

CHAPTER VI
AN OVERVIEW OF THE STUDY

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CHAPTER VI AN OVERVIEW OF THE STUDY

INTRODUCTION

The current trend in science teaching programme is to emphasize on providing learning activities, so that the children can develop the practical skills through conducting simple investigations. The practical skills thus gained can be transferred to life skills. The purpose of this chapter is to provide a resume of the whole work done by the investigator. Apart from the summary of findings and conclusions, the recommendations and suggestions for further research are presented in this chapter.

EDUCATIONAL TECHNOLOGY

Educational technology is a very comprehensive and complex concept covering harmonization of appropriate human resources with material and machines organization, management and administration forming a cohesive operational network system to optimize the efficiency of training of educational programme. There are many definitions of educational technology. All the definitions agree that it is the systematic application of scientific knowledge on teaching and learning and conditions of learning to improve the efficiency of teaching and training.

The important component of educational technology, which can be applied in all our schools, is the application of scientific principles to the whole instructional process. This involves the formulation of specific objectives of teaching, provision of suitable learning experiences to developmentally appropriate teaching strategies and development of curriculum and objective evaluation of the pupils' progress in learning.

The term 'Educational Technology' involves the application of scientific knowledge to education: input, output and process aspects of education: organization of learning situations for realizing the goals of education, development of methods and techniques for effective learning and designing tools for measuring learning outcomes.

EDUCATIONAL TECHNOLOGY AND SCIENCE EDUCATION

National Policy on Education (1986:22) emphasized: "Educational Technology will be employed in the spread of useful information, the training and re-training of teachers... The generation of relevant and culturally compatible educational programs will form an important component of educational technology, and all available resources in the country will be utilized for the purpose.

Technology in science Education implies the operational efforts to re-arrange, re-organize and systemize the application of scientific knowledge to optimize the learning process. Educational technology helps in the choice of effective media to suit the instructional mode, which in turn has to be determined taking into consideration the parameters of pupil characteristics, instructional objectives, learning tasks involved as well as the teaching style of individual teachers. Science in the elementary school should certainly be characterized by picking and choosing from a variety of sources for maximum effectiveness in a particular situation for this reason we should seek also to integrate new ideas into our programme whenever possible. Educational Technology provides answer to such problems. Latest Technologies of education like programmed instruction and system approach provide a comprehensive variety experience in science education at all levels of

education. Scientific method of instruction itself is a process of Educational Technology. Science teaching with the real objects or improvised materials enhances learning and proceeds in a positive direction. Educational Technology provides way for these situations.

IMPORTANCE OF ACTIVITY-BASED LEARNING IN SCIENCE

Activity-based teaching learning is to be the latest trend in science teaching in elementary education. The word activity suggests that something is active. Learning takes place all the time when our senses are activated. Sometimes only one or two senses may be used. The greater the number of senses, as a rule, the better is the quality of learning.

The following recommendations have been given in the National Policy on Education-1986 regarding teaching-learning strategies:

1. A child-centred and activity-based approach to learning should be adopted. First generation learners should be allowed to set their own pace and be given supplementary remedial instruction.
2. Children with special talent or aptitude should be provided opportunities to proceed at a faster pace, by making good quality education available to them, irrespective of their capacity to pay for it.

Psychological studies of effective learning, emphasizes the importance of first hand concrete experiences involving sensory contacts as the starting point of learning, which later only proceeds towards greater and greater abstraction. A pupil profits most from instruction when he becomes involved through his own interests and purposes and such as involvement is possible when concepts and principles are introduced to him through well-chosen

educational media appealing to the different senses. Such a people will also act creatively.

Research findings show that the effective utilization of manipulating materials led for the better learning of science by children. To make classroom effective, interesting and easily graspable a variety of teaching aids need to be used in the teaching learning process. The teaching learning process should provide opportunities for children to explore with concrete materials, to participate in activities indicated in their book.

NEED FOR THE STUDY

The investigator with the accumulated experience as a Post Graduate Teacher in science over a decade and as Elementary Teacher Educator in science over another decade has been able to observe the absence of practical skills in science in the students of upper primary schools. Discussions with the senior science teachers revealed that the traditional methods of science teaching in upper primary schools have not produced the requisite skills among children.

The theories, Piaget (1950), Bruner (1960) and Gagne (1961), reveal a great richness in children's thought. They appear to be capable of relating theories and the phenomena they observe to laboratory experiences.

Global Elementary School Science programs like Science-A Process Approach (SAPA), The Science Curriculum Improvement Study (SCIS), The Elementary Science Study (ESS) and Nuffield Science Teaching Project (NSTP) emphasized the development of practical skills in science teaching among children.

Report of Education Commission (1964-66), National Policy on Education (1986), NCERT Guidelines on Science Teaching (1990), Yashpal Committee Report (1993) and National Curriculum framework, NCERT (2000) also insisted the development of skills in children.

In the trend report of Research in Elementary Education (Grewal and Gupta, 1991) in the fourth survey research in Education it was suggested that research on learner-centred strategies should be given priority. Also in the trend report of Research in Science Education (Gangoli and Vashiswta 1991) in the fourth survey of research in Education, indicated that, science education research, should direct its attention to improve the existing procedures of science instruction and to establish new and verified procedures for teaching science. Shukla (1991) in the trend report of research in Educational Technology in the fourth survey of research in Education stated that, the numbers and the problem in education are most numerous at this stage, greater attention should be paid to the application of Educational technology at Primary level.

Rao, C.N.R. (1993) stated "I am especially concerned about experimental work because it is that which will eventually determine science. Although we may be good in theory here and there, our experimental work become very difficult. There are very few people doing, for example, good work in experimental science ... many of them are getting old and I do not know who will replace them... "

World bank sector, (1995) reviewed the priorities and strategies for education as –The third and probably the most important challenge is to

improve educational quality; it is poor at all levels in low and middle-income countries. Students in developing countries are neither acquiring the skills called for within their own countries curricula nor are they doing as well as students in more developed countries.

According to Vaidya (1996), the present-day state of affairs in science teaching has been and still oral in character with demonstration vocationally thrown in. There is very little practical work up to the eighth class. At the higher stage, prescribed list of experiments are rigidly followed by the teachers in the laboratory, which is mostly in the nature of verifying knowledge, or working according to set rules made quite explicit before introducing the real experiment to the students. They deviate very little, in this respect. The element of investigation, training in the use and practice of the scientific method and even mastery of the research operations (the discovery approach of learning) are conspicuous by their absence, even at those places where laboratory facilities and equipments are generous. It is also added that the aims and objectives of science education are on paper only. Most of them vapourise during implementation.

Ediger, Marlow and Baskara Rao (1996) rightly stated that development of practical skills in science subjects not only leads to learning of scientific concepts but also is instrumental in developing scientific attitude among the students besides reinforcement of learning. It is, therefore, necessary that while formulating instructional objectives, care may be taken that proper weightage is given to the psychomotor skills as also to objectives in the affective domain, which relate to appreciations, interests and attitudes. Psychomotor skills include manipulative skills, observational skills, drawing

skills, reporting skills etc. All these skills must be taken care of while teaching the science subject.

According to the guidelines of the National Curriculum Framework, (2000), science operates through its processes. Consequently, teaching and learning of science needs to be characterised by focused emphasis on processing, i.e., experimentation, taking observations, collection of data, classification, analysis, making hypothesis, drawing inferences and arriving at conclusions for the objective truth. The process skills so acquired would help in developing attitudes and values that constitute the spirit of scientific temper. Science has to be learned more in familiar environment and not in alien and contrived situations.

Ediger, Marlow (2002) emphasized that experiments, demonstrations, construction activities and unit study would emphasize hands-on approach in learning. Chouhan, (2002) suggested that science teachers must provide activities and experiences that are interesting to the learners, so that they may learn, achieve up to the mark and grow. Also science teachers need to provide activities and experiences for pupils that are reflective in nature so that students individually ponder what has been taught.

An effective science programme in elementary schools plays an important role in importing knowledge to the child about his environment, developing necessary practical skills and an insight into the structure of science, offering a wide variety of learning experiences and providing varied activities to satisfy the individual differences. The above discussion establishes the need for the present study.

STATEMENT OF THE PROBLEM

A review of various theories, global science programs, reports of commissions and published articles revealed the importance and need for the present study. Also the published research revealed that little had been done to the development of practical skills for the children in the upper primary stage. So the investigator is motivated to evolve a suitable strategy to develop the appropriate practical skills needed for the children in the upper primary stage. In the context of the above said need, the present study can precisely be stated as ***“INSTRUCTIONAL STRATEGIES IN RELATION TO PRACTICAL SKILLS IN SCIENCE AT UPPER PRIMARY LEVEL.”***

OPERATIONAL DEFINITIONS OF THE TERMS

Instructional strategy: It is defined as the systematic way of designing, carrying out and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non-human resources.

Practical Skills: The process and products skills (process of performance and product of performance)

Upper- primary level: The standards VI-VIII in an elementary school.

OBJECTIVES

The objectives of the study are stated as follows:

1. To analyze the contents in terms of theory and practicals (activities) in studying science at upper primary level.
2. To identify the practical skills needed for conducting practicals (activities) in teaching science.

2. To identify the practical skills needed for conducting practicals (activities) in teaching science.
3. To develop criterion tests to assess the extent of development of practical skills among upper primary students.
4. To develop activity based learning packages to develop practical skills.
5. To develop low cost improvised materials and apparatus to conduct practicals (activities).
6. To study the effectiveness of the developed packages through individual try out.
7. To study the effectiveness of the developed packages through small group try out.
8. To study the effectiveness of learning packages at the demonstration stage.
9. To prepare training programme for teachers to involve in the extension stage.
10. To study the effectiveness of the learning packages at the extension stage.
11. To study the attitude of teachers towards the learning packages.
12. To study the reaction of students towards the learning packages.

HYPOTHESES

The hypotheses of the study are summarized as follows:

1. The students of the *control* and *experimental* groups are identical in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the *pretest* at the *demonstration stage*.

2. The students of the *control* and *experimental* groups do not differ from each other in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the *posttest* at the *demonstration stage*.
3. There is no significant difference between the *pre* and *posttest* scores of the students of the *control group* in terms of their primary process skills, integrated process skills and scientific communication skills at the *demonstration stage*.
4. There is no significant difference between the *pre* and *posttest* scores of the students of the *experimental group* in terms of their primary process skills, integrated process skills and scientific communication skills at the *demonstration stage*.
5. There is no significant difference in the mean scores of performance of *control group* among the three divisions of skills at the *demonstration stage*.
6. There is no significant difference in the mean scores of performance of *experimental group* among the three divisions of skills at the *demonstration stage*.
7. There is no significant difference in the mean scores of performance among the fifteen individual skills as measured by the *posttest* in the *demonstration stage*.
8. The students show favorable reaction towards the learning packages.
9. The students of the *experimental* groups are identical in terms of their primary process skills, integrated process skills and scientific

- communication skills as measured by the *pretest* at the *extension stage*.
10. There is no significant difference between the *pre* and *posttest* scores of the students of the *experimental groups* in terms of their primary process skills, integrated process skills and scientific communication skills at the *extension stage*.
11. There is no significant difference in the performance among the experimental groups in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the *posttest* at the *extension stage*.
12. There is no significant difference in the mean scores of performance of *experimental group* among the three divisions of skills at the *extension stage*.
13. There is no significant difference in the mean scores of performance among the fifteen individual skills of the *experimental group* as measured by the *posttest* at the *extension stage*.
14. There is no significant difference in the mean scores of performance of fifteen individual skills among the schools as measured by the *posttest* at the *extension stage*.
15. The teachers show positive attitude towards the learning packages.

TOOLS USED IN THE STUDY

The tools used in the study are

- i) Content analysis.
- ii) Activity based learning packages to develop practical skills.

- iii) Criterion tests to assess the extent of development of practical skills.
- iv) Low cost improvised materials to conduct practicals (activities)
- v) A scale to study the attitude of teachers towards the learning packages.
- vi) A scale to study the reaction of students towards the learning packages.

OUTCOMES OF THE STUDY

The outcomes of the study are

- i) Validated activity based learning packages to develop practical skills.
- ii) Validated criterion tests to assess the extent of development of practical skills.
- iii) Low cost improvised materials to conduct practicals (activities)
- iv) A scale to study the attitude of teachers towards the learning packages.
- v) A scale to study the attitude of students towards the learning packages.

METHODOLOGY IN BRIEF

The following stages were involved in the methodology of this study:

I. PRE – PILOT STAGE

The major objective of this study is to develop the practical skills among the upper primary students. To initiate the process, the content area, units and the components of skills were identified at this stage.

II. PREPARATION OF LEARNING PACKAGES

At this stage, learning packages were developed by establishing instructional outcomes and preparing instructional means. Learning packages were prepared for eight units and for fifteen skills in eighth standard science. The packages were revised in consultation with the experts in content, methodology and evaluation.

III. PREPARATION OF CRITERION – REFERENCED TESTS

Criterion tests were developed at this stage taking into consideration the specific objectives to be achieved. The preparation of criterion test consists of four steps namely (a) Preparation of a blue print, (b) Construction of test items, (c) Question analysis and, (d) Preparation of marking scheme.

IV. PILOT STAGE

The individual and group responses were tested at this stage. The programme was administered individually on six students of Eighth standard. It was revised according to the response of the students. The revised programmes were tried out in a group of ten students and the group reactions were noted.

V. DEMONSTRATION STAGE

The effectiveness of the learning packages was studied in a classroom situation against the conventional method. One of the quasi-experimental designs namely, pretest-posttest, parallel, equated group design was used in this stage. The experimental group was treated by the investigator using the learning packages and the control group was treated by the regular teacher. A criterion test was administered before and after the treatment for both

experimental and control groups. After the completion of the experiment the reactions of the students were measured through a reaction scale.

VI. EXTENSION STAGE

The sources of variation of learning through the packages were studied at this stage. Single group pretest – posttest design was used in the experiment.

Before administering the design the teachers who were involved in the programme were oriented through an orientation programme. The attitudes of 24 teachers regarding the effectiveness of the learning packages were measured. At the school level the criterion test was administered before and after the treatment for all the 24 schools, which were involved in the extension stage.

Analyses of the scores were made using descriptive statistics like mean, standard deviation and inferential statistics like t-test, analysis of variance, post-hoc analysis and correlations.

DELIMITATIONS OF THE STUDY

Due to the constraints of time, money and administrative difficulties, the investigator has delimited the study as given below.

1. Only a few topics from the science course book of class VIII prescribed by the Tamilnadu Textbook Corporation were taken up for treatment and that constituted contents of the treatment.
2. No randomization has been exercised in the selection of sample.
3. No control group has been included in the extension stage of the study.
4. No deliberate attempt was made to prevent out of class or peer group interaction among different groups.

5. No deliberate attempt was made to control the teacher variables in the extension stage.

SUMMARY OF FINDINGS AND CONCLUSION

The following are the major findings and conclusions emerged from the present study.

A. Demonstration stage.

From the analysis of hypothesis 1, it is evident that there is no significant difference between the experimental group and the control group with regard to the attainment of primary process skills, integrated process skills and scientific communication skills, as measured by the pretest. Hence, the null hypothesis is accepted. So, it is concluded that the experimental and the control groups are identical in terms of the attainment of the practical skills before the treatment as measured by the pretest.

Form the analysis of hypothesis 2, it is found that there is a significant difference between the experimental and control groups with regard to the attainment of primary process skills, integrated process skills and scientific communication skills as measured by the posttest. The vast difference in the mean scores between the experimental and control groups shows the effectiveness of the learning packages in realizing the instructional objectives.

From the analysis of hypothesis 3, it is evident that there is no significant difference between the mean scores of pre and posttests of the control group with regard to the attainment of primary process skills, integrated process skills and scientific communication skills. Hence, the null hypothesis is accepted. So, it is concluded that the performance of the control

group using traditional method does not make any significant difference regarding the attainment of practical skills.

From the analysis of hypothesis 4, it is found that there is significant difference between the mean scores of the pre and posttests of experimental group with regard to the attainment of primary process skills, integrated process skills and scientific communication skills. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. So, it is concluded that the experimental group, treated using learning packages performed significantly when compared to the control group. It is also evident that the learning packages are effective in developing the practical skills among upper primary children.

The analysis of hypothesis 5 revealed that the F-ratio is significant at 0.01 level. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted. So, it is concluded that there exists significant difference among the three divisions of skills of control group in the posttest performance.

The analysis of hypothesis 6 revealed that the F-ratio is not significant. Hence, the null hypothesis is accepted. So, it is concluded that there is no significant difference among the three divisions of skills of experimental group in the posttest performance. It is also concluded that the experimental group received equivalent treatment in the three divisions of skills.

The analysis of hypothesis 7 revealed that the F-ratio is significant at 0.01 level. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted. So, it is concluded that there exists significant difference among the fifteen individual skills in the posttest performance.

Further, on ranking the posttest performance of the individual skills, it is found that the mean score of 'formulation of hypothesis' skill is the highest with 3.21 and the mean score of 'interpretation skill' is the lowest with 1.94. The ranking of the attainment of the practical skills is in the following sequence 1) Formulation of Hypothesis, 2) Measuring 3) Observation 4) Revision of Hypothesis 5) Classification 6) Inquiry 7) Tabulation 8) Identification 9) Graphical Representation 10) Generalization 11) Drawing 12) Experimental Set Up 13) Inference 14) Testing Hypothesis and 15) Interpretation.

From the analysis of critical difference method it is found that the following mean differences are significant according to the rank given.

1 and 6, 1 and 7, ...	1 and 15
2 and 8, 2 and 9, ...	2 and 15
3 and 9, 3 and 10, ...	3 and 15
4 and 10, 4 and 11, ...	4 and 15
5 and 11, 5 and 12, ...	5 and 15
6 and 11, 6 and 12, ...	6 and 15
7 and 11, 7 and 12, ...	7 and 15
8 and 12, 8 and 13, ...	8 and 15
9 and 12, 9 and 13, ...	9 and 15
10 and 13, 10 and 14, 10 and 15,	
11 and 15,	

Reaction of the students

From the analysis of hypothesis 8, it is evident that the mean of the actual score is of significant greater than the mean of the neutral score. The

results show that VIII standard students have favourable reaction towards of the learning packages.

B. Extension stage

The analysis of hypothesis 9 reveals that there is no significant difference among the experimental group, with regard to their attainment of primary process skills, integrated process skills and scientific communication skills as measured by the pretest. Hence, the null hypothesis is accepted. So, it is concluded that all the 24 schools are equivalent before the treatment with the learning packages. This result emerges due to convenience sampling.

The analysis of hypothesis 10 shows that there is significant difference between the mean scores of pretest and the posttest in attaining the primary process skills, integrated process skills and scientific communication skills. So, the null hypothesis is rejected and the alternative hypothesis is accepted. Hence, it is concluded that the higher t - value is due to the treatment using learning packages.

From the analysis of hypothesis 11, it is found that there is no significant difference among the experimental groups in attaining the primary process skills, integrated process skills and scientific communication skills as measured by the posttest. So, the null hypothesis is accepted. Hence, it is concluded that all the 24 experimental groups got almost equal treatment in attaining the practical skills using the learning packages.

The analysis of hypothesis 12 revealed that the F-ratio is significant at 0.01 level. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted. So, it is concluded that there exists significant

difference among the three divisions of skills of experimental group in the posttest performance.

From the analysis of hypothesis 13, it is evident that the F - ratio is significant at 0.01 level. Hence, the null hypothesis is rejected and the alternative hypothesis is accepted. So, it is concluded that there exists significant differences among the fifteen individual skills in the posttest performance.

Further, on ranking the posttest performance of the individual skills, it is found that the attainment of the skills is in the following sequence. 1) Revision of hypothesis 2) Observation 3) Measuring 4) Formulation of Hypothesis 5) Tabulation 6) Inquiry 7) Identification 8) Classification 9) Graphical Representation 10) Drawing 11) Generalization 12) Experimental Set Up 13) Inference 14) Testing Hypothesis and 15) Interpretation.

From the analysis of critical difference method, it is found that the following mean differences are significant according to the rank given.

1 and 3,	1 and 4, ...	1 and 15
2 and 3,	2 and 4, ...	2 and 15
3 and 5,	3, and 6, ...	3 and 15
4 and 5,	4 and 6, ...	4 and 15
5 and 9,	5 and 10, ...	5 and 15
6 and 9,	6 and 10, ...	6 and 15
7 and 9,	7 and 10, ...	7 and 15
8 and 9,	8 and 10, ...	8 and 15
9 and 11,	9 and 12, ...	9 and 15
10 and 12,	10 and 12, ...	10 and 15

11 and 12,	11 and 13, ...	11 and 15
12 and 14,	12 and 15, ...	
13 and 14,	13 and 15	
14 and 15		

From the analysis of hypothesis 14, it is found that there is no significant difference between the mean scores of individual skills among the experimental groups with regard to the posttest (except for the skill components: revision of hypothesis and tabulation). Hence, the null hypothesis is accepted. So, it is concluded that the effectiveness of the learning packages with regard to the individual skills are equivalent for all the 24 schools (except for the skill components: revision of hypothesis and tabulation).

Attitude of Teachers

From the analysis of hypothesis 15, it is found that the mean of the actual score is significantly greater than the mean of neutral scores with regard to the attitude scale. Hence, the hypothesis is accepted. So, it is concluded that the teachers have favourable attitude towards the learning packages.

SUGGESTIONS FOR FURTHER RESEARCH

Based on the procedures and decisions made in this study, the following suggestions are given for further research:

1. The learning packages developed need to be further validated in different cultural settings in our country.
2. The study may be repeated with the longer exposure of the treatment.

3. Further study need to be made to determine the results of such a study with high school students.
4. Comprehensive projects may be developed at the secondary level to develop the skills through an interdisciplinary approach.
5. Comprehensive projects can be developed including the skills like improvisation, collecting, preservation, laboratory discipline, etc.
6. A study may be conducted to relate the achievement in science with the attainment of practical skills
7. This study may be repeated to find out the effect of development of skills on variables like sex, locality, etc.
8. A comprehensive project may be conducted to study the effect of development of skills on scientific attitude and scientific aptitude.
9. A study may be conducted to develop life skills through science practical skills.
10. A project may be undertaken to study the influence of the science practical skills on mathematical, language and social science skills.