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INTRODUCTION

1.0 Background of the Study

Science is one of those human activities that can be created to gratify certain human needs and desires. In our modern world science should be regarded as a ‘way of life’ or “philosophy of living” because the whole of the universe is being dominated by the application of science. Science is progressing at an alarming pace and it has surpassed all the miracles of mythology. There is not even a single area which is left out by the magical touch of science. By exploiting the inquisitive nature of man, science goes on changing minute by minute and constructing new knowledge day by day.

Since science is an advancing subject, students are finding it hard to cope with the immense amount of data that is being generated. The teachers too must devise new strategies and methods to assimilate the scientific knowledge and disseminate it among his students. The known knowledge of the teacher about the concerned subject must be presented as a problem before the students from which they must be able to derive solutions and such an experience will lead the students to know about the unknown.

While learning science, the students should be able to solve problems independently and to apply the theories learnt in practical situations. He should develop a scientific attitude, interest and
curiosity. We cannot develop these qualities only by giving factual information. Science students should be considered as little scientists working in laboratories. The teacher should guide and lead students to discoveries and to solve problems. This is the first step to scientific literacy. Students gain a lot by doing experiments individually and also in groups. The task of science teachers is to develop and experiment new strategies which will help the students to acquire the ever increasing knowledge of science.

1.1 Environmental Science

Environmental science can be defined as the science that deals with the interrelationship between organisms and their environment. A close interaction occurs between life, and the environment in which it exists. For example, the environment of a plant includes the soil, water, mineral nutrients and the air in the immediate vicinity. Rainfall and temperature affect the life of the plant and so do the plants which are present around it and compete for water, food and other resources. All these constitute the plant's environment. The exchange of gases and nutrients affect and modify the environment. There are animals which eat the plant and others which help it to reproduce. The science which deals with the ways in which plants and animals (biota) affect their environment and are affected by it, is called environmental science (Mukherjee, 1997).
1.2 Environmental Education

Good environmental education like any good education, must lead students out and on from their immediate perceptions and experiences to a wider understanding, which must develop their capacity and this cannot happen by chance. A number of subjects and aspects of the school curriculum deal with matters to do with the interplay between man and his environment. Pupils must first learn about natural phenomena in order to understand complex environmental matters. The importance of environmental education is that sensitizes us to the causes and effects of problems of which for long, we have been only dimly aware. The environment involves our children’s future and many already know, that we must encourage them to think positively about it (Ghante, 1998).

Environmental education today serves as a common thread uniting long standing interests and emphasizing nature study, conservation education, and outdoor education. Environmental education has also been characterized by the development of explicit and implicit interconnection with human health, science and technology, and the environmental, economic, and social issues and problems of society. It is generally accepted that increased concern for environmental quality and fear of severe deterioration of human health and quality of human life caused by dramatic decline in
environmental quality gave impetus for synthesis leading to environmental education. Every individual has the right to seek a healthy environment to live in. It makes the environmental awareness and environmental education internationally imperative (Chanda, 2000).

The most hazardous event of the 21st century is the rapid degradation of environmental quality. The population explosion creates situations like more people needing more food, more energy, and more things of daily use, such as housing, clothing and automobiles. As a result we use more water resources, fertilizers and pesticides for more production and in turn, increase the level of air pollution, water pollution besides disturbing the ecological balance. All these conditions cause diseases and deaths in many species of animals, birds and human beings. Similarly the indiscriminate use of renewable and non-renewable physical resources lead to severe difficulties.

Lack of environmental awareness about preservation and conservation of environment effectively add fuel to fire. All these are greatly responsible for rapid degradation of the environmental quality at grass root level. If a similar situation continues in the near future, the entire human civilization will face disastrous situations in various spheres. At this juncture, the only alternative is to create
environmental awareness among the people in respect of protection, preservation, conservation of environment and also for the mitigation of environmental degradation. Further, the environmental awareness moves people towards environmental protection and environmental preservation. All these are possible only through environmental education.

Environmental education should result in the development of an ecological ethic, and enable the individual and the society to perceive environment in its totality and integrate physical, biological, technological, socio-cultural, moral, economic, historical and aesthetic components. In a country like India where 76% of its population lives in rural and tribal areas, environmental education is necessary to protect our environment and to attain sustainable development.

The crucial aim of environmental education is the development of behaviour which is in accordance with environmental needs. This means to transfer our knowledge and experience into everyone's life. Therefore environmental education should be related to the problems as they exist in the pupils (Vashist, 2003).

An environmental education programme based on a sound pedagogical basis should be directed towards achieving the following
objectives formulated in Tbilisi Conference (1975) [UNESCO/UNEP Intergovernmental Conference].

1. Awareness: To develop individuals and social groups acquire an awareness and sensitivity to the total environment and its associated problems.

2. Knowledge: To help individuals and social groups, acquire basic understanding of the total environment, its associated problems and humanity's critically responsible presence and roll in it.

3. Attitude: To help individuals and social groups, acquire social values, strong feelings of concern for the environment and motivation to actively participate in its protection and improvement.

4. Skills: To help individuals and social groups, acquire the knowledge and skills of solving environmental problems.

5. Evaluation ability: To help individuals and social groups, evaluate environmental measures and educational programmes in terms of ecological, political, economical, social, aesthetic an educational factors.

6. Participation: To help individuals and social groups, develop a sense of responsibility and urgency, regarding environmental problems to ensure appropriate action for solving the problems.
The spectrum of environmental education falls in four major but integrating components: Awareness, Real-life situations, Conservation and Sustainable development. This has to be watched with the needs of the primary, lower secondary, higher secondary and tertiary or the adult education (Khoshoo, 1991).

The goal of environmental education is to develop world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively towards solution of current problems and prevention of new ones (Saxena, 1996). Environmental education is indeed very important to child and adult for self-fulfilment and social development. It helps in the maintenance of life and health, in self-preservation and in the preservation of human race (Rao & Reddy, 1997).

1.3 Individualised Instruction

The shift in emphasis from conventional approaches in teaching to that of reconceptualization is relatively new and is developing at a faster rate. Students receiving education today should be competent to face the realities of tomorrow. Therefore the educational system imparted is to be strengthened to meet the challenges of the new century. Education, the action or process of education or being
educated is an integral part of human development, leading to human progress. The learner is an important factor in the teaching learning process. His intelligence, creativity, motivation, personality etc. are much more important determinants of how much he will learn than anything the teacher can do.

Individualised instruction enables each child to study at his own pace and according to his interests and abilities. "The main goal of individualised instruction is that each child's learning becomes self initiated and self directed" (Sharma, 1990). The Secondary Education Commission (1964-66) has also emphasized the importance of individualised instruction. The Commission says, "The present practice of mechanically applying the same methods to average as well as bright children is responsible for much of the ineffectiveness of the instruction given in schools. If these various groups of children are allowed to proceed at their own appropriate pace and the method, as well as the curricula load are properly adjusted, it will be good for all children, it will save the dull children from discouragement and the bright children from a sense of frustration." The method of instruction which caters to the need of individual students is known as Individualised instruction (Yadav, 1993).

Individualised instruction provides for a learning environment that encourages the child to be motivated intrinsically. The classroom climate is flexible and psychologically open. The students and
teachers jointly explore the aspects of problem rather than teacher
telling the students about the solution of the problem. The need for
radical changes in educational technology for keeping up with the
increasing volume and variety of knowledge, is being recognized as an
inevitable phenomenon in the changing process of secondary
education in India. Several instructional procedures and self-learning
materials are being used today for imparting instructions at the
individual level.

1.4 Learning Module

Among the individualized instructional techniques, instructional module has a very significant place. A module is a self
contained, self sufficient and independent unit of instruction with primary focus on a few well-defined objectives (Sampath, 1984).

A module is self-contained, self-pacing and self-learning by nature, but a teacher has a positive role to play in its use. A module
contains three co-ordinated basic elements of instructions namely objectives, learning activities and evaluation.

The philosophy behind instructional module is rooted on the generally accepted fact that each learner is unique and is different from others in background, experience, inherent qualities, habits and learning styles and as such should be allowed to grow and develop to the fullest potential. One of the important characteristics of a module
is that it is meant for self-study and self-evaluation by a student or a group of students.

A module is arranged with capsules and each capsule has pre-determined expected behaviour outcomes. At the end of each capsule, a self-evaluation test and its key are given which provide immediate reinforcement to the learner (Aggarwal, 1995).

1.5 Need and Significance of the Study

Today, qualitative improvement of education is of great importance and it can be achieved only by improving the quality of instruction. Even though great advancement in science as well as educational technology are made in our country, the methods of teaching prevalent are not significant to meet the requirements of students at all levels. Several studies on classroom practices reveal that even though the student characteristics and societal expectations have changed, our educators still employ these traditional methods and modes of instruction. To train reflective and totally active world citizens, many of our traditional educational practices must be seriously questioned and novel approaches based on sound objectives must be implemented. Hence, it is necessary to refine and improve the teaching methods and instructional techniques to realize the fullest potentialities of individual learners.

Education, for all its remarkable achievements in this country, still is largely unable to accommodate individual student learning
needs and to achieve acceptable levels of individual student mastery, proficiency and expertise.

Even though the academic community, including curriculum planners, educationalists and teachers are quite aware of the need for the development of environmental awareness at every level, it has been neglected till recently in our educational system. Unfortunately our present method of teaching environmental science is based on giving information as bits. It demands rote memorization of concepts, facts and principles and through this traditional methods of teaching, the objectives of environmental education are not realized. Therefore we are in need of new strategies for developing environmental awareness which will help to accomplish definite goals.

To develop environmental awareness among higher secondary school students, we must rely on systematic and effective instructional strategies. The investigator’s experience as a teacher convinced him that adequate content and activities are not provided to the higher secondary school students for developing environmental awareness. A careful review of the earlier studies carried out in the field of environmental education indicates that not much has been done in this field.

The investigator felt that learning modules would be of great help in awakening the curiosity, the love of learning and the capacity to think and judge for oneself. This approach may also lead to the
replacement of monotonous classroom teaching with interesting and active teaching learning process. But reviewing the studies conducted in India, it is found that not much works have been done in the area of preparation of learning modules. Hence to realize the need for maximizing environmental awareness, the investigator decided to prepare learning modules and to test the prepared modules to find its effectiveness among higher secondary school students. Hence the importance of the study.

1.6 Statement of the Problem

The present study is undertaken with the objective of preparing learning modules in environmental science and testing its effectiveness at higher secondary level. So the problem under investigation is entitled “PREPARATION AND TESTING OF LEARNING MODULES IN ENVIRONMENTAL SCIENCE AT HIGHER SECONDARY LEVEL”.

Explanations of Key Terms

**Learning Modules:** Learning materials which are self contained and self-sufficient for the learners to achieve specific objectives.

**Environmental Science:** Study of the relationship between man and the environment, the problems caused by pollution, loss of habitats etc. and the proposed solutions. This relatively new science includes other traditional subjects such as geography, geology and economics (Collin, 1996).

**Higher Secondary Level:** Forms the third stage in educational structure of the school and it covers plus one, plus two classes. In the present study the investigator collected data from plus two students.

1.7 **Objectives of the Study**

The study has the following specific objectives in view:

1. To study the facilities available and activities conducted in the schools for enhancing environmental awareness among higher secondary school students.

2. To study the Environmental Awareness of students at higher secondary level with respect to the environmental issues.

3. To prepare Learning Modules in Environmental Science at the higher secondary level.

4. To test the effectiveness of the prepared Learning Modules in environmental science at the higher secondary level.
5. To compare the effectiveness of the prepared learning modules over conventional text book oriented approach with respect to environmental awareness of higher secondary school students.

6. To compare the effectiveness of the prepared learning modules over conventional text book oriented approach with respect to achievement in environmental science areas of higher secondary school students.

7. To compare the effectiveness of the prepared Learning Modules over conventional textbook oriented approach on achievement in environmental science areas particularly under the categories of objectives-Knowledge, Understanding, Application, Skill.

1.8 Hypotheses of the Study

The hypotheses formulated for the present study are the following:

1. The facilities available and activities conducted in the schools for enhancing environmental awareness of higher secondary school students are very limited.

2. The higher secondary school students have low awareness regarding environmental aspects and issues.

3. The learning modules prepared in the environmental science areas would be effective in enhancing environmental awareness among higher secondary school students.
4. The modular approach would be more effective than conventional textbook oriented approach in enhancing achievement of higher secondary school students in the environmental science areas.

1.9 Methodology in Brief

As the present study was intended to prepare and test learning modules, Survey and Experimental methods were adopted. The survey method is used to identify the facilities available and activities conducted in the schools for enhancing environmental awareness of higher secondary school students and to understand the level of awareness of higher secondary school students with respect to the environmental issues. The experimental method is used to test the effectiveness of the prepared learning modules. The research design adopted for the experiment was pre-test, post-test parallel group design. In this design, the experimental group receives the treatment condition and both experimental and control groups were measured and compared on the independent variables for testing the significance of the difference.

The study was conducted on a final sample of 2200 students and 40 teachers from various higher secondary schools in Pathanamthitta district, Kerala State, selected on the basis of proportionate random sampling technique. For the survey, a questionnaire, a standardized environmental awareness test and an
interview technique was adopted. The data thus obtained were analysed using appropriate statistical techniques. Based on the findings, learning modules were prepared for enhancing environmental awareness and achievement in environmental science among higher secondary school students. The effectiveness of the learning modules prepared was tested using an experimental approach.

The experiment was conducted in the two divisions of plus two classes of Govt. Higher Secondary School, Kadapra, Pathanamthitta District. By comparing the previous year achievement and general mental ability 120 students (60 each) were taken as the final sample. Environmental Awareness test and Achievement test (pre-test) were also conducted before starting the experiment. The experimental group was taught by using the prepared learning modules, and the control group was taught in the conventional textbook oriented approach. When the classes for the selected topics were over, the same environmental awareness test and achievement test were administered to both the groups as post-tests. A retention test was also conducted after a couple of weeks. The pre-test scores and post-test scores and also the retention test scores obtained were subjected to appropriate statistical analysis.
1.10 Scope of the Study

The present study makes an attempt to identify the facilities available and activities conducted in the schools for enhancing environmental awareness, to know the environmental awareness of students and to prepare learning modules in environmental science areas. It is hoped that the study would be helpful to find out and understand the environmental awareness of higher secondary school students. It is also hoped that the learning modules would be helpful in enhancing environmental awareness and in identifying the environmental issues and problems now facing the earth. The findings of the study can be much useful in educational planning, and in executing programmes of environmental education. It would also be helpful to educationists and curriculum framers to prepare need-based curriculum materials for environmental education. In short, it is hoped that the results of the study and the modules would be of immense help to all those who are concerned with environmental education.

1.11 Limitations of the Study

It is presumed that the procedure adopted for the present study is adequate enough to throw light on the problem under investigation. Despite all possible precautions taken up to arrive at valid and reliable results, certain limitations, which are inevitable in a study of the present type, have crept into the study.
The sample for the survey was selected from Pathanamthitta district only and this was mainly due to the difficulty in getting plus two students for collecting data. The school authorities are very particular about the result of plus two students and allow very limited intervention at the XII level.

The experiment was conducted only in two divisions of a higher secondary school, again due to non-availability of plus two students. Only twenty capsules related to environmental issues were selected for detailed study and this was mainly due to the time limits at the school authorities.

Despite the above mentioned limitations, all possible attempts were taken to make the study as reliable as possible. It is hoped that the results of the present study would help one to reach new frontiers in environmental and educational practices.

1.12 Organisation of the Report

The report of the present study has been presented in five chapters as given below:

**Chapter I** deals with the significance of the study, statement of the problem, important terms and their definition, objectives, hypotheses and methodology in brief.

**Chapter II** contains the related literature and studies.
Chapter III contains the method adopted for the study, the
details of sample, details of standardisation of environmental
awareness test, details of achievement test, preparation of learning
modules, questionnaire etc. are included.

Chapter IV presents the prepared Learning Modules and
describes the various aspects of the analysis of data and
interpretation of the results.

Chapter V contains the major findings, implications,
suggestions and suggestions for further research.