CHAPTER – V
FINDINGS, INTERPRETATIONS, RECOMMENDATIONS AND SUGGESTIONS

5.1 OVERVIEW
This chapter forms the summary of the present research. It consists of seven sections. The first one enumerates the entire chapter. The second section states the problem, objectives and hypotheses of the study. The third section describes the sampling design, content analysis and instrumentation. The fourth section summarises the findings of the study. The fifth section lists the limitations of the study. The sixth section identifies the scope for further research in the field.

5.2 PROBLEM
The problem of the study is stated as:
“To what extent Computer Assisted Instruction (CAI) is effective in Teaching Chemistry for higher secondary students?”

5.2.1 OBJECTIVES
1. to find out the effectiveness of CAI in achievement of Chemistry.
2. to find out the Achievement in Chemistry with Experimental group-I and Experimental group-II through CAI.
3. to compare the Achievement in Chemistry of the Control group (Traditional Method) with that of the Experimental group-I without discussion(CAI) and Experimental group-II with discussion (CAI).
4. to find out the relationship between Achievement in Chemistry and the Correlates such as AB, ALC, ATLC, PLC and CBLC.
5. to find out the relationship between Competency Based Learning Chemistry and the Correlates such as AC, AB, ALC, ATLC and PLC.
6. to structure the profiles of Control group and Experimental groups I and II in terms of the two criterion variables(AC, CBLC) and correlate variables(AB, ALC, ATLC, PLC).
7. to find out the Students’ Reaction to CAI.
5.2.2 HYPOTHESES

1. The Post-test performance of the Experimental groups (I and II) will be significantly greater than the Post-test performance of the Control group.

2. There will be significant difference between the Post-test performances of the Experimental group - I without discussion and Experimental group - II with discussion.

3. Gap closures in Experimental groups will be greater than in Control group.

4. Criterion variables (Achievement in Chemistry and Competency based Learning Chemistry) will be positively and substantially related to each of the correlate variables Academic Background (AB), Aptitude in Learning Chemistry (ALC), Perception on Learning Chemistry (PLC), Attitude towards Chemistry Learning (ATC) and 16 Personality Factors.

5. Control group and Experimental group-I & II will significantly differ from each other in terms of criterion variables (Achievement in Chemistry and Learning Competency on Chemistry) and correlates. Academic Background (AB), Aptitude in Learning Chemistry (ALC), Perception on Learning Chemistry (PLC), Attitude towards Chemistry Learning (ATC) and 16 Personality Factors.

6. There will be significant difference between Experimental-I and Experimental–II group Students’ Reaction to CAI.

5.30 SAMPLE DESIGN

Based on the conceptual framework cited above the investigator identifies and defines the population and sample of the study as follows.

There are three higher secondary schools affiliated to Tamil Nadu State Government from Tenkasi Taluk of Tirunelveli district is taken for this experimental study. In the academic year 2011-2012, the enrolment students from Biology and Computer in the higher secondary course were around 100 for each school. The investigator is a teacher educator who teaches Physical science in the B.Ed. course at JP College of Education, which is affiliated to Tamil Nadu Teacher’s Education University. His population was all those students, who were enrolled for Chemistry as a one of the subjects for higher secondary school. Thus
the sample of the study was large enough for generalization. Details are furnished in the pages that follow. The sample was drawn from students studying Chemistry as one of the important science subjects from Biology and Computer science groups from Hilton Matric higher secondary school, Bharath Montessori Matric higher secondary school, Mkvk Matric higher secondary school from Taluk of Tenkasi from Tirunelveli District.

5.4 Content Analysis

Ten Units of Chemistry were taught to the Control group through Traditional method and to the Experimental group–I and Experimental group-II through CAI Approach. For this Experimental study, the investigator prepared ten lessons for the higher secondary students using CAI. Computer assisted Instructional materials were Prepared for ten Units with the help of a computer.

5.5 Instrumentation

This section deals with the development of tools of research employed in the study. The Present study requires an Entry Behaviour Test, a Pre/Post-test and a Criterion test to evaluate the students’ mastery of XII standard Chemistry. These tests were structured and validated against a sample of higher secondary students before the commencement of the study. A perusal of related studies shows that Perception on Learning Chemistry, Aptitude in Learning Chemistry, Attitude towards Chemistry Learning, and Personality factors happen to be promising correlates of Achievement in Chemistry. Hence the investigator has also administered the scales of Aptitude in Chemistry, Perception on Learning Chemistry, Attitude towards Chemistry Learning, Competency Based Learning Chemistry and Cattell’s 16PF Questionnaire to the Control group and two Experimental groups. A scale of CAI reaction was constructed and administered to the Experimental group-I & II of this study. In order to have a higher degree of validity and reliability and to have adequate content coverage, the objective type of questions were chosen for the construction of Entry Behaviour Test, Pre / Post test and a Criterion test. Among the various objective types, multiple choice types were used to evaluate the mastery of a subject. The following tests and tools were structured and validated by the investigator for the Present study.
The items in the refined tool of Entry-Behaviour Test were of 108 multiple choice items and Pre/Post-test consisted of 282 multiple choice items. Out of the 150 multiple choice items in the tryout tool of the Entry Behaviour Test only 108 multiple choice items were selected on the basis of higher values of discrimination indices 0.20 and difficulty indices between 25% to 75%. In the same way out of 310 multiple choice items in the tryout tool of Pre/Post-test only 282 multiple choice items were selected on the basis of higher values of discrimination indices above 0.20 and difficulty indices between 25% to 75%. The investigator adopted and computed the rationale equivalence for calculating the reliability of the Entry Behaviour Test and the Pre/Post-test. The reliability of the present Entry Behaviour Test as measured by rationale equivalence method is 0.8 and the reliability of the Pre/Post-test is 0.9 which are highly reliable. The investigator employed Patted’s Perception on Learning Chemistry Scale (PLCS) to 120 students of learning Chemistry. This tool was revalidated by the investigator and to find out the validity of the tool ‘t’ and for reliability, item whole correlation was calculated for each of the 18 items. All ‘t’ values were significant at 0.001 level and all the items were highly reliable. The investigator constructed an Aptitude in learning Chemistry with 75 items and an Attitude Scale towards learning Chemistry with 44 items. Using the statistical techniques,
the Aptitude test and Attitude Scale were validated. The refined Aptitude test consisted of 65 items and the refined Attitude Scale consisted of 40 items. The reliability of the Aptitude test was 0.95 and so the test was highly reliable. The reliability of the Attitude Scale was determined by calculating item whole correlation co-efficient. The investigator in order to study the Competency based Learning Chemistry of the XII standard students in studying Chemistry; a ten point learning competency scale was used. The assessment based on the tool concurred with the assessment of the annual examination of XI standard higher secondary course. So this tool had a high degree of concurrent validity. Inter-rater reliability was used to assess the reliability and this tool had a high degree of reliability. The investigator used the sixteen Personality factor questionnaire of Cattell to assess the personality traits of the students. To measure the reaction of the student towards CAI approach, CAI Reaction Scale was developed and used by the Investigator. The investigator inorder to findout the validity of this tool (t) and for reliability applied item-whole correlation technique and this tool had a high level of reliability.

5.6 Findings

This section summarises the findings of the present study and highlights their implications. The findings have been interpretations of ‘t’ values, gap closure and correlation co-efficients. The ‘t’ values and gap closure indicate the difference between the mean values of the Control group Vs Experimental group-I, Control group Vs Experimental group-II and Experimental group-I vs. Experimental group-II. The correlation co-efficient brings out the degree of relationship between one variable and the other. The following is an outline of the findings and their implications.

5.6.1 Differential Studies

An attempt was made to find the differential level of achievement in Chemistry among XII standard higher secondary students between Control and Experimental groups.

Pre-test (Control group, Experimental group-I & Experimental group-II)

There is no significant difference between the pre-test means of Control group, Experimental group-I and Experimental group-II. This indicates that there
is a strong evidence in favour of balancing the three groups namely, Control group, Experimental group-I and Experimental group-II. This is in addition to balancing the three groups in terms of the pre-test scores.

**Post-test (Control group Vs Experimental group-I)**

The difference in the post test performance between Experimental group-I (without discussion) and Control group in the unit-1 “Atomic structure II & Periodic classifications” and the unit-7 “Chemical equilibrium, kinetics & Thermodynamics showed a difference at 0.01 level of significance and at 0.001 level of significance in all other units, in favour of Experimental-I group (without discussion). This analysis reveals that the performance of the students within the Experimental group-I in the units, 2,3,4,5,6,8,9 and 10, is better than in the unit-1 “Atomic structure II & Periodic classifications” and the unit-7 “Chemical equilibrium, kinetics & Thermodynamics”. This may be due to the effective treatment to the topics, P,D blocks of elements(unit-2), D,F blocks of elements(unit-3), “Coordination compounds & Nuclear Chemistry” (unit-4), “Electro chemistry I & II” (unit-5), Solid & surface Chemistry(unit-6), “Chemistry in action” (unit-8), Isomerism of organic & Nitrogen compounds (unit-9), “Biomolecules”(unit-10) through Computer Assisted Instructional mode. In the unit-1 “Atomic structure II & Periodic classifications” and the unit-7 “Chemical equilibrium, kinetics & Thermodynamics”, the treatment through CAI seems to be less effective which needs more explanation and discussions.

**Post-test (Control group vs. Experimental group-II)**

The difference in the post-test performance between Experimental group-II (with discussion) and Control group in all the 10 units is 0.001 level of significance in favour of the Experimental group – II (with discussion). The observation of this analysis reveals that the performance of the students in the Experimental group-II in the unit-3 and 5 “D, F blocks of elements” and “Electro chemistry I & II” is more effective than the other units, 1,2,4,6,7,8,9 and 10. This may be due to the CAI treatment of the topic followed with discussion. Thus a CAI of unit 3 & 5 seems to be more effective than the treatment given through Computer Assisted Instructional of other units by discussion.
Post-test (Experimental group-I Vs Experimental group-II)

The difference in the post-test performance between Experimental group–I (without discussion) and Experimental group-II (with discussion) at 0.05 level of significance in global, 0.01 level of significance in the units of 6 and 8 and 0.001 level of significance in the units of 1 and 7, in favour of Experimental group-II. The observation of this analysis reveals that the performance of the students in P,D blocks of elements(unit-2), D,F blocks of elements(unit-3), “Coordination compounds & Nuclear Chemistry” (unit-4), “Electro chemistry I & II” (unit-5), Isomerism of organic & Nitrogen compounds (unit-9), “Biomolecules”(unit-10) makes no significant difference in Experimental I(without discussion) & Experimental II(with discussion). During the treatment period, the investigator inferred that the treatment through CAI (units 2, 3, 4, 5, 9 and 10) are self-explanatory. Treatment through CAI with discussion (Experimental group-II) is more effective than CAI without discussion (Experimental-I) in the units Solid & surface Chemistry (unit-6), “Chemistry in action” (unit-8), unit-1 “Atomic structure II & Periodic classifications” and the unit-7 “Chemical equilibrium, kinetics & Thermodynamics”. These units are embedded with more on principles of the methods which need more illustrations and discussions hence the students’ performance in the Experimental group-II (CAI with discussion) is higher than the Experimental-I (CAI without discussion).

Pre-test Vs Post-test–Control, Experimental –I & Experimental groups-II

There is a significant difference between the pre-test and post-test mean scores of the Control group, Experimental group-I and Experimental group-II. The ‘t’ values are significant at 0.001 level and it is in favour of the post-test. The post-test mean scores of the three groups indicate that the students learn more effectively through CAI Approach followed by discussion than through the CAI Approach without discussion and through the Traditional method.

Gap Closure – Control group vs. Experimental group-I

There is a significant difference between the Control group and the Experimental group-I in the gap closures (unitwise as well as in global). The gap closures (unitwise as well as in global) in the Experimental group-I are greater
than those of the Control group. The Experimental group-I students (without discussion) learnt more effectively through CAI Approach when compared with the Control group.

**Gap Closure – Control group Vs Experimental group-II**

There is significant difference between the Control group and the Experimental group-II in the gap closures (unitwise as well as in global). The gap closures (unitwise as well as in global) in the Experimental group-II students are greater than those of the Control group. The Experimental group-II (with discussion) learnt more effectively through CAI Approach when compared with the Control group.

**Gap Closure–Experimental group-I Vs Experimental group-II**

There is a significant difference between the Experimental group-I and Experimental group-II, in the gap closures (unitwise except in the unit-5). The gap closures in the Experimental group-II are greater than those of the Experimental group-I. This difference may be due to the treatment through CAI approach was more effective at the higher secondary students could comprehend the content without having discussion. Thus it is established that teaching of Chemistry through CAI Approach followed with discussion (except in unit-5) to the higher secondary students is more effective than the CAI Approach followed without discussion.

### 5.6.2 Relationship Studies

**Relationship between Achievement in Chemistry (AC) and Academic Background (AB) and Aptitude in Learning Chemistry (ALC)**

Achievement in Chemistry has very high positive relationship with Academic Background (AB) in the Experimental group-I and Experimental group-II and Aptitude in Learning Chemistry (ALC) in the Experimental group-I, at 0.01 level of significance.

Achievement in Chemistry (AC) has high positive relationship with Aptitude in Learning Chemistry (ALC) in the Experimental group-II and in the Sample at 0.01 level of significance.
Achievement in Chemistry (AC) has substantial positive relationship with Academic Background (AB) in the Sample at 0.01 level of significance.

Achievement in Chemistry (AC) has low positive relationship with Academic Background (AB) in the Control group at 0.05 level of significance.

There is negligible positive relationship between Achievement in Chemistry (AC) and Aptitude in Learning Chemistry (ALC) in the Control group.

**Relationship between Achievement in Chemistry (AC) and Perception on Learning Chemistry (PLC) and Attitude towards Learning Chemistry (ATLC).**

Achievement in Chemistry (AC) has very high positive relationship with Attitude towards Learning Chemistry (ATLC) in the Experimental group-II at 0.01 level of significance.

Achievement in Chemistry Education has high positive relationship with Perception on Learning Chemistry (PLC) in the Experimental group-I and in the Sample and Attitude towards Learning Chemistry (ATLC) in the Experimental group-I and in the Sample at 0.01 level of significance.

Achievement in Chemistry (AC) has substantial positive relationship with Attitude towards Chemistry in the Control group and Perception on Learning Chemistry (PLC) in the Experimental group-II at 0.01 level of significance.

**Relationship between Achievement in Chemistry (AC) and the Personality Factors (PF).**

Achievement in Chemistry (AC) has low positive relationship with the Personality Factors B (less intelligent Vs more intelligent) in the Experimental group-I, Experimental group-II and the Sample, C (affected by feeling Vs emotionally stable) in the Sample, I (tough minded Vs tender minded) in the Experimental group-I, L (trusting Vs suspicious) in the Control group at 0.05 level of significance and in the Experimental group-I, O (self assured Vs self-reproaching) in the Control group and Q4 (relaxed Vs tensed) in the Control group at 0.05 level of significance and low negative relationship in the Experimental group-II.
There is negligible positive/negative relationship between Achievement in Chemistry (AC) and the Personality factors, A, B, C, E, F, G, H, I, L, M, N, O, Q1, Q2, Q3, and Q4 in the Control group, Experimental group-I and Experimental group-II.

Relationship between Competency Based Learning Chemistry (CBLC) and the Cognitive Correlates–Achievement in Chemistry (AC), Academic Background (AB) and Aptitude in Learning Chemistry (ALC).

Competency Based Learning Chemistry (CBLC) has very high positive relationship with Achievement in Chemistry in the Experimental group-II at 0.01 level of significance.

Competency Based Learning Chemistry (CBLC) has high positive relationship with Achievement in Chemistry (AC) in the Experimental group-I and in the Sample, Academic Background (AB) in the Control group, Experimental group-II and in the Sample and Aptitude in Chemistry in the Experimental group-I and in the Sample at 0.01 level of significance.

Competency Based Learning Chemistry (CBLC) has substantial positive relationship with Academic Background (AB) in the Experimental group-I at 0.01 level of significance and Aptitude in Chemistry in the Control group and Experimental group-II at 0.01 level of significance.

Competency Based Learning Chemistry (CBLC) has low positive relationship with Achievement in Chemistry in the Control group.

Relationship between Competency Based Learning Chemistry (CBLC) and Perception on Learning Chemistry (PLC) and Attitude towards Learning Chemistry (ATLC).

Competency Based Learning Chemistry (CBLC) has high positive relationship with Perception on Learning Chemistry (PLC) in the Experimental group-I, Attitude towards Chemistry Learning in the Experimental group-II and in the Sample at 0.01 level of significance.

Competency Based Learning Chemistry (CBLC) has substantial positive relationship with Perception on Learning Chemistry (PLC) in the Sample and Attitude towards Chemistry Learning (ATLC) in the Control group and Experimental group-I at 0.01 level of significance.
Competency Based Learning Chemistry (CBLC) has low positive relationship with Perception on Learning Chemistry (PLC) in the Experimental group-II.

There is a negligible positive relationship between Competency Based Learning Chemistry (CBLC) and Perception on Learning Chemistry (PLC) in the Control group.

Relationship between Competency Based Learning Chemistry (CBLC) and the Personality Factors (PF).

Competency Based Learning Chemistry (CBLC) has substantial positive relationship with the Personality factors B (less intelligent Vs more intelligent) in the Experimental group-II and in the Sample at 0.01 level of significance, H (shy vs venturesome) in the Control group and Q4 (relaxed Vs tensed) in the Experimental group-I at 0.05 level of significance.

Competency Based Learning Chemistry (CBLC) has low positive relationship with the Personality factors A (reserved vs outgoing) in the Sample, B (less intelligent vs more intelligent) in the Control group at 0.05 level of significance and in the Experimental group-I, C (affected by feeling vs emotionally stable) in the Experimental group-I, Experimental group-II at 0.05 level of significance and in the sample at 0.05 level of significance, G (expedient vs conscientious) in the Control group and Experimental group-II, L (trusting vs suspicious) in the Experimental group-I at 0.05 level of significance, M (practical vs imaginative) in the Experimental group-I at 0.05 level of significance, O (self-assured vs self-reproaching) in the Control group, Q2 (group dependent vs Self-sufficient) in the Experimental group-II, Q3 (Undisciplined Self-conflict vs Controlled) in the Control group and in the Sample.

Learning Competency has low negative relationship with E (humble vs assertive) and H (shy vs venturesome) in the Sample, L (trusting vs suspicious) in the Experimental group-II, M (Practical vs imaginative) in the Experimental group-I and Experimental group-II.

There is a negligible positive/negative relationship between Competency Based Learning Chemistry (CBLC) and the Personality factors A, B, C, E, F, G,
H, I, L, M, N, O, Q1, Q2, Q3 and Q4 in the Control group, Experimental group-I and Experimental group-II.

5.6.3 Criterion Variables And Correlates

Control group Vs Experimental group-I

The Experimental group-I students have higher level of Achievement than the Control group students in Chemistry (AC) and in Competency Based Learning Chemistry (CBLC). Both the Control group and Experimental group-I students have lower level in Academic Background (AB), Aptitude in Learning Chemistry (ALC), in Perception on Learning Chemistry (PLC) and in Attitude towards Learning Chemistry (ATLC). The Control group students have lower level of Achievement in Chemistry (AC) and in Competency Based Learning Chemistry (CBLC). There is no difference between the Control group and Experimental group-I students in Academic Background (AB).

Control group Vs Experimental group-II

The Experimental-II group students have higher level of Achievement than the Control group students in Chemistry (AC) in Competency Based Learning Chemistry (CBLC), in Aptitude in Learning Chemistry (ALC), in Perception on Learning Chemistry (PLC) and in Attitude towards Learning Chemistry (ATLC). Both the Control group and Experimental-II group student teachers have lower level in Academic Background (AB). The Control group students have lower level of Achievement in Chemistry (AC) in Competency Based Learning Chemistry (CBLC) in Aptitude in Learning Chemistry (ALC) in Perception on Learning Chemistry (PLC) and in Attitude towards Learning Chemistry (ATLC). There is no difference between the Control and Experimental group-II group students in Academic Background (AB).

Experimental group-I Vs Experimental group-II

Both the Experimental group-I and Experimental group-II students have higher level of Achievement in Chemistry (AC) and in Competency Based Learning Chemistry (CBLC). The Experimental group-II students have higher level of Aptitude in Chemistry Education (ALC), in Perception on Learning Chemistry (PLC) and in Attitude towards Chemistry Learning (ATLC) than the
Experimental group-I students. Both the Experimental group-I and Experimental group-II students have lower level in Academic Background (AB). The Experimental group-I students have lower level in Aptitude in Learning Chemistry (ALC), in Perception on Learning Chemistry (PLC) and in Attitude towards Chemistry Learning (ATLC).

There is no difference between the Experimental group-I and Experimental group-II students in Achievement in Chemistry (AC), in Competency Based Learning Chemistry (CBLC) and in Academic Background (AB).

The profiles drawn for the Control group vs Experimental group-I, Control group vs Experimental group-II and Experimental group-I vs Experimental group-II in Personality Factors comparing their relative position in the sixteen Personality Factors are given below:

**Control group Vs Experimental group-I**

Both the Control group and Experimental group-I student teachers are enthusiastic (F+), conscientious (G+), venturesome (H+), suspicious (L+), shrewd (N+) and experimenting (Q1+). The Experimental group-I student teachers are outgoing (A+), more intelligent (B+), self-reproaching (O+), self-sufficient (Q2+) and controlled (Q3+). The Control group student teachers are more assertive (E+) and tender minded (I+). Both the Control group and Experimental group-I student teachers are affected by feelings (C-), practical (M-) and relaxed (Q4-). Experimental group-I student teachers are humble (E-) and tough-minded (I-). The Control group student teachers are reserved (A-), less intelligent (B-), self-assured (O-), group-dependent (Q2-) and undisciplined self conflict (Q3-). The Control group and Experimental group-I student teachers do not differ significantly from each other in the Personality factors such as, affected by feelings (C-), enthusiastic (F+), conscientious (G+), venturesome (H+), suspicious (L+), practical (M-), shrewd (N+), experimenting (Q1+) and relaxed (Q4-).

**Control group Vs Experimental group-II**

Both the Control group and Experimental group-II are enthusiastic (F+), conscientious (G+), venturesome (H+), suspicious (L+) and shrewd (N+).
experimenting (Q1+). The Experimental group-II student teachers are outgoing (A+), more intelligent (B+), emotionally stable (C+), imaginative (M+), self-reproaching (O+), self-sufficient (Q2+) and controlled (Q3+). Both the Control group and Experimental group-II student teachers are relaxed (Q4-). Experimental group-II student teachers are humble (E-), tough-minded (I-) and relaxed (Q4-). The Control group student teachers are reserved (A-), less intelligent (B-), affected by feelings (C-), practical (M-), self-assured (O-), group dependent (Q2-) and undisciplined self-conflict (Q3-). Both the Control and Experimental group-II student teachers do not differ in the Personality factors of enthusiastic (F+), conscientious (G+), venturesome (H+), suspicious (L+), shrewd (N+), experimenting (Q1+) and relaxed (Q4-).

**Experimental group-I Vs Experimental group-II**

Both the Experimental group-I and Experimental group-II student teachers are outgoing (A+), more intelligent (B+), enthusiastic (F+), conscientious (G+), venturesome (H+), suspicious (L+), Shrewd (N+), self-reproaching (O+), experimenting (Q1+) and self-sufficient (Q2) and controlled (Q3+). The Experimental group-II student teachers are emotionally stable (C+) and imaginative (M+). Both the Experimental group-I and Experimental group-II student teachers are humble (E-), tough minded (I-) and relaxed (Q4-). The Experimental group-I student teachers are affected by feelings (C-) and practical (M-). Experimental group-I and Experimental group-II, do not significantly differ in the Personality factors of outgoing (A+), more intelligent (B+), humble (E-), enthusiastic (F+), conscientious (G+), venturesome (H+), tough minded (I-), suspicious (L+), shrewd (N+), self-reproaching (O+), experimenting (Q1+), self-sufficient (Q2+) and controlled (Q3+) and relaxed (Q4-).
5.6.4 Multiple Regressions

Prediction of Criterion variables, Achievement in Chemistry (AC) and Competency based Learning Chemistry (CBLC) with Multiple regression.

A multiple regression was structured in order to predict the size of the Criterion variable-I of Achievement in Chemistry (AC), given the sizes of effective Academic Background (AB) and Aptitude in Learning Chemistry (ALC) and Perception on Learning Chemistry of Chemistry (PLC), Attitude towards Learning Chemistry (ATLC) and Personality Factor (PF), for the Sample and the study as a whole.

A multiple regression was structured in order to predict the size of the Criterion variable-II of Competency based Learning Chemistry (CBLC) given the sizes of effective Achievement in Chemistry (AC), Academic Background (AB) and Aptitude in Learning Chemistry (ALC) and Perception on Learning Chemistry of Chemistry (PLC), Attitude towards Learning Chemistry (ATLC) and Personality Factors (PF), for the Sample and the study as a whole.

Multiple R tells the extent to which Criterion variable is determined by the combined action of variables, in the present situation. The following Multiple regression explain the size of Criterion variables of Achievement in Chemistry (AC) and Competency based Learning Chemistry (CBLC) and the sizes of effective predictors.
Multiple Regression

Control Group

(AC WITH PREDICTORS)

Achievement in Chemistry (AC), Academic Background (AB) and Aptitude in Learning Chemistry (ALC)

Multiple R = 0.38
R Square = 0.15
AC = 47.24 + 0.91 AB + (-0.09) ALC

The value of Multiple R indicates that the Achievement in Chemistry (AC) is moderately related with Academic Background (AB) and Aptitude in Learning Chemistry (ALC).

Achievement in Chemistry (AC), Perception on Learning Chemistry (PLC) and Attitude towards Learning Chemistry (ATLC)

Multiple R = 0.48
R Square = 0.23
AC = 58.37 + (-0.20) PLC + 1.07 ATLC

The value of Multiple R indicates that the Achievement in Chemistry (AC) is substantially related with Perception on Learning Chemistry (PLC) and Attitude towards Learning Chemistry (ATLC).

Achievement in Chemistry (AC) with Personality Factors (PF)

Multiple R = 0.44
R Square = 0.19
AC = 47.52 + 0.23 L + 0.09 O + 0.29 Q4

The value of Multiple R indicates that the Achievement in Chemistry (AC) is substantially related with the Personality factors L (trusting vs suspicious), O (Self-assured vs self-reproaching) and Q4 (relaxed vs tensed).
Multiple Regression

Control Group

(CBLC WITH PREDICTORS)

Competency Based Learning Chemistry (CBLC), Achievement in Chemistry (AC), Academic Background (AB) and Aptitude in Learning Chemistry (ALC)

\[
\begin{align*}
\text{Multiple R} & = 0.687 \\
\text{R Square} & = 0.47 \\
\text{CBLC} & = 31.69 + 0.03 \text{ AC} + 0.20 \text{ AB} + 0.07 \text{ ALC}
\end{align*}
\]

The value of Multiple R indicates that Competency Based Learning Chemistry (CBLC) is highly related with Achievement in Chemistry (AC), with Academic Background (AB) and with Aptitude in Learning Chemistry (ALC).

Competency Based Learning Chemistry (CBLC) with Perception on Learning Chemistry (PLC) and Attitude towards Learning Chemistry (ATLC)

\[
\begin{align*}
\text{Multiple R} & = 0.471 \\
\text{R Square} & = 0.221 \\
\text{CBLC} & = 45.93 + 0.02 \text{ PLC} + 0.24 \text{ ATLC}
\end{align*}
\]

The value of Multiple R indicates that Competency Based Learning Chemistry (CBLC) is substantially related with Perception on Learning Chemistry (PLC) and with Attitude towards Learning Chemistry (ATLC).

Competency Based Learning Chemistry (CBLC) with Personality Factors (PF)

\[
\begin{align*}
\text{Multiple R} & = 0.490 \\
\text{R Square} & = 0.240 \\
\text{CBLC} & = 43.20 + 1.93 \text{ B} + 0.69 \text{ G} + 0.83 \text{ M} \\
& \quad + 0.83 \text{ O} + 0.06 \text{ Q3}
\end{align*}
\]

The value of multiple R indicates that Competency Based Learning Chemistry (CBLC) is substantially related with the Personality factors B (less intelligent vs more intelligent), G (expedient vs conscientious), M (practical vs imaginative), O (self-assured vs self-reproaching) and Q3 (undisciplined self-conflict vs controlled).
5.6.5 Profiles

Profiles of the Control and Experimental groups-I & II have been compared their relative position with the post-test performance and the predictors AC, CBLC, AB, ALC, PLC, ATLC and the Personality Factors. In this section, the investigator has drawn profiles showing the difference between Control group and Experimental groups I & II and the difference between Experimental group-I & Experimental group-II and their relative position with the post-test performance (unitwise as well as in the global) and the predictors AC, CBLC, AB, ALC, PLC and ATLC and the Personality factors.

Post Test Performance

Profiles have been drawn for the control and experimental groups comparing their relative positions with the post-test performance.

Control group Vs Experimental group-I

The Experimental group-I students have higher level of Achievement than the Control group students in “Atomic structure II & Periodic classifications” (unit-1), “Coordination compounds & Nuclear Chemistry” (unit-4), “Electro chemistry I & II” (unit-5), “Chemical equilibrium, kinetics & Thermodynamics” (unit-7), “Chemistry in action” (unit-8), “Biomolecules” (unit-10) and in the global. The Control group students have lower level of Achievement in all the 10 units (1, 2, 3, 4, 5, 6, 7, 8, 9 and 10) and in the global. The Experimental group-II students have higher level of Achievement than the Control group students in all the 10 units namely, “Atomic structure II & Periodic classifications” (unit-1), P,D blocks of elements (unit-2), D,F blocks of elements (unit-3), “Coordination compounds & Nuclear Chemistry” (unit-4), “Electro chemistry I & II” (unit-5), Solid & surface Chemistry (unit-6) “Chemical equilibrium, kinetics & Thermodynamics” (unit-7), “Chemistry in action” (unit-8), Isomerism of organic & Nitrogen compounds (unit-9), “Biomolecules” (unit-10). The Control group students have lower level of Achievement in all the 10 units (1, 2, 3, 4, 5, 6, 7, 8, 9 and 10).

Experimental group-I and Experimental group-II

The Experimental group-II students have higher level of Achievement than the Experimental group-I students in “Atomic structure II & Periodic
classifications” (unit-1), P,D blocks of elements(unit-2), D,F blocks of elements(unit-3), “Coordination compounds & Nuclear Chemistry” (unit-4), Solid & surface Chemistry(unit-6) “Chemistry in action” (unit-8), Isomerism of organic & Nitrogen compounds (unit-9). The Experimental group-I students have higher level of achievement than the Experimental group-II students in “Biomolecules”(unit-10).

5.6.6 Student Reaction to CAI

This section is an attempt to study the reaction of the students to CAI in the Higher secondary programme. The reaction of the students of the Experimental group-I, (CAI without discussion) and Experimental group-II, (CAI with discussion) towards CAI is measured by administering the CAI Reaction Scale developed by the investigator. The CAI has proved to be more effective in teaching Chemistry than the Traditional method. CAI followed by discussion has made Chemistry Learning very effective and the achievement of the students is very high. So the students have to be oriented in this approach so that they employ them in their classroom practice. Further when the students are exposed to the advantages of the CAI as well as the techniques involved, they will also be motivated to employ them in their classroom work. Perception on Learning Chemistry, Aptitude in Learning Chemistry, Attitude towards Learning Chemistry and Competency Based Learning Chemistry do influence Achievement in Chemistry. If the students of higher Aptitude and higher level of Attitude towards Chemistry Learning are selected, their achievement will be high. Students must be aware about the kind of CAI that can be used suitable for the content.

5.70 Limitations Of The Study

The sample of the study comprises for XII standard higher secondary students studying Chemistry from Bharath Montessori, MKVK and Hilton Metric higher secondary schools from Tenkasi Taluk in Tirunelveli District in the year 2011-2012. The investigator works as Principal incharge from JP College of Education and the study being experimental in nature, he had limited his sample for the Experimental groups in the same taluk. Besides, the investigator had easy accessibility to visit the nearby schools which are under the jurisdiction of
Manonmanium Sundaranar University for the purpose of carrying out his research. Hence, the investigator has limited his study written the schools of Tirunelveli District. The investigator studied the effectiveness of CAI for teaching ten Units of Chemistry for the English medium students only.

5.80 Scope For Further Research

1. The effectiveness of CAI may be studied through experiments with all other subjects from higher secondary schools.

2. There are different kinds of media, which can be utilized for teaching. The teacher can identify the suitable media and methodology of different units for high schools.

3. Each unit may be taught through CAI will be really helpful for all the students to score high marks in Chemistry.

4. This study can be extended to Secondary Grade Teacher Training Schools and in Colleges of Education in other areas.

5. This study can be extended to high schools for teaching Science and other subjects also.

6. Experimental study on CAI modules can be done for other subjects at various levels.

7. Interactive e-learning modules in relation to achievement of students on various subjects at different levels can be studied.

8. Influence of other variables like social economic factors, ICT skills and soft skills also can be investigated.

9. In-depth study may be undertaken to teach content based e-learning modules.

10. A study of CAI in all the subjects from high schools for all the standards.

11. As the present study is limited to the educational districts of Tirunelveli, further studies may be conducted by selecting students from other educational districts also.
12. In the present study, higher secondary students alone were including. It may be suggested that further studies may be conducted by selecting students from high school.

13. A comparative study on the CAI and study skills of slow learners and gifted students.

14. A comparative study of problem students and normal students with regard to CAI, study skills, academic achievement.

5.9 Discussions

Hiralkumar and Barot (2005) conducted a study on the effectiveness of CAI in Sanskrit for std. VIII student, CASE, MSU, Baroda.

The major findings were CAI package significantly improved the performance of students in learning sankrit, 86 students of Std. VIII of Shree AmbeVidyalaya, Waghodia Road, Baroda constituted the sample for the study. A single group pre-test and post-test design was employed for the study. When we analyse the findings of above study with this present, similarly three groups have been taken for the study. (Control, Experimental-I (without discussion) and Experimental-II (with discussion)). In this same way this study also reveals that Experimental-I (without discussion) is superior to Control groups of students and Experimental-II (with discussion) is superior to both the Experimental-I and Control groups of students.

Praveen Dhar (2010) has conducted a study on teacher mediated computer learning package as an effectiveness tool for teaching botany at higher secondary level.

The investigator had used experimental method for the above study Experimental design was parallel group. The sample consisted of 62 students of standard X1 from Government Higher secondary school, Marthandam, kanyakumari District and Tamil Nadu. The investigator had used computer mediated learning package for the Experimental group and the control group was taught by lecture method. The investigator had used group test if Intelligence for equating two groups. The investigator has also prepared an achievement test in
Botany for taking the entry and exit behaviour of students. The above study has revealed that comparison of the mean scores of Experimental group and control group with regard to pre-test achievement has showed no significant difference between the groups. If the gain scores of above study is compared with the present study of three groups Control, Experimental-I (without discussion) and Experimental-II (with discussion) reveal that Experimental-I (without discussion) has scored high gain scores than superior to Control groups of students and Experimental-II (with discussion) has scored high gain scores which is superior to both Experimental-I and Control groups students.


The major findings of the study told mean achievement score of experimental group was significantly higher than that of the control group. Though enhancement is significant as a result of CAI in all the three cases i.e. above average and below average intelligent students, yet it is highest in the case of average intelligent students followed by below average intelligent students and is least in the above average intelligent students. It has been found that the experimental group performed better in case of learning objectives of knowledge, comprehension and application. The above study reveals that Experimental group II students from fast, average, slow learners were scored high marks than Experimental I group of students. Both Experimental group II & I groups of students were scored high marks than control group of students.

5.10 Conclusion

This study is a primary attempt to find out the effectiveness of Computer Assisted Instruction in teaching Chemistry for higher secondary students. This study is an attempt to pave way for many other research problems. This study concludes that the teacher could teach chemistry effectively through Computer Assisted Instruction to make the students to score high marks in chemistry. Now a day’s innovative method of CAI teaching chemistry is really helpful to the teachers for teaching chemistry in a more simplified manner as well as making the students to learn the subject effectively.
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