CHAPTER III

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CHAPTER - III

DESIGN OF THE STUDY

3.0 Methodology (Procedure for the Study)

As discussed in Chapter I, the main objective of the present study is to develop and validate a computer software package to facilitate students of IX standard in developing competency and required skills in learning a few selected units in Mathematics. Chapter II provided review of related literature which is essential for designing of the present study. This chapter is developed to describe the methodology of the study.

3.1 Statement of the Problem

DEVELOPMENT AND VALIDATION OF COMPUTER INSTRUCTIONAL PACKAGE ON SELECTED UNITS IN MATHEMATICS FOR IX STANDARD.

3.2 Defining the Problem

The present study intends to develop a computer instructional software package which is self instructional kit for both students and teachers which facilitates the learning of for IX class students. The investigator also intends to know the effectiveness of software package so developed with the help of CAL or CAI to those programmed text learning and traditional teaching method. Another important aspect of the study is to validate the instructional package so developed.
3.3 Design of the Study

The present study is an experimental design involving Control, Experimental-I and Experimental-II groups. Effects on different treatments is estimated by pre and post criterion tests. The design of the study is as follows:

Formation of Groups

The main objective of the study is to know the achievement of the students of IX standard which taught through three types of methods. Accordingly groups are to be formed. Hence the following model has been done. The present study involved three types of treatments to the three groups of students. The investigator formed three groups by controlling the intelligence.

Group I - Control

In the University Public School, there are four IX divisions. The Investigator gave Group Intelligence test to all the students and IQ of each student was calculated. He selected 25 boys and 25 girls having similar intelligence.

Control Group - 25 boys + 25 girls having IQ 105.

Group II - Experimental-I

There are 240 students studying in IX standard at Rotary English Medium School, Mundagod. The Investigator administered group intelligence test to all of them and calculated the IQ of each student. He selected 25 boys and 25 girls out of 240 students having similar intelligence.
Experimental-1 - 25 boys + 25 girls having IQ 105.

Group III - Experimental-2

There are four IX divisions at the Lions’ English Medium School, Haveri. The group intelligence test was administered to all the students and IQ of each student was calculated. Students having similar intelligence were selected.

Experimental-2 - 25 boys + 25 girls having IQ 105.

Table-3.1: Showing Formation of Groups.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>Class</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Control Group</td>
<td>IX</td>
<td>Traditional method of teaching</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental-I</td>
<td>IX</td>
<td>Teaching with programmed text material</td>
</tr>
<tr>
<td>3.</td>
<td>Experimental-II</td>
<td>IX</td>
<td>Teaching with computer software package</td>
</tr>
</tbody>
</table>

The investigator also wanted to know the effect of socio-economic and educational status of the students in such treatments and also in their achievements. Hence he categorised three sub-groups among the each main group.

Table-3.2: Showing three SEES groups

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Main Group</th>
<th>Treatment</th>
<th>Sub groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Control</td>
<td>TMT</td>
<td>HSEES MSEES LSEES</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental-1</td>
<td>PTM</td>
<td>HSEES MSEES LSEES</td>
</tr>
<tr>
<td>3.</td>
<td>Experimental-2</td>
<td>CSP</td>
<td>HSEES MSEES LSEES</td>
</tr>
</tbody>
</table>
Similarly the investigator wanted to know the effect of sex factor on the treatment and achievement of the students. Hence he categorised two sub-groups among each main group.

Table-3.3: Showing Formation of Sexwise groups

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Groups</th>
<th>Treatment</th>
<th>Sub groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Control</td>
<td>TMT</td>
<td>Boys</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental-1</td>
<td>PTM</td>
<td>Girls</td>
</tr>
<tr>
<td>3.</td>
<td>Experimental-2</td>
<td>CSP</td>
<td>Boys</td>
</tr>
</tbody>
</table>

3.4 Definition of Terms

1. Development: "Development of the computer package is nothing but to prepare a computer software for teaching learning process."

2. Validation: "This is nothing but standardisation of the tool and also knowing the effectiveness."

3. Computer Instructional package: "It is a computer software developed with certain specific objectives and also with content given to a group of students through which they learn effectively."

4. Selected units in mathematics of IX Standard: "This is for developing a computer software package since it is not possible to develop software for all units of IX standard. Few units chosen in Mathematics."

5. Control of Intelligence: We know that intelligence variable directly related with achievement of the individual. Hence, the investigator
controlled the intelligence by choosing such students who are having same or similar intelligence while forming the three groups. In this way, he has controlled the variable like intelligence.

3.5 Treatment Effects

The effectiveness of three types of treatments are to be estimated as follows:

1. **Main Effects:** The achievements of the students of:
   
   i. Control and Experimental-I group
   
   ii. Control and Experimental-II group
   
   iii. Experimental and Experimental-II group

2. **Secondary Effect:**

   **Part-I:** This part contains the effect of HSEES, MSEES and LSEES in three treatments respectively like:

<table>
<thead>
<tr>
<th>Group</th>
<th>HSEES</th>
<th>MSEES</th>
<th>LSEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>HSEES</td>
<td>MSEES</td>
<td>LSEES</td>
</tr>
<tr>
<td>Experimental-I group</td>
<td>HSEES</td>
<td>MSEES</td>
<td>LSEES</td>
</tr>
<tr>
<td>Experimental-II group</td>
<td>HSEES</td>
<td>MSEES</td>
<td>LSEES</td>
</tr>
</tbody>
</table>

   **Part-II:** This part contains the effect of three types of treatment on Boys and Girls.

<table>
<thead>
<tr>
<th>Group</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Experimental-I group</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Experimental-II group</td>
<td>Boys</td>
<td>Girls</td>
</tr>
</tbody>
</table>
3.6 Mechanism of three groups formed for the study

Control group: In this group the teacher teaching the unit should teach in his/her usual manner using minimum teaching aids and also with text books the students' emotions are being controlled which means very less participation of the students. This fairly means teacher dominated class. The factors controlled are methodology of teaching, usage of teaching aids, students’ participation, students’ intelligence and the time.

Experimental-I: In this type of treatment the teacher is allowed to use Programmed Instructional frames along with text books. The programmed text material is systematic with logical development of topics written in a linear manner containing small steps. For each concept each student has facility to self evaluate along with self pacing. In this way both the teachers and students equally take part in teaching-learning process. Here also intelligence of students is controlled.

Experimental-II: In this method use of computer software package prepared systematically and methodically for the three units is supplied to the teachers and students. Both of them have to study and understand the subject matter with the help of computer. There are simple steps to go forth interesting problems to solve and get solution for the problems in this way. Teacher can guide and the students can learn on their own with minimum teaching and maximum learning.

3.7 Over view of the treatments

1. Control group - Teacher Dominated (Traditional) Method

2. Experimental-I Group - Equal participation of teacher and students (Programmed text material)
3. Experimental-2 group - Pupil centered, individualised learning
Computer Assisted Instruction (CAI).

3.8 Selection of Sample for the study

The present study is an experimental study involving three groups,
namely traditional learning group, programmed learning group and
computer assisted learning group and the groups should also contain both
boys and girls of different socio-economic and educational status.

Sample should be true representative of the population. Hence the
following points are to be considered for choosing the sample for the
present study:

1. Common units for three types of syllabus which are existing in
the state for IX class students, namely (i) State government, (ii) CBSC
syllabus and (iii) ICSC syllabus.

2. IX class wherein both boys and girls are studying in the same
class with different SEES but having similar intelligence.

3. Teachers willing to adopt the method of teaching for chosen class
in their respected schools and evaluate the students accordingly.

4. Such IX classes wherein English is the medium of instruction.

Keeping the above factors in mind, the investigator consulted some of
the Principals/Headmasters, management members of same schools and
finally chosen the sample likewise.

1. Selection of Schools: Following schools were randomly selected
for the study:
1. University Public School, Dharwad
2. Lions' English Medium School, Haveri
3. Rotary English Medium School, Mundgod

2. Selection of class and students: The following table shows the IX class and number of boys and girls chosen for the study in the above schools. As already discussed the students having similar intelligence were selected for the study.

Table-3.4: Showing the Class and Number of Boys and Girls chosen for the study.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>School</th>
<th>Class</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>University Public School Dharwad</td>
<td>IX D</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Lions' English Medium School, Haveri</td>
<td>IX A</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>Rotary English Medium School, Mundgod</td>
<td>IX A</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

3. Teachers involved in the Group: The investigator approached the Principals/Headmasters of the respective schools and requested the above classes to act according to the man of the study.

Following staff members were involved:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the School</th>
<th>Name of the Teacher</th>
<th>Qualification</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>UPS, Dharwad</td>
<td>Sri Bolishetty</td>
<td>B.Sc., M.Ed.</td>
<td>12 years</td>
</tr>
<tr>
<td>2.</td>
<td>LES Haveri</td>
<td>Sri C.B.Gondi</td>
<td>B.Sc., B.Ed.</td>
<td>10 years</td>
</tr>
<tr>
<td>3.</td>
<td>RES Mundgod</td>
<td>Sri Anand S.</td>
<td>M.Sc., B.Ed.</td>
<td>13 years</td>
</tr>
</tbody>
</table>

The above teachers were readily agreed to teach the units according
to the plan of the study. Sri Bolishetty, Senior Teacher of University Public School, Dharwad was requested to follow the traditional method of teacher.

Similarly, Sri C.B. Gondi, Senior teacher, Lions' English Medium School, Haveri has been requested to teach the class with computer instructional package designed and developed by the investigator.

The following schools of IX class are randomly selected for the study:

i. University Public School, Dharwad.. State Syllabus
ii. Lions' English Medium School, Haveri .. CBSC Syllabus
iii. Rotary English Medium School, Mundgod.. ICSC Syllabus

i. University Public School, Dharwad: Dharwad is a big city having 25 secondary schools where we find most of the students of are from urban area. University Public School (UPS) is a residential school where most of the students are residing in the school hostel. The school has co-education and fully managed by Karnataka University. There are four IX divisions, IX-A, IX-B, IX-C and IX-D. The group intelligence test was given to all the students and the investigator calculated IQ of each student and finally selected 25 boys and 25 girls having similar intelligence were selected and the class is named as IX D. The school is equipped with well qualified staff and no computers are in the school and hence the UPS is included in the sample.

ii. Lions English Medium School, Haveri: Haveri is a semi urban
place where Lions' English Medium School is situated. There are four IX divisions. The school is having good infrastructure and well equipped with 15 computers. The students are allowed to operate the computers and also learn the subject matter through the computers with corresponding software. There are few computer trained teachers in the school. The investigator gave group intelligence test to all the IX class students and selected 25 boys and 25 girls having similar intelligence and named it as IX A division. The Mathematics teacher was also included in the sample.

Rotary English Medium School, Mudagod: Mundagod is a town of Uttar Kannada district. The Rotary English Medium School is established for rural students. The school is having good infrastructure. There are four divisions of IX. The investigator administered the group intelligence test and calculated the IQ of each student. And he finally selected 25 boys and 25 girls having similar intelligence and named the class as IX A. In the Rotary English Medium School, computer aided instruction is not yet introduced. Hence the investigator desired to introduce programmed text instructional method for the IX-A class students. Hence the school was included in the sample.

3.9 Variables involved in the study

Three types of variables are involved in the study.

1. Control variable - Intelligence and Treatment or the method of teaching.
2. Dependent variable - Achievement of the students.

3. Independent variable - Age of the students, sex of the students, socio-economic and educational status of the students.

Discussion of the variables

1. Control variable:

i. Intelligence. This is one of the important factor directly related to the achievement of the students. The present study involved the effect of three types of treatment on the achievement of the students. Since intelligence factor play key role in the achievement whatever may be the treatment. The investigator hence, decided to control the intelligence of the students choosing a group of similar intelligence students in each case. This would be done by administering group test of intelligence to all the students of three schools and IQ of each student may be calculated and the students with similar IQ in a particular school would be selected in the group so as to form set of three groups having similar IQ (average of 105 IQ ranging from 100-107).

ii. Treatment or method of teaching: The main objective of the study is to know the effectiveness of the three methods of teaching some of the units in Mathematics for IX standard selected sample of students.

<table>
<thead>
<tr>
<th>Group I controlled</th>
<th>Group II Experimental-1</th>
<th>Group III Experimental-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional teaching</td>
<td>Programmed text frames material</td>
<td>Computer self instructional software package</td>
</tr>
</tbody>
</table>
2. **Dependent variable:**

Achievement of the students: The achievement of the students would be estimated by administering pre and post achievement tests. The gain scores were also be calculated. The investigator constructed achievement tests for each unit, viz. theory of computing, statistics and commercial arithmetic. The pre-pre test (the VIII standard annual examination Mathematics marks) were also noted to know the level of achievement.

3. **Independent variable:**

Age and the sex of the student and the socio-economic and educational status of the students are independent factors.

3.10 Tools used for the study

Following tools were used for the study:

1. **Programmed text material (Instructional frames)**
2. **Computer instructional software package.**
3. **Socio-Economic and Educational Status Questionnaire to the students.**
4. **Group Intelligence test**
5. **Achievement Test**

1. **Programmed Text Material (Instructional frames)**

Skinner (1954) developed a new technique of ‘Auto instruction’ which was later termed as ‘Programmed Instruction’ and ‘Programmed Learning’. This concept was based on the apparent conditioning theory in
which the learning activities will be automatic after some exercises. This theory also based on Thorndikes (1929) laws of learning. S.Kinner considered that the learning taken in an individual by knowledge of correct response with proper reinforcement. He has given whole principles of programmes instruction.

i. Meaning of Programmed Instruction: Generally speaking the instructions provided by teaching machine or programmed text book is referred to as programmed instruction or programmed learning. Let us seek help from the definitions put forward by various scholars in understanding the meaning of the term programmed instruction.

According to Leith (1966), “Programme is a sequence of small steps of instructional material (called frames), most of which requires a response to be made by completing a blank space in a sentence. To ensure that expected responses are given, a system of using is applied, and each response is verified by the provision of immediate knowledge of results. Such a sequence is intended to be worked at the learner’s own pace as individual self instruction.”

According to Gulati and Gulati (1976), “Programmed learning as popularly understood is a method of giving individualised instruction in which the student is active and proceeds at his own pace and is provided with immediate knowledge of results. The teacher is not physically present. The programmer while developing programmed material has to follow the laws of behaviour and validate his strategy in terms of student learning.”
According to Skinner (1969), "Teaching is the arrangement of contingencies of reinforcement which follows the occurrence of desired response. The learning material therefore should be organised so as to increase the incidence of correct responses moreover since the intended behaviour or often a complex composite of many smaller behaviours. It is unlikely to be spontaneous. Teaching should be a process of maintaining interaction by reinforcing successive approximations to the desired behaviour.

ii. Principles of Programmed Instruction: The following are the basic principles of programmed instruction:

1. Principle of small steps
2. Principle of active responding
3. Principle of immediate confirmation (feedback)
4. Principle of self pacing
5. Principle of student testing.

iii. Styles of Programming: There are three major types of programming as below:

1. Linear programming (Skinner, B.F. 1958)
2. Branching programming (Crowder, N.A. 1954)
3. Mathematics (Gilbert, T.F., 1962)

Linear Programming: Based on Skinner theory of operant conditioning attempts have been made to teach a desired behaviour to the learner in which the instructional material is divided into small logical
modules. Each behavioural changes is reinforced in the direction of learning objectives.

iv. Features of Linear Programme:

1. Information is broken into small steps, each of which is called ‘frame.’
2. Frames are systematically arranged.
3. Stimulus part of the frame calls for defined response.
4. Every frame calls for a response.
5. Response is followed by immediate feedback.
6. Frames provide prompts to get response correctly every time.
7. Frequency of errors is maintained at less than 5% (Shah, 1991).

v. Dimensions of Linear Programme

1. Programme output: Some material (a frame) is projected to the student. This material takes the student one small group steps towards the desired behaviour.
2. Student input: The student makes some kind of response. For e.g. by filling one or two blank spaces.
3. Programme reaction:
   (a) The programme provides the correct response or confirms if it is right.
   (b) Programme moves on the next frame. The next frame is independent of the correlations of the student responses.
In linear programming the individual student's freedom is that he may work through the material at his own pace. He has no freedom to receive different material. In other words, all the students receive in the form of frames. Linear programming as a technique has vanished from computer assisted learning.

Last (1979) described strictly Skinnarian programme on German language. The computer provides student responses to be evaluated for presentation matches the given answer exactly enables presenting teaching material flexible as planned and accumulate statistics in students performance.

vi. Branching Programming

Branching programming developed by Crowder N.A. (1954) adapts to the needs of the students by allowing the student response to control the next material. If the student responds correctly he goes to next frame with the wrong answer, the programme provides an appropriate explanation or suggestion. The programme retests on the current frames.

Branching programme is based on three assumptions:

(a) Students learn better if the whole content is exposed.

(b) Students errors help in diagnosis and do not necessarily hinder in learning process.

(c) Students learn better if remediation are provided side by side for the weakness of learners and for the betterment too.
3.11 Development of programmed instruction material

One of the objective of the study is to develop programmed text material for three units of IX class mathematics. The following aspects are important to prepare programmed instruction frames.

(a) Target group
(b) Selection of units
(c) Overview of topics
(d) Specifying the objectives
(e) Content analysis
(f) Writing programmed instructional frames.

Target Group

The target group for the study of IX class students study maths with three different syllabi viz. Karnataka State, CBSE IX Syllabus and ICSC IX syllabus.

So the researcher intends to prepare programmed instructional material for the above target group. One can find the three types of syllabi of secondary schools in Karnataka State, CBSC in central and Navodaya Vidyalayas, ICSC in Railway and private schools.

Selection of Units

As earlier mentioned we find three types of syllabi is provided to IX class students, the detailed contents of each type is given in the chapter II. According to researcher, chosen common units from the three types of Syllabi following units are found to be common units.
So the above three units have been selected since the above topics are basically important for students.

3.12 Overview of units

(a) Theory of computing: We are in the era of computers and computing and hence each and every one should be computer literate. For this purpose the computer education has been introduced from secondary level. So the researcher selected the unit to give clear picture of the computing. The basic skills and essential features etc. are to be included in programmed instruction material so that the students can learn themselves with little help of teacher.

(b) Commercial Arithmetic: This is another important unit which should be known by each and every student, the bank transactions, stock shares, the business system, money exchanges etc. is the necessity of the Number of students are unable to understand the unit through traditional methods. So researcher intends to present programmed instructional material for the students to learn the unit effectively.

(c) Statistics: This is also important unit in mathematics which contains some of the basic calculations like Mean, Median, Mode, Mean deviation, Quartile deviation etc. The students find the difficulty to understand the mode of calculation. So researcher intends to prepare a programmed instructional material for the students to learn effectively.
The above three units are common from the three types of syllabi for prescribed for IX std. students. The units are vital important to develop future of the individuals.

Specific objectives (Unitwise)

Unit 1. Theory of computing
1.0 Student will be able to:
1.1 recall the electronic devices.
1.2 define the meaning of computer.
1.3 Explain the process of computer
1.4 Explain the characteristics of computer
1.5 Label the different parts of computer
1.6 Recall and recognise input and output devices
1.7 Explain the functions of CPU.
1.8 Explain the function of ALU
1.9 Define storage devices
1.10 Explain the storage devices
1.11 Define ROM and RAM
1.12 Recall and recognise languages of computer.
1.13 Explain the High Level Language (HLL) and Machine Level Language (MLL) and Low Level Language (LLL).
1.14 Recall different computer languages like BASIC, PASCAL and COBOL.
1.15 Define program and Algorithm
1.16 Explain Algorithm
1.17 Solve the problems on Algorithm
1.18 Define flow chart
1.19 Recall and recognise the symbols of flow charting
1.20 Draw the flow chart quickly and accurately
1.21 Take interest to solve problems on algorithm.
1.22 Draw flow chart on different examples.

Unit 2: Commercial arithmetic

2.0 Students will be able to:
2.1 Recall the concept of simple interest
2.2 Recognise the formula of simple interest
2.3 Recognise the meaning of P, T and R
2.4 Explain the formula of simple interest
2.5 Solve the problems on simple interest quickly, neatly and accurately.
2.6 Apply the knowledge of simple interest in day to day life.
2.7 Take interest to solve maximum problem based in simple interest
2.8 Recall the process of compound interest
2.9 Define the compound interest
2.10 Find out the formula of compound interest
2.11 Explain the compound interest
2.12 Solve the problems on compound interest quickly and neatly by using formula
2.13 Collect and solve the problems on compound interest in day to day life.
2.14 Recall and recognise bank accounts like savings, current and term deposit account
2.15 Explain the concept of recurring deposit
2.16 Define the concept of fixed deposit and term deposit
2.17 Explain the meaning of savings.
2.18 Define the concept of savings account.
2.19 Collect the pay slips/challan and withdrawal form from the banks
2.20 Deposit the money and draw the money
2.21 Fill the challans and withdrawal slips quickly and accurately
2.22 Recall and recognise the pass book of bank accounts
2.23 Explain the pass book
2.24 Recall and recognise the cheques and drafts
2.25 Recognise the different types of cheques
2.26 Explain the functions of depositor and drawer
2.27 Explain the concept of draft.

Unit 3. Statistics

3.0 Students will be able to:
3.1 Recall the concept of statistics
3.2 Define the statistics
3.3 Recognise the primary data and secondary data
3.4 Recognise grouped and ungrouped data
3.5 Explain the class interval
3.6 Recall the measures of central tendencies (MOCT)
3.7 Define Mean
3.8 Find out the formula of mean
3.9 Solve examples on mean by using formula
3.10 Define Median

3.11 Explain the formula of Median for grouped and ungrouped data

3.12 Define Mode

3.13 Solves examples on Median and Mode, quickly and neatly

3.14 Gives examples

3.15 Recall the measures of dispersion

3.16 Define the concept of dispersion

3.17 Define the range

3.18 Find out the range on given problem

3.19 Recall the recognise the lowest and highest score

3.20 Define co-efficient of range

3.21 Solves problem related to co-efficient of range quickly, accurately and neatly

3.22 Define quartile deviation

3.23 Find out the formula of quartile deviation

3.24 Recognise the second quartile, third quartile

3.25 Able to solve the problems (grouped and ungrouped) relating quartile deviation quickly, neatly and accurately.

3.26 Define Mean deviation

3.27 Findout the formula of Mean deviation

3.28 Explain the formula of Mean deviation

3.29 Recall and recognise the graphical representation of data

3.30 Define the ‘Histogram’

3.31 Draw Histogram on given examples

3.32 Explain the concept of frequency polygon
3.33 Define the frequency polygon
3.34 Draw the frequency polygon on given problem neatly, quickly and accurately
3.35 Compare Histogram and frequency polygon
3.36 Explain the characteristics of frequency polygon and Histogram.

Content analysis

1.0 Theory of computing
1.1 Meaning of computer
1.2 Computer and Mathematics
1.3 Computer model
1.4 Characteristics of Computer
1.5 Computer Languages
1.6 Meaning of Algorithm
1.7 Examples of Algorithm
1.8 Meaning of flow chart
1.9 Symbols used in flow chart
1.10 Problems of flow chart
2.0 Commercial arithmetic
2.1 Concept of simple interest
2.2 Formula of simple interest
2.3 Problems on simple interest
2.4 Meaning of compound interest
2.5 Formula of Compound interest
2.6 Examples on compound interest
2.7 Current account
2.8 Savings account
2.9 Term deposit account
2.10 Cheques and types of cheques
2.11 Recurring deposit
2.12 Problems of deposit

3.0 Statistics
3.1 Meaning and definition of statistics
3.2 Collection of data and types of data collection
3.3 Measures of central tendency (MOCT)
   3.3.1 Mean/Average - Meaning, definitions and examples
   3.3.2 Median - Meaning, definitions and examples
   3.3.3 Mode - Meaning, definitions and examples
3.4 Measures of dispersion
   3.4.1 Range - co-efficient of range
   3.4.2 Quartile deviation
   3.4.3 Formula of quartile deviation like $Q_1$, $Q_2$, $Q_3$ and Problems of Quartile Deviation
   3.4.4 Mean Deviation (MD)
   3.4.5 Formula of MD
   3.4.6 Problems in Mean Deviation
3.5 Diagrammatic representation of data
   3.5.1 Histogram
   3.5.2 Frequency polygon
   3.5.3 Difference between Histogram and frequency polygon
3.13 Sample for programmed text material frames

The sample programmed text material frames of three units is given in Appendix.

3.14 Standardisation of programmed instructional material

To know whether learning through programmed text material is effective. The investigator prepared a programmed text material for three units according to the principles of linear programming.

After the frames have been prepared by the investigator he showed them to guide and to the experts and made necessary corrections. He wanted to know the effectiveness of the tool prepared. So first tryout was conducted.

Tryout-1

Table: 3.5: Showing Sample for Tryout-I

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>School</th>
<th>Division</th>
<th>Units</th>
<th>No.of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basel Mission Boys High School, Dharwad</td>
<td>IXC</td>
<td>Theory of computing</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Basel Mission Girls’ High School, Dharwad</td>
<td>IXE</td>
<td>Commercial Arithmetic</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Vidyaranya High School Dharwad</td>
<td>IXB</td>
<td>Statistics</td>
<td>50</td>
</tr>
</tbody>
</table>

All the three classes students were given pre test and noted that they do not have knowledge about the unit. Hence the Investigator gave them frames to learn. After the completion of instruction/learning the investigator administered post test and the scores were noted. He calculated the mean, SD and also the t-value.
Table-3:6: Showing t-value of pre and post test of tryout.

<table>
<thead>
<tr>
<th>Units</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1. Theory of computing</td>
<td>3.88</td>
<td>0.94</td>
</tr>
<tr>
<td>2. Commercial arithmetic</td>
<td>3.28</td>
<td>1.89</td>
</tr>
<tr>
<td>3. Statistics</td>
<td>4.2</td>
<td>1.12</td>
</tr>
</tbody>
</table>

The t-value of all the three units is significant.

Validity of the test

1. Content validity: The programme text material prepared on the IX Standard Mathematics (three units). Hence it has content validity.

2. Concurrent validity: The programme text material so prepared is according to the existing syllabus of IX standard students studying in Karnataka State. The three units of Mathematics chosen for the study is included in all the three types of syllabus of IX standard, namely, state syllabus, CBSC syllabus and ICSC syllabus. Hence the text material has concurrent validity.

The Reliability of the text material: The Reliability of the programme text material prepared for the study has been calculated by split-half method using Spearman-Brown Prophecy formula and r was found to be 0.75. This means the tool programmed instruction material seems to be valid and reliable. Hence the frames were used for fixed data collection.
3.15 Development of Computer Instructional software package

One of the important objectives of the study is to know the effectiveness of the computer instructional software package on learning of mathematics for IX standard students.

Following aspects are important for development of a software package.

1. Target group
2. Subject and standard of study
3. Objectives of the software material
4. Content analysis
5. Other requirements

Target group: The target group is of IX class students studying in Karnataka State with three different syllabus, viz. State government, CBSC and ICSC syllabus.

Subject and Standard: As already mentioned Mathematics units are common in the three types of syllabi, viz. State government, CBSC and ICSC for IX class. They are:

1. Theory of computing
2. Commercial Arithmetic
3. Statistics

Objectives with behavioural specifications: This has been explained in length in development of programmed text material.

Content Analysis: The units chosen for the study are duly analysed according to the requirements. It is also explained in the previous programmed text material development.
Other requirements: In twin cities of Hubli-Dharwad there are many computer training centres, schools, institutes and numerous software developers, professionals, programmers, engineers, specialists. Among the few good software centres out of which ICMS Computer centre is one of the best centre. Investigator approached the centre along with proposal to prepare three sets of software packages for IX standard students in mathematics. The following materials were supplied:

1. Objectives
2. Content with content analysis
3. The target group on which the software will be developed
4. Textbooks and reference books related with the content
5. Programmed text frames which are already prepared
6. Some Mathematics software packages which are prepared for other chapters by commercial person.

Accordingly, the ICMS Computer Software engineers, along with the investigator took about two months to prepare the software package for all the three units. The software engineers gave the following specifications regarding the software:

i. Selection of programming language: While virtually any language (like that of BASIC, PASCAL, VISUAL BASIC, C etc.) can be used to create a programme, in the present case, after specifying the requirements of the present programme and discussing with the computer experts, VISUAL BASIC language was selected for programming. It was important to select a programming language that flows our design to be programmed
according to our specifications. Selection of VB as programming language is justified on the following specific features:

1. It is a fast and efficient language.
2. Object code generated is short.
3. Good compilers are universally available.
4. Skilled programmers are available.
5. Userfriendly
6. Window-based

Hardware Setup

For developing the computer software, Computer laboratory of ICMS of Dharwad was utilised. For speedily processing and simultaneous programming and data entering network facility was utilized.

The network consisted of a 486 PC based server with 600 MB hard-disk running on Windows 95/98. There were random based nodes each with 64 MB RAM and 14" colour monitor.

Low Level Design

Various userfriendly features were incorporated while developing the computer software. They refer to:

1. Screen design
2. User interface
3. User control
4. Menus
Screen Design

Though screen design is similar to the design of a printed page, it is much more complex. The screen is a dynamic display medium. Many factors have to be considered in designing the screen for an educational software.

A lot of attention was given to the design of screen as this is what the learners would ultimately see. Quality of the programme is often judged by this factor.

i. Colour of the screen
ii. The format of the screen
iii. Windows
iv. Scrolling
v. Use of attentional devices

While designing the screen, criteria for evaluation were kept in mind.

Colour of the screen: The present programme can be used for both monochrome and colour monitor. It was decided to have a light shade instead of the usual black for the monochrome monitor. For remedial frames reverse video is used.

Format of the screen: Using the VB uniform Windows are created within which the text was to appear. The border facility was also made use of for other Windows as well.

Scrolling: Though one of the characteristics of a good software is to avoid the use of scrolling. It had to be used in this programme for
obvious reasons. The programme is based on branching logic which allows lengthy texts to be adopted in the programme. Secondly, the very nature of the programme viz., to aid school children in Mathematics compelled the programmer to use scrolling. However, whenever scrolling is required, clear instruction is provided through the message bar. The user can scroll the screen up and down using the arrow keys.

Use of attentional devices: Blinking, reverse video (RV), colour and sound effects are the devices which can be used to draw attention to something important on the screen. However, the value of these wears off quickly if they are overused. Further, user’s attention is diverted to these devices instead of the content on the screen. Therefore, in the opinion of experts, these have to be used sparingly and as a rule only one of these devices is to be used per screen.

User Interface: The word interface refers to the characteristics of the communication between the user and computer. With most microcomputers, one can have several user interface devices to choose from. They include the Keyboard, Joysticks, Paddles, Mouse, Light pen, etc. Keyboard was chosen as the user interface for the present programme, since it was not necessary to provide other alternative interface.

While designing the interface, care was taken to ensure that there was consistency of keys and their functions. There is no unusual delays or quirks. Pressing of keys other than required produces no effect.
User Control: One important design factor on which the success of most educational software depends is user control. The user should always be in control of the programme.

Instead of having the programme set the pace, user should be allowed to set the pace at which words, sentences etc. are displayed. This is essential since every one reads at a different speed. By allowing the user to select the next display or event, individual approach is facilitated.

Use of scrolling facility in designing the programme is an example of user control. The user can move the text up and down according to his/her requirement by using the arrow keys. Only after he/she has finished reading, he/she can move to next display by pressing a specific key.

Also, the user can control the sequence of the appearance of text. This includes both intra and inter unit sequencing. Within a module the user can either move to next screen or previous or he/she can quit to main menu using function keys. From main menu he/she can have direct access to any module or help menu.

Menus: There are basically three ways to allow users to control a programme: Menus, Command Language and Function keys. In the present programme only two viz. menus and function keys have been adopted as only an experienced user can handle the command languages.

Menus consist of a list of options or selections. They are used for two different purposes, to present control options and choices among content selection. Menus can be created in a variety of formats.
Function keys are used in conjunction with menus by displaying the current function of each key at the bottom of the screen.

**Documentation remarks:** This computer software was developed from the notion that skills are strengthened when information is presented to a child on a visual sensory channel. Also children can integrate their motor sense by practising.

To ensure that this programme performed the service for which it was developed, it was extensively tested in an academic environment. An instructional programme was prepared first. It was tried out at simulated and then small group level. Finally a field test was carried out involving 25 boys and 25 girls students studying in class IX. Its effectiveness was established through appropriate statistical methods.

The same instructional programme was taken up for computer programming so that it could be presented through computer. The first version of the software was pilot tested to locate and debug the probable flaws that might had existed. After necessary modifications, final testing was carried out with 50 students participating in it.

The results of the testing showed the effectiveness and workability of the software.

**Details of the software:**

1. Name : COMMAT
2. Subject : Mathematics-I
3. Level : Class IX students
4. Hardware requirement: PC/AT 486 needed
5. Monitor (VDU): Monochrome as well as colour
6. User interface: Keyboard
7. Special features: (a) Userfriendly aspects like creation of menus, including help, message bar, etc.
                (b) Interactivity of different levels
                (c) Facility of student input record
                (d) Provision for computer free activities.

This product is recommended for use with students between the ages of 14 and 15 or students studying in IX standard. This software should be considered supplemental or independently.

Name of the Programme: COMMAT

Purpose: Undoubtedly the largest use of the computers in schools at all levels will eventually be as an aid in learning various subjects of the curriculum, including learning to read, write and to solve the mathematical problems and all other tasks associated with the learning process.

The principle of individualized instruction in education has been stressed by many psychologists over the last 50 years. Individuals differ in their abilities, their rates of learning and often even in their general approaches to learning. Unfortunately, the cost of providing individualized instruction that adapts to these differences is prohibitive if one depends on the use of teachers. This is true especially in Indian schools where number of students varies from 30 to 40 in a class.
Author/Copyright: As the computer software was developed as a Ph.D. project undertaken by the researcher, the copyright rests with the author.

Date of Generation: 15.6.1999

Memory Requirement: The programme can be run on a 486 PC machine with 640 MB memory capacity.

Execution time: The average time required is 10 hours. This excludes the time that a learner takes to respond in a natural language on paper.

The software package was shown to the guide and other experts. Necessary corrections were made and tool was kept for preliminary try-out.

Achievement tests (unit ten): The researcher prepared unit test for three units according to the objectives having 50 items.

Researcher also approached experienced teachers who are having computer literacy and gathered their suggestions and modified the same. The three sets of software packages kept for tryout.

3.16 Standardisation of Computer Instructional Software Package

Investigator planned the first try-out selecting the following three schools for three units namely:

i. Police residential school, Dharwad ... Theory of computing   50
ii. Karnataka High School, Dharwad ... Commercial Arithmetic 50
iii. K.E.Board's School, Dharwad ... Statistics 50
The above schools are having computers and the students are well aware of learning through computer software package.

The investigator requested the Principals and subject teachers and got the consent. The IX class students of the above schools were given the pre test and then the software. The students took one week to learn the units through computers. After the treatment the investigator administered the post test to the above students and noted the achievement of pre and post test.

Table 3.7: Showing Mean, SD and t-value of try-out-I

<table>
<thead>
<tr>
<th>Units</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>1. Theory of computer</td>
<td>4.48</td>
<td>2.82</td>
<td>46.6</td>
</tr>
<tr>
<td>2. Commercial arithmetic</td>
<td>4.72</td>
<td>6.51</td>
<td>47.2</td>
</tr>
<tr>
<td>3. Statistics</td>
<td>4.2</td>
<td>2.826</td>
<td>46.5</td>
</tr>
</tbody>
</table>

To cross validate the computer instructional software packages, the researcher gave three sets of software to other three schools.

Sample for try-out II

Table-3.8: Showing the sample for try-out II

<table>
<thead>
<tr>
<th>Name of the school</th>
<th>Class</th>
<th>No.of students</th>
<th>Software &amp; package</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lamington High High School, Hubli</td>
<td>IX B</td>
<td>25</td>
<td>Theory of computing</td>
</tr>
<tr>
<td>3. New English School, Hubli</td>
<td>IX C</td>
<td>25</td>
<td>Statistics</td>
</tr>
</tbody>
</table>
The students took 15 days to learn the respective units soon after the completion. Researcher administered achievement test on three units.

Table-3.9: Showing Mean, SD and t-value of try-out-II.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Units</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>1</td>
<td>Theory of computing</td>
<td>3.88</td>
<td>1.94</td>
<td>45.72</td>
</tr>
<tr>
<td>2</td>
<td>Commercial Arithmetic</td>
<td>4.45</td>
<td>2.76</td>
<td>46.2</td>
</tr>
<tr>
<td>3</td>
<td>Statistics</td>
<td>4.2</td>
<td>2.12</td>
<td>45.45</td>
</tr>
</tbody>
</table>

By observing the above Table-3.9, it is clear that the students achieved significantly more. Hence, both try-outs I and II revealed that the computer Aided Instruction/Learning helped the students of IX standard to learn the units more effectively. Both teachers and students opines that the Computer Aided Instruction/Learning is really helpful to learn in a better way than the traditional method and other methods of teaching.

Reliability of the Computer software

The reliability of the Computer software package so developed was calculated by split-half method using Spearman-Brown Prophecy formula and r was found to be 0.75 which reveals that the Computer software developed is reliable.

3.17 Questionnaire of SEES for students

To know the impact of learning through three treatments on socio-economic and educational status of the students the researcher developed a questionnaire on the following aspects:
a. Social factors of the pupils
b. Economic factors of the parents
c. Educational status of the parents
d. Sex aspects

Social aspects of pupils means the locality that they are living, family members and family norm, the peer group, the school atmosphere, relationship with schoolmates, relationship of parents with neighbours, role of individual in play and cultural activities.

Economic aspects means parents occupation, monthly/yearly income, material status, facilities in the house, dress and food habits, taking private tuitions.

Educational status of parents means qualification of parents, individual educational attainment, study habits, other habits, position in the school.

After identifying the different components the researcher fairly made three groups of students namely, HSEES, MSEES and LSEES.

HSEES: Graduate more than Rs.20,000 income per month with all facilities, own house, living in a sophisticated post area for Ex-professor, engineer, bank manager, businessman, owners.

MSEES: Middle class group with parental income of 6-15 thousand, two wheelers, rented or own small house and living in a thickly populated area for example, office superintendent and AOS, Clerks, teachers etc.
LSEES: Lower class peoples with 3-5 thousand monthly income, low educational status, illiterates, coolies, peons, attenders etc.

Writing of items: According to plan mentioned above, the researcher prepared items in the form of questions. Initially he has written 20 items for each aspects. Totally 50 items written when they were shown to the guide and experts finally 45 items were retained and they were retained in the form of questions having direct answers and the final format was prepared kept for administration.

3.18 Group intelligent tests

One of the objectives of the study is to know the relationship between the achievement and intelligence of the students learnt through three different types of approaches.

Researcher wanted to know the intelligence of the students for this purpose he gone through the theory of intelligence and different types of intelligence test and he also verified many group intelligence tests like:

a. Bhatia’s Battery
b. General group test of intelligence
c. MGTI (Madras Group Test of Intelligence)
d. GGIT (Mysore Group Test of Intelligence)
e. Alahabad Group Intelligence test
f. Chinnamma group intelligence test (Kannada version)
g. Ahuja Group test of intelligence.
h. DAT
i. Non-verbal Intelligence Test

Since none of the above test was found to be appropriate for the
present student the investigator after detailed study of all the above group test of intelligence decided to use Dr. R.T.Jantli group test of intelligence for the age group of twelve to fourteen years. The tool was prepared for his doctoral thesis.

**Group Test of Intelligence (Dr. Jantli, 1987):** One of the objective of the study is to control the intelligence of the students to know the effect of three types of treatment to the three groups of students. Hence the investigator used the group test of intelligence constructed and standardised by Dr. R.T.Jantli. This tool was constructed for calculating IQ of the IX class students. The group of intelligence test consisted of the following sub-tests.

i. Analogies

ii. Non-verbal test

iii. Picture completion test

iv. Vocabulary test

v. Classification

vi. Arithmetical test

**3.19 Achievement test**

To know the effectiveness of three types of treatment, achievement test was prepared to use them as pre and post test. This test was constructed taking the content of three units, namely (a) Theory of computing, (b) Commercial Arithmetic and (c) Statistics. The content was analysed according to objectives kept for construction of achievement test.
The blueprint was also prepared accordingly. This type of items are fill in the gaps, match the following, abbreviations, short answer types and essay types etc.

The items were written and was shows to subject experts and scoring key was also prepared. The test was validated by using proper validation procedure.

Construction of Achievement Test

The sample selected for the study was IX standard students. The investigator being a Teacher-Educator specialised in teaching Mathematics, decided to construct achievement test for the three units which are already chosen for the study.

Units and sub-units

The first unit chosen was ‘Theory of computing’ which is the X chapter in Mathematics for IX standard.

The unit consist the following sub-units.

1. Theory of computing
1.1 Meaning of computer
1.2 Computer and Mathematics
1.3 Characteristics of computer
1.4 Computer languages
1.5 Algorithm
1.6 Flow chart
1.7 Problems on flow chart

The second unit chosen was ‘Commercial Arithmetic’ which is the
VII chapter in Mathematics for IX standard. The unit consists the following sub units:

2. Commercial Arithmetic
   2.1 Simple interest
   2.2 Compound interest
   2.3 Current account
   2.4 Savings accounts
   2.5 Term deposit account
   2.6 Cheques and types of cheques
   2.7. Deposits and recurring deposit

The third unit chosen was ‘Statistics’ which is also the VIII chapter in Mathematics Part-I for IX standard. The unit consists the following sub-units:

3. Statistics
   3.1 Collection of data and types of collection of data
   3.2 Measures of central tendency (MOCT)
   3.3 Measures of Dispersion
   3.4 Diagrammatic representation of data

Previous knowledge

The students of IX standard could have studied the following basic operations of computer and basic concepts in their previous classes:

1. Basic operations of computer, Algorithm
2. Simple interest, compound interest, accounts, types of cheques, deposits etc.

**Defining Educational Objectives**

An important step in the construction of an achievement test is to make a survey of the aims and objectives of instruction of the particular subject chosen. To be valued this can only be done by examining the curricular programme prescribed by the Department of Public Instruction and the textbook prescribed.

A test, constructed must match the teaching objectives of the course. It is designated for various educationists have attempted to provide classification. Systems and lists of common classroom objectives of Mathematics teaching and testing. But the investigator for the present study has restricted himself to four categories of objectives in the cognitive and conative or psychomotor domain. They are knowledge, understanding application and skill.

The specifications of each objectives are reported in Table-3.10

**Table-3.10: Showing Specification of each objectives**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Objectives</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Knowledge</td>
<td>The pupil-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. recalls</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. recognises</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. repeats</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. discrimination</td>
</tr>
</tbody>
</table>
| 2. Understanding | The pupil-  
1. gives examples and illustrations  
2. defines  
3. detects the errors  
4. rectifies the errors  
5. observes the relationship  
6. explains  
7. classifies  
8. Compares and contrasts  
9. finds similarities |
|---|---|
| 3. Application | The pupil-  
1. analyses  
2. verifies the results  
3. interpret  
4. gives reason  
5. establishes the relation  
6. finds cause and effect relationships  
7. suggests appropriate procedures  
8. selects appropriate tools  
9. draws inferences  
10. accepts the mistakes without any hesitation |
<table>
<thead>
<tr>
<th>4.</th>
<th>Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pupil-</td>
<td></td>
</tr>
<tr>
<td>1. does oral calculation neatly, quickly and accurately</td>
<td></td>
</tr>
<tr>
<td>2. does written calculation neatly, quickly and accurately</td>
<td></td>
</tr>
<tr>
<td>3. Reads the tables, charts, graphs and ready reckoners</td>
<td></td>
</tr>
<tr>
<td>4. Selects appropriate instruments</td>
<td></td>
</tr>
<tr>
<td>5. Takes measurement accurately</td>
<td></td>
</tr>
<tr>
<td>6. Draws the diagram accurately, neatly and quickly</td>
<td></td>
</tr>
</tbody>
</table>

**Preparation of Blue print**

The investigator consulted his Guide and other expert Mathematics teachers for the weightages of marks to be given to each objective. After due consultation the weightage for knowledge objectives arrived at was 25%. Understanding application and skill 25% each. The details are reported in Table-3.11. In Table the blue print of the try-out form of the test is given.
Table-3.11: Showing Content Weightage

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Content</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Meaning and definition of computer.</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>2.</td>
<td>Parts of computer</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Computer devices</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>4.</td>
<td>Flow charts and Algorithms</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Table-3.12: Showing Objective Weightage

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Content</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Knowledge</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>Understanding</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>3.</td>
<td>Application</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>4.</td>
<td>Skill</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Table-3.13: Showing Questionwise Weightage

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Content</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Objective questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>Multiple choice</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>ii.</td>
<td>Fill in the blanks</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>iii.</td>
<td>Abbreviations</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>iv.</td>
<td>Match the following</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>Short answer type</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>3.</td>
<td>Essay type</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
**Blue-print**

Table-3.14: Showing Blue-print of the achievement test.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Knowledge</th>
<th>Understanding</th>
<th>Skill</th>
<th>Application</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form of items</td>
<td>O SA E</td>
<td>O SA E</td>
<td>O SA E</td>
<td>O SA E</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>2(1) 1(2)</td>
<td>1(1) 2(2)</td>
<td>1(4)</td>
<td>-</td>
<td>7(13)</td>
</tr>
<tr>
<td>2.</td>
<td>4(1) -</td>
<td>1(1) 1(4)</td>
<td>1(1)</td>
<td>7(10)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>2(2)</td>
<td>2(1) 2(2)</td>
<td>2(1)</td>
<td>2(2)</td>
<td>10(14)</td>
</tr>
<tr>
<td>4.</td>
<td>3(1) 1(2)</td>
<td></td>
<td>2(4)</td>
<td></td>
<td>6(13)</td>
</tr>
<tr>
<td>Total</td>
<td>13(15)</td>
<td>9(16)</td>
<td>3(12)</td>
<td>5(7)</td>
<td>30(50)</td>
</tr>
</tbody>
</table>

O - Objective type; SA - Short answer type; E - Essay type

The investigator planned to construct 50 items in each test with a score of one mark for objective type items and two marks for very short answer type items and three marks for short answer type items and four marks for essay type items.

Writing of Test items

The investigator keeping in view the objectives, the specifications of the objectives and plan of constructing different types of items, started writing down the items in identical form (test re-test form) of tests so constructed for each unit consisting of 50 items each were prepared and they were given to experts and other experienced Mathematics teachers for
their comments and suggestions. Based on the comments and suggestions suitable modifications were done. The test items are given in Appendix.

Sample Items

1. Fill in the blanks 1x6=6

1. Computer is an ....................... device.

2. Computer performs both arithmetic and ............... calculations

3. A part of the computer which looks like a TV is known as ................

4. ..................... act as the brain of computer.

5. Keyboard is an ......................... device.

6. BASIC is the name of .................... level language.

II. There are four alternative answers for each question. Choose the proper answer and fill in the box provided. 1x5=5

1. Computer is a child of

   (a) Science (b) Technology (c) Mathematics (d) Electronic

2. Father of Computer

   (a) Newmann (b) Charles Babbage (c) Alan Turing (d) John Dalton

3. AND is an example for

   (a) Multiplication (b) Logical Operator (c) Mouse (d) Storage device

4. Secondary storage device is

   (a) Mouse (b) Floppy (c) Keyboard (d) Monitor
5. Process indicator is

(a) Circle (b) Rectangle (c) Diamond (d) Square

III. Match the following

<table>
<thead>
<tr>
<th>A-List</th>
<th>B-List</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Input</td>
<td>(a) CPU</td>
</tr>
<tr>
<td>2. Output</td>
<td>(b) Keyboard</td>
</tr>
<tr>
<td>3. Primary memory</td>
<td>(c) Monitor</td>
</tr>
<tr>
<td>4. Process</td>
<td>(d) ROM</td>
</tr>
<tr>
<td>5. Secondary storage device</td>
<td>(e) Plotter</td>
</tr>
<tr>
<td></td>
<td>(f) Hard disk</td>
</tr>
</tbody>
</table>

IV. State the elaborated form of the following abbreviations:

(a) RAM ....................
(b) ALU ....................
(c) HLL ....................
(d) CPU ....................

3.20 Standardisation Procedure of the achievement test

1. Tryout: Tryout is a vital stage in the construction of a good test. Only careful analysis can show that a test is soundly constructed. The following four principles should govern the tryout.

i. every reasonable precaution should be taken to ensure normal condition for the test.

ii. the time allowance for the test should be generous
iii. the scoring procedure adopted should be fairly simple and

iv. before the actual scoring begins, answer keys and scoring keys should be prepared.

2. Sample for tryout: Tryout of a test means trying it out under test conditions on representative cross-section of the pupils for whom the test is intended. In order that the data collected in tryout should be helpful in determining the quality and nature of the test items with respect to the population on which norms have to be established later on, the sample used for tryout should obviously reflect the population.

In Dharwad four schools were selected randomly. IX standard English medium classes of the four selected schools were chosen. In Table-315, details of the sample are reported.

Table-3.15: Showing details of samples

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the school</th>
<th>Class chosen</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>K.E.Board's High School, Dharwad</td>
<td>IX</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Vidyaranya High School, Dharwad</td>
<td>IX</td>
<td>25</td>
</tr>
<tr>
<td>3.</td>
<td>K.N.K.Girls’ High School, Dharwad</td>
<td>IX</td>
<td>25</td>
</tr>
<tr>
<td>4.</td>
<td>Police Residential School, Dharwad</td>
<td>IX A</td>
<td>25</td>
</tr>
</tbody>
</table>

The total sample consists of 100 IX standard pupils (50 boys and 50 girls). The investigator being the Teacher-Educator teaching of Mathematics to B.Ed. trainees, took the help of B.Ed. trainees and given pre-test before teaching the units and noted down the scores. Then he organised teaching programme for the sample and the process went on for three weeks. Then he gave the post test and the test papers were scored.
Tryout-II

The investigator carried out II tryout selecting three other schools, namely:

1. Basel Mission Boys School .. IX D
2. Karnatak High School .. IX B
3. Vidyaranya High school .. IX B

The students were given pre-test and the reaching of three units carried out for one week and then the post-test was administered. The scores were noted and the mean and SD were noted.

Table 3.16: Showing mean and SD of tryout II

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.3</td>
<td>45.6</td>
</tr>
<tr>
<td>SD</td>
<td>3</td>
<td>6.8</td>
</tr>
</tbody>
</table>

The post-test scores of tryout I and II were subjected to t-test. The t-value calculated was 6.81 which is significant at 0.05 level which means the test is valid and reliable.

Item Analysis

The duly scored answer sheets were arranged in the descending order of the score.

The answer sheets of 27% of the students scoring highest and the answer sheets of 27% of the students scoring lowest were selected for item analysis. They formed the upper and the lower group respectively.
The procedure of calculating the facility and discriminating index used in the case of group intelligence test was employed here.

Table-3.17: Showing results of item analysis

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Sub-tests</th>
<th>Total No.of items</th>
<th>No.of items retained</th>
<th>No.of items rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Objective type</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>1.1</td>
<td>Fill in he gaps</td>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>1.2</td>
<td>Multiple choice</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>1.3</td>
<td>Matching</td>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>2.0</td>
<td>Very short answer</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>Short answer</td>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>4.0</td>
<td>Essay type</td>
<td>8</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>38</td>
<td>42</td>
<td>12</td>
</tr>
</tbody>
</table>

From the results of the item analysis, it was clear that 38 items of the first test and 42 items of the second test could be retained and some of the sub test items could be rejected. But as the investigator wanted to prepare two sets of test in equivalent form which meant that in both the forms equal number of items testing particular specification was to be retained making the total items equal in both the forms. Hence he consulted his guide and expert Mathematics teachers and with their help modified the same border line test items. So that the total number of items should be in the same in these two forms.
Table-3.18: Showing Details of the final form of achievement test.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Sub-test</th>
<th>No.of items</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Objective type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Fill in the gaps</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1.2</td>
<td>Multiple choice</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1.3</td>
<td>Matching</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2.0</td>
<td>Very short answer</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4.0</td>
<td>Essay type</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

The final form of the test consists of 30 items distributed in six sub-tests as reported in Table-3.18. The scoring key was also prepared.

3.19 Validation Procedure

The scores of the sample of 100 students were tabulated in a frequency distribution table. The maximum and minimum scores were noted. The Mean, Median, Standard Deviation and Quartile Deviation were calculated.

Table-19: Showing Measures of Central Tendency of Variability of the two achievement tests.

<table>
<thead>
<tr>
<th>Index</th>
<th>Test-I</th>
<th>Test-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>40.82</td>
<td>42.14</td>
</tr>
<tr>
<td>Median</td>
<td>39.12</td>
<td>39.25</td>
</tr>
<tr>
<td>SD</td>
<td>10.5</td>
<td>12.13</td>
</tr>
</tbody>
</table>
The mean and Median of the two best are similar but SD of the second test is little higher.

**Reliability of the test**

Reliability of the test was calculated by the split-half method the odd number items forms one group and the even number items formed the other group. When both the groups were correlated by Spearman-Brown Prophecy formula the r was calculated and found to be 0.72 which means the test is reliable.

**Validity of the test**

1. **Content Validity:** Since the test was constructed specifically for IX standard students and the content was taken from IX standard Mathematics too, so the test has content validity.

2. **Concurrent validity:** In this method some 50 students out of 100 students sample were randomly selected. The Mathematics marks of the annual examination of the above students was correlated with test scores. The co-efficient of correlation of 0.59 was found to be significant. This shows that the test is valid. The two forms of achievement tests (Test-retest forms) were reliable and valid. So they could be used with confidence in the final data collection.

3. **Construct validity:** The test is constructed for calculating the achievement of IX class students in the Mathematics. So it is having construct validity.
3.21 Data gathering procedure

The investigator collected the data required for the study in three stages.

First stage : Before the treatment

1. Pre-Pretest scores (PPT): These scores are nothing but the scores of the students at the annual examination of previous year in Mathematics (VIII class). These marks indicate the status of the students, achievement at the entry level to the IX standard in Mathematics subject. So the investigator noted down the marks code by each student in VIII class annual examination.

2. Administering SEES Questionnaire

One of the objective of the study is to know the effect of socio-economic educational status of the students with different kinds of teaching methodology. Accordingly, following groups were formed:

   i. HSEES - High Socio-Economic and Educational Status
   ii. MSEES - Middle Socio-Economic and Educational Status
   iii. LSEES - Low Socio-Economic and Educational Status

3. Group Intelligence test: Administering the group intelligence test to know the IQ of the students.

4. Training of the Teachers: The teachers teaching the IX classes of the sample were invited to University College of Education and given training in particular treatment.
Sri Bolishetty, a Mathematics teacher in University Public School requested to handle the IX D class with chosen three units with traditional method or usual teaching method using minimum teaching aids and minimum particular students. Hence the students of IX D class have treated as control group. The time (total periods) allowed was six periods for each unit.

The IX A class Mathematics teacher of Mundagod High School Sri Anand S. was requested to handle the class with three units with the help of programmed text materials. The materials were supplied to the teacher with clear cut instruction and the procedure of using them were also administered.

The teacher was requested to know the principle of programmed learning with help of programmed text material, frames as well as teacher instructions or guidance.

This group served as experimental-I group. The IX B class Mathematics teacher of Lions English Medium, Haveri requested to use software packages materials were displayed on the computer monitor screen and necessary instruction was given to him to include them in his instruction. Three computer software packages in the form of floppy disc (25 sets for each were supplied to the teacher. Thus this group served as experimental-II group.

5. Administration of pre-test: Giving pre-test to students. The students involved in the study were given Pre-test (Achievement test) on the units chosen to know the level of understanding for the units chosen one hour time was given to solve the question.
Second stage

During the treatment: After the preliminary arrangements were made, the investigator requested the teacher to start the treatment i.e. the teaching units by respective teacher of school.

The control group treatment was over by three weeks whereas the program text group completed taking one month. The computer software package group took three weeks to study and understand the units.

Third stage:

After the treatment: After the treatments were over the investigator requested all the three teachers to administer the post-test which is a similar form of pre-test. The investigator gathered the oral opinion of the students, teachers and observers about the various aspects like methods of teaching, programmed text material and computer software package.

3.22 Statistical Technique used

Following statistical techniques have been used:

i. Mean, Median and SD

ii. F-ratio through ANOVA

iii. t-test

The data collected was duly analysed with the above technique and the same is reported in the preceding Chapter IV.