CHAPTER – V
SUMMARY, FINDINGS AND CONCLUSION

5.0 INTRODUCTION

Education is a natural, harmonious and progressive development of man’s innate powers. It is the development in the individual of all the perfection of which he is capable. It provides children, youth and adults with the power to reflect, make choices and enjoy a better life. It breaks the cycle of poverty and is a key ingredient in economics and social development. Education is a medium through which the society transmits its heritage of past experiences and modifications, system of values and the modes or skill of acquiring it.

In the 21st century, ‘Information Explosion’ and ‘Population Explosion’ are the major problems in the higher education. Realizing the danger of this disastrous situation, India has embarked upon a great adventure; the adventure of putting to use modern information and communication technologies for the delivery of education services as in many manifestations as possible. New experiments, creative innovations and appropriate strategies are being developed and tried out to improve education at all levels.

Today technology of education is being developed with the aim not only of making education, but also of improving the quality of education which is already available. To satisfy the needs of the 21st century education must be harnessed with technology and the teachers and learners are to be made familiar with and use ICT tools in their teaching learning process. Educational technology is mainly concerned with teaching, training and learning process in view of realizing the educational goals. It provides the scientific foundation to education process.

5.1 SIGNIFICANCE OF THE STUDY
Any research can be carried out only on the basis of its significance which in turn depends on its necessity, urgency, and utility value. The significance of the present problem is to develop and utilize the pointer software in enhancing program writing ability among computer science graduate students. It may also be due to its complex nature. A pointer can be defined as a variable that may contain the address of another variable. The address is the location where the variable exists in memory. A pointer variable can be declared using asterisk “*” in front of the variable. The computer science students lack awareness on the usage of pointers in program development. To develop programs using pointers, the students must possess the knowledge of referring the memory locations properly, and the knowledge of logical thinking. In ordinary classroom it is much difficult to develop this kind of skill. When the same concept is taught through this newly developed software, the above mentioned skills will be developed among students.

Therefore, the investigator sensitized the importance of pointers in development of high level programs. To enhance their program writing ability using pointers and create interest towards learning it through pointers software is the main aim of this research. To develop efficient programs one must have the knowledge of logical reasoning and mathematics which will help them to do so. But if a person’s self-efficacy level is low in the programming language he/she uses, it will definitely affect their program writing ability. Though a person has very good mathematical and logical intelligence and his/her self-efficacy level is also high, the knowledge of error diagnosis is very much required for debugging the program during program execution. Therefore inclusive of the above mentioned factors knowledge of error diagnosis is also included as one of the influencing factors in writing programs. To develop such efficient program one must have the knowledge of meta-cognition, which is closely related to the type of brain dominance. Therefore, the researcher had chosen the following psychological factors: meta-cognition, Self-efficacy in using C language, type of brain dominance, Mathematical and logical Intelligence, and knowledge of error diagnosis. In this study, the researcher would like to find the level of influence of the above mentioned psychological factors on the gain score and the retention scores of the first year computer science students. The result of this experimental research will reduce their difficulties in learning “Pointers” and helps them to develop efficient programs using pointers which in turn will fetch them an employment opportunity at multinational companies.
5.2 RESTATEMENT OF THE PROBLEM

*Development of Pointers Software and Its Effectiveness on Program Writing Skill Among Computer Science Graduate Students*

5.3 OBJECTIVES

1. To develop Pointers software in C-language for first year computer science students.
2. To find out the level of gain scores and retention scores of control and experimental group students.
3. To find out the effectiveness of the pointers software in teaching and learning of C-programming.

5.4 HYPOTHESES

Experimental group

1.1 There is no significant difference between pre-test and post-test scores of the experimental group students.

1.2 There is no significant difference between experimental group students who read computer journals and those who do not read computer journals in the gain scores.

1.3 There is no significant difference between experimental group students who read computer journals and those who do not read computer journals in the attainment of objectives: knowledge, understanding and application in the gain scores.

1.4 There is no significant difference among left, right and middle brain dominant experimental group students in the gain scores.

1.5 There is no significant association between gain scores of the experimental group students and their
1.6 There is no significant relationship between gain scores of the experimental group students and their

   i. Self-efficacy in using C language
   ii. Metacognition
   iii. Mathematical and Logical Intelligence
   iv. Knowledge of Error Diagnosis

1.7 There is no significant difference between experimental group students who read computer journals and those who do not read computer journals in the attainment of the retention scores.

1.8 There is no significant difference among left, right and middle brain dominant experimental group students in the retention scores.

1.9 There is no significant association between retention scores of the experimental group students and their

   i. Order of birth
   ii. Father’s educational qualification
   iii. Mother’s educational qualification
   iv. Monthly income of the family

1.10 There is no significant relationship between retention scores of the experimental group students and their

   i. Self-efficacy in using C language
   ii. Metacognition
   iii. Mathematical and logical intelligence
   iv. Knowledge of error analysis
Control group

2.1 There is no significant difference between pre-test and post-test scores of the control group students.

2.2 There is no significant difference between control group students who read computer journals and those who do not read computer journals in the gain scores.

2.3 There is no significant difference between control group students who read computer journals and those who do not read computer journals in the attainment of objectives: knowledge, understanding and application in the gain score.

2.4 There is no significant difference among left, right and middle brain dominant control group students in the gain scores.

2.5 There is no significant association between gain scores of the control group students and their
   i. Order of birth
   ii. Father’s educational qualification
   iii. Mother’s educational qualification
   iv. Monthly income of the family

2.6 There is no significant relationship between gain scores of the control group students and their
   i. Self-efficacy in using C language
   ii. Metacognition
   iii. Mathematical and logical intelligence
   iv. Knowledge of error diagnosis

2.7 There is no significant difference between control group students who read computer journals and those who do not read computer journals in the attainment of the retention scores.
2.8 There is no significant difference among left, right and middle brain dominant control group students in the retention scores.

2.9 There is no significant association between retention scores of the control group of students and their
   i. Order of birth
   ii. Father’s educational qualification
   iii. Mother’s educational qualification
   iv. Income of the families

2.10 There is no significant relationship between retention scores of the control group students and their
   i. Self-efficacy in using C language
   ii. Meta-cognition
   iii. Mathematical and logical intelligence
   iv. Knowledge of error diagnosis

**Effectiveness of pointers software**

3.1 There is no significant difference between gain scores of experimental and control group students.

3.2 There is no significant difference between experimental and control group students in the attainment of the objectives: knowledge, understanding, and application in the gain scores

3.3 There is no significant difference between the retention scores of experimental and control group students.
3.4 There is no significant difference between experimental and control group students in the attainment of objectives: knowledge, understanding, and application in the retention scores.

5.5 DELIMITATIONS

i. The investigator has delimited the study with First year B.Sc Computer Science students.

ii. It is delimited to Tirunelveli district of Tamilnadu Only.

iii. Though there are many psychological factors influence the performance of the students, the investigator had chosen the following factors for her study. They are: type of brain dominance, metacognition, self-efficacy in using C language, Mathematical and logical Intelligence and Knowledge of error diagnosis.

5.5 METHOD AND DESIGN OF THE STUDY

The researcher has adopted the “Experimental Method” for the study, and the design adopted is ‘Pre-test - Post-test Equivalent Group Design’.

5.6 SAMPLE

Randomly selected 44 first year computer science students studying in Sarah Tucker College for Women, Palayamkottai constituted the total sample.

5.7 TOOLS USED FOR THE STUDY

The following tools were used for data collection:

i. Personal Data Sheet

ii. Pointers Software- Developed by the investigator

iii. Achievement test in C-Pointers- Developed by the investigator


v. Logical And Mathematical Intelligence- Developed by the investigator

vi. Knowledge of Error Diagnosis- Developed by the investigator
vii. Self-efficacy in using C language- Developed by the investigator

5.8 SOFTWARES USED
For developing the “Pointers Software” the following multimedia softwares are used:
i. Macromedia Flash 8.0
ii. Macromedia Dream weaver 8.0
iii. Adobe Photoshop 7.0

5.9 STATISTICAL TECHNIQUES USED
For analyzing the data the following statistical techniques were used. They are: Percentage Analysis, Mean, Critical ratio, ANOVA, Chi-square and Pearson Product Moment Coefficient of Correlation.

5.10 FINDINGS OF THE STUDY
a. This study reveals that 81.8% of experimental group students have high level of gain score.

b. This study reveals that 63.6% of experiment group students have habit of reading computer journals. Among the students who have the habit of reading computer journals 81.8% of them have high level of gain score.

c. This study reveals that 63.6% of the experimental group students have high level of retention scores.

d. Among the students those who have habit of reading computer journals, 64.3% of them are having high level of retention scores. Among the students those who do not have habit of reading computer journals, 62.5% of them scored high level of retention scores.

1.1 There is significant difference between pre-test and post-test scores of experimental group students. While comparing the mean scores of pre-test and post-test, the post-test score is greater than the pre-test scores of the experimental group students.
1.2 There is no significant difference between the experiment group students who read computer journals and those who do not read computer journals in the attainment of the gain scores.

1.3 There is no significant difference between the experiment group students who read computer journals and do not read computer journals in the attainment of objectives: knowledge, understanding and application in the gain scores.

1.4 There is no significant difference among the left, right and middle brain dominant experimental group students in the gain scores.

1.5 i. There is no significant relationship between the gain scores and the self-efficacy in using C language of the experimental group students.

ii. There is no significant relationship between the gain score and the Meta cognition of the experimental group students.

iii. There is no significant relationship between the gain scores and the Mathematical and Logical intelligence of the experimental group students.

iv. There is no significant relationship between the gain score and the Knowledge of Error Diagnosis of the experimental group students.

1.6 There is significant association between the gain scores and the order of birth of the experimental group students.

1.7 There is no significant association between the gain scores of the experimental group students and their fathers’ education, mothers’ education and monthly income of the family.
1.8 There is no significant difference between the experimental group students who read computer journals and those who do not read computer journals in the attainment of the retention scores.

1.9 There is no significant difference among the left, right and middle brain dominant experimental group students in the retention scores.

1.10 i. There is no significant relationship between the retention scores and self-efficacy in using C language of the experimental group students.

ii. There is no significant relationship between the retention scores and the Metacognition of the experimental group students.

iii. There is no significant relationship between the retention scores and the Mathematical and Logical intelligence of the experimental group students.

iv. There is no significant relationship between the retention scores and the Knowledge of Error Diagnosis of the experimental group students.

1.11 There is significant association between the retention scores and their father’s educational qualification of the experimental group students.

1.12 There is no significant association between the retention scores and their order of birth, mother’s education and monthly income of the family of the experimental group students.

**Control group**

a. This study reveals that 4.5% of the students have high level of gain scores.

b. In this study 45.5 % of the students have habit of reading computer journals and 54.5 % of them do not read computer journals. Among the students who read computer journals, 10% of them have high level of gain scores.

c. This study reveals that 9.1% of the control group students are having high levels of retention scores.
d. Among the students those have habit of reading computer journals, 20% of them have high level of retention score.

2.1 There is significant difference between pre-test and post-test scores of control group students. While comparing the mean scores of pre-test and post-test, the post-test score is greater than the pre-test score of the control group students.

2.2 There is no significant difference between the control group students who read computer journals and those who do not read computer journals in the attainment of the gain scores.

2.3 There is no significant difference between the control group students who read computer journals and those who do not read computer journals in the attainment of objectives knowledge and understanding in the gain scores, but there is significant difference between the control group students who read computer journals and those who do not read computer journals in the attainment of application objective in gain scores.

2.4 There is no significant difference among the left, right and middle brain dominant control group students in the gain scores

2.5 i. There is no significant relationship between the gain scores of the control group students and their self-efficacy in using C language

ii. There is no significant relationship correlation between the gain scores of the control group students and their Meta cognition.

iii. There is no significant relationship between the gain scores of the control group students and their mathematical and Logical intelligence.

iv. There is no significant relationship between the gain scores of the control group students and their Knowledge of Error Diagnosis.
2.6 There is no significant association between the gain scores of the control group of students and their order of birth, father’s educational qualification, mother’s educational qualification and income of the families.

2.7 There is no significant difference between the control group students who read computer journals and do not read computer journals in the attainment of the retention scores.

2.8 There is no significant difference among the left, right and middle brain dominant control group students in the retention scores.

2.9 i. There is no significant relationship between the retention scores of the control group students and their self-efficacy in using C language.

ii. There is no significant relationship between the retention scores of the control group students and their metacognition.

iii. There is no significant relationship between the retention scores of the control group students and their mathematical and Logical intelligence.

iv. There is no significant relationship between the retention scores of the control group students and their Knowledge of Error Diagnosis.

2.10 There is significant association between the retention scores of the control group students and income of the families.

2.11 There is significant association between the retention scores of the control group students’ order of birth, father’s educational qualification, and mother’s educational qualification.

**Effectiveness of pointers software**

3.1 There is significant difference between the experimental and control group students in their gain scores. While comparing their mean scores, the experimental group students
are better than the control group students. This may be due to the effectiveness of Pointers software used to teach the concepts.

3.2 There is significant difference between experimental and control group students in the attainment of the objectives: knowledge, understanding, and application in the attainment of gain scores. While comparing the mean scores, experimental group students are better than the control group students in the attainment of the Knowledge, Understanding and Application level objectives as perceived in the attainment of gain scores. This difference may be due to the multimedia effects such as sounds, representation of appropriate pictures used to explain the topic and its immediate feedback on testing the gain score of the students.

3.3 There is significant difference between the retention scores of the experiment and control group students. While comparing the mean scores, the experimental group students are better than the control group students. This difference exists because of the effectiveness of the pointers software used which has captured the attention of the students using the multimedia effect used in the softwares.

3.4 There is significant difference between experimental group and control group students in the attainment of the objectives: knowledge, understanding, and application in the retention scores. While comparing the mean scores, experimental group students are better than the control group students in the attainment of the Knowledge, Understanding and Application level objectives as perceived in the attainment of retention scores. The experimental group students perform better because of the pointers software since it has the various types of animation and multimedia effects being used.

5.11 INTERPRETATIONS

a. This study reveals that 81.8% of experiment group students have high level of gain scores. This may be due to the effectiveness of the Pointers Software. Since the pointers software has multimedia effects such as graphics, animation and sound would have helped
them to understand the concepts very clearly and easily. Hence, it can be interpreted that this software has high level of impact among the experiment group students to learn the concepts.

b. This study reveals that 63.6% of experiment group students have habit of reading computer journals. Among the students who have the habit of reading computer journals 81.8% of them are having high level of gain scores. From this finding, it can be interpreted that the habit of reading computer journals has an impact on scoring high gain scores.

c. While comparing the gain scores in the attainment of knowledge, understanding and application, 63.3%, 65.8% and 65% of the students have habit of reading computer journals respectively. Hence it can be interpreted that the students with the habit of reading computer journals helped them to grasp the abstract concepts easily and quickly using the “Pointers software”.

d. While comparing the retention scores of the experiment group students 63.6% of them have high level of retention scores. This retention may be due to the multimedia effects used in the pointers software.

e. Further, it can be interpreted that the students those who have the habit of reading computer journals have 64.3% high level of retention scores, which ensures the finding (b). This retention is due to the multimedia effects such as sounds, Pictures, Animation and Graphics used in the pointers software.

f. There is significant difference between pre-test and post-test scores of experimental group students. While comparing the mean scores of pre-test and post-test, the post-test score is greater than the pre-test scores of the experiment group students. This may be due to the pointer software which has various types of multimedia effects employed using Macromedia Flash and Dreamweaver to explain the abstract concepts.

g. There is significant association between the gain scores of the experimental group students and their order of birth. Since, the order of birth is one of the demographical variables; it would have an impact on learning the concept using the pointers software.
h. There is significant association between the retention scores of the experimental group students and their father’s educational qualification. This may be due to the fact that the educated fathers can encourage their children to learn the blooming technology in every field, to make they competent in the technology era. Hence, there is association between the retention scores of the experimental group students and their father’s educational qualification.

**Effectiveness of pointers software**

a. There is significant difference between the gain scores of the experimental and control group students. While comparing their mean scores, the experimental group students are better than the control group students. This may be due to the effectiveness of Pointers software used to teach the concept, which was developed using Macromedia Flash, Dreamweaver and Adobe Photoshop. This POINTERS SOFTWARE has animation and graphic effects to explain the concepts with sound effects. Hence the students may found it interesting, motivated and easy to understand the abstract concept without any hindrance. Therefore, difference was found between the gain scores of the experimental and control group students.

b. There is significant difference between experiment and control group students in the attainment of the objectives: knowledge, understanding, and application in the gain scores. While comparing the mean scores, experiment group students are better than the control group students in the attainment of the Knowledge, Understanding and Application level objectives in the gain scores. This difference may be due to the multimedia effects such as sounds, representation of appropriate pictures used to explain the topic and its immediate feedback on testing the gain score of the students.

c. There is significant difference between the retention scores of the experimental and control group students. While comparing the mean scores, the experimental group students are better than the control group students. This difference exists because of the effectiveness of the pointers software used which has captured the attention of the students using the multimedia effect used in the softwares.
d. There is significant difference between experimental group and control group students in the attainment of the objectives: Knowledge, Understanding, and Application in the retention scores. While comparing the mean scores, experimental group students are better than the control group students in the attainment of the Objective: Knowledge, Understanding and Application, in the attainment of retention scores. The experimental group students perform better because of the pointers software since it has the various types of animation and multimedia effects being used, which helped them to remember the abstract concepts for a longer period with understanding.

i. In this study the rejection of the null hypothesis that there is no significant difference between the gain scores of the experimental and control group students led to the conclusion that there is significant difference between the control and experimental group students in their gain scores.

This result is agreeing with the findings of Radha(2008), Arunkumar(2008), Arokiaraja(2007), Antony Gracious(2006, Nirmala Sundara Raj(2006) and Vinodhkumar(2006) who found that there was significant difference between the control and experiment group students in their gain scores. Further, Vinodhkumar(2006) found that the students taught by power point assisted instruction scored higher than the students taught by traditional lecture method. Antony Gracious (2006) found that there was significant difference between the control and experimental group students in their gain scores and found that the experiment treatment is effective to the students. Nirmala Sundararaj(2006) found difference between CAI group and Control Group students, Multimedia Group and Control Group Students. Among these groups the CAI and Multimedia groups are found to be better than the control group students. Further, She found that the difference is due to the experiment treatment given to both the groups using Power Point slides and Visual Basic Based CAI package in learning Zoology.

This result is contradicting with the findings of Rosales(2006) found out that there was no statistically significant difference between the mathematics achievement of the two groups i.e. students in the lower Rio Grande Valley who have participated in CAI and the
students who did not participated in CAI. *Jothikani and Thiagarajan (2004)* found that the control group students scored more than the experimental group students. *Planznela and Elizebeth (2001)* found that the computer assisted writing instruction showed no significant difference in raising the achievement level of the participating students. *Socder and Kathryn (2000)* who found out that there was no measurable improvements in the students who used the computer assisted instruction.

ii. The *rejection* of the null hypothesis that there is no significant difference between the control group students who read computer journals and those do not read in the attainment of application objectives in the gain scores, led to the conclusion that there is significant difference between the control group students who read computer journals and do not in the attainment of application objective in the gain scores.

This result is agreeing with the findings of *Arockiarja (2006)* found a significant difference in the attainment of application objective in the gain scores. *Nirmala Sundararaj (2006)* found that the gain score of the control group students who read computer journals is better than those who do not read computer journals.

iii. The *rejection* of the null hypothesis that there is no significant difference between the control and experimental group students in the attainment of the objectives: knowledge, understanding, and application in the attainment of gain scores led to the conclusion that there is significant difference between the experimental and control group students in the attainment of the objectives: knowledge, understanding and application in the attainment of gain scores.

This result is agreeing with the findings of *Nirmala Sundararaj (2006), Antony Gracious (2006), Arockiaraja (2007), Radha (2008) and Arunkumar (2008)*, who found that there was significant difference between the control and experimental group students in the attainment of knowledge, understanding and application objective in their gain scores. Further, their findings are agreeing that the gain scores of experimental group students are better than the control group students.
Nirmala Sundararaj (2006) found that CAI and Multimedia group students are better than the Control group students in the attainment of objectives: Knowledge, understanding and Skill in their gain scores, which supports the present study.

iv. The rejection of the null hypothesis that there is significant difference between the retention scores of the experimental and control group students led to the conclusion that there is significant difference between the experimental and control group students in their retention scores.

In general, POINTERS SOFTWARE is effective in learning ‘Pointers in C language’ among first year computer science students. This is because of the animation, sound and graphics effects of the software. Further, the content was presented in a logical manner with multimedia effects i.e. from simple to complex. Therefore, the students are highly interested and motivated to learn Pointers using the POINTERS SOFTWARE.

5.12 RECOMMENDATIONS

On the basis of the findings the investigator suggests the following

i. The teachers at all level may be trained to prepare CAI package using MS Power Point, Visual Basic and Java to teach computer science to the students.

ii. Computer Assisted Instruction may be integrated to teach at college level as it helps the students to understand the concepts easier.

iii. Authorities in all the Educational Institutions can supply the educational software at free of cost.

iv. Parents may spend time along with their children for the proper use of the computers with regard to education.

v. Students may be encouraged to use web-based learning.
vi. Teachers in colleges may be trained to use the various multimedia devices for teaching-learning process.

vii. Blended instruction can be integrated to teach various difficult concepts in computer science at college level.

viii. Collaborative and Cooperative learning can be integrated among students at the colleges.

ix. Government can encourage teachers by awarding funds to those involved in the development of CAI and teaching-learning packages.

x. Training programs can be conducted exclusively for the teachers to utilize the multimedia devices in schools.

xi. ITS, ICAI and Sensor based teaching package may be developed

5.13 SUGGESTIONS FOR FURTHER STUDY

The present study can be further extended to

i. Teaching – learning software can be developed for varied complex topics in computer science namely Computer Architecture, Networking, Data structures using C Programming language and Linked List, to study its effectiveness in teaching.

ii. Attitude towards integrating ICT in teaching among arts and science college teachers.

iii. Similar study can also be conducted among Polytechnic and Professional college teachers.

iv. Development of Java/Visual basic based package for teaching computer science at all levels will be done.
v. Effectiveness of CAI packages in teaching computer science at schools and colleges.

vi. Effectiveness of teaching-learning soft wares among learners with different learning styles.

5.14 CONCLUSION

Teaching is generally considered as an activity which is designed and performed for multiple objectives in terms of changes in pupil behavior. Pupils on the other hand have multidimensional personalities having different styles. The common implication of both these facts is that the teacher should use different strategies for teaching which match the objectives of teaching on one hand and pupils learning styles and personality dimensions on the other hand. Teaching of pointers using POINTERS SOFTWARE have revolutionized the whole teaching and learning process among teachers and students. And also it helps the students to understand the abstract concepts such as allocation of memory location for data storage during execution and declaration, accessing the memory location directly without any difficulties which helped them to improve the efficiency of the program. Therefore this study would be more useful if the suggestions and recommendations given by the investigator are taken up and applied for further research.