Chapter - III

Development of Experimental Material

-The agendum is comparable to the blue print which the architect prepares before the bids are let and building commences.

- John W. Best
CHAPTER III
DEVELOPMENT OF EXPERIMENTAL MATERIAL

The instructional material was developed in the form of Conventional Instructional system, Audio-Video Instructional System and Multimedia Instructional System for Secondary School students. The content related for the development of Instructional material were taken from 'Information Technology' prescribed by C.B.S.E. for Secondary School. Three units of content were taken viz Information Technology-Basics (unit I), Information Technology-Uses and Applications (unit II), Information Technology-MS-Word (unit III). The main objective of the study was to compare the relative effectiveness of three Instructional Systems and to analyse the interactions of 'Intelligence' and 'Sex' with three Instructional Systems using factorial design (3x2x2).

Before the development of instructional material, it is essential to write the objectives. Investigator followed the Robert Mager's Approach while framing the objectives.

3.0.0 WRITING ASSUMPTIONS OR ENTERING BEHAVIOUR OF THE LEARNER:

The nature of the content pertaining to a topic in "Information Technology" under investigation requires a certain level of entering behaviours in the learner for developing three instructional systems. On the basis of the content requirement the following assumptions were made about the learner. Students are able to:

- have a few ideas of Communication Technology and Information Technology but having little knowledge of various means of Communication Technology and Information Technology.
- have very little knowledge about uses and applications of 'Information Technology'.
- have little knowledge about alphabets of keyboard and having very little knowledge about functions of various keys in keyboard of computer.
- have no knowledge about Input, output and data storage devices, various types of memories, window programmes, paint programmes & MS-word.
- have no any idea of various programmes of Microsoft Office in computer.
3.1.0 TERMINAL OBJECTIVES IN BEHAVIOURAL TERMS:

Another important and fruitful aspect of preparation of three instructional systems is the formulation of terminal behaviours or end products of the instructional system. Developing terminal behaviours of the programme in advance would mean deciding the goal. The direction of movement and the strategies of teaching learning operations. One of the outstanding contributions that instructional system has thus far made to educational practice is its emphatic insistence on the importance of specifying educational objectives in terms of observable events.

The investigator has assumed that the learner will attain the desired level of performance or change in behaviour after completing the instructional system. It is expected that the objectives formulated in Units I to III are to be achieved at the completion of the Instructional System.

3.1.0 WRITING OBJECTIVES IN BEHAVIOURAL TERMS:

UNIT-1 (INFORMATION TECHNOLOGY-BASICS)

The students will be able to:

- name the various means of communication. (Knowledge)
- recognise the various communication channel. (Knowledge)
- select the cheapest source of communication channel. (Knowledge)
- name the informations received through the different media. (Comprehension)
- list the various features of Information. (Knowledge)
- verify that a report prepared by any means cannot be taken as good information unless it is meaningful and action oriented. (Comprehension)
- distinguish that the information is more valid than data. (Comprehension)
- explain that the attribute of information should be relevant, timeliness & available one. (Knowledge)
- define that the computer is an electronic device. (Knowledge)
- verify that the computers can not talk to them. (Comprehension)
- identify that the instructions are given to computer in the form of input. (Comp.)
- identify that the results are obtained from the computer in the form of output. (Comp.)
- recognise that the processing of data takes place in CPU of computer. (Knowledge)
- name the parts of computer. (Knowledge)
- identify the software in computer (Comprehension).
- recognise that the keyboard can not type pictures. (Knowledge)
- recognise that pictures can be drawn on monitor screen with the help of mouse. (Know.)
- recognise the secondary memory in computer. (Knowledge)
- recognise the primary memory in computer. (Knowledge)
- distinguish the storage of data among the floppy, CD-Rom and Hard disk. (Comp.)
- recall the primary memory as fixed memory, permanent memory & internal memory. (Comprehension)
- interpret that computer works on three basic principals i.e. Input, Process, Output. (Comprehension)
- name the mouse the printing device as well as input device. (Comprehension)
- interpret that Hard- disk is the data storage device, which can store more data than other devices. (Comprehension)
- recognise that there are 12 functions keys in keyboard. (Knowledge)
- recognise the spacebar as the longest key in computer keyboard. (Knowledge)
- reason out that CPU is the brain of computer. (Application)
- list the plotter, printer and monitor as output devices in computer. (Knowledge)
- list that there are 26 alphabet keys on computer keyboard. (Knowledge)
- recognise that computer monitor looks like Television. (Knowledge)
- recognise that delete key erases the letters left to the cursor. (Knowledge)
- recognise that there are three arrow keys on computer keyboard. (Knowledge)
- recognise that there are two shift keys in the keyboard. (Knowledge)
- recall that primary memory is also called as internal memory. (Knowledge)
- recognise that floppy is not the internal storage medium. (Knowledge)

Unit-II (Information Technology-uses & applications) :
The students will be able to:
- explain that E-Mail is sent from your computer to another computer. (Comp.)
- state that computer plays music with help of multimedia kit. (Knowledge)
- list the major application of computer in business, in education and in entertainment. (Knowledge)
- define the computer programme. (Knowledge)
- identify that the Command resources, Be-User friendly & Provide utilities are the primary job of operating system of computer. (Comprehension)
- identify that the operating system makes control of computer system on start-up. (Comprehension)
- recognise that the window explorer is considered as file manager in window-98. (Knowledge)
- verify that the file deleted from floppy disk in window goes to permanently deleted. (Comprehension)
- select that an application can be opened through short cut on desktop by double clicking on its short-cut or Right clicking & choosing "open" option or selecting an icon & pressing an enter. (Knowledge)
- recognise that the start menu provides the access to all active applications by maintaining a row of open applications title boxes. (Knowledge)
- identify the programme on the start menu application for further selecting the appropriate application on it. (Comprehension)
- recognise that the title bar displaying the name of the document lies on the topmost bar in any application window. (Knowledge)
- identify that the window explorer is a file management programme that you can use to view and change the contents of your folder and files.
- recognise that the paint application is present on accessories. (Knowledge)
- identify the path to run the paint in window 98 i.e. start-> programme-> accessories> paint. (Comprehension)
- identify the four tools in the tool box that make the free hand drawing are pencil,
brush, air brush, eraser. (Comprehension)
- identify the four tools in the tool box that make shapes are ellipse, rectangle, rounded rectangle, polygon. (Comprehension)
- recognise the various items displayed in the paint window. (Knowledge)
- recognise the text tool as the tool used for writing text on pictures. (Knowledge)
- recognise the option box below the toolbar giving two choices for using the text tool. (Knowledge)
- state that in police stations, computers are used to keep track of criminals. (Knowledge)
- state that computer is used in reservations of tickets in Railway and Aeroplane Reservation offices. (Knowledge)
- explain that you can play music on computer. (Comprehension)
- state the computer are used for typing in offices. (Knowledge)
- state that doctor takes help of computer in treating the patients. (Knowledge)
- explain to state that computer can play music. (Comprehension)
- state that doctors can use computer to treat patients in hospitals. (Knowledge)
- explain that computer can correct your spelling errors. (Comprehension)
- state that you can write your letter on computer in any style. (Knowledge)
- reason out that for sending E-mail, internet is necessary. (Application)

Unit-III (Information Technology-MS-word):
The students will be able to:
- define that meaning of MS-Word is Microsoft company. (Knowledge)
- explain that how to start MS-Word on computer. (Comprehension)
- list the various components of the Word window. (Knowledge)
- identify the location of "title bar" in the word application window. (Comprehension)
- recognise the main menu bar which is located below title bar. (Knowledge)
- identify the various icons shown in the main menu bar. (Comprehension)
- recognise that use of ruler in MS-Word. (Knowledge)
- recognise the use of status bar in MS-Word. (Knowledge)
- identify the open, close, new options in file icon in the main menu bar. (Comp.)
- select insert icon which is found in the main menu of MS-Word. (Comprehension)
- select format icon which is found in the main menu of MS-Word. (Comprehension)
- explain that how file is closed in file menu of MS-Word. (Comprehension)
- explain that how text is deleted with the help of delete key. (Comprehension)
- explain that how to find the word or text as document in MS-Word. (Comp.)
- explain that how to make undo the work in MS-Word. (Comprehension)
- explain that how to make redo the work in MS-Word. (Comprehension)
- recognise the toolbar in MS-Word. (Knowledge)
- recognise the print preview used in MS-Word. (Knowledge)
- recognise the field for the current time displayed on the status bar. (Knowledge)
- recognise the shortest key used for pasting text from clipboard is Ctrl+V. (Know.)
- recognise that short key to open a new file in MS-Word is Ctrl+N. (Knowledge)
- recognise the status of your document like page numbers, number of pages which is shown on status bar. (Knowledge)
- recognise the alignment buttons which are found on formatting toolbar. (Know.)
- recognise that the short for saving a file is Ctrl+S or save option from file menu or save button on standard toolbar. (Knowledge)
- recognise the edit menu for cut, copy & paste. (Knowledge)
- use the Ctrl+B as short key to bold the text. (Application)
- recognise the justified alignment which makes sure that none of the edges of the text appears. (Knowledge)
- use the short key Ctrl+C to copy the selected text. (Application)
- use the short Ctrl+X to cut the selected text. (Application)
- use backspace to delete the previous latter. (Application)
- define the MS-Word as Microsoft Word which is a part of MS-office. (Knowledge)
- recognise the short key Ctrl+P to print a file. (Comprehension)
- recognise how to select any text with the help of mouse. (Knowledge)
- recognise the printed copy of document as hard copy. (Knowledge)
3.2.0 CONSTRUCTION OF ACHIEVEMENT TEST IN 'INFORMATION TECHNOLOGY'

After deciding the terminal behaviours, the programmer attempts to mould the pupils behaviour accordingly. The tool used to assess whether the behaviour has been modified as depicted is known as criterion test.

'Achievement test' is one that tests whether the student has attained behavioural goals. Constructing any Achievement test involves the following stages:

★ planning the test.
★ preparing the test items.
★ trying out the test.
★ administering and scoring the test.
★ item analysis of the test.
★ selection of the test items.

3.2.1 Planning the Test:

Construction of good test is a time consuming process and requires skill and insight. Planning of the test, involves decisions about sub-units of the content, technical behaviours, type of questions, relative weightage to various aspects of the content and the duration of the test etc. In view of these considerations, the achievement test items cover the objectives described earlier in this Chapter. Out of a total of 150 items included in the test, 85 were 'Multiple Choice Questions' and 48 items of 'Fill in the Blanks Questions' & 17 items of 'True & False Questions.' The multiple choice type items have the advantage of defining the examinee's task and the basis for the examiner's judgment. The multiple choice type of the item is regarded as most valuable and most generally applicable to all test forms. It can be scored very conveniently. Multiple choice items can be constructed at any level of difficulty. Keeping these points in view, the investigator used maximum multiple choice items in the achievement test.
Thorndike and Hegen have demonstrated that multiple choice type can be used effectively for higher mental process also. According to them "the multiple choice item is the most flexible and most effective of the objective item types. It is effective for measuring information, vocabulary, understanding, application of principles, or ability to interpret data. In fact, it can be used to test practically any educational objective that can be measured by pencil and paper test except the ability to organise and present material. The versatility and effectiveness of the multiple choice item is limited by the ingenuity and talent of the item writer. To construct the achievement test in 'Information Technology' for the present study, the objectives were defined in behavioural terms. Since the concern here was with achievement testing, the researcher focused primarily as the cognitive domain, taxonomy of educational objectives (Bloom & others 1956) was useful guide for approaching this task. Intellectual outcomes of the cognitive domain were divided into three major classes i.e. 1. Knowledge 2. Comprehension 3. Application.

<table>
<thead>
<tr>
<th>Contents</th>
<th>Type of Question</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Total Qs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit-I</td>
<td>1) Multiple Choice Qs.</td>
<td>12</td>
<td>13</td>
<td>Nil</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>2) Fill in the Blanks Qs.</td>
<td>4</td>
<td>Nil</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3) True/false Qs.</td>
<td>5</td>
<td>Nil</td>
<td>Nil</td>
<td>5</td>
</tr>
<tr>
<td>Unit-II</td>
<td>1) Multiple Choice Qs.</td>
<td>11</td>
<td>9</td>
<td>Nil</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2) Fill in the Blanks Qs.</td>
<td>4</td>
<td>1</td>
<td>Nil</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3) True/false Qs.</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Unit-III</td>
<td>1) Multiple Choice Qs.</td>
<td>14</td>
<td>11</td>
<td>Nil</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>2) Fill in the Blanks Qs.</td>
<td>1</td>
<td>Nil</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3) True/false Qs.</td>
<td>4</td>
<td>1</td>
<td>Nil</td>
<td>5</td>
</tr>
<tr>
<td>Total Unit-I, Unit-II and Unit-III</td>
<td></td>
<td>57</td>
<td>37</td>
<td>6</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No. 3.1
Blue print of Criterion Test
Table No. 3.2
Unitwise weightage in terms of percentage of Items in Criterion Test

<table>
<thead>
<tr>
<th>Subject</th>
<th>Content</th>
<th>Weightage in %</th>
<th>No. of items proposed for the final test draft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit-I</td>
<td>1) Communication Technology ?</td>
<td>8.57%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2) Information Technology ?</td>
<td>14.29%</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3) What is Computer ?</td>
<td>37.14%</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>4) Input, Output and data storage devices, Memory, its types, Hardware &amp; Software?</td>
<td>40.00%</td>
<td>14</td>
</tr>
<tr>
<td>Unit-II</td>
<td>1) Uses of Computer ?</td>
<td>43.34%</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>2) Programming Instructions given to Computer ?</td>
<td>10.00%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3) Window Programme in Computer ?</td>
<td>23.33%</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>4) Paint Programme in Computer ?</td>
<td>23.33%</td>
<td>7</td>
</tr>
<tr>
<td>Unit-III</td>
<td>1) Introduction of MS-word in Computer ?</td>
<td>31.43%</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>How to start MS-word in Computer ?</td>
<td>31.43%</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2) How to work in MS-word in Computer ?</td>
<td>17.14%</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3) How to Open, close, save &amp; Print a file in MS-word in Computer ?</td>
<td>17.14%</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4) How to Insert text, delete text, select text, Alignment of text, Find, replace of text, create tables in MS-word in Computer ?</td>
<td>34.29%</td>
<td>12</td>
</tr>
</tbody>
</table>

3.2.2 Preparing the Test Items:

The multiple choice items were constructed with four choice for each item. The preliminary draft of Achievement Test consisted of 150 items. Each item was subjected to modification and improvement on the basis of the suggestions given by the experts viz: subject expert, language expert and the persons who are engaged in research work. These test items were tried out on a group of ten students of IX class, individually to improve the language and ambiguity. Thus the draft consisting of 150 items (i.e. 50 items from each unit) was developed and one hundred fifty copies of the draft were prepared for the purpose of preliminary tryout. The types of items and marks distribution are shown in the following table:
Table - 3.3
Types of items & marks Distribution
for Unit I, II & III- Initial Draft

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Types of Item</th>
<th>Unit I</th>
<th>Unit II</th>
<th>Unit III</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiple choice Questions</td>
<td>33</td>
<td>22</td>
<td>30</td>
<td>one mark for each</td>
</tr>
<tr>
<td>2</td>
<td>Fill in the Blanks Questions</td>
<td>10</td>
<td>23</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>True or False questions</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

3.2.3 Try Out and Scoring the test:

The first draft of the criterion test was administered on a group of 50 students of IX class of D.A.V. Sr. Sec School, Bhiwani. The intact classes were taken for that purpose. The students were taught one unit per day by lecture method by the investigator himself. The teaching was done in the normal class room atmosphere.

Schedule of Test Administration

<table>
<thead>
<tr>
<th>Unit</th>
<th>Date</th>
<th>School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology - Basics</td>
<td>3-9-2003</td>
<td>D.A.V. Sr. Sec School, Bhiwani.</td>
</tr>
<tr>
<td>Information Technology - Uses &amp;</td>
<td>4-9-2003</td>
<td>D.A.V. Sr. Sec School, Bhiwani.</td>
</tr>
<tr>
<td>&amp; Application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology - MS-Word</td>
<td>5-9-2003</td>
<td>D.A.V. Sr. Sec School, Bhiwani.</td>
</tr>
</tbody>
</table>

The photostat copies of the first draft of the criterion test were administered on the try-out sample. Before administering the test on the examinees, general instructions about taking the test were explained. The conditions for testing were properly controlled. During the time of the test no extraneous intervention was permitted. The investigator expressed a friendly attitude towards the examinees in order to establish a rapport with them. After completing the teaching, the test was given and the time was recorded and it was found that all the students had completed the test within one hour and thirty minutes.

Students's responses on the criterion test were scored with the help of answer key. Each question carried one score for the correct response.
3.2.4 Item Analysis of the Test:

The step which usually follows the scoring of the answer scripts of the try out is known as item analysis. The most common use of the item-analysis is the selection of best item to compose the final test form, starting with a surplus number of item. The technique of item analysis was applied with a view to ascertaining the two characteristics of items—the difficulty value and discrimination power.

In order to find out the difficulty level of each item and also to test its power of discrimination between good and poor examinees, each item on the criterion test was analysed. It has been demonstrated that optimum point at which this comparison can be made is when the upper and lower 27 per cent of the cases are analysed. After arranging the scored answer scripts in order from high to low, 27 percent of student from the top and 27 percent from the bottom were taken separately for item analysis. The total sample consisted of 50 students. For convenience of statistical analysis 16 students were taken each for upper and lower groups separately against a measure of 27 percent. The indices of discrimination power and difficulty value were calculated with the help of the formulae discussed here.

\[
\text{Index of Difficulty Level} = \frac{\text{Sum of the number selecting the Correct Answer}}{\text{Total Number of Students in Upper and Lower Group}}
\]

\[
\text{Index of Discrimination Power} = \frac{\text{No. of students in the Upper Group who got the Answer Right} - \text{No. of students in the Lower Group who got the Answer right}}{\text{No. of students in each group}}
\]

After calculating the discrimination power and difficulty value of each item of the criterion test, the indices were classified in a tabular form. The details about discrimination power and difficulty value of each item are presented in Appendix - 1.

A bivariate scatter diagram were made to depict a global picture of discrimination power and difficulty values of the items of the test. The columns in the table depict discrimination powers and the rows present difficulty values.
A BIVARIATE SCATTER DIAGRAM FOR ACHIEVEMENT TEST, BETWEEN DIFFICULTY VALUE (DV) AND DISCRIMINATION POINT (DP)

UNIT-I

<table>
<thead>
<tr>
<th>DV</th>
<th>0.00-0.09</th>
<th>0.10-0.19</th>
<th>0.20-0.29</th>
<th>0.30-0.39</th>
<th>0.40-0.49</th>
<th>0.50-0.59</th>
<th>0.60-0.69</th>
<th>0.70-0.79</th>
<th>0.80-0.89</th>
<th>0.90-0.99</th>
<th>1.00-1.19</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00-0.09</td>
<td>27* (1)</td>
<td>26* (1)</td>
<td>32* (1)</td>
<td>3* 9* (2)</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.10-0.19</td>
<td>35*, 49* (2)</td>
<td>38* (1)</td>
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<td></td>
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<tr>
<td>0.20-0.29</td>
<td>28*, 30*, 36* (3)</td>
<td>41* (1)</td>
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</tr>
<tr>
<td>0.30-0.39</td>
<td>50* (1)</td>
<td>39 (1)</td>
<td>22, 33 (2)</td>
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<td></td>
<td></td>
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<tr>
<td>0.40-0.49</td>
<td>2, 42 (2)</td>
<td>45 (1)</td>
<td>31 (1)</td>
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<tr>
<td>0.50-0.59</td>
<td>12, 37, 40, 43, 44, 47 (6)</td>
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<tr>
<td>0.60-0.69</td>
<td>23 (1)</td>
<td>1, 4, 6, 8, 10, 11, 15, 17, 18, 20, 21, 24, 25, 23, 26, 46, 48 (16)</td>
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<td></td>
</tr>
<tr>
<td>0.70-0.79</td>
<td>7, 13, 16, 14*, 19* (2)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.80-0.89</td>
<td>14*, 19* (2)</td>
<td></td>
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<tr>
<td>0.90-0.99</td>
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<td>1.00-1.19</td>
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</tr>
</tbody>
</table>

Note: (1) Items with asterisk (*) were dropped and others within the boundary rectangular area of the scatter diagram were selected for the final draft.
(2) Each Item is placed in the appropriate column and row according to its difficulty value and discrimination point respectively.
A BIVARIATE SCATTER DIAGRAM FOR ACHIEVEMENT TEST, BETWEEN DIFFICULTY VALUE (DV) AND DISCRIMINATION POINT (DP)

UNIT-II

<table>
<thead>
<tr>
<th>DV</th>
<th>0.00-0.09</th>
<th>0.10-0.19</th>
<th>0.20-0.29</th>
<th>0.30-0.39</th>
<th>0.40-0.49</th>
<th>0.50-0.59</th>
<th>0.60-0.69</th>
<th>0.70-0.79</th>
<th>0.80-0.89</th>
<th>0.90-0.99</th>
<th>1.00-1.19</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00-0.09</td>
<td>83*, 84*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.10-0.19</td>
<td>74*, 77*, 92*, 93*, 95*</td>
<td>82*, 87*, 91*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.20-0.29</td>
<td></td>
<td>85*, 88*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.30-0.39</td>
<td></td>
<td></td>
<td>52*, 57*, 73*, 78*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.40-0.49</td>
<td></td>
<td></td>
<td></td>
<td>53, 55, 58, 59</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50-0.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>61, 63, 80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.60-0.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>69, 75,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.70-0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.80-0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>61, 54, 60, 62, 66, 67, 70, 81, 86, 97, 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.90-0.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>76, 98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00-1.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: (1) Items with asterisk (*) were dropped and others within the boundary rectangular area of the scatter diagram were selected for the final draft.

(2) Each Item is placed in the appropriate column and row according to its difficulty value and discrimination point respectively.
A BIVARIATE SCATTER DIAGRAM FOR ACHIEVEMENT TEST, BETWEEN DIFFICULTY VALUE (DV) AND DISCRIMINATION POINT (DP)

UNIT-III

A BIVARIATE SCATTER DIAGRAM FOR ACHIEVEMENT TEST, BETWEEN DIFFICULTY VALUE (DV) AND DISCRIMINATION POINT (DP)

Note: (1) Items with asterisk (*) were dropped and others within the boundary rectangular area of the scatter diagram were selected for the final draft.

(2) Each Item is placed in the appropriate column and row according to its difficulty value and discrimination point respectively.
3.2.5 Selection of test Items:

Selection of the items was made on the basis of difficulty value and discrimination power of each item. After calculating the discrimination and difficulty indices of the test items, the subsequent step was to make a selection and rejection of items. It may be observed from Table 3.4 that 35 items out of a total of 50 items have a DV value of .30 to 0.69 and DP value more than 0.50. These items were found very good discriminators, and did not require any change.

Tables 3.5 and 3.6 reveal that 30 items out of 50 and 35 items out of 50 respectively have DV value between 0.30 to 0.69 and DP value more than 0.40. These items were found very good discriminators, and did not require any change. These items were considered as acceptable items and were selected for the criterion test. Rest of the items above and below these ranges of difficulty value and discriminating power were rejected.

After thoroughly revising the first draft in the light of the expected causes affecting the difficulty value and discriminating power, 100 items of achievement test were selected. Each item carrying one score. A printed copy of the final draft along with instructions of the criterion test has been attached in Appendix II. The instructions for taking the test have been given at the top of the test.

Difficulty value:

Most of the items selected were having medium difficulty value. Lindeman (1971) emphasised that easy items should be included in a test in order to encourage the students of low ability. Some difficult items should be included to challenge the abler students. However, in the interest of constructing a measuring instrument of maximum quality and utility, most items included should be in the middle range of difficulty.

Discrimination power:

According to Garrett (1967) items with validity indices of 0.20 or more are regarded as satisfactory. Thorndike (1955) considered an item with a validity coefficient as high as 0.25 as an outstanding valid item. Hence the researcher retained those items for the final draft which were having discrimination power 0.25 and higher. The items with zero
discrimination power and negative discriminating power were discarded while selecting items for final draft.

Gronlund (1988) states, "Zero discrimination power (0.00) is obtained when an equal number of students in each group answers correctly. Negative discriminative power is obtained when more students in lower group answer correctly than students in the upper group. Both types of items should be removed from norm-referenced tests and then discarded or improved."

A bivariate scatter diagram was prepared for the items of the achievement test, placing each item in the appropriate column and row according to its difficulty value and discrimination power respectively. Thus 100 items (35 items from unit-I, 30 items from unit-II and 35 items from unit-III) were selected keeping in view the above criteria for final test and assigned them serial no. 1 to 100. The final draft is attached in the Appendix no. II.

3.2.6 Evaluation of Criterion Test

In order to evaluate the criterion test, the final draft was administered on a sample of 50 students of D.A.V. Sr. Sec. School Bhiwani selected randomly. Before administering the test on students, the investigator taught them three units of content through lecture method. They were exposed to all those sub-topics which were covered by the criterion test. The responses of students on the criterion test were scored with the help of the key attached in Appendix III and the scores thus obtained were arranged in tabular form. The distribution of scores on the criterion test has been recorded in the table given below:

<table>
<thead>
<tr>
<th>Table - No.3.7 Distribution of Scores of Sample Subject On Achievement Test after final draft of Criterion Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Intervals of Scores</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
</tbody>
</table>

The mean is found to be 68.06 and S.D. 12.44
(a) Estimating the Reliability of Achievement test:

Reliability denotes the degree to which the test agrees with itself. It measures the extent to which a test may be relied upon to give the same results when it is repeated. In other words, reliability means consistency. Estimation of reliability of a test is always desired because a low reliability indicates poor quality of the test. To calculate the reliability coefficient of the criterion test, the simplified Kuder-Richardson Formula-21 was applied. The formula used is as follows:

$$r_{tt} = 1 - \frac{M(K-M)}{KS^2} \quad \text{KR-21.}$$

where:
- \(r\) = coefficient of reliability.
- \(k\) = number of items in the test.
- \(M\) = mean of the test scores.
- \(S\) = standard deviation of the test scores.

By substituting the obtained values in KR-21 formula we get:

$$r_{tt} = 1 - \frac{68.06 (100 - 68.06)}{100 \times (12.44)^2} = 1 - 0.14 = 0.86$$

This reliability was based on a small test of 100 items administered on a small sample of 50 students. It was estimated that an increase in the number of test items could give a higher reliability of coefficient. Hence, the Spearman-Brown Prophecy formula applied to estimate the effect of lengthening the test. The formula is as follow:

$$r_{nn} = \frac{r_{tt}}{1 + (n-1)r_{tt}}$$

where:
- \(n\) = the number of times the test is lengthened
- \(r_{nn}\) = the correlation between \(n\) forms of a test and \(n\) alternative forms.
- \(r_{tt}\) = the reliability coefficient of test 1 or the obtained reliability coefficient of test 1.
If the length of the test had been three times, the reliability coefficient would have been:
\[
r_{33} = \frac{3 \times 0.86}{1 + (3-1) 0.86} = \frac{2.58}{2.72} = .94
\]

The reliability coefficient of .82 approaches an acceptable standard as mentioned by Ebel. It may be interpreted from the obtained value that the reliability coefficient of the final draft of the criterion test is high. According to Helmstadter the obtained value .94 is to be considered acceptable for an achievement test.

On the basis of the above estimations it may be stated that the Achievement test was reliable for measuring the terminal behaviours.

(b) Estimating the validity of criterion test:

The validity of a test may be defined as the accuracy with which it measures that which it is intended to measure.

Technical recommendations for achievement tests, formulated and published by a number of specialists in educational and psychological measurement, usually mentioned four types of validity: content, prediction, concurrent, and construct validity. Content validity is concerned with the adequacy of sampling of a specified universe of content. Anastasi has stated that content validity may be established by calculating logical validity. Since face validity depends upon subjective evaluation, the second form of content validity viz., logical validity is being used here to establish the validity of the Achievement test.

Logical validity implies that the test actually measures the traits for which it was designed. The use of logical validity, therefore, requires defining of the content in behaviour terms, a breakdown of the content area into categories which represent all the major aspects of the area and a judgment regarding discrimination of items between the person who know the subject and those who do not know.

In order to determine logical validity of the criterion test, the weightage given to instructional frames and the weightage given to the test items for different units of the programme were analysed in terms of number of frames in the programme and the number of items on the criterion test. The percentage of instructional frames and criterion test items have been shown in the following table:
Table No. 3.8

Weightage Given to Instructional Systems and Achievement Test Items

<table>
<thead>
<tr>
<th>Unit</th>
<th>Three Instructional Systems</th>
<th>Achievement Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Sub-units</td>
<td>Percentage</td>
</tr>
<tr>
<td>I</td>
<td>45</td>
<td>37.5%</td>
</tr>
<tr>
<td>II</td>
<td>35</td>
<td>29.17%</td>
</tr>
<tr>
<td>III</td>
<td>40</td>
<td>33.33%</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100%</td>
</tr>
</tbody>
</table>

It may be observed from the above table that items on the criterion test are approximately equally distributed over all the three units of the programme. It may further be noted that the percentage of items devoted to the programme and the criterion test are also approximately equal. It indicates that equal weightage has been given to instructional situation and testing situations.

In order to test logical validity of the criterion test, the data were further analysed to see the significance of difference between the percentage of three instructional system and achievement test items. The chi-square ($X^2$) test was applied to ascertain this difference. The chi-square test represents a method of comparing experimentally obtained results with these to be expected theoretically on some hypothesis. The equation for chi-square ($X^2$) is stated as follows:

$$X^2 = \sum \frac{(F_o - F_e)^2}{F_e}$$

in which $F_e = $ Expected frequency of occurrence on some hypotheses, and $F_o = $ Frequency of occurrence of observed or experimentally determined facts.

The results of the application of chi-square test have been recorded in table 3.9.
Table No. 3.9

Chi-Square Test for Difference of Weightage Given to Three Instructional Systems and Criterion Items

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Unit-I</th>
<th>Unit-II</th>
<th>Unit-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Instructional Systems (Fo)</td>
<td>37.50</td>
<td>29.17</td>
<td>33.33</td>
</tr>
<tr>
<td>% of Achievement Test Items (Fe)</td>
<td>35</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>(Fo - Fe)</td>
<td>2.50</td>
<td>0.83</td>
<td>1.67</td>
</tr>
<tr>
<td>(Fo - Fe)^2</td>
<td>6.25</td>
<td>0.69</td>
<td>2.79</td>
</tr>
<tr>
<td>(Fo - Fe)^2</td>
<td>0.18</td>
<td>0.02</td>
<td>0.08</td>
</tr>
</tbody>
</table>

The table value of $X^2$ for 2 degree of freedom at .05 level is 5.99 and at .01 level is 9.21. The obtained value of $X^2$ was found to be less than the table value even at .05 level of confidence. Thus, the null hypothesis was accepted and it may be interpreted that the observed difference of items in the programme and achievement test may probably be attributed to chance factor.

On the basis of the evidence obtainable from the value of chi-square ($x^2$) test, it may be stated that the weightage given to test items is approximately equal to the weightage given to the different units of the three instructional systems. It may, therefore, be concluded that the test has a high content validity.

3.3.0 CONSTRUCTION OF CONVENTIONAL INSTRUCTIONAL SYSTEM:

The Conventional Instructional systems of three units i.e Information Technology-Basics (unit-I), Information Technology-Uses and Applications (unit-II), Information Technology-MS-Word (unit-III), were prepared by the investigator himself. The content of Conventional Instructional lessons were the same as those of Audio-Video Instructional System and Multimedia Instructional System so as to avoid the intervening variable of content/topic. The time limit of the Conventional Instructional lessons is the same as Audio-Video Instructional System and Multimedia Instructional System i.e 35-40 minutes. All the required
essential aids in the form of charts, flash cards, models were prepared so as to explain the nature of the topic. Before preparing the Conventional Instructional System, entering behaviours, terminal behaviours and Criterion Test were decided. The contents were taken from the text-book of the IXth class students and delivered in an usual classroom situation by Conventional Instructional System. However, the description of the diagrams wherever necessary was also given by the teacher orally. The contents of Conventional Instructional System is given in Appendix no. IV.

3.4.0 CONSTRUCTION OF AUDIO-VIDEO INSTRUCTIONAL SYSTEM:

For teaching-learning process or for any other type of communication of instructions, Audio-video medium is proving to be the very powerful and versatile of all audio-visuals. Video medium of providing instructions has greater potential of creating special effects like controlling time and space & to create illusion for a desired visual impact, showing any action in fast motion or in slow motion. These properties have peculiar place or value in Information Technology subjects. Various topics need to be shown in different dimensions of time and space. Sometimes the Information Technology topics and their demonstrations consists of a series of sequences. These sequences incorporate live effect, animation and designed graphics related to that issue or topic. These Audio-video lessons are very helpful in clarifying closely related concepts. Human learning is also assisted by simulation, both in sciences, social sciences and also in 'Information Technology' The complicated & practical subjects of Information Technology can be effectively and easily explained to the students as simulation with the help of Audio-video mode of teaching. Hence keeping in view the possibilities to simulate the human interaction clearing them for example, between various topics by teachers and students, the instructions given through such medium were named Audio-video mode. The Audio-video mode of teaching consisted of two types of material - hardware and software. The hardware included the electronic gadgets like television and video cassette recorder (VCR). The software consisted of Audio-video Instructional System which were recorded on the video cassettes.

Television and VCR were used as an electromechanical devices to teach the students. Three units of Information Technology were recorded on Audio-Video cassette tape. The
Audio-video Instructional System were developed under the guidance of expert video recorders. The average duration of the 'Audio-Video Instructional System' was 35-40 minutes per unit. The salient features of the Audio-Video Instructional System were:

1. The graphics were generated letter by letter with a videocassette and captions were shown wherever required.
2. All the spoken words/commentary were supplemented by visuals at appropriate place.
3. Experts from films were also taken as support medium.
4. Minor details of any figure of object were enlarged with the help of zoom lens.

For teaching-learning process or for any other type of Communication of instruction, Audio-video medium is proving to be very powerful. Video medium of providing instruction has greater potential of creating special effects like controlling time & space to create illusion for a desired visual impact, showing any action in fast motion, reverse motion or in slow motion. These properties have peculiar place or value in Information Technology subjects.

The objective of the study was to prepare 'Audio-Video Instructional System' of Information Technology comparing with other methods, viz. Multimedia instructional system and conventional instructional system. In the development of this type of Instructional System, the following electro mechanical devices were taken into consideration.

- Video cameras - Two is number.
- Overhead Projector - to record the slides for video-recording
- Sound system - having collar mike to record the sound of investigator.
- Different charts, pictures, real components of computer, slides prepared on Power Point with text, diagram, picture & captions etc. along with animation effect to show the movement in between the slides.
- VCR (video cassette Record Player) to see the video cassette after its development.
Steps involved in the Development of this Instructional System.

Step-1: Selection of Media:

All the available media are related to our Sensory Organs. The key factor in using the media knowing how to select the medium that most, effectively and efficiently meet our needs. Before selecting the media, the important task is to decide the following things.

- Selection of Unit of Content
- Basic assumptions about the learner or entering behaviours.
- Terminal behaviours
- Criterion Test

The Investigator selected the Audio-video media keeping in view the maximum involvement of sensory organs. In the selection of media, following points were also taken into account after consultation of experts.

- Economical aspect.
- Easily availability and preparation.
- Age and mental status of the learners.
- Appropriateness of the curriculum.
- The language of the media familiar and understandable to the students.
- Motivational and highly informative.
- Capture the attention of the pupils.
- The time limit - Normal Classroom- 35-40 Minutes.

Step II - Presentation & operation of the media:

The investigator has taken three units of contents of Audio-Video-media, i.e. Information Technology - Basics (unit I), Information Technology - Uses & Applications (unit II), Information Technology - MS-Word (unit III). Each unit is prepared on the basis of discussions with media experts, educationists & computer teacher. In the preparation of Instructional System logical sequence without any interruption were followed. The draft of this Instructional System was prepared, the initial draft was edited by language expert, media expert and content expert lastly by persons involved in research. Their suggestion were emancipated. The draft was modified in the light of suggestions given by them. The
mode of presentation of each unit follows a systematic order.

- Connect the VCR with television and switch on VCR with television and switch on the electric supply.
- Put the video cassette in VCR & start it.
- The lecture will start with recorded sound of investigator presenting- text, graphics, pictures, captions diagram with animation effect etc.
- Students will watch the Television for 35-40 minutes for one unit of 'Information Technology'.

Step III - Try outs:

The investigator recorded the contents of each unit. The intensity of sound & pace were settled with the help of team of experts of various fields viz : media experts, educationists and computer teacher. They were asked to evaluate the recorded contents on Audio-Video cassette in the light of following points along with the terminal behaviour.

- Are desirable details shown in proper size?
- Sharpness of text, pictures, graphics & diagrams etc.?
- Is the animation given by the power point is appropriate?
- Is the content free of irrelevant material?
- Are pictures free of distortion because of a good balance between artists’s technique & educational needs?
- Do sets of pictures provide adequate continuity and range?
- Is the designed continuity of pictures appropriate for the teaching objectives?
- Are the captions & explanations readable and suitable for teaching purpose?
- Is the programme free of conflicts between background, sound and speech or dialogue?
- Is the programme on a topic is of appropriate time & length?

Thus the draft was reviewed on the basis of suggestions given by the team of experts, on the basis of the above criteria. At this time the first draft was prepared along with the instructions and tried on a groups of five students taken randomly from Halwasia Vidya
Vihar Sr. Sec. School, Bhiwani. Carton erickson (1970) suggested that the group judgements are superior to individual judgements. The instructional material was exposed to five students and took 35 minutes and their comments were considered.

On the basis of suggestions the draft was revised. The revised draft was administered to a small group of 20 students taken randomly from Halwasia Vidya Vihar Sr. Sec. School, Bhiwani. The draft was reviewed in the light of comments given by the participants and the final draft was prepared.

**Step IV - Evaluation:**

The final draft was evaluated in terms of reliability and validity. To find out the reliability, the final draft of instructional mode of communication was administered to a sample 40 students. The institution viz: Halwasia Vidya Vihar Sr. Sec. School, Bhiwani was taken out randomly. All the available students were taken out. Since this phase of try out is administered in class room situation, no attempts were made to interrupt or change the usual class administratively. Co-operation was also sought from the class teachers. The larger the number of pupils involved, the greater will be the reliability of measures obtained from the post-test scores. A post test was given to the students after the completion of this programme. The answer sheets were scored with the help of an answer key. The data so obtained were analysed and the distribution of scores in given in the following table

<table>
<thead>
<tr>
<th>Class Intervals of Scores</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
<th>55-59</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
<th>80-84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

The mean & S.D. were found to be 71.08 and 11.11 respectively.

The reliability calculated by K.R. formula -21 was found be 0.84. This reliability is quite satisfactory for this programme. The final draft of video cassette is given in Appendix V.
3.5.0. CONSTRUCTION OF MULTIMEDIA INSTRUCTIONAL MATERIAL:

Multimedia instructional lesson preparation is not so easy because it requires system which integrate video, audio, text, graphics of Information Technology topics. Multimedia strategy calls for the use of number of media, devices and techniques for the lesson development of Information Technology. The power point programme in computer is used to prepare various slides and which gives improvement in various fashion with the help of animation in power point Programme. The various graphics can be presented on the overhead projector and can be recorded along with power point slides and movement of slides can be given with the help of animation and sound is recorded accordingly to provide audio visual impact. The multimedia instructional lessons of Information Technology prepared on computer CD have the main advantage that you can see the lesson and can practice while learning. Computer CD lessons can be forwarded and backwarded according to your convenience. The instructions given through computer CD are known as multimedia instructional system consisted of two types of material - hardware and software. The hardware included the electronic gadgets like computer monitor and computer CPU which have the computer CD drive. The software consisted of computer CD lessons which were recorded on the computer CDs. Three units of Information Technology were recorded on computer CDs under the guidance of computer digital camera man and under the guidance of power point software expert on computer.

The average duration of the Multimedia Instructional System was 35-40 minutes. The Salient features of computer CD instructional lessons were:

1. The graphics were generated letter by letter with a computer Digital camera or video camera and captions were recorded where ever required with the help of overhead projector or LCD Slides.
2. All the spoken words/Commentary were supplemented by visuals at appropriate place.
3. Experts from computer were taken as support medium.

The one of the objective of the study was to prepare Multimedia Instructional System. As mentioned earlier in the first Chapter, Instructional Medium is simply a means of
transmitting instruction. It is not the substance of that instruction. Instructional media are the electromechanical devices which act as middle condition between the student and what he is to learn. Erickson pointed out several traditional media still make important contributions to the instructional process. Among these are mock-ups, pictures, motion pictures, still pictures, film strips and tape recording and like. The tape recordings have been the chief aural instructional medium. Erickson also describes new media like television, teaching machine and increasing popularity of kits contained variety of carefully related material including objects, models, motion pictures, film strips, tape recording, programmed materials, apparatus assembles and workbook etc. Another media classification scheme has been proposed by Postlethwait. A Scheme proposed was found useful to classify media on the basis of the senses stimulated in the learner. This results in four major categories of classifications: (1) Audio or Sound Media; (ii) Visual Media; (iii) Tangible items; and (iv) Audio-Visual and Tangible combinations.

**Step I - Selection of Media:**

All the available media are related to our sensory organs. The key factor in using the media knowing how to select the medium that most effectively and efficiently meet our needs. Before selecting the media, the important task is to decide the following things:

- Selection of Unit of Content.
- Basic Assumptions about the Learner or entering behaviours.
- Terminal Behaviours.
- Achievement Test.

All these things have been already discussed and described earlier in this Chapter. Although so many media are available which can be used in teaching Information Technology, but the investigator selected multimedia instructional material after consulting the experts, educationists, teachers and keeping in mind the following points:

- Economical aspect.
- Easily availability and preparation.
- Age and mental status of the learners.
- Appropriateness of the curriculum.
The investigator kept the above mentioned criterion in mind for the selection of the media.

Step II - Presentation and operation of the media:

The investigator has taken three units of contents of Multimedia Instructional System, i.e. Information Technology - Basics (unit I), Information Technology - Uses & Applications (unit II), Information Technology - MS-Word (unit III). Each unit is prepared on the basis of discussions with media experts, educationists & teachers. In the preparation of Instructional System logical sequence without any interruption were followed. The draft of this Instructional System was prepared, the initial draft was edited by language expert, media expert and content expert. Lastly by persons involved in research. Their suggestion were emancipated. The draft was modified in the light of suggestions given by them. The mode of presentation of each unit follows a systematic order.

Three Computer CDs on three units were prepared.

Computer CD having graphics, text, diagrams with animation effect was made on Power Point programme and sound of investigator was recorded while preparing Multimedia Instructional System on power point programme in computer. This part is shown on the computer monitor by inserting computer CD in CPU which is having text, graphic, diagram along with animation effect & investigator's recorded sound. The mode of presentation of each unit follows a systematic order.

Switch on the CPU, monitor and put the computer CD in CD driver & start.

The lecture will start and you will watch the lesson on computer monitor for 35-40 minutes for one unit of information technology in form of Multimedia Instructional System.

If you want to clear any concept you can forward or backward the lesson according to your requirement.
This multimedia technique encourages self learning.

**Step III - Tryouts:**

The investigator recorded the contents to explain each unit. The intensity of sound and pace were settled with the help of team of experts of various fields viz: media experts, educationists and teachers.

They were asked to evaluate the recorded content on computer CD, in the light of following points along with the terminal behaviours.

- Are desirable details shown in proper size?
- Sharpness of text, pictures & diagrams.
- Is the content free of irrelevant material?
- Are pictures free of distortion because of a good balance between artist's technique and educational needs?
- Do sets of pictures provide adequate continuity and range?
- Is the designated continuity of pictures appropriate for the teaching objectives?
- Are the captions and explanations readable and suitable for teaching purposes?
- Is the programme free of conflicts between background, sound and speech or dialogue?
- Is the programme on a topic of appropriate length?
- Is the animation effect given by power point is appropriate.
- Computer CD prepared on power point have continuity of slides with appropriate time gap or not.

Thus the draft was reviewed on the basis of appropriate comments & suggestions given by team of experts. At this time the first draft was prepared along with the instructions and tried on a group of five students taken randomly from Baptist Sr. Secondary School Bhiwani. Carton Erickson (1970) suggested that the group judgments are superior to individual judgements. The instructional material was exposed to five students and they took 35 minutes and their comments and suggestions were considered. On the basis of suggestions the draft was revised.

The revised draft was administered to a small group of 20 students taken randomly
from Baptist Sr. Secondary school Bhiwani. Now again the draft was reviewed in the light of comments given by the participants and the final draft was prepared.

Step IV - Evaluation:

To find out the reliability, the final draft was administered to a sample of 40 students. The institution Viz: Baptist Sr. Secondary school Bhiwani taken out randomly. All the students available were taken out. Since this phase of try-out is administered in class room situation, no attempts were made to interrupt or change the usual class administratively. Cooperation was also sought from the class teachers. The larger the number of pupils involved, the greater will be the reliability of measures obtained from the post-test scores. A post-test was given to the students after the completion of this programme. The answer-sheets were scored with the help of an answer key. The data so obtained were analysed and the distribution of scores is given in the following table:

**Table No. 3.11**

<table>
<thead>
<tr>
<th>Class Intervals of Scores</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-44</td>
<td>3</td>
</tr>
<tr>
<td>45-49</td>
<td>1</td>
</tr>
<tr>
<td>50-54</td>
<td>3</td>
</tr>
<tr>
<td>55-59</td>
<td>3</td>
</tr>
<tr>
<td>60-64</td>
<td>5</td>
</tr>
<tr>
<td>65-69</td>
<td>5</td>
</tr>
<tr>
<td>70-74</td>
<td>4</td>
</tr>
<tr>
<td>75-79</td>
<td>8</td>
</tr>
<tr>
<td>80-84</td>
<td>18</td>
</tr>
</tbody>
</table>

The mean & S.D. were found to be 70.12 and 12.89 respectively.

The reliability calculated by K.R. formula -21 was found be 0.88 This reliability is quite satisfactory for this programme. The final draft of Multimedia is given is Appendix VI.

3.6.0 SELECTION & DESCRIPTION OF GROUP INTELLIGENCE TEST FOR CHILDREN (2/70)

General Intelligence has very often been found to have a high positive correlation with academic achievement. Since the three methods of instruction were used as the three different approaches of teaching of Information Technology in the present study, it was considered necessary to use General Intelligence as a control variable. This test was to serve two main purpose:
(98)

(i) Allocation of subjects to different experimental groups

(ii) To test the interaction between Methods and Intelligence.

For this purpose, "A Group Test of Intelligence for Children (2/70) constructed by Dr. R.K. Tandon was used in this investigation. The brief description of this test is as follows:

(i) Description of the Test:

It is a group test of intelligence in verbal form. It is named as Samoohik Mansik Yogyata Parikcha (2/70). It is a point scale in omnibus form. It has a total of 91 questions employing seven types of subtests namely, number series, vocabulary similar, vocabulary opposites, classifications, best answers, analogies and reasoning. All the questions have been framed in selective type providing 4 to 5 alternatives to each. The questions are in simple Hindi to enable the children of Hindi speaking areas to answer them without being influenced by proficiency in language. Thus, it can used on school going pupils of Hindi speaking areas of India of the age group 10 to 16 years.

(ii) Sample:

The final version of the test has been standardized on 1667 children of Moradabad town and its suburbs ranging from ages 10 to 16 years and reading in classes from VI to XI.

It is a group test in reusable booklet form. The answers are to be given on answer sheets which are provided with the test booklets. The test paper consists of a work of 20 minutes only and another 20 minutes are needed for explaining the examples for practice and giving directions to children. Hence, the whole test can be administered conveniently in a period of 40 to 45 minutes in a classroom situation. The test can also be used in an individual situation when only one child is available at a time. However, it can be conducted on a batch of 30 to 40 children.

After the children have understood clearly the mode of answering the questions, and when they are left with 'all doubts removed.' start should be given to them and stop watch should be set moving. After 10 minutes are over, the examiner, should announce loudly 'ten minutes more' and then after five minutes, 'five minutes more'. As soon as 20 minutes are over, the children should be asked to stop writing and all the booklets and answer
sheets should be collected. No extra time should be allowed to any child.

(iii) Scoring:

The answer sheets are scored conveniently by using stencil key prepared for this purpose. The wrong and left out questions are crossed out and then the number of correct questions is counted, which becomes the raw score. Here, one score is provided to one correct answer. No marks are deducted for wrong answers.

(iv) Reliability:

Two methods have been used to find out the reliability of the test, namely split half method and Kunder-Richardson formula-20. In both cases the reliability coefficient comes to be 0.93, which is very high and the test results should be relied upon.

(v) Validity:

The test items have been found to discriminate well between high and low scores. Further most of items reveal positive high correlations with total scores. Thus the test seems to consist of homogeneous items and can discriminate well between dull and bright children.

The test has also been correlated against the examination marks. For classes X, XI, and XII, the correlations have come to 0.36, 0.59, and 0.42 respectively.

The $g$-saturation of the test range from 0.5354 to 0.8009. Further, using the centroid technique of factorization, the test has been found to be highly loaded with a general factor.

(vi) Norms:

For easy and meaningful interpretations of raw scores, four types of norms have been provided. They can be used conveniently by research workers, teachers and even by the lay users. These norms are age-wise means, age-wise percentiles, age and grade-wise standard scores, age and grade wise deviation of $I.Q$. A raw score can be interpreted in any manner the users wish to do so.

A booklet of a Group Test of Intelligence (2/70) for Children has been provided in Appendix VIII.