CHAPTER VI

SUMMARY
### CHAPTER - VI

**SUMMARY**

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CHAPTER VI
SUMMARY

6.1 INTRODUCTION

The present study aimed at developing and validating a CAL package in Zoology for +1 students to measure the achievements in Zoology. In recent years, there has been a rapid advance of technology on all fronts. Hence, it is not surprising to find educationists being concerned with the use of Educational Technology at all levels and in all types of education. Educational Technology is relatively a new field emerging now, where the scientific and psychological knowledge is being put to use in the teaching-learning process. Educational Technology is being made use of now-a-days to overcome the problems of population growth and explosion of knowledge in the field of education. Having understood the importance of Educational Technology, the National Policy on Education (NPE) (1986) assigned an important role to Educational Technology for improving the quality of education. CAL Means using the computer to learn academic content of the students. When a computer is used as a teaching learning medium, the medium, the method of learning could be called CAL.

6.1.1 Need and Significance of the Study

The NPE (1986) has recommended the introduction of Modern Technologies like Computer and Television Technologies in Education. According to the programme of Action of NPE, Computer Literacy Programmes
were started to cover all higher secondary schools by 1991, secondary schools by 1995 and elementary schools in the long term. The National Council of Educational Research and Training (NCERT), Delhi, a Government funded autonomous institution charged with overseeing changes in school education in the country, introduced at the beginning of 1984 a project known as Computer Literacy And Studies in School (CLASS) Programme. Its main objective was to train students and teachers in Computer Education in selected Schools. Computer facilities were provided to 1200 educational institutions under this project.

In the state of Tamil Nadu the Government distributed 38 Multimedia Computers with multimedia softwares to the Government Schools in the year 1998. Further the Government has introduced computer course in 666 government schools for the students studying +1 and +2 intended to extend down to 6th std and also to the public after the school time hours. Moreover the government has introduced special keyboard configuration designed monolingual (Tamil) and bi-lingual (Tamil and English) so that the medium of computer language cannot be a barrier in utilizing the benefits of computer.

Thus computers are very nearer to the students/institutions by their greater availability and less cost. According to Figher (1983), when a Computer Assisted Instruction is integrated into a regular curriculum as a supplement, it is particularly successful. Bitter (1987) reported that CAI was an effective medium for improving academic skills at significantly less time than conventional class room methods.
The investigator had been teaching Zoology in Higher Secondary Schools for 12 years. As the investigator knew the potentially of computers in the field of Education, she was able to imagine the utilisation of computers in the classroom teachings. The investigator wanted to measure to what extend this computer technology could be effective when compared with the traditional technology of lecture method. Hence it was felt that there is an immediate need to formulate and implement the Modern Technology of CAL in teaching Zoology.

6.1.2 Scope of the study

An important feature of education has been its use of physical and intellectual tools. Computers represent a truly generic tool, limited in application only by the imagination of the user. The rapid by changing nature of Computer Technology continues to expand the range of resources available for any subject, specific learning. Globalisation has its serious impact on the content, methods and quality of education.

The aim of this is to help the students to learn Zoology through Computer Assisted Learning individually. The study encourages both independent and collaborative learning. This study highlights the potentiality of modern technology and utilisation of the same in the teaching-learning process.
6.1.3 Statement of the problem

Computer has become a familiar sight in Indian Schools. But the problem is in most of the schools computer is taught as a subject to be studied, rather than a tool to be used in the classroom teaching-learning process. Most of the heads of institutions, teachers and students are aware of the potentiality of the computers but only a less fraction of the population use them in classroom activities. Though the government and private agencies are preparing and selling ready made computer Disc floppies on text materials in different modes of CAI, the utilisation of the same is very meagre. Hence the present investigation intends to apply Computer Assisted Learning software in teaching Zoology in the Classroom through experimental study. So the problem for the present study is stated below:

"EFFECT OF COMPUTER ASSISTED LEARNING IN ZOOLOGY AMONG HIGHER SECONDARY STUDENTS".

6.2 Objectives of the study

The major objective of the study was to find out the effectiveness of Computer Assisted Learning in Zoology of the +1 students. The specific objectives have been:

1. to construct and validate Achievement test in Zoology for +1 students.
2. to develop and validate the CAL software in Zoology for +1 students.

3. to find out the effect of CAL software on the achievement in Zoology in different learning objectives such as Knowledge, Understanding, Application and Skill.

4. to find out the effect of CAL software on achievement in Zoology among experimental and control group of students based on different mental ability such as Gifted, Average and Slow-learners.

5. to find out the effect of CAL software on achievement in Zoology among the groups of students classified on the basis of their community, parents' occupation and educational qualification.

6. to find out the effect of CAL software on achievement in three Follow-up tests conducted during the treatment in Zoology for +1 students.

7. to compare the effect of CAL software and traditional method of teaching among experimental and control group students with respect to the learning objectives, (such as Knowledge, Understanding, Application and Skill) parents' occupation, educational qualification and community and different categories of students based on mental abilities.
6.2.1 Hypotheses

1. There is no significant difference on the achievement scores in pre-test among control and experimental groups.

2. There exists no significant difference among the groups taught through Computer Assisted Learning and Traditional Lecture method on achievement in Zoology for +1 students.

3. There exists no significant difference among the groups taught through Computer Assisted Learning and Traditional Lecture method on achievement in the learning objectives such as Knowledge, Understanding, Application and Skill in Zoology among +1 students.

4. There is no significant difference among the groups taught through Computer Assisted Learning and Traditional Lecture method on achievement with respect to the classifications made by Mental ability test such as Gifted, Average and Slow Learners.

5. There is no significant difference among the groups taught through Computer Assisted Learning and Traditional Lecture method on achievement with respect to the Community to which they belong, Parents' Education and Occupation.
6. There is no significant difference on achievement in four Follow-up tests conducted during the treatment in Zoology among +1 students.

6.2.2 Assumption of the study

1. Students do not have any computer anxiety and show interest in learning through computer.

2. Students can learn Zoology through Computer Assisted Learning easily.

3. All the learning objectives, such as Knowledge, Understanding, Application and skill can be learnt by the students easily through Computer Assisted Learning.

4. It is possible to get answers to all the questions raised by different categories of students, Gifted, Average and Slow Learners.

6.2.3 Delimitations of the Study

The delimitations of the present study are enumerated below:

1. The present study is confined to +1 students studying Zoology as one of their major subjects.
2. The sample consists of only 65 students selected on the basis of the performance in their half yearly examination and also Raven's Progressive Matrixes (RPM).

3. Four units of Zoology in +1 syllabus are included for the study.

4. The investigation has been carried out only at two Higher Secondary Schools at Krishnagiri.

5. Treatment for experimental group is conducted for a period of 30 working days.

6.2.4 Experimental Design

A design of experimental research consists of an outline, plan or strategy one conceives in an attempt to answer a research question. It has a full structure of the procedure that tells the researcher what one should do at what stage and how. In an experimental research the investigator herself sets up the conditions of investigation and is free to vary the conditions in order to study the phenomenon.

6.2.5 Experimentation in Phases

Phase I

1. Understanding the technology of Computer Assisted Learning.

3. Identifying the suitable topics in Zoology of +1 level for the preparation of CAL software.

**Phase II**

4. Conducting a pre-test to assess the entry behaviour of the students in the classroom.

5. Conducting Mental Ability test to categorise the students.

**Phase III**

6. Administering the treatment of CAL software to the experimental group and lecture method to the control group students.

**Phase IV**

7. Conducting four Follow-up tests after the completion of each unit.

8. Administering the Post-test

9. Entering, categorising and analysing the scores in pre-test, follow-up tests and post-test.

**Phase V**

10. Evaluating the effectiveness of the CAL and traditional method and comparing the achievement of both.
6.2.6 Sample of the Study

The sample for this experiment was selected through the random sampling technique. The control group students were selected from the Government Higher Secondary School, Papparapatti, Krishnagiri and the experimental group students were selected from the Government Higher Secondary School, Shanthi Nagar, Krishnagiri. Based on the half-yearly examination marks, the students of similar groups in different categories were selected for the control and experienced groups. All the students involved in the study were studying in the class and confined with the same syllabus of Zoology in English medium. The names of the school and the number selected as sample are presented in the table.

TABLE - 6.1

SAMPLE SELECTED FOR THE EXPERIMENT

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<thead>
<tr>
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<th>School</th>
<th>Number of Sample</th>
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<tr>
<td>Experimental Group</td>
<td>Government Higher Secondary School, Shanthi Nagar, Krishnagiri</td>
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6.2.7 Tools used in the study

In the present study, the investigator used two types of tools. The first type of tool was the Standardized one named, A Group-test of General Mental Ability. The second type of tool named Achievement Test in Zoology (ATZ) was developed by the investigator.
6.2.7.1 Development of Achievement Test in Zoology

The treatment of CAL software was developed in Zoology for the topics cell Biology, Nucleic Acids, Protein Synthesis and Cancer Biology. As a validated Achievement test was not readily available, the investigator developed a tool to measure the achievement of the students in the present study.

As the investigator happened to be a Post Graduate in Zoology, the subject chosen for developing the achievement test was familiar to her. After selecting the units, the investigator went on developing suitable items to test each of the selected units for the study. The investigator framed the items on four learning objectives such as Knowledge, Understanding, Application and Skill.

The multiple choice items were selected by the investigator for ATZ, as the objective type items are considered the best other than the other objective type items.

There were 105 items in all four units in Zoology consisting of four learning objectives such as Knowledge, Understanding, Application and Skill. The number of items from different units developed on the learning objectives such as Knowledge, Understanding, Application and Skill were 37, 23, 28 and 17 respectively. The technique of item analysis was conducted for selecting the right type of items for the final draft.
On the basis of the results of the Item Analysis, certain items were eliminated. Eighty nine items were selected from the 105 items included in the preliminary draft. The values of difficulty value and discriminative index are given in Appendix.

The investigator used the split-half method to estimate the reliability of the test. The correlation between these two scores provided a measure of accuracy. The correlation co-efficient was worked out using Karl Pearson Product Moment correlation formula as it was found to be .88 which showed a high reliability of the responses made.

In the present study the investigator prepared the test items with reference to the instructional objectives relating to the content area. Thus the content validity of the tool was established. Moreover the tool was given to the panel of experts who are handling the subject Zoology to go through it. The agreement of the views of the experts was taken as the index of validity of the content of achievement test.

6.2.7.2  Construction of Follow-up Tests in Zoology

The investigator also constructed four follow-up tests besides the Achievement Tests in Zoology, to measure the performance of the students at the periodic intervals. Gradual evaluation of the learners and feedback given would ensure effective learning and would ensure the learner to confirm his experiences.
The prepared Follow-up tests were given to the panel of experts who are handling the subject Zoology to go through. The agreement of the views of the experts was taken as the index of the validity of the content of Follow-up tests. To find out the reliability of the same, the investigator used the Split-half method. The tests were administered to twenty students studying +2. From the collected questionnaire, two separate scores were derived, that is scores on the odd-numbered items and even-numbered items. The Karl Pearson’s Product Moment Correlation was used between these two scores to find out the accuracy. The found correlated values were found to be .88, .87, .86 and .87 for the Follow-up tests I, II, III and IV respectively. These values are found to be reliable.

6.3 DEVELOPING COMPUTER ASSISTED LEARNING IN ZOOLOGY

The purpose of the present study was to develop a Computer Assisted Learning (CAL) package in Zoology for the +1 English medium students and to find out its effectiveness on the achievement of Zoology. Therefore the investigator had to develop Computer Assisted Learning (CAL) package in Zoology pertaining to certain units in +1 students.

Computer Assisted Learning (CAL) is a self instructional process. For developing self instructional package, a number of techniques and methods are available viz., Programmed Learning Instruction, Auto Tutorial System, Personnalised Instruction, Learning Modules, Objectives Based Instruction etc. Out of these, the investigator followed the theory of Skinner’s Operant
Conditioning. The investigator selected ‘Visual Basic’ for the development of CAL.

6.4 DATA COLLECTION

The design of the study was discussed under caption (4.8) The investigator started collecting data from the selected Control and Experimental groups. Using the developed tool (1) Achievement Test in Zoology (ATZ) and (2) The standardised tool of Mental Ability test by Jalota were given to the control and experimental group. The investigator got prior permission from the Heads of Control and Experimental schools. The investigator was able to present the prepared Computer Assisted Learning Package systematically. The subject was taught by the investigator through the traditional method to the Control group students. The Zoology Teachers of Control and Experimental groups co-operated very much in providing simultaneous treatments and conduct of tests.

Four Follow-up Tests were conducted after every weeks during the period of thirty working days of experimentation. The Follow-up Tests were conducted simultaneously for the Control and Experimental groups. After teaching Zoology to the Control and Experimental groups the post-test, (i) Achievement Test in Zoology (ATZ). Thus all data were collected systematically for the analysis in the present study.
6.5 SCHEME OF DATA ANALYSIS

The data obtained from pre-test, follow-up tests and post-test among control and experimental groups were analysed. Two types of analysis were made in this study. The first one is Descriptive Analysis and the second one is Inferential Analysis.

In descriptive analysis, Mean and Standard Deviation were used to determine the central tendencies and description variables on the achievement in pre-tests, follow-up tests and post-tests among control and experimental groups. This type of analysis highlights the nature of a particular group of individuals.

Under the Inferential analysis, ‘t’ test was used to find out the level of significance of difference in pre-tests, post-tests and follow-up tests on the achievement among the control and experimental groups. Chi-square test was used to find out the association on achievement among the different categories of mental ability with students of different Community and Parental occupation and Education. Effect size was used to compare the results of different experiments. The non-parametric statistics of Mann Whitney ‘U’ test was also used to verify the results of parametric test.

6.6 FINDINGS

The derived findings based on the data analysis made are enumerated below:

1. There was no significant difference in the Achievement Mean scores with respect to learning objectives, Unit-I to Unit-IV and
total achievement scores obtained from pre-test among control and experimental groups.

2. There was significant difference between pre-test and post-test Mean scores of control group students.

3. There was significant difference between pre-test and post-test Mean scores of experimental group students.

4. There was significant difference in the post-test Mean achievement scores in Unit-I, Unit-II, Unit-III and Unit IV on the learning objectives of Knowledge, Understanding, Application and Skill between control and experimental groups.

5. There was significant difference in the post-test achievement Mean scores in four units.

6. There was significant difference in the post-test Mean achievement scores between control and experimental groups of SC, MBC and BC students.

7. There was significant difference in the post-test Mean scores between control and experimental groups whose parents are Agriculturists, Businessmen and others.
8. There was significant difference in the post-test Mean scores of control and experimental students whose parents education is upto +2 level and Degree level.

9. There was significant difference in the Mean Gain scores in Unit-I, Unit-II, Unit-III and Unit-IV on the learning objectives of Knowledge, Understanding, Application and Skill.

10. There is significant difference in the total Gain scores of all the four Units and the learning objectives, Knowledge, Understanding, Application and Skill.

11. There is significant association on the achievement of the control group students of different mental abilities whose Parents’ Qualifications are +2 level and Degree.

12. There is significant association on the achievement of the experimental group students of the different mental abilities whose Parents’ Qualifications are +2 and Degree.

13. There is no significant association on the achievement of the control group students of different mental abilities with the Parents Occupations are such as Agriculture, Business and others.
14. There is no significant association on the achievement of the experimental group students of different mental abilities whose Parents' Occupation are such as Agriculture, Business and others.

15. There is no significant association on the achievement of the control group students of different mental abilities such as Gifted, Average and Slow Learners with students Community such as SC, MBC and BC.

16. There is no significant association on the achievement of the experimental group students of different categories of mental abilities such as Gifted, Average and Slow Learners with students' Community such as SC, MBC and BC.

17. The effect size for the difference of Mean scores between Pre-test and Post-test of experimental group is small in Follow-up test-I, it is medium in Follow-up test-II and Follow-up test-III whereas it is large in Follow-up test-IV.

6.6.1 Discussion

The present study has attempted to find out the effect of Tutorial mode of CAL over the Traditional Method of Instruction on the achievement in Zoology among the +1 English medium students. The effectiveness of these two methods was compared. Achievement Test in Zoology and Mental Ability Test were the tools used to collect the data. In the present caption the results are discussed in accordance with the hypotheses formulated. It may be stated that
there were six hypotheses to be tested in the study. The hypotheses were related to the achievement in Zoology and association with respect to Mental Ability, Community to which they belong, Parents’ Education and Occupation.

The effect of different treatments among control and experimental groups was analysed by employing ‘t’ test. They observed ‘t’ value on achievement in Zoology was 3.46 with df 63 between control and the experimental groups. It indicates that the CAL has produced a significant difference on achievement in Zoology. It is, therefore, inferred that experimental group students who learnt through CAL have gained significantly in Zoology.

It is to be noted that there was no significant difference found in pre-test scores between control and experimental groups in four Units separately as well as collectively. This revealed that the control and experimental groups were similar in academic previous knowledge on selected Units before the treatment was made. But, the significant difference in the post-test Mean scores having higher Mean score of the experimental group revealed that CAL was more effective to the experimental group than the control group.

It is quite interesting to note that significant difference was observed when the pre-test scores were compared with post-test scores of control and experimental group separately. It revealed that both lecture method and CAL made significant effect on achievement of the students. At the same time, when the comparison was made on the achievement between control groups and experimental groups, experimental groups achievement score was
significantly high. When the analysis was made on the achievement with respect to the learning objectives, Knowledge, Understanding, Application and Skill in all the four units, the same trend was observed. The significant higher achievement Mean score of the experimental students may be due to the fact that CAL is an individualised one where the students can learn at their own pace, the large amount of information stored in the computer is made available to the active learner more rapidly than by any other medium, the dynamic instructional programme etc.

From the perusal of the related literature made on CAI in Science subjects it was found that many studies both in India and Abroad fall in line with the findings of the present study (India : Chandra, 1987; Singha, 1988; Nachimuthu, 1989; Madhur Gupta, 1989; Govindaraj, 1999; Panda & Chaudhry, 2000. Abroad : Swahmart, 1972; Bork, 1979; Faughn & Kuhn, 1979; Moore et al., 1980; Anderson et al., 1980; Vazgues, 1983; Ayoubi, 1986; Dalton, 1986; Bannet, 1986).

It was also found that the studies conducted on CAI in the subjects of Mathematics both in India and Abroad also in agreement with the findings of the present study (India : Sharma, 1979; Sivaraj, 1988; Steela, 1989. Abroad : Burns, 1981; Robin, 1982; Austin, 1983; Wright, 1983; Sasser, 1985; Rhoads, 1986; Kismani, 1988; Barnsley, 1989; Hayden, 1989; Alifrangis, 1989; Schmidt and Susan carol, 1991).
The findings of the studies conducted on CAL in Languages Abroad: Tarrent, 1983; Taylor, 1983; Porinchak, 1984; Winslow, 1985; Chin, 1986; Karen et al., 1988; Quienette, 1989 and also fall in line with the present study.

In this General discipline studies conducted on CAL in India: Singh, 1993; Steela, 1993; Sivakumar, Arunkumar and Sundaramurthy, 1994. Abroad: Cox, 1974; Ford, 1985; Mann, 1986; Acosta, 1987; Galinski, 1989; Regser, 1991; Elmore, 1992; Robert Michael, 1994 and Tenyankam, 1994 also in agreement with the present study.

The findings contrary to the present one indicates that treatment of CAL has not produced any significant effect upon the students achievement (India: Sivakumar et al., 1993; Stella, 1993 and Studies Abroad: Zielinski, 1981; Wainwright, 1985; Rayston 1989; Hiatt, 1990; Nishiho, 1994; Terrell, 1996; Johnson, 1996; Schardt, 1997). It is to be noted here that the above studies were conducted in different areas in different subjects. The nature, the methodology followed differed very much. The difference in the infrastructural facilities of the educational institution, attitude and apptitude of the students may also lead to the contrary results. But the present study is conducted on achievement in Zoology. In the present attempt the finding regarding the CAL has been consistent in the post-test and Follow-up test on the achievement in Zoology. From these facts it is derived that learning through CAI has produced significant results on achievement in Zoology among +2 students.
The achievement scores were analysed on the basis of the Mental Ability of the students such as Gifted, Average and Slow Learners with respect to their Community, Parents Qualification and level of education. The experimental group student who learnt through CAL were achieved significantly high, while comparing their counterparts from control group. Hence it may be concluded that the CAL may be helpful not only to the gifted but all levels of mental ability students. It may be due to the fact that gifted students can learn at their own speed and need not wait for others. At the same time average students can take their own time to listen to illustrations to understand the concept. Moreover slow learners may go concept by concept with serious concentration on suitable diagram and illustrations made available in the software and not bother about the time that they take. These may be the causes for the higher Mean scores achieved by the Gifted, Average and Slow Learners in the experimental group.

From the perusal of the review of related literature, it was inferred that four studies were conducted on the effect on CAI on Slow Learners (Palaniappan, 1988; Stella, 1993; Reddy and Ramar, 1995 and Govindaraj, 1999) while two studies revealed the significant favourable effect of CAL for Slow Learners over the traditional method (Stella, 1993 and Reddy and Ramar, 1995), the remaining two studies found that CAI did not made significant effect in post-test performance over the control group (Palaniappan 1988 and Govindaraj 1999).
The results of the study showed that there was significant positive association with the mental ability of the students of both control and experimental groups with parents’ qualification but there was insignificant association among mental ability of students with parents profession and community. This may be due to the reason that educated parents naturally motivate the students for higher aspiration and achievement so that the students will always be attentive in the studies. The result ensures that educated parents’ influence on the achievement of the student by way of either clarifying the doubts by themselves or arranging tuitions or arranging conducive climate. Moreover, the students of educated parents may try to utilise the potentiality of the higher teaching materials. All the parents irrespective of nature of profession either Agriculture, Businessmen or Daily labourers and type of community either SC, MBC or BC, all are having similar insignificant influence on the achievement of the students. Insignificant associations with parents’ profession and community may be due to the reason that these factors are in no way directly connected in the act of influencing the achievement of both groups of students either classroom instruction or teachers attitude or students habit. It is concluded in brief that CAL is effective on the achievement on the selected units in the learning objectives of Knowledge, Understanding, Application and Skill in Zoology of +1 standard.

6.6.2 Educational Implication of the Study

Learning occurs among the students by all the methods of teaching but the effective learning could be made by the modern technologies rather than by the mere teacher. As the study found significant effect favourable to CAL
over the traditional method, CAL may confidently be used as an effective method of teaching Zoology to the Higher Secondary Students.

The present study has also demonstrated that the students of different mental abilities such as, Gifted, Average and Slow Learners were benefitted significantly over the traditional method of teaching. Therefore the self instructional package of CAL may be used for the Higher Secondary Students in teaching Zoology.

Though the Government provides hardware and software to the schools, the numbers are very meagre, when compared with the total strength of the schools which exist. Hence the Government should make efforts to extend all sorts of facilities to all institutions.

Keeping the result of the study in mind, NCERT and SCERT can take up the work of producing the CAL software with the consultation of the experts in the subject and technology which can be supplied to the schools. A central Library may be set up in schools. A Central Library may be setup at all the district head quarters of the state, if it is not possible to supply computers to all the schools. At present since most of the schools have computers of their own, it will be possible for them to utilize the software to the maximum extent.

As the CAL software is a self-instructional software, a student can use it at her/his convenient places. Hence the schools may provide the facility of lending CAL software of different subject to study at their home, hostel, private computer centre and other places.
6.6.3 Suggestions for Further Study

In the present study, the following suggestions for further research are being given keeping in view the findings of the present study.

1. The similar study may be conducted in other Science subjects, such as, Physics, Chemistry, Botany etc.

2. The similar study may be replicated at various standards.

3. The present study may be replicated at different medium of instruction.

4. The present study may be replicated at different types of institutions like Municipal schools, Corporation schools, Matriculation schools and so on.

5. A parallel study may be conducted to find out the effect of CAL among the disabled students.

6. A comparative study may be conducted among students studying in rural and urban schools.

7. Similar type of researches may be carried out on other teaching purposes such as remedial teaching, mastery learning, Drill and Practice etc.
8. Similar types of experimental researches may be conducted to compare the effect of CAL with other methods of individualised instruction such as Programmed Learning, Keller Plan, Multimedia instructional softwares.

9. Studies may be conducted to determine the effectiveness of different modes of CAL such as Drill and Practice mode, Simulation mode, Animation mode, Problem-solving mode.

6.7 CONCLUSION

The students learnt through CAL in Zoology have scored significantly higher over the students learning through traditional Lecture method. The same trend was observed on the achievement in the learning objectives of Knowledge, Understanding, Application and Skill in all the four units in Zoology of +1 students. It was found that Parents' Qualification associates significantly with the achievement of both groups of students. At the same time Parents' Profession and Community did not associate with the achievement of both control and experimental groups. It is concluded that CAL is effective in Teaching Zoology to the +1 students better than the Traditional Lecture Method.