atmosphere.

4. To the Colleges of Education

*The Colleges of Education* have to produce proficient and effective teachers in order to make the students learn joyfully. They can bestow sufficient training on the teacher educators in utilizing effective strategies to create interest among the students and to *learn co-operatively in small groups*; here is the platform where teachers can be trained well and facilitated to incorporate effective learning strategies like CAI and CL.
5. To the Board of School Education

The Board of School Education should have the vision to instill quality in the educational institutions. They may provide ample opportunity to all the teachers to make them efficient and excellent in their profession so that, they can be efficient teachers in their real classrooms.

Awards and incentives may be given to teachers who are able to make use of the techno-pedagogy based Courseware and Co-operative Learning Strategies so as to follow innovative methods of instruction into the process of teaching and learning.

The Directorate of School Education ought to have farsightedness and vision to produce students with high proficiency and excellence and direct the CEOs to implement these innovative techniques such as CAI and CL in the schools to attain greater achievement in education. They should take steps to enhance technology enriched classrooms. Proper planning, inspection and support should be provided by the government for the successful utilization of computers for instructional purpose. Suitable software should be made available at the local levels that cover the contents in different subjects.

The Chief Educational Officers may insist the school Heads on making their school teachers use Computer Assisted Instruction and Co-operative Learning strategies for students’ high achievement. They should have the forethought to make the best use of technological inputs, as available, to improve the quality of schooling at all levels and in turn raise the quality of life of the people in knowledge society.

The Managements should update the lab according to the need of the present day education. Managements may generate financial assistance to the schools concerned for preparing the materials for CAI so that it won’t be a burden to the teachers. Workshops can be organized by the managements to emphasize and enlighten teachers on the importance of Computer Assisted Instruction and Co-operative Learning.
Headmasters may provide ample opportunity to all the teachers to make use of technology in the classroom. They should realize the necessity of establishing hi-tech computer lab in their schools. They should encourage teachers to use the technology to enhance the quality of teaching and learning. They can make use of technology-based and active learning in the teaching process. CAI should also be integrated in the teaching of Chemistry because it enhances students’ achievement and creates interest in learning. They should also hearten the teachers to motivate the students to learn in small groups with self-determination and joy through CL by providing proper environment in the school campus.

Teachers are in a position to shoulder lot of responsibilities with regard to the future of the students. Four or five minds are smarter than one. Teachers should be aware of students’ abilities when they work in small groups to make their learning easy and effective. Teachers should be advocated to prepare the resource material to integrate technology and make use of Co-operative Learning strategies in their teaching. They have to adopt the modern techniques and co-operative learning strategy and make use of them to teach students for easier understanding and retention of the concept. They can attract the students using videos and audios for making the teaching-learning process very effective.

5.4 EPITOME

Today, in the age of Science and Technology, there is an urgent need to study the effect of new teaching methods and strategies. The present study was conducted to assess the effect of CAI and CL on the Achievement of Chemical Bonding at Higher Secondary level in relation to the conventional method of teaching Chemistry. CAI made learning exciting and engaging. Chemistry is the amalgamation of hard and new topics. Such hard and boring topics are made easier, more interesting and effective by dint of CAI which is a powerful instrument which simplifies a complex content into a simple one. In this way, CAI supported learners to manage their own learning.
Co-operative learning strategy also encouraged learners to learn from one another and from their knowledgeable peers. Here, learners were encouraged to communicate, collaborate and shared their knowledge with their peers. It was found that in Co-operative Learning, the students were actively involved in the process of learning and the frequent interaction among the learners, in turn, augmented the amount of student talk and student participation in the classroom. This kind of active involvement in the process of learning enhanced the achievement of students. The process of learning became more goal-oriented, more participatory and flexible in time and space and increased collaboration between teachers and students. The bond thus developed among learners may lead to profound understanding and acceptance of all members of the learning society. Thus, the benefit of co-operative learning can expand beyond the walls of the school itself.

In the digital era, the process of teaching and learning should be techno-based. Every teacher should have techno-pedagogical skills so as to teach their wards easily, interestingly and effectively. Moreover learning a unit or a subject should be strategy-oriented. Teachers have to select any strategy which must kindle interest among the learners.

The results of the study have established that the CAI and CL are effective in teaching Chemistry. Since these strategies are found to be more effective in the teaching of chemical bonding in terms of achievement and retention, it is found that the students in the experimental groups mastered the subjects on the successful implementation of these strategies. Hence, this study strongly recommends to the teachers that their lecture has to be tailored with CAI and CL. Similar studies can also be attempted in a wide range of schools to make teaching-learning process more interesting, exciting, lively and vibrant and to arrive at more dependable conclusions.

5.5 SUGGESTIONS FOR FURTHER STUDY

The investigator would like to put forward a few suggestions for further studies.
1. This experimental study can be extended to teach other subjects like Biology, Physics and Mathematics at the higher secondary level.

2. An experimental study can be done on teaching English grammatical items to prospective teachers on achievement of their grammar skills.

3. A study can be done on teaching of methodology to chemistry teachers by dint of CAI.

4. An experimental study can be done on effect of Computer Assisted Co-operative Learning on achievement of Teacher Trainees in the Colleges of Education.

5. A study can be done on achievement of Teacher Trainees in developing CAI packages.