

**EFFECTIVENESS OF MODULE ON PEDAGOGY OF TEACHING  
BIOLOGICAL SCIENCE FOR B. Ed. STUDENTS IN TERMS OF  
ACHIEVEMENT AND REACTION**

A Summary Submitted to Devi Ahilya Vishwavidhyalaya  
for the fulfilment of Pre-Presentation  
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## INDEX

1.0.0	INTRODUCTION	01
1.1.0	CONCEPT OF SELF INSTRUCTIONAL MATERIAL	01
1.1.1	MODULE	02
1.1.2	ADVANTAGES OF MODULE	03
1.1.3	LIMITATIONS OF MODULE	04
1.2.0	RATIONALE OF THE STUDY	04
1.3.0	STATEMENT OF THE PROBLEM	10
1.4.0	OPERATIONAL DEFINITIONS	10
1.5.0	OBJECTIVES	11
1.6.0	HYPOTHESES	12
1.7.0	DELIMITATIONS	13
1.8.0	SAMPLE	13
1.9.0	EXPERIMENTAL DESIGN	14
1.10.0	DEVELOPMENT OF MODULE	15
1.10.1	CONTENT ANALYSIS	15
1.10.2	POINTS CONSIDERED WHILE DESIGNING THE MODULE	17
1.10.3	FORMAT OF MODULE	18
1.10.4	LEARNING OUTCOMES AND STRUCTURE OF EACH MODULE	19
1.10.5	FEEDBACK FROM EXPERTS	26
1.11.0	TOOLS	27
1.11.1	ACHIEVEMENT TEST	27
1.11.2	STUDY HABIT INVENTORY	27
1.11.3	SCIENTIFIC ATTITUDE SCALE	28
1.11.4	SELF- CONFIDENCE INVENTORY	28
1.11.5	REACTION TOWARDS MODULE	29
1.12.0	PROCEDURE OF DATA COLLECTION	29
1.13.0	DATA ANALYSIS	30
1.14.0	FINDINGS	31
1.15.0	CONCLUSION	32
1.16.0	EDUCATIONAL IMPLICATIONS	33
1.17.0	SUGGESTIONS FOR FUTURE RESEARCHES	35
	BIBLIOGRAPHY	

## **1.0.0 INTRODUCTION**

The present study entitled “Effectiveness of Module on Pedagogy of Teaching Biological Science for B.Ed. students in terms of Achievement and Reaction” was Experimental in nature and related to the area of Self Learning Material and Pedagogy of Biological Science. It is a well-known fact that each learner is unique. Every learner differs with each other. They may differ in intelligence, experiences, inborn abilities, habits, interests, aptitude, personality, family background, the pace of learning, creativity, Self-Confidence, etc. These differences are known as individual differences. Since the student is an essential part of the teaching-learning process. There is a need to organize the teaching-learning process in such a way that it may become suitable for all learners. Therefore we can say that individualized instruction is a must for a fruitful teaching-learning process. Self-learning materials are used for individualized instruction. Self-learning materials follow learner-centered approaches. In this study, the purpose of the researcher was to explore the utility of the Self-learning material in the form of Module for B.Ed. students. The researcher attempted to find out whether the Module is effective in comparison to the Traditional Method of teaching.

## **1.1.0 CONCEPT OF SELF INSTRUCTIONAL MATERIAL**

During ancient times education was considered a teacher-centered process. Thus the teachers were free to select any method at their convenience, but after that psychologists suggested that teaching methods should be learner-centered. This approach brought a revolution in the teaching learning process. Individual difference plays a major role when teachers want to create a learner centered learning environment. Self-learning materials support learner-centered approaches. Self-learning materials are designed and developed as per the needs of the learners. In self-learning material, content is presented in simple language with the help of diagrams and examples. The main objective of the self-learning material is that the students can understand the subject easily and clearly by themselves, with their own efforts.

Students study through self-learning material suited to their interests, mental level, ability, and aptitude and can easily understand the course material. Self-learning materials often include structured content that builds progressively, offering a logical sequence for understanding complex topics. Interactive elements, such as quizzes and exercises, enhance engagement and reinforce comprehension. A module is also a form of self-learning material.

### **1.1.1 MODULE**

The module is one of the self-learning materials which, designed to help the learner to achieve predetermined objectives. A module is self-contained, self-pacing, and self-learning by nature. The modular approach is an attempt to make the instruction individualized so that a learner learns at his own pace according to his interest and capacities. The module includes clear and precise instructions, a set of learning activities, and experiences to facilitate the learner's performance for pre-decided objectives. Hence a module contains three basic elements of instruction namely 1) Objectives, 2) Learning Activities, and 3) Evaluation. A module is an ordered set of instructions designed to facilitate the learner's mastery of a body of knowledge or a procedure. Modules are available for students to use by them for learning on their own and usually do not require any teacher for help. The use of modules entirely relies on the hands of students, and these are self-learning materials that will aid students to learn and do at their own pace and interest (Maile and Cooper, 2014). Self-learning Modules undoubtedly made the learners active, interactive, and independent learners during learning. In this situation, they were answering effectively by module. They can apply what they learned based on their reading with minimum support from teachers.

Definitions of the module are given as follows:

**According to Goldsmith (1973)**, “Module is a self-contained, independent unit of a planned series of learning activities designed to help the students accomplish certain well-defined objectives”.

**According to Creager and Murray (1971)**, “A module is a self-contained and independent unit of instruction with the primary focus on a few well-defined objectives”.

**According to Arendset (1971)**, “A module is a set of learning activities intended to facilitate the student’s achievement of an objective or set of objectives”. The substance of a module consists of materials and instruction needed to accomplish these objectives. The boundaries of a module are definable only in terms of stated objectives

**According to W. R. Honston (1972)**, “Module is a set of experiences designed to facilitate the learner’s demonstration of specified objectives”.

### **1.1.2 ADVANTAGES OF MODULE**

The advantages of the module are as follows:

- 1) The students have full control of the rate of the study, thus they can progress at their own pace.
- 2) As the module is evaluated and tested by experts, it makes learning effective.
- 3) It enables the teachers to diagnose the problems of the individual learners.
- 4) The module provides a way to assess the student’s progress in learning.
- 5) The use of the module provides an opportunity for organizing numerous sequences of experiences to reflect the special interest of the students.
- 6) The module reduces the routine aspect of instruction and creates an independent and innovative learning environment in the classroom.
- 7) The students are involved actively in the learning process through modules, so their commitment to the task is likely to be enhanced.

- 8) It develops self-confidence, self-dependency, self-study habit and creative thinking among the students.
- 9) The consequences of failure are reduced.
- 10) There are relatively fewer restrictions for the completion of the syllabus in terms of time.
- 11) It reduces the workload of teachers.

### **1.1.3 LIMITATIONS OF MODULE**

Limitations of a module are as given below

- 1) It is very costly in terms of money, energy, and time.
- 2) Development of the module is a difficult task. There is a need for special skills, communication skills, content mastery, language experts, and subject experts for the development of the module.
- 3) A higher level of mental abilities can't be achieved through the module.
- 4) It is difficult to develop a module on each topic of subject and for every subject.
- 5) Use of the module is possible only through trained teachers.
- 6) All the students have to follow the same path, so it creates boredom for the bright student.

### **1.2.0 RATIONALE OF THE STUDY**

In present times, the role of the teacher is active and effective in the teaching-learning process. The teacher is at the centre of the teaching-learning process and controls the entire teaching-learning process. The teacher does the work of providing information to the students, this work is mostly done by the traditional method and the students act according to the instructions given by the teacher. The interests, attitudes, and capabilities of the students are ignored, which is opposite to the principles of learning. It does not encourage critical

thinking, exploring, and taking initiative in students. Considering the present teaching-learning process, the need can be expressed that the student should be at the center of the teaching-learning process and the role of the student should not be that of a passive learner but that of an active learner. The teaching-learning process should be planned in such a way that students can learn & self-motivated on their own. The aim of education is to provide the overall development of students, not merely the sharing of knowledge with them. Therefore teachers must be equipped with appropriate teaching strategies and techniques to improve the quality of the teaching-learning process and the active participation of learners. The teacher's job should be that of an instructor, a supervisor, and a solution provider to the student for their learning problems. For this, teachers should incorporate various psychological principles and educational innovations in the teaching-learning process so that challenges in the teaching-learning process like individual differences can be overcome. At present, there is a need to adopt such new techniques, which give importance to the student in the teaching-learning process, so that they can be actively involved in the learning process and can learn on the basis of their interest, intelligence, perception, gender, ability, learning styles, study habit, self-confidence, scientific attitude, etc. Towards the fulfilment of all needs, self-learning material is one such method through which all the students can successfully achieve the instructional objectives during the teaching-learning process at their own pace.

After reviewing the related literature, it was found that there have been many research works conducted on self-learning material. Research conducted by various researchers are categorized as effectiveness of Module and effectiveness of another form of Instructional Material.

Under the category of the effectiveness of Module researches Ahuja (2002) studied the effectiveness of Module on environmental education of college students, Chopra (2002) developed a Self-Instructional Module to enhance the communication skills of college

principals, Suri (2002) Studied the enhancement of reasoning skills of school students through the specially developed Module, Maharana (2003) Studied the effectiveness of Module on standardized and non-standardized approaches in guidance and counselling at B.Ed. level in terms of achievement and reaction towards the Module, Dubey (2004) Studied the effectiveness of the Module related to Indian national heritage for the students of class VIII, Saini (2004) Studied the efficacy of the modular instructional strategy of teaching English in relation to achievement motivation and cognitive style of secondary school students, Sharma (2004) Studied the effectiveness of Module on learning of B.Ed. trainees with learning disabilities, Shetty(2004) Studied the effectiveness of self-instructional Modules on staff development for secondary school principals, Kumar (2005) Studied the effectiveness of self-instructional materials, work cards, and games on English language, Londhey (2007) Studied the effectiveness of the Module in terms of achievement in science of class IX students and their reaction towards the Module, Parashar (2007) Studied the effectiveness of the self-instructional material on time management in terms of time management competency, Ajudiya (2008) Studied the effectiveness of Module in terms of achievement in education in the emerging Indian society of B.Ed. students, Pathak (2008) Studied the effectiveness of the Module in terms of self-concept and achievement in the Hindi subject of B.Ed. trainees, Patidar (2008) Studied the effectiveness of self-instructional material on population education and awareness, Kankreja (2009) Studied the effectiveness of self-instructional material on a selected topic of maths subject for class x<sup>th</sup> students, Sharma (2009) Studied the effectiveness of instructional material on business communication for commerce students, Renugambal (2010) Studied the effectiveness of self-instructional Module regarding learning disabilities of primary school children among primary school teachers, Devra (2011) Studied the effectiveness Module for educational psychology practicals in terms of performance in educational psychology practical of B.Ed. students,



Maharana (2011) Studied the effectiveness of Modules with and without jerk technology on environmental education in terms of achievement on environmental education on B.Ed. students, Suryavanshi (2011) studies the effectiveness of Modules on educational administration for B.Ed. trainees, Hudmare (2012) Studied the effectiveness of instructional material on Hindi grammar for 10<sup>th</sup> students, Daniel (2013) Studied the effectiveness of educational Module on knowledge of primary school teachers in context to early symptoms of childhood psychiatric disorders, Sharma (2013) Studied the effectiveness of Module on selected topics of subject measurement and evaluation of the B.Ed. curriculum in context of students' achievement, study habits and reactions towards the Module, Gupta (2014) Studied the effectiveness of self-instructional Module on environmental education on level of awareness of prospective teachers, Pawar (2014) Studied the effectiveness of self-instructional Module on knowledge of primary school teachers regarding learning disorders among children, Joshi (2015) Studied the effectiveness of computerized self-learning materials on mathematics teaching of B.Ed., Ojha (2015) Studied the effectiveness of Module constructed on selective topic of educational psychology for M.Ed. students, Reeta (2015) Studied the effectiveness of computerized self-learning material, computer assisted instruction and traditional method in learning of geography at secondary level, Kanchan (2016) Studied the effectiveness of self-learning Modules on the achievement and retention of undergraduate students in commerce, Kaur (2017) Studied the effect of self-learning Modules and constructivist approach on academic performance of secondary school students, Marimutu (2017) Studied the effectiveness of self-instructional Module and computer assisted instruction for enhancing performance of higher secondary students in Economics, Perumal (2017) Studied the effectiveness of self-instructional Modules and enhancing rational reflective thinking of Dr. S. Radhakrishnan's among B.Ed., trainees, Eske (2018) Studied the effectiveness of self-instructional material developed on the subject of Hindi

literature of bachelor of arts with traditional teaching method, Sultan (2018) Studied the effectiveness of modular and E-lecture approaches for learning educational research, Sareen(2019) Studied the effectiveness of self-learning Modules on process skills in science in relation to study habits of class IX students, Shah (2019) Studied the effectiveness of Module on social science teaching for B.Ed. trainees, Tyagi (2019) Studied the effectiveness of Module on educational research ,Valencia (2020) Studied effectiveness of modular teaching approach in teaching science, Verma (2020) Studied effectiveness of study material on health and physical education for B.Ed. students with reference to their achievement, memory, self-confidence, and anxiety, Malgapo (2021) Studied the effectiveness of the developed instructional Module on the enhancement of learners' academic achievements in physics, Benito (2022) Studied the effectiveness of self-learning Modules in teaching mathematics. Pawar (2022) Studied the effectiveness of the Module on education technology and information communication technology of B.Ed. trainees'. By studying these previous researches, conclusion can be drawn that the self-learning material was found effective in achievement.

Under the category of effectiveness of other form of Instructional Material, Singh (2001) Studied the effect of television teaching and computer assisted instruction on achievement in mathematics at the secondary level, Vij (2003) Studied the effectiveness of computer assisted instruction and computer managed instruction on students' achievement in science, their self-concept and participation, Pancholi (2006) Studied the effect of computer assisted instruction in science on high school students in terms of achievement and their reaction toward CAI, Shinde (2007) Studied the effectiveness of video instructional material on research methodology and statistics in terms of achievement and reaction towards video instructional material on research methodology and statistics, Makwana (2010) Studied on computer assisted language learning package for instruction of 'parts of speech' of English language ,

Chiniwar (2013) Studied the effectiveness of CAI among the VIII standard students in relation to the attitude towards English grammar and their achievement in English grammar, Jagannath (2013) Studied the effectiveness of computer-assisted instruction in the development of study habits in relation to gender, locality and socio-economic status of secondary school students, Solanki (2014) Studied the effectiveness computer assisted instruction and traditional instruction in terms of achievement, attention and response of secondary level students, Dubey (2015) Studied comparative analysis of computer assisted instruction with traditional method in terms of mathematics of class-IX, Kumari (2016) Studied the effectiveness of computer-assisted instruction on the academic achievement in mathematics for secondary school students, Afsarpasha (2019) Studied the effectiveness of computer assisted instruction on achievement in English of secondary school students. These researchers found that other forms of Instructional Material such as video instructional material and Computer-Assisted Instruction were found to be more effective than traditional teaching.

The research works completed in the field of self-learning Modules shows that Module is an effective way of providing instruction. The Modules were developed in different subjects for different levels. Most of the Modules were developed for training purposes and for spreading awareness among learners. Because it is exhausting work to develop a Module thus it should be emphasized to develop curricular subjects. It appears to be an effective, economical, and flexible way of developing specific knowledge and skills with the minimum direction and supervision of teachers.

This approach provides the opportunity for students to clear their doubts and can find out the solution to vague concepts. The modular approach improves understanding and enhances higher-level thinking skills. The main emphasis of Modules is on active learning strategies and student-centered approaches. Modules were designed for different subjects at different

levels but the investigator could not find any study related to the development of a Module on the Pedagogy of Teaching Biological Science and evaluating its effectiveness. This pedagogy subject is based on maxims and principles of teaching such as learning by doing, learning by observation, from concrete to abstract, and from known to unknown, all these criteria will only be fulfilled by active learning and the Module is one of the best options. All these facts motivated the investigator to develop a Module on concepts of Pedagogy of Teaching Biological Science and study of its effectiveness in terms of achievement and reaction towards the Module

### **1.3.0 STATEMENT OF THE PROBLEM**

The problem of the present study was stated as:

Effectiveness of Module on Pedagogy of Teaching Biological Science for B.Ed. students in terms of Achievement and Reaction

### **1.4.0 OPERATIONAL DEFINITIONS**

The operational definitions of the key terms are as follows:

#### **MODULE**

In the present study, Module refers to a self-contained unit of learning experiences of subject pedagogy of biological science, through which B.Ed. students are encouraged to achieve predetermined objectives according to their own pace.

#### **PEDAGOGY OF TEACHING BIOLOGICAL SCIENCE**

In the present study the term Pedagogy of Teaching Biological Science was used as a subject of the second semester of two year B.Ed. curriculum program for private colleges affiliated by Devi Ahiliya Vishwavidyalaya, Indore.

## **ACHIEVEMENT**

In the present study, the achievement refers to the scores of the test, which was assessed through an achievement test developed by the investigator to know the learning outcomes of the module based on subject Pedagogy of Teaching Biological science of B.Ed. students.

## **REACTION**

In the present study, the term reaction refers to the reaction of the B.Ed. students of the experimental group towards the module of Pedagogy of Teaching Biological science. The reaction was used to know the effectiveness of the Module.

## **B.Ed. STUDENTS**

In present study B.Ed. students stand for the students who studied in the second semester of .B.Ed. teacher training program session 2021-23 from private colleges, affiliated by Devi Ahiliya Vishwavidyalaya, Indore.

### **1.5.0 OBJECTIVES**

The objectives of the present study were as follows:

1. To compare adjusted mean scores of achievement in Pedagogy of Teaching Biological Science of B.Ed. students taught through the Module and Traditional method by taking pre-achievement as a covariate.
2. To study the effect of Treatment, Study Habit, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.

3. To study the effect of Treatment, Scientific Attitude, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.
4. To study the effect of Treatment, Self-Confidence, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.
5. To study the effect of Treatment, Gender, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by considering pre-achievement as a covariate.
6. To study the reaction of B.Ed. students towards the Module.

#### **1.6.0 HYPOTHESES**

The hypotheses of the present study were as follows:

1. There is no significant difference between adjusted mean scores of achievement in Pedagogy of Teaching Biological Science of B.Ed. students taught through the Module and Traditional method by taking pre-achievement as a covariate.
2. There is no significant effect of Treatment, Study Habit, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.
3. There is no significant effect of Treatment, Scientific Attitude, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.

4. There is no significant effect of Treatment, Self-Confidence, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.

5. There is no significant effect of Treatment, Gender, and their interaction on achievement in Pedagogy of Teaching Biological Science of B.Ed. students by taking pre-achievement as a covariate.

### **1.7.0 DELIMITATIONS**

The delimitations of the present study were as follow:

1. The Modules on Pedagogy of Teaching Biological Science were developed on selected content only.

2. Modules on Pedagogy of Teaching Biological Science were developed only in the English medium.

3. The study was conducted on regular B.Ed. students of five private colleges affiliated to Devi Ahilya Vishwavidyalaya, Indore only.

4. The study was conducted on regular B.Ed. students of session 2021-2023 only.

### **1.8.0 SAMPLE**

The population of the study was second-semester B.Ed. students, studying in different colleges of Indore affiliated with Devi Ahilya Vishwavidyalaya. The present study was experimental in nature. Five colleges of Indore affiliated with Devi Ahilya Vishwavidyalaya were selected for study by the purposive technique of sampling. Out of these colleges, three colleges were assigned randomly as the experimental group namely Shri Sai Baba College of Teachers Training, Arihant College, and Aspire Institute. The rest of the two colleges namely Shiva College of Education and Annie Besant College were treated as the control group. The

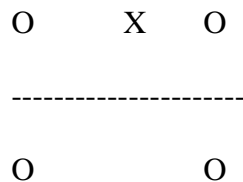
sample of the study comprised of 138 B.Ed. students out of which 72 were in the experimental group and 66 were in the control group, both groups consist of male and female students from the second semester. These students belong to the subject of Pedagogy of Teaching Biological Science. A detail of the sample is given in table 1.1.

Table 1.1: College and gender-wise distribution of sample

S.No.	Name of college	Gender		Total
		Male	Female	
01	Shri Sai Baba College of Teachers Training	06	11	17
02	Arihant College	12	22	34
03	Aspire Institute	09	12	21
04	Shiva College of Education	15	22	37
05	Annie Besant College	12	17	29
	Total	54	84	138

### 1.9.0 EXPERIMENTAL DESIGN

The present study was Experimental in nature and Non-Equivalent Control Group Design (Campbell and Stanley,1963) was used for the experiment. Its layout is as given follows:



where ;

X = Treatment (with the developed Module)

O = Observation (pre-test and post-test)

----- = Non-equivalence of the groups



As mentioned under the sample, from the selected colleges, the intact group as existed in colleges was taken for this research. The treatment was assigned randomly to the groups. The group receiving the treatment of the Module was considered the Experimental group while the second group without any treatment was treated as the control group. The four units of Pedagogy of Teaching Biological Science were taught through the Module to the Experimental group and the control group was taught through the traditional method by their concerned subject teachers. In the beginning, the criterion test was administered to both groups. It was considered a pre-test. After the treatment period, the same criterion test was administered to both groups. This was considered the post-test. Simultaneously the independent variable of the present study namely Study Habits, Scientific Attitude, and Self-Confidence was assessed with the help of appropriate standardized tools. At the end of treatment, a reaction scale towards the Module was administered to the experimental group only.

#### **1.10.0 DEVELOPMENT OF MODULE**

The details related to the development of the Module on Pedagogy of Teaching Biological Science have been presented under the following captions:

#### **1.10.1 CONTENT ANALYSIS**

Content analysis is one of the most important steps for developing a Module. For developing the Module revised syllabus of Devi Ahilya Vishwavidyalaya was referred for the course of B.Ed. second semester. Pedagogy of Teaching Biological Science was taken up as a subject. The syllabus of Pedagogy of Teaching Biological Science was divided into four units. During the process of content analysis, each unit was divided into several topics and sub-topics. All the topics and sub-topics were arranged systematically so that the developed module can be an effective one. While content analysis, it was prime objective to figure out ways to present

difficult and lengthy topics in an easy and precise form. The selected topics for the module are as follows:

**Topic: Introduction to Teaching Biological Science**

- Biological Science: Meaning, Nature, and Scope
- Streams of science
- Relationship between biology & human welfare
- Scientific method
- Scientific Attitude

**Topic: Co-curricular Activities and Resources in Teaching Biological Science**

- Meaning, Importance, and Organization of Co-Curricular
- BioScience laboratory - Need and importance
- Aquarium
- Vivarium
- Terrariums
- Plastination
- Bio-Science Club
- Field Trip

**Topic: Aim and Objectives**

- Meaning of Goal, Aim & Objective
- Difference between Aims and Objectives
- Types of Objective
- Comparison of the educational and instructional objectives
- Bloom's taxonomy

- Action verbs related to different levels of the cognitive domain
- How to write a specific objective

**Topic: Teaching method, Approach, and Models of Teaching Biology**

- Meaning of Teaching
- Teaching maxim
- Lecture method
- Problem-solving method
- Inductive and Deductive approach
- Inquiry model
- Memory Model

**Topic: Instructional Design in Teaching Biological Science**

- Lesson plan
- Unit plan
- Difference between lesson plan and unit plan
- Format of the lesson plan

While analyzing the content above mentioned points were included in the Module.

**1.10.2 POINTS CONSIDERED WHILE DESIGNING THE MODULE**

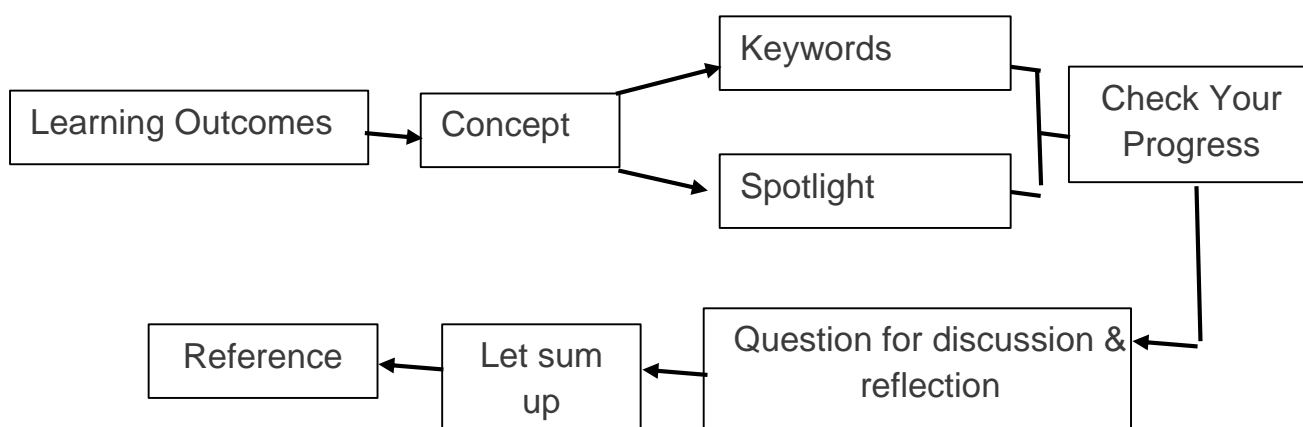
The learning process is influenced by many factors and one of the most important factors which influence the learning process is the teaching method or how the teacher delivers the content. It has been proven that the active participation of learners is most important for better output of the learning process. Self-learning materials play a major role in the active participation of the learner. So for making an effective Module on Pedagogy of Teaching Biological Science the following points were kept in mind during its development.

- The language of the Module must be very clear and according to the learner, which he/she can understand quite easily.
- Content must be presented systematically.
- The content in the Module must be presented interestingly.
- Flow charts, mind maps, and content-related diagrams must be incorporated into the Module.
- To make technical terms easier to understand, keywords must be mentioned.
- Interesting and extra information must be given.
- The Module must be designed in such a way that it can promote self-learning.
- The Module must have a segment for increasing critical thinking in the learner.
- The content of the Module must grab the attention and concentration of the learner.
- For recapitulation, a summary must be given.

### **1.10.3 FORMAT OF MODULE**

After reviewing many Modules and their components, the format adopted by Indira Gandhi National University (IGNOU) is followed. This Module comprises several components such as learning objectives which clarify outcomes beforehand and make it easy for the learner to formulate strategies. Examples, flow charts and mind maps are used to make the explanations systematic and interesting. Keywords were also included in the Module to overcome difficulty while reading the Module. Spotlights keep the Module interesting by providing additional information and fun facts to break the monotony and boredom of the learner. Questions under the special heading ‘Check your progress’ were given in between the contents which helped to track the record of learners' achievement. Questions for discussion & reflection covered the whole Module and helped develop critical thinking among the learners. Under the caption 'Let's sum up' a summary of the Module was presented which

helped in recapitulation. At the end of the Module, a reference was given which guided further reading.



#### **1.10.4 LEARNING OUTCOMES AND STRUCTURE OF EACH MODULE**

The systematic structure was followed by a researcher for designing the Module. Special attention was paid to the needs of the learner. Following were the learning outcomes and structure of the Modules.

##### **Module 01**

**The learning outcomes of Module one are as follows:**

- Define the meaning of science
- Define the meaning of biological science
- Understand the nature of biological science
- State essential characteristics of science
- Define the scope of biological science
- Identify the characteristics of the person who has a scientific attitude
- Describe the steps of the scientific method
- Explain the relationship between biology and human welfare

**The structure of Module one is as follows:**

- Learning outcomes
- Keywords and Spotlights
- Meaning and definition of science
- Check your progress
- Nature of science
- Streams of science
- Check your progress
- Scope -the relationship between biology and human welfare
- Concept of scientific attitude
- Scientific method
- Let's sum up
- Reference

**Module 02**

**The learning outcomes of Module two are as follows:**

- Define Co-curricular activities
- Make a list of Co-curricular activities
- Define the role of Co-curricular activity
- Explain how Co-curricular activities are useful in all-round development
- Define the process of plastination
- Explain the step of fixation
- List the steps of the plastination
- Explain the use of formalin in the process of plastination
- Evaluate the process of plastination

- Write the name of the father of plastination
- Evaluate the role of science club in students around all-round development
- List activities are undertaken in the science club
- Elaborate on the organization of the science club
- Explain the merit of the science club
- Discuss the place of field trip in biology

**The structure of Module two is as follows:**

- Learning outcomes
- Keywords and Spotlights
- Meaning and definition of Co-Curricular activity
- Features of Co-Curricular activities
- Scope of Co-Curricular activities
- Different types of Co-Curricular activity
- Need of Co-Curricular activities
- List of Co-Curricular activities
- Check your progress
- Plastination: meaning, importance & steps
- Check your progress
- Bioscience club
- Check your progress
- Concept of herbarium
- Field trip
- Questions for Discussion and Reflection
- Let's sum up

- Reference

### **Module 03**

#### **The learning outcomes of Module three are as follows:**

- Differentiate between goal and aim
- Differentiate between aim and objective
- Describe bloom's taxonomy of educational objective
- Elaborate on revised bloom's taxonomy
- Explain the aim and objective of the teaching life science
- Discuss the significance of the taxonomy of educational objectives
- Define and explain the meaning of instructional objectives with example
- Formulate instructional objectives in behavioural terms

#### **The structure of Module three is as follows:**

- Learning outcomes
- Keywords and Spotlights
- Meaning of goal, aim & objective
- Difference between aims and objectives
- Types of objective
- Comparison of the educational and instructional objectives
- Check your progress
- Bloom's taxonomy of educational objective
- Mind map of the taxonomy of the cognitive domain
- Different levels of cognitive domain and their action verbs
- Check your progress
- Questions for discussion and reflection



- Let's sum up
- Reference

## **Module 04**

**The learning outcomes of Module four are as follows:**

- Describe the meaning of teaching
- Name various methods of teaching biological science
- Listing the characteristics of teaching Models
- Describe the merit and demerit of the Lecture method
- Define the meaning of approaches
- Differentiate between the Inductive approach and the Deductive approach
- Discuss the importance of the Problem-solving method
- Define the steps of the Problem-solving method
- Discuss the Memory model
- Evaluate the Memory model

**The structure of module four is as follows:**

- Learning outcomes
- Keywords and Spotlights
- Meaning of Teaching
- Check your progress
- Teaching maxim
- Lecture method
- Check your progress

- Problem-solving method
- Check your progress
- Inductive and deductive method
- Check your progress
- Memory Model
- Questions for Discussion and Reflection
- Let's sum up
- Reference

## **Module 05**

**Learning outcomes of the fifth Module are as follows:**

- Define the meaning of the lesson plan
- Explore the purpose of the lesson plan
- Explain the steps involved in the lesson plan
- Explain how to make lesson plans more effective
- Formulate instructional objectives based on the domains
- Prepare a lesson plan for Biological Science
- Differentiate between lesson plan and unit plan

**The structure of Module fifth is as follows:**

- Learning outcomes
- Keywords and Spotlights
- Concept of the lesson plan
- Definition of the lesson plan
- Importance of lesson plan
- Need for Lesson Planning

- Components of a Lesson plan
- Check your progress
- How to make an effective lesson plan
- Check your progress
- Concept of Unit Plan
- Criteria of the unit plan
- Difference between lesson plan and unit plan
- Format of the lesson plan
- Questions for Discussion and Reflection
- Let's sum up
- Reference

## **Module 06**

### **Learning outcomes of the sixth Module are as follows:**

- Describe the concept of evaluation
- Explain the Need for Evaluation
- Importance of Evaluation
- Justify the purpose of the Evaluation
- Write the administrative purpose of the evaluation
- Explain the educational purpose of the evaluation
- Explain the characteristics of the Evaluation
- Explain the characteristics of a Good Test
- Explain the use of Diagnostic Evaluation
- Meaning of Formative Evaluation
- Explain the utility of Summative Evaluation

- List the tool of evaluation
- Differentiate between Teachers-made Achievement Test and Standardized Achievement Test
- Define the Blueprint

**The structure of Module sixth is as follows:**

- Concept and Process of Evaluation
- Need of Evaluation
- Importance of Evaluation
- Check your progress
- Purpose of Evaluation
- Characteristics of Evaluation
- Check your progress
- Types of Evaluation
- Tools of Evaluation
- Testing techniques
- Diagnostic test
- Achievement test
- Characteristics of a Good Test
- Blueprint

#### **1.10.5 FEEDBACK FROM EXPERTS**

Effective feedback can be both positive and negative and both are equally important. Feedback is valuable information that will be used to make important decisions in the same way several experts were consulted for their opinion on the developed Module. The main purpose of consulting experts was to know the Module's effectiveness and reduce the chances of error. Experts evaluated the Module on various criteria such as whether the

Module is self-contained or not, and whether the Module is user-friendly & adaptive. Experts evaluated the language of the Module and the format of the Module. The experts were also competent in a particular subject so they gave many ideas for making the Module more effective. The suggested corrections were noted and the Modules were modified accordingly. The corrected Modules were administered to the experimental group.

### **1.11.0 TOOLS**

In the present study, the data were collected in respect of Study Habits, Scientific Attitude, and Self-Confidence with the help of standardized tools. The data of Achievement and reaction towards the Module was collected with the help of tool developed by the investigator. The details of each tool is described as follows:

#### **1.11.1 ACHIEVEMENT TEST**

The achievement of students in the pedagogy of biological science was assessed with the help of a criterion test developed by the investigator. This criterion test consists of a total 30 questions and for answers to these questions, four alternatives were presented. A total of 30 minutes was given to students for completing the test, and for each correct answer one mark was given to students, there was no negative marking for wrong answers.

#### **1.11.2 STUDY HABIT INVENTORY**

Study Habits were assessed with the help of the Study Habits inventory developed by Dr. M. Mukhopadhyaya and Dr. D.N.Sansanwal and this inventory was standardized on 500 polytechnic and engineering college students. The inventory identified nine different kinds of study behaviors, namely Comprehension, Concentration, Task orientation, Sets, Interaction, Drilling, Supports, Recording, and, Language. The test contained both positive and negative items. The total numbers of items were 52. The scoring procedure was 4, 3, 2,1, and 0 for

positive items while 0,1,2,3, and 4 for negative items. There was no fixed time for responding but the students took approximately 35 minutes. Internal consistency for the test was checked by correlating the scores of the subtest with the total test scores. Internal consistency is evident as all the coefficients are significant at 0.01 level and range between a minimum of 0.49 to a maximum of 0.87. The reliability of the whole inventory was worked out by using Spilt half method. The reliability coefficient was found to be 0.91 which is fairly high and indicates that the inventory is reliable.

### **1.11.3 SCIENTIFIC ATTITUDE SCALE**

The Scientific Attitude of the students was assessed with the help of the tool developed and standardized by Dr. Sukhwant Bajwa and Monika Mahajan. The test includes the following components: curiosity, open-mindedness, faith in the scientific method, cause-and-effect relationship, critical judgment, and aversion to superstition. The reliability of the test was found to be 0.970 and the concurrent validity is .475. The test comprised 49 items out of which 21 items were of positive polarity and 28 items were of negative polarity. A positive item weighed a score of 5 for strongly agree (SA), 4 for agree (A), 3 for undecided (UD), 2 for disagree (D), and 1 for strongly disagree (SD) and a negative item weighted score of 1 for strongly agree (SA), 2 for agree (A), 3 for undecided (UD), 4 for disagree (D) and 5 for strongly disagree (SD).

### **1.11.4 SELF- CONFIDENCE INVENTORY**

The tool that was used for the study of Self-Confidence is Self-Confidence Inventory (SCI) developed by Dr.Rekha Gupta. The reliability of this inventory by the Split half method is '0.91' and test-retest reliability was found to be 0.78. The validity coefficient obtained is .82. Inventory comprised 56 items with the response 'RIGHT' or 'WRONG'. The construction of

the items was in such a way that the lower the score the higher would be the level of Self-Confidence and vice-versa.

#### **1.11.5 REACTION TOWARDS MODULE**

The reaction scale was developed by an investigator for assessing the reaction of B.Ed. students toward the developed Module. The reaction scale comprised 20 items out of which 7 items were negative and 13 items were positive. A positive item weighted score of 5 for strongly agree (SA), 4 for agree (A), 3 for undecided (UD), 2 for disagree (D), and 1 for strongly disagree (SD) and a negative item weighted score of 1 for strongly agree (SA), 2 for agree (A), 3 for undecided (UD), 4 for disagree (D) and 5 for strongly disagree (SD). Important instructions were also mentioned in the reaction scale.

#### **1.12.0 PROCEDURE OF DATA COLLECTION**

The data were collected in three phases-

Phase I: This was the first phase in which first of all the permission was granted from the principals of the purposively selected colleges. After that the investigator took the introduction of the B. Ed. students and gave them information about the details of the advantages of present research. In this way the investigator tried to convince them in a satisfactory manner. The investigator tried to arouse interest among the students for active participation in the present study. The investigator assured them about confidentiality of data which will be gathered in phase-II. After convincing successfully to the B.Ed. Students, the investigator administered the criterion referenced achievement test for pre-testing of achievement.

Phase II: In this phase the Modules of Pedagogy of Biological Science were distributed to each B.Ed. Students of the experimental group. Further the experimental group were also

given instructions to study the Module at their own speed and time as per their own convenience. The same content during this phase was taught to the control group by their concerned subject teachers. During this phase the data related to independent variables namely Study habit, Scientific attitude and Self-confidence were also collected through Study habit inventory, Scientific attitude scale and Self-confidence scale respectively. This phase took 45 days.

Phase III: This was the last phase in which the investigator administered the same Criterion Referenced Achievement test to both of the groups for post test purpose. The reaction towards the Module was assessed only of the B.Ed. Students of the experimental group with the help of the reaction scale developed by the investigator. At the end the principals, teachers and B. Ed. students of both the groups were thanked for their cooperation in the study.

The scoring of all the tools was done according to the scoring procedure given in the respective manual.

### **1.13.0 DATA ANALYSIS**

The objective-wise statistical techniques used for data analysis are given as follows:

1. One-way ANCOVA was used to compare the adjusted mean scores of achievement in Pedagogy of teaching Biological science of B.Ed. Students taught through the Module and traditional method by taking pre-achievement as covariate.
2. A 2 X 2 Factorial Design ANCOVA was used to study the effect of treatment, Study habit and their interaction on the achievement in the Pedagogy of teaching Biological science of B.Ed. Students by taking pre-achievement as covariate.



3. A 2 X 2 Factorial Design ANCOVA was used to study the effect of treatment, Scientific attitude and their interaction on the achievement in the Pedagogy of teaching Biological science of B.Ed. Students by taking pre-achievement as covariate.
4. A 2 X 2 Factorial Design ANCOVA was used to study the effect of treatment, Self-confidence and their interaction on the achievement in the Pedagogy of teaching Biological science of B.Ed. Students by taking pre-achievement as covariate.
5. A 2 X 2 Factorial Design ANCOVA was used to study the effect of treatment, Gender and their interaction on the achievement in the Pedagogy of teaching Biological science of B.Ed. Students by taking pre-achievement as covariate.
6. Percentage was used to study the Reaction of B.Ed. Students towards the Module of Pedagogy of teaching Biological science.

#### **1.14.0 FINDINGS**

The findings of the study were as follows:

1. The Module was found significantly more effective than Traditional Method in terms of achievement in Pedagogy of Teaching Biological Science of B.Ed. students when groups were matched with respect to pre-achievement.
2. Achievement in Pedagogy of Teaching Biological Science was found to be independent of Study Habits when pre-achievement was considered as a covariate.
3. Achievement in Pedagogy of Teaching Biological Science of B.Ed. students was found to be independent of interaction between Treatment and Study Habit when pre-achievement was considered as a covariate.
4. Achievement in Pedagogy of Teaching Biological Science of B.Ed. students was found to be independent of the Scientific Attitude when pre-achievement was considered as a covariate.

5. Achievement in Pedagogy of Teaching Biological Science of B.Ed. students was found to be independent of interaction between Treatment and Scientific Attitude when pre-achievement was considered as a covariate.
6. Achievement in Pedagogy of Teaching Biological Science of B.Ed. students was found to be independent of Self-Confidence when pre-achievement was considered as a covariate.
7. Achievement in Pedagogy of Teaching biological science of B.Ed. students was found to be independent of interaction between Treatment and Self-Confidence when pre-achievement was considered as a covariate.
8. Achievement in Pedagogy of Teaching biological science of B.Ed. students was found to be independent of Gender when pre-achievement was considered a covariate.
9. Achievement in Pedagogy of Teaching biological science of B.Ed. students was found to be independent of interaction between Treatment and Gender when pre-achievement was considered as a covariate.
10. Students of the Experimental group expressed favourable reactions toward different aspects of the Module.

#### **1.15.0 CONCLUSION**

The researcher has found that the developed Module is effective in terms of Achievement, and Reaction. There is no significant effect of Study Habits, Self-Confidence, gender, and Scientific Attitude on the achievement of the Pedagogy of Teaching Biological Science. The researcher did not find any significant interactional effect of Study Habit, Self-Confidence, Gender or Scientific Attitude with treatment on achievement in Pedagogy of Teaching Biological Science of B.Ed. students.

### **1.16.0 EDUCATIONAL IMPLICATIONS**

The findings of the present study concluded that the Module is found effective in terms of achievement in Pedagogy of Teaching Biological Science of B.Ed. students. Thus, the findings of the present study have implications for student-teachers, teacher-educators, textbook writers, and In-service trainees. Education implications for all these categories are as follows:

#### **Implications for student-teachers**

- In B.Ed. curriculum the pedagogic subjects play an important role in making student-teachers competent teachers. The present findings show that the developed Module is effective for the student-teachers besides their Study Habit, Self-Confidence, Gender, and their Scientific Attitude.
- Student-teachers can study at their own pace and improve their achievement by doing the activities given in the Module. The Module may be beneficial for the students to understand the pedagogic subject easily and interestingly.
- Through these Modules, student-teachers can get an opportunity to learn in a new way by moving away from a traditional method.
- If the student-teachers want to study the topic in more detail, then the reference of the books have been given in the Module, which can be useful for student-teachers.
- An attempt has been made to provide extra information to the student-teachers under ‘spotlight’ captions in the Module, which can be very useful for the student-teachers.
- In the Module, the difficult content has been presented through mind-map and flow charts, which can facilitate the student-teachers to understand the content easily.

### **Implications for Teacher-Educators**

- Teacher-Educators play an important role in sculpting future teachers. A learning outcome is also dependent on how the teacher delivers and explains the content. Present research work can be helpful for teacher-educators in their teaching preparation.
- The Teacher-Educators can take ideas from the Module and make their teaching more interesting and effective.
- The developed Module is effective in the achievement of the Pedagogy of Teaching Biological Science so related subject teachers can also use this Module in their classes for productive results.
- Teacher-Educators can use this Module to change their teaching pattern and to break the monotony of the class.
- Teacher-Educators of other subjects can also be guided in developing self-learning material in their subject.
- Teacher-Educators can use the modular approach for their teaching so that they can achieve all the instructional objectives and make their teaching versatile.

### **Implications for textbook writers**

- Most of the textbooks have lengthy paragraphs, difficult words, boring way of presentation and monotonous text which make it difficult to hold the concentration of readers. Book writers can adopt the components which will make textbooks more interesting and facilitate active learning in students.
- The developed Module has several components which can make a text book interesting.

### **Implications for In-service trainees**

- Trainees associated with distance learning programs may get benefit from the developed Module.

### **1.17.0 SUGGESTIONS FOR FUTURE RESEARCHES**

No area has been completely studied or tested, it always has scope for further research, that's why it is stated that research is an ongoing process. The present study has its limitations as every other study has. The only need is to find the scope and improve the work. These are some suggestions for the future areas of research emerging from the present study:

- Future researchers may develop self-learning material on other subjects for different courses like D.El.Ed., B.Ed., and M.Ed.
- The present Module was developed in the English language, it may develop in other languages also.
- In the future studies can be conducted on comparative analysis of Modules with other learning materials.
- Considering the present scenario researchers may digitalize Modules and can incorporate digital elements like QR codes.
- The effectiveness of the Module can be studied by the researcher by considering variables such as Achievement Motivation, Learning Styles, Self- Concepts, Level of Aspiration, etc.
- Future researchers may develop and test the effectiveness of AI based Modules and other learning material.

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