C H A P T E R VI

AN EXPERIMENT WITH ALTERNATIVE INSTRUCTIONAL COMPONENTS

It may be recalled from Chapters I and II that besides developing a duly validated multimedia instructional strategy and studying its feasibility, in the investigation, an attempt has also been made to develop alternative instructional components for teaching a few concepts in one of the units and study the relative effectiveness of the components. This chapter pertains to the study of the above aspect in the present investigation. The objective in respect of this has been stated as 'To develop alternative instructional components for teaching a few concepts and studying their relative effectiveness'.

Details related to development of software material to be presented through the alternative instructional components, methodology followed, results and discussion are presented in what follows.

DESIGN

For fulfilling the objective, alternative instructional components for teaching a few concepts were identified and software material to be presented through the components were developed. The relative effectiveness of the alternative components has been studied by administering

2 them on the experimental group which was divided into two matched groups for this purpose.

DEVELOPMENT OF SOFTWARE MATERIAL

Through task analysis it was identified that a few concepts in Unit IV (Heterotrophic Nutrition) could be presented through two types of Programmed Learning Material (PLM), namely, PLM developed on the principles of inductive reasoning (Inductive PLM) and deductive reasoning (Deductive PLM), without bringing in any change in the sequencing of the concepts. For the concepts identified, PLM was developed in both inductive and deductive approaches. It may be mentioned that while writing frames for the two types of PLM, deliberate attempts were made to restrict to two types of frame sequence, namely, 'Eg-rule' and 'Rule-eg'. In the PLM developed on the principles of inductive reasoning, 'Eg-rule' frame sequence was followed for writing the frames. In this type of frame sequence, first a number of examples related to a concept are given and students are made to recognize the commonalities present in different examples. From this, students are required to arrive at the 'rule' and later generalize to other situations. In the PLM developed on the principles of deductive reasoning, 'Rule-eg' frame sequence was followed for writing the frames. In this type of frame sequence, first the rule is presented to the students which would be followed by examples. It should be mentioned that the PLM developed in inductive and deductive

3 approaches differed only with regard to frame sequence. They remained similar with regard to other principles of programming such as style of programming, prompts, etc., and also with regard to nature and number of examples considered to teach the concepts. The concepts treated through the two types of PLM are presented below.

Concepts Treated:

1. Concept of heterotrophic nutrition.
2. Difference between heterotrophic and autotrophic nutrition.
3. Different kinds of heterotrophs.
4. Interdependence of plants and animals and their association.

For flow chart in respect of sequencing of these concepts and specification of terminal behaviours, refer flow chart (No. 6) and terminal behaviours specified for Unit IV in Section I of Chapter III in this report, as these concepts form part of Unit IV.

Below are presented a few frames taken from the text to illustrate the frame sequence in the two types of PLM developed.

4 Illustrative Frames: Inductive Approach:

Holozoic: 1. You are correct. So far, we have studied about animals and plants which are holozoic in their mode of feeding. Let us take the example of bacteria (other than photosynthetic and chemosynthetic) which are non-green and which depend on dead and decaying organisms for their food. Since these organisms depend on dead and decaying organisms, they are called as saprophytes.

So, _____ are organisms which feed on dead and decaying organisms.

Correct response -Sapro-phytes

2. Let us split the word 'saprophytes' to understand it better. 'Sapro' means dead and decaying, and 'phyta' means plants.

Like bacteria and fungi, there are many more living organisms which depend on dead and decaying organisms for food, and these

5 organisms are called as _____

Correct response - Saprophytes

3. And, their mode of feeding is called as _____tic nutrition.

Correct response - Saprophytic

Illustrative Frames: Deductive Approach:

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1. Like holozoic animals, there is another kind of animals which are called as saprophytes and they depend on dead and decaying organisms for their food.

_____ are animals which depend upon dead and decaying organisms for their nourishment.

Correct response - Saprophytic

2. Let us consider an example. You are all familiar with bacterias which are other than photosynthetic and chemosynthetic. You know that they feed on dead and decaying organisms.

These bacterias which feed on dead

6 and decaying organisms are called as _____tic bacteria.

Correct response - Saprophytic.

Both the types of PLM were examined by methodology and content experts for frame sequence and content respectively. The materials were modified as per the suggestions given by experts. The PLM developed on the principles of inductive reasoning contained 62 frames, and the other contained 50 frames. Both the types of PLM have been presented in Vol.II of this report.

INSTRUMENTATION

To study the relative effectiveness of the two types of PLM in terms of students' achievement, a criterion test was developed. This was developed by culling out criterion test items related to the concepts treated through the two types of PLM from unit test-IV. In all, the test included 7 test items with a maximum score of 12. Out of the 7 criterion items, 3 items belonged to the objective knowledge and 4 to the objective understanding. The maximum score attainable on knowledge and understanding were $4\frac{1}{2}$ and $7\frac{1}{2}$ respectively. This test has been presented as Part-I of unit test-IV in Appendix-A.

SAMPLE

Sample for this aspect of the study consisted of 45 students who formed the experimental group of the validation experiment described in Section II of Chapter III of the report. The total of 45 students was divided into two matched groups of 23 and 22 students each. Matching of the groups was done in terms of mean and S.D. The variable considered for matching was their achievement on the preceding criterion test, namely, unit test-III. The groups were randomly assigned to the two types of treatment, namely, Inductive and Deductive PLMs. For the sake of convenience, the group which was exposed to Inductive PLM is denoted as Group A, and the other as Group B.

EXPERIMENTATION

In the beginning, both the groups were oriented about the purpose of the experiment and also the method through which they would be learning the concepts. Students of both the groups were informed not to exchange their learning material. They were also informed not to consult the prescribed textbook or any other learning material for the concepts dealt through the PLM. This instruction was given with a view to avoiding the influence of textbook reading or any other learning material related to the concepts dealt through the PLM, on their achievement. As the learning material was self-instructional, students were asked to read the material at home and come prepared for

8 the criterion test (test referred earlier under instrumentation), which was held in the subsequent science period.

ANALYSIS OF THE DATA

In the beginning, all the raw scores on the criterion test were converted into percentages. This was done for the scores on each category of objective as well as for the score on the test as a whole (objectives combined). These percentages have been analysed using statistical techniques such as percentiles, mean and S.D. to study the distribution of students' performance on the criterion test. To study the mean difference in the achievement of the two groups on the test, Student's 't' test was used. The formula has been represented below.

$$SE_D M_1 - M_2 = \sigma_D = \sqrt{(\sigma^2 Mx_1 + \sigma^2 Mx_2)(1 - r^2 xy)}$$

- Garrett ... (60).

It may be noted that the formula for correlated means has been used, since the groups were matched groups.

Students' performance in terms of knowledge and understanding objectives separately and both combined (test as a whole are presented in Tables 6.1 to 6.3 respectively.

RESULTS AND DISCUSSIONS

TABLE 6.1

Percentiles, Means, S.D.s and 't' Value for Groups A and Group B Students' Performance on the Criterion Test - Knowledge Objective

Groups	P_{10}	P_{20}	P_{30}	P_{40}	P_{50}	P_{60}	P_{70}	P_{80}	P_{90}	Mean	S.D.	't' value
Group A (exposed to Inductive approach)	25.5	54.0	73.0	83.50	88.75	91.60	93.70	96.80	97.90	75.90	27.6	0.07 N.S.
Group B (exposed to Deductive approach)	52.4	56.8	66.0	73.0	78.0	82.0	91.75	94.50	97.25	75.45	18.90	

N.S. - Not Significant

TABLE 6.2

Percentiles, Means, S.D.s and 't' Value for Group A and Group B Students' Performance on the Criterion Test - Understanding Objective

Groups	P_{10}	P_{20}	P_{30}	P_{40}	P_{50}	P_{60}	P_{70}	P_{80}	P_{90}	Mean	S.D.	't' value
Group A (exposed to Inductive approach)	51.0	66.0	71.55	73.77	76.11	78.44	83.50	91.30	95.80	74.05	19.50	1.46 N.S.
Group B (exposed to Deductive approach)	35.0	50.0	56.30	60.80	65.50	71.00	84.75	87.50	90.35	64.80	22.60	

N.S. - Not Significant

TABLE 6.3

Percentiles, Means, S.D.s and 't' Value for Group A and Group B Students' Performance on the Criterion Test - Objectives Combined

Groups	P_{10}	P_{20}	P_{30}	P_{40}	P_{50}	P_{60}	P_{70}	P_{80}	P_{90}	Mean	S.D.	't' value
Group A (exposed to Inductive approach)	51.00	62.50	73.75	79.00	82.64	85.64	88.64	92.1	96.30	76.9	19.6	0.96 N.S.
Group B (exposed to Deductive approach)	42.50	63.50	68.50	71.25	74.00	77.00	83.50	87.70	92.10	71.9	17.7	

N.S. - Not Significant.

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It may be seen from Tables 6.1 to 6.3 that the three 't' values obtained for mean difference between Group 'A' and Group 'B' students' performance in respect of the objectives knowledge and understanding, and on the test as a whole are not significant. It indicates that the two groups do not differ with regard to their mean achievement on both the objectives and on the test as a whole. However, an examination of the percentile positions depicted in Tables 6.1 to 6.3 indicates that at most of the percentile points, students exposed to inductive PLM have fared better in comparison to students exposed to deductive PLM, even-though the difference does not seem to be high. What could be inferred from the above results and discussion is that PLM developed on the principles of inductive reasoning and deductive reasoning have proved equally effective in the achievement of specified instructional objectives. In other words, both the types of PLM could be effectively used as alternative instructional components for teaching the concepts listed earlier in this chapter. It may have to be remembered that the above experiment is just one single attempt in the development of alternative instructional components. However, the implication of this attempt for enhancing the effectiveness of the strategy is that if such alternative instructional components of equal effectiveness are developed for various concepts in the course and made available to learners, an option can be made possible for

learners to choose the ones which suit their characteristics most. This would bring in more flexibility in organizing remedial instruction to students, which forms an integral part of the strategy when attempts would be towards the achievement of the mastery learning.

Besides, this experiment in the investigation has one methodological significance also. While discussing about the significance of developmental studies in Chapter II of this report, it was argued that through carrying out developmental studies the process of instruction with all its multiplicity of factors and their operation could be subjected to scientific examination, which would facilitate hypothesising about and testing certain relationships between various factors operating in actual classroom situations and also in studying the effectiveness of different instructional models when implemented over a period of time. Through carrying out experiments of the above type (strict laboratory type of experiments) within the purview of the developmental type of studies, the effect of certain variables which are hypothesised to influence learning, or certain hypothesised relationships between various factors operating in actual classroom situations could be studied independently under strict controlled situations - for example, the effect of frame sequence in the above experiment - and the results could be utilized for further systematisation and improvement of

the instructional strategy. The experiment with the alternative modes of instruction in the present investigation serves as a concrete example in demonstrating how developmental and laboratory type of studies should go hand in hand.