B.Ed. 1st Year | Paper - IX (A)-II

Teaching of Life Sciences

Units 1-8

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B.Ed. First Year

Paper IX – A (ii)

TEACHING OF LIFE SCIENCES

Content

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TEACHING OF LIFE SCIENCES

Course objectives: Marks: 50 (40 + 10)

The student teachers will be able to:

1. Understand various objectives of teaching life sciences and to write the same in behavioural terms.
2. Understand and apply various methods of teaching life sciences.
3. Understand, analyze and improve present curriculum of life sciences operative at school level.
4. Understand the importance and appropriate use of different audio visual aids and improvised apparatus in Indian conditions with reference to concepts to be taught.

Unit 1: Foundations of Teaching of Life Science

➢ Meaning, nature and scope of Life Science, Historical development of Life Sciences in secondary school curriculum, Importance of Life Science in school curriculum.

➢ Aims and Objectives of Teaching Life Sciences at secondary stage; Writing instructional Objectives in behavioural terms. Formulation and classification of Instructional Objectives for teaching of Life Sciences with reference to cognitive, affective and psychomotor domains.

➢ Life Sciences Curriculum at School stage: concept, scope and principles of curriculum construction, approaches of curriculum construction such as concentric approach, topical approach and unit approach.

➢ Process of Evaluation of Life Sciences Curriculum at School level (HPBSE and CBSE).

Unit 2: Teaching Methods, Approaches and Techniques

➢ Teaching methods in Life Science: lecture method, lecture-cum demonstration method, project method, heuristic method, laboratory method.

➢ Approaches in Life Science: Inductive-deductive approach, problem solving approach, computer assisted instructions and web based instructions.

➢ Visualizing, Organizing and contextualizing learning situations through :

a. Field Trips

b. Biological Associations, Science Fairs and Exhibitions

c. Botanical Garden

d. Museum

e. Aquarium and Vivarium

f. Biological Clubs

g. Science Excursions

h. Concept Mapping

➢ Facilitating Life Science Learning: issues in practice; collaborative learning, peer learning; dealing students in heterogeneous classes.

Activity (Any one of the Following)

The student teacher will perform the following experiments and record them in the practical journal/file:

1. To prepare a temporary mount of a leaf peel to show stomata.

2. To show experimentally that carbon dioxide is given out during respiration.

Prepare a report on critical analysis of life sciences curriculum prescribed by HPBSE / CBSE for secondary school stage.

Suggested Readings:

Bhandula, N. Chadha, Sharma, P.C.(1989): Teaching of Science, Ludhiana: Prakash Brothers,.

Gupta V.K.(1994): Life Science Education Today. Chandigarh: Arun Publishing House,.

Kohli, V.K.(2006): How to Teach Science. Ambala : Vivek Publishers,.

Sharma R.C. (1998): Modern Science Teaching, New Delhi: Dhanpat Rai Publishers.

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Mangal S.K.(2005): Teaching of Life Science India: Arya Publication,.

Sharma, P.(2007): Teaching of Life Science, New Delhi: APH Publishing Corporation,.

INSTRUCTIONS FOR THE PAPER-SETTER AND CANDIDATES

The question paper will consist of three sections: A, B and C. Section A will consist of 4 short answer type questions (2 marks each) which will cover the entire syllabus uniformly and carry 8 marks. Sections B and C will have two long answer type questions from the respective units 1 and 2 of the syllabus and will carry 16 marks each.

Candidates are required to attempt one question each from the sections B and C of the question paper and entire Section A. Answer to short question should be completed in around 60-65 words each.

UNIT-1

LIFE SCIENCE: SCOPE, IMPORTANCE AND HISTORICAL DEVELOPMENT

1.1 INTRODUCTION

Dear learners, science is a systematic attempt to understand rationally what exists around us. Things have always existed around us however, there were no known principles which tells us the reality in an objective way. With development of human civilisation, we developed our knowledge about various phenomena existing in nature and other things as well. In todays world, our knowledge has dived deep into the human body and as vast as upto the universe. The human knowledge about various sciences like biology, physics, chemistry, mathematics and others have developed so much that almost every event in the world can be explained and predicted well in advance. We have solutions to almost every aspect of world problems. During covid-19, sciences have led to solve the problem by understanding the virus and then introducing vaccines to fight the pandemic. In life sciences, we get to learn about different life forms and seek to know the cause behind their existence. Here, we learn about the life, living organisms and their

mechanisms of living. It includes the study of humans, animals, birds, microorganisms and the environment surrounding us. Life sciences are very interesting as it gives the explanation of life existing around us.

1.2 LEARNING OBJECTIVES

After going through this unit, students will be able to:

- Understand the nature of life science.
- Understand the meaning of life science.
- Know the scope of life science.
- Discus the historical perspective of life science.

1.3 MEANING, NATURE AND SCOPE OF LIFE SCIENCE

Life science is an important discipline in education which needs to be well integrated in the curriculum of schools. Life science provides us with explanations of various life processes associated to different living beings. Therefore, it is very important to plan the curriculum of life sciences in the school education specifically as it is the foundation stage of a child. Also, school stage is something where a child is curious and wants to explore different areas of the subjects. Thus, the curriculum should offer ample opportunities to child to explore the world around him/her and exploring life science contributes to the same.

Meaning:

The literal meaning of life science is the study of life i.e. the living organisms and various life mechanisms and processes associated.

According to Griggs,”In the literal sense science means the pursuit of knowledge but it has a wider connotation for our purpose, and can be said to mean a knowledge of nature in the widest possible form”.

Life science is a field in science which lets us explore different aspects of life and living organisms. For instance, biology deals with the living beings, their structures, organs and their functioning, growth and evolution. On the similar

lines, botany deals with the plants, their structure, surroundings and functioning.

According to the Columbia dictionary, “Science is an accumulated and systemised learning, in general usage restricted to natural phenomenon”.

Life science, as the name suggest aims to understand the lifeforms, living mechanisms and various kinds of interaction amongst organisms. We should keep in mid that nothing exists in isolation, our surrounding is always there. In nature, where different kinds of lifeforms exist, everything is connected. For example: food chain is the concept where all organisms including plants and animals are a part of food chain existing in nature. Here, it forms a part of nature and there is always an exchange of energy at each trophic level. Ultimately, the energy remains the same which also calls for the law of conservation of energy.

Life science also deals with the micro level studies. In our environment, we cannot see the microorganisms existing with our naked eyes. However, with microscopes one can see and study these microorganisms. Life science deals with these and helps to know various aspects related these. During the covid-19 pandemic, the corona virus is a classic example of microorganism which is studied in deep. Vaccines were made and then tested as per the suitability of human beings, and then we came with solutions. This proves the worth of micro level studies which are being dealt in life science.

Nature:

As we have discussed earlier that life science deals with the study of living organisms and the life processes, the nature of life sciences is generalised and objective. It means that the life science does not call for subjectivity or opinions.

Life science is not different from general science. Therefore, all the scientific principles are applied to life science too. The rules and and principles are practical in nature and applied universally. The nature of life science is different from that of humanities in the sense that humanities emphasise upon different opinions and appreciate diversity and multiple perspectives. On the contrary, life science calls for a fixed perspective which applies to all. For example, in life science, there is a concept of chromosome or DNA which says that it carries genes and traits from one generation to other which results in occurrence of similarity in different generations.

The type of studies which witness in life science is generally quantitative. It means that there is less room for subjectivity and it is more focussed on the quantity or the practical aspect. Here, things are more of specific in nature. Specific here means that there are not multiple perspectives rather the reality is fixed. For instance, the knowledge about the process of photosynthesis is fixed and there are no different viewpoints. Photosynthesis is a process where plants use sunlight to make their food and produce oxygen. This is a universal phenomena and the definition does not change with respect to location.

Self-Check Exercise-1

Q.1 What is the literal meaning of life science?

Q.2 Name a process which manifests the interactions in nature.

1.4 SCOPE AND IMPORTANCE OF LIFE SCIENCE

Life science deals with the latest development happening in the field of biology, botany, environment and other fields as well. Life science is not just limited to human beings and their life processes. The scope importance of life science is as follows:

- It makes learners sensitive towards nature. Nature is considered as a home as it nurtures the living beings.

- It helps in developing a scientific outlook as life science give answers to the cause of all natural phenomena happening in nature. Earlier we discussed about the process of photosynthesis which is explained rationally and objectively. We can also understand the principle of growth by looking at the nature. A plant when nurtured properly with water and adequate minerals grows healthy.

- Life science develops a spirit to appreciate the aesthetic values. Nature is very simple to understand yet complex too. This means that if one goes to see nature without appreciating its uniqueness and diversity, one cannot understand its essence. However, one can understand it by following the underlying principles and values by appreciating it.

- Life science explains the living world around us in terms of certain scientific principles. The biggest flex of life science is that it follows the scientific principles of general science. Science makes it easy and valid to understand something. Nature itself is a science . Therefore, the understanding of natural phenomena in terms of scientific principles become interesting for learners. Also, science gives validation to the concept. For example, water cycle is the phenomena which explains the journey of water from oceans to high altitudes. Water cycle explains this with the help of various scientific processes like evaporation, sublimation and condensation.

- Life science raises curiosity among the learners. The reason is that the various phenomena that we study in life science are something that we

witness in our everyday life. Therefore, it creates a natural interest among learners.

- Life science also deals with environment. In today's world, environment study has been widely focused upon since it is getting polluted with increase in development. This is the area where we need to focus upon. Life science is doing the same by telling about the components of environment and how it works. The focus is on sustainable development. Thus, life science is aimed towards creating sense of belongingness with nature and environment.

- The existence of any society depends upon the well-being of its people. In life science, it deals with this area too. The human body, its organs and functioning of body is dealt. It also suggests the ways to stay healthy. Only if our health is good, we shall be able to contribute to our fullest. Thus, life science focus upon physical and mental health as well.

- In biology, we study about various kinds of biological threats to mankind. There are biological weapons which have been used in the history and these were proved to be fatal and life threatening. Thus, life science deals with the promotion of peace and harmony by not using such things which poses a threat to the life.

- Learning and studying science inculcates in learners the spirit of objectivity and rationality. Thus, it makes learner bias free who can take decisions effectively and don't believe in prejudices and discriminatory practices.

- In the ongoing era, there is a huge demand of science education in society since science is working to promote technology for the mankind. Science has been proves as a boon for the society. This can be understood from

the fact that the life expectancy rates is higher in countries where medical sciences have progressed.

- Science has led its learners to imbibe the value of creativity. We have witnessed that the best method to teach science is learning by doing where learners themselves perform the task to learn. That's why sciences demand lot of practical work as compared to humanities. Thus, the curriculum of sciences should be filled with elements of creativity.

- The knowledge of sciences help students to utilise their leisure time effectively. It is so because science creates curiosity and motivates the students to use their leisure time appropriately. For example, students may plant trees or visit biological parks to actually increase their knowledge about the plants.

So far, we have come to know about the scope and importance of life science. We can say that life science is a dynamic subject which increases the curiosity among the learners and encourage creativity amongst the learners.

Self-Check Exercise-2

Q.1 State any two values which can be imbibed by life science.

Q.2 How life science can be helpful for utilising our leisure time?

1.5 HISTORICAL DEVELOPMENT OF LIFE SCIENCE

Sciences have always been a part of our education from the very beginning. We have got so many evidences right from Indus Valley Civilisation to the recent past. Although, there has been ups and down in this historical development of life science. However, it is presented as below:

Ancient and Medieval India:

The most prominent source of science education in the earliest time is vedas. Vedas are very vast and act aa source of knowledge in almost all the fields. Vedas have covered every sphere of education right from philosophy to science and technology.

In ancient India, vedas which are as old as 1500 BCE had been guiding the mankind. Earlier, the education was based on the concept of Shruti and Samriti. There was memorisation and recalling of the knowledge and thus the knowledge used to get transmitted from one generation to the other.

In the Indus Valley Civilisation, we have seen that the cities were very well planned which shows the level of scientific development in the civilisation. There used to use of standard size bricks which shows that the people were having the knowledge of physics and chemistry.

Vedas have always guided people. Vedic system consists of four vedas i.e. Rigveda, Yajurveda, Atharvaveda and Samaveda. In Atharvaveda, Ayurveda has got attribution which deals with the medicine. Ayurveda is a system of medicine which has been developed to serve the mankind. Ayurveda has explained every aspect of human body in detail and tell us the ways to maintain the health and hygiene in order to live a healthy life. The two foundational texts of Ayurveda are Charak Samhita and Sushruta Samhita. Ayurveda emphasises that the life is of four kinds: Sukha (happy), Dukha (unhappy), Hit (good) and Ahita (bad).

Life sciences have continuously developed and had been an integral part of our education system. There were world level universities where people from all over the world used to come to take education in life science along with others. Then, the main centres of learning were Nalanda, Takshshila, and

others. However, with the beginning of medieval period we witnessed a fall in science education in specific. Nalanda university and many other learning centres were destroyed. Along with these universities, knowledge of thousands of years also got burnt.

Modern India:

The modern Indian education is mainly influenced by western conception of education. Macaulay's minute is a significant event which laid the foundation of modern Indian education. Although, Britishers wanted to create a clerical class so they didn't focus much on science education. But, with the awareness amongst people there were provisions of science education as well. Some of the developments in before independence are as follows:

- Indian Association for the Education of Science for development in the field of science in India. It aimed to foster high quality research in science.

- Indian University Commission under the leadership of lord Curzon was formed to bring reforms at university level. It focussed to improve science education and imminent scholars from other countries were also invited to suggest reforms in science education in India.

- Saddler Commission was appointed in 1917 to bring reforms in the Calcutta University. It suggested to establish inter colleges to focus on engineering and medicine.

- Sargent report came in 1944 which suggested to stress upon science education in India.

Development in science education after Independence:

- University Education Commission was appointed in 1948 under the chairmanship of Dr. Sarvapalli Radhakrishnan. It stressed on science education and stated that in Bachelor degree of science, students have to opt for at least two subjects.

- Secondary Education Commission was appointed in 1952 under the chairmanship of Dr. A.L. Mudaliar which suggested that science should be made a compulsory subject in high schools and appropriate teachers to be appointed for transacting the same.

- Tara Devi Report in 1956 was discussed in Shimla which highlighted the major shortcomings in the file of science education in India. It suggested to extend the science education upto senior secondary level of education.

- Panel for Science Education in Secondary Schools was constituted in 1964 under the chairmanship of Dr. K.N. Mathur. This panel stressed to have high end laboratories in schools, good salary for teaching science and organisation of workshops.

- The education commissions have stressed time and again the importance of science education. Kothari Commission (1964-1966) emphasised on infrastructure measures like laboratories and the curriculum related measures. The recent National Education Policy 2020 have redesigned the school structure in 5+3+3+4 model. It has emphasised much on science education as it is helpful for nation building along with the inculcation of values.

Self-Check Exercise-3

Q.1 In ancient India, what was the ultimate source of science education?

Q.2 In modern India, which was the first concrete effort for laying the stone of Modern Education in India?

1.6 SUMMARY

Science education is very important for a child to learn many universal rules and principles. In life science, we learn about the living organisms and the various life processes related to it. Life science is related to almost every concrete aspect of our life. Therefore, it is very important to understand the subject. Life science deals with organisms, their interactions in the environment and interconnections with other disciplines. In this chapter, we have also studied about the historical developments of life science from ancient to modern times.

1.7 GLOSSARY

Science: It is a systematic approach of explaining something logically and rationally.

Life Science: It is the study of life, living organisms and life processes associated to it.

1.8 ANSWERS TO SELF-CHECK EXERCISE

Self-Check Exercise-1

Answer1: Study of life

Answer2: Food Chain

Self-Check Exercise-2

Answer1: Aesthetic, logic

Answer2: By channelising the leisure time effectively by creating curiosity and creativity.

Self-Check Exercise-3

Answer1: Vedas

Answer2: Macaulay's Minute

1.9 REFERENCES/SUGGESTIVE READINGS

Bhandula, N. Chadha, Sharma, P.C.(1989): Teaching of Science, Ludhiana: Prakash Brothers,.

Gupta V.K. (1994): Life Science Education Today. Chandigarh: Arun Publishing House,.

History of Science Education. (October 4, 2016). http://pratheeshpallath.blogspot.com/2016/10/history-of-science-education.html

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Ministry of Education. (1962. *The report of university education commission*

Report of The Secondary Education Commission. (1953). https://www.educationforallinindia.com/1953 Secondary_Education_Commission_Report.pdf

Ministry of Education.(1966). *Education and National Development (1966).*

Ministry of Education. *National policy on Education 1986 Programme of Action 1992.*

National Council of Education Research and Training. (1971). *Modern India.*

Sharma, P.(2007): Teaching of Life Science, New Delhi: APH Publishing Corporation,.

1.10 TERMINAL QUESTIONS

Q.1 Explain the meaning and scope of Life Science?

Q.2 Discuss the importance of Life Science?

Q.3 Explain in detail the historical development of Life Science.

UNIT-2

AIMS AND OBJECTIVES OF TEACHING LIFE SCIENCE

2.1 INTRODUCTION

Teaching life science in the curios alum has certain fixed aims and objectives. The teacher of life science should well versed with the subject. Teacher needs to be familiar with the subject and should possess ample knowledge. A teacher will not be able to transact the teaching learning process if he/she does not know the objectives and aims of teaching life science.

2.2 LEARNING OBJECTIVES

After going through this unit, students will be able to:

- Know the aims and objectives of life science.
- Understand the instructional objectives in behavioural terms.
- Formulate and classify affective and psychomotor domain.

2.3 AIMS AND OBJECTIVES OF TEACHING LIFE SCIENCE AT SECONDARY STAGE

To teach life science, firstly we need to get familiar with the aims and objectives of the subject. The objectives should be very well determined before the actual teaching. If things are not clear we would not be able to deliver the lesson effectively. There are multiple questions which needs to be

answered before the actual teaching. This, it is necessary that the teacher determine the aims and objectives well in advance.

Through education, man gains knowledge, develop habits and do overall development. Every subject gives a certain type of knowledge and learning habits. Science has its own kind of knowledge and learning habits. It is necessary to determine the objectives before teaching life science. An aimless teaching will result in nothing and will only waste resources.

Objective determination is a pre-requisite for teaching. If it is done so, it will lead to better conditioning and desired behavioural changes in students. This things is valid for science subject to a greater extent. The reason is science is objective and free from any sort of bias. Therefore, bringing behavioural change is quite prominent. We should always keep in mind while teaching that the thing which is being taught should bring a real life connect for the student. For instance, if the student is being taught about the properties of matter, he/she should get the real life experience. It could be experimental learning, learning by doing or anything else that creates a lasting impact. This kind of gaining of knowledge is practical and results in better retention and understanding, thereby resulting in desired behavioural changes.

Before fixing objectives, following should be kept in mind:

- The objectives should be set keeping in mind the intellectual level and the current understanding of the students.

- The objectives should be in line with the needs, requirements and interest of the learners.

- The objectives are intended to bring some desired behavioural changes in the learner. This point is one of the most crucial.

- The objectives should be aligned to curriculum and syllabus.

- The objectives should be in line with proper use of resources.

- The objectives should be kept in line with the evaluation strategies that helps the students.

The above mentioned points for objectives should be kept in mind while planning for the subject and its teaching.

Many a times, we use the terms “aim” and “objectives” interchangeably but these are different terms. Aim is a general term or the final goal while objective is the path to reach the aim.

Aims of teaching life science:

- Cultural.
- Social
- Disciplinary
- Intellectual development.
- Inclusion of values.
- Utilisation of resources.
- To values the aesthetics.
- Interlinkages with other disciplines.

Objectives of teaching life science:

In general sense, the objectives of science and life science are similar. Still, there are few disciplinary objectives which differentiates it from other subjects. One of the main objective of teaching life science is to develop a scientific temper and understanding of life and related life processes.

Types of objectives:

1. General objectives
2. Specific objectives
3. Desired behavioural objectives

General Objectives:

These are not specific to life science. These are the objectives of general science. It includes inculcation of scientific values, scientific temper, objectivity, rationality along with others.

Specific Objectives:

These are related to the subject. In life science, the specific objectives are mainly classified under the following heads:

- Knowledge
- Understanding
- Application
- Synthesis

Desired Behavioural Objectives:

These are the objectives related to what have been expected out of students to learn at the end of the course in terms of behaviour. It refers to actual visible change which can be observed. For example, if a teacher teaches a topic by doing experiment, he/she is inculcating the value of reality, logic and explanation in the students. When such changes are visible in the students too, it can be said that the desired behavioural objective is fulfilled.

NCF 2023 has suggested the science curriculum to be stage specific. It suggests to explore the environment around in the foundation and preparatory stage. In the middle stage, it calls to explore the world of matter, physical and living world. It calls to understand the components of health and hygiene and science and technology. In the secondary stage, it calls to

explore at the atomic level and go deeper in terms of observations. It calls to explore the nature of science by doing science.

Self-Check Exercise-1

Q.1 State any two objectives of teaching life science.

Q.2 Specific objectives are related to _____.

2.4 INSTRUCTIONAL OBJECTIVES IN BEHAVIOURAL TERMS

While framing the instructional objectives, bloom's taxonomy becomes very important. It is so because bloom has classified the educational objectives in in cognitive, affective and psychomotor domains of learning.

Educational objectives of a discipline are specific and they are aimed to bring desired behavioural change in the learner. By taxonomy, we means a type of classification. Bloom has given the taxonomy of educational objectives and mainly divided it in three domains.

Cognitive Objectives:

It has categorised the objectives and placed them in a sequence. The cognitive objectives are as follow:

- Knowledge
- Understanding
- Application
- Analysis
- Synthesis
- Evaluation

Knowledge:

This objective is related to the field of knowledge. Different types of objectives included under it are as follows:

- Knowledge of specific information.
- Knowledge of facts.
- Knowledge of concepts.
- Knowledge of procedure.
- Knowledge of methods.
- Knowledge of trends.
- Knowledge of rules.
- Knowledge of principles.

Understanding:

It comes after the level of knowledge. After knowing something, its important now to understand it to make further progressions. Without knowledge, understanding cannot be build. Here, whatever the learns understands he/she should be able to interpret or explain it. The main three types of processes under the understanding are:

- Translation
- Interpretation
- Explanation

Application:

After understanding level, there comes application level. Here, one is supposed to apply the concept that he/she has understood. First of all, one needs to have the knowledge of a particular concept, rule or principle. Only, one can move to higher order i.e. application. For instance, to solve equations of triangle, one needs to have the knowledge of triangle and related formulas. Only, then the students will be able to apply the knowledge effectively.

Analysis:

The analysis is a higher order thinking skill. To analyse means to think about all the aspects of the concerned problem. In analysis, one is supposed to break down the problem into its constituent part and then look for each component separately. What we do in analysis is the analysis of relationships, patterns and parts. For instance, to analyse the administration of education sector, one needs to break down the problem into its constituent parts. The parts are national and state bodies like NCERT, SCERTs, ministry at national and state level, directorates etc. After analysing these different components one can understand the education sector and its administration.

Synthesis:

It is the process of creating something from what we have already know. For instance, in education if we see there are developed and developing disciplines. With time, when we saw specialisation new subjects emerged and came into existence because of synthesis. The subject “Education” itself is a product of synthesis. It includes perspectives of philosophy, psychology, sociology, political science and other disciplines.

Evaluation:

It is the highest objective of cognitive domain. This is the level where a student can evaluate what he/she has learnt from the lower processes of knowledge, understanding, application, analysis and synthesis. Here, a student becomes able to decide effectively.

Affective Objectives:

The affective objectives in life science are related to the hobbies, habits, values and perspective about the life and its related processes. Bloom and his associates have categorised the affective objectives as follows:

- Receiving
- Responding
- Valuing
- Organising

Receiving;

In life science, receiving means to intake the knowledge, values, habits and learning styles. To receive in a better way, one needs to have:

- Awareness
- Willingness
- Controlled attention

In awareness, one needs to be aware to receive. Without out awareness, all efforts of receiving go in vain.

One also needs to be willing to receive the information. Many a times, we have witnessed that the student is not willing to study, thereby resulting in a bad performance in studies.

In life science, one needs to have controlled attention as the subject is science based and one needs to learn many rules and principles.

Keywords: ask, describe, name, select, identify, etc.

Responding:

It refers to active participation from learner's side. Here, one needs to attend and react to a particular phenomenon. Here the learning outcomes may lead to compliance in responding, willingness to respond or satisfaction while responding. For example, one participates in classroom discussions, one answer to the questions asked by the teacher during lecture.

Keywords: answer, discus, present interpret, etc.

Valuing:

Valuing is related to the worth or value which the learners attaches to a particular object, event or behavior. Valuing is based on the internalisation of specified set of values. It also means to evaluate or assess something. Evaluation leads to the worth of that thing.

Keywords: explain, differentiate, evaluate, justify, etc.

Organisation:

Organisation means to bring together different values and arrange them as per the magnitude in the personality. Organisation means the priority of each value. In some situations of conflict, when one value overpowers the other it means that one value is superior than the other in the personality. The reasons for this organisation can be many. It includes past experiences, environment, exposure and others.

Keywords: adhere, compliance, organise, arrange, etc.

Characterisation of value:

It refers to the actual personality which is made by the specific value set that has been there in the personality for a very long time. Although, it is difficult to change, still it can be changed by continuous conditioning in behaviour. As the name suggests, it reflects the character of the person by showing the personality traits.

Keywords: act, display, discriminate, verify, etc.

Psychomotor Objectives:

Categorisation of objectives on psychomotor domain are as follow;

- Imitation
- Manipulation
- Precision
- Articulation
- Naturalisation

Imitation:

This simply means to copy something. In imitation, one tries to behave in the similar manner as the other. This is the basic level of psychomotor skill upon which the further objectives can be fulfilled.

For example, to learn dance or music, first of all the learner tries to mimic the steps in order to learn.

Manipulation;

In manipulation, one gets one step above the imitation. Here, one can perform the actions with a bit more precision but with consciousness. If one is not aware of the activity, the won't be able to perform.

Precision:

In this part, one will be able to perform the task effectively with actual movements. For example, in dance, one will be able to perform the dance movements with a good flow and rhythm.

Articulation:

It is a more refined form of articulation. Here, one is able to arrange the movements as per the time, and speed with more accuracy.

Naturalisation:

Here, the movement becomes a part of body and one can perform it unconsciously. It goes like the body performs the movement on its own when the music is played.

Self-Check Exercise-2

Q.1 Cognitive objectives are related to _____.

Q.2 In psychomotor objectives, the first step is _____.

2.5 SUMMARY

In this chapter, we studied about the importance of objectives of life science in the curriculum. The objectives should be very well defined, only then the teacher could teach potentially. The various objectives of teaching life science is categorised under cognitive, affect time and psychomotor domains on the basis of which instructional objectives are decided.

2.6 GLOSSARY

Objective: It refers to the path that is to be taken to achieve the larger goal.

Behaviour: It refers to way someone behave in a particular situation.

2.7 ANSWERS TO SELF-CHECK EXERCISE

Self-Check Exercise-1

Answer1: 1. Inculcating scientific temper. 2. Disciplinary knowledge.

Answer2: Discipline.

Self-Check Exercise-2

Answer1: Mind.

Answer2: Imitation.

2.8 REFERENCES/SUGGESTIVE READINGS

Bhandula, N. Chadha, Sharma, P.C.(1989): Teaching of Science, Ludhiana: Prakash Brothers,.

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2.9 TERMINAL QUESTIONS

Q.1 What is the difference between aim and objective?

Q.2 Discuss the aims and objectives of teaching life science.

Q.3 Explain the cognitive based objectives for teaching of life science.

UNIT-3

CURRICULUM OF LIFE SCIENCE AT SCHOOL

3.1 INTRODUCTION

Curriculum is a set of experiences designed to attain specific educational outcomes. Curriculum leads us to achieve the educational objectives. It usually consists of aims and objectives, content, methodology, assessment and resources. In life science, curriculum refers to the set of learning experiences that it intends to provide to learners. In this unit, we shall learn about the curriculum construction and its approaches with regard to life science.

3.2 LEARNING OBJECTIVES

After reading this chapter, students will be able to:

- Understand the concept of curriculum construction.
- Discuss the scope and principles of curriculum construction.
- Know the approaches of curriculum construction.
- Apply the approaches of curriculum construction.

3.3 CONCEPT, SCOPE AND PRINCIPLES OF CURRICULUM CONSTRUCTION

Concept:

Curriculum construction is an important process in teaching learning process. In life science, curriculum construction is important as the subject deals with life processes which is very much emphasised these days. Life science follows a scientific approach but is influenced by other subjects too.

A curriculum gives instructions on how the subject matter should be and how the transaction of teaching and learning will take place. There have been different phases of curriculum construction in history of life science curriculum. Traditionally, the focus during curriculum construction used to be on the subject and subject matter. There was less focus on the learner and learning styles. But, the modern day approach is student centric where the learner is in limelight while constructing curriculum. There is focus on the ways to deliver content and the learning experiences to be provided.

Scope:

The scope of curriculum construction in life science is very vast. It is not just limited to the scientific or fact-based approach. There is difference between the type of content and ways to construct curriculum. Content shall remain science based but the curriculum construction is a cumulative effort of multiple perspectives. This gives room for scope of curriculum construction in life science.

Construction of curriculum requires the developers to look for the human aims and objectives which should be taken care of while constructing curriculum. The reason being is life science is not aimed to fulfil subject related objectives rather the man related aims like values also need to be fulfilled.

As life science deals with the life and life related processes, there must be experiential learning too in the curriculum. Learners should be able to learn by getting involved into the concept. This could be taken to the next stage when their senses would be involved during the learning process. Apart from this, scientific approach should also be there. It could be manifested in the form of practical based learning where students are require to perform practicals in order to learn the concept. Since, life science is a science, it becomes easy rot have practical learning. One can also base the learning on reality. For instance, there must be regular visits to botanical parks, gardens to perceive the nature to reality.

Today is the era of science. Therefore, the scientific nature of curriculum should be there. There must be inculcation of all the scientific elements, processes and topics in the curriculum which are required.

There is also a sociological perspective according to which the student should be capable enough to socialise and make adjustments with the social environment.

Principles:

There are few principles of curriculum construction which are as follows:

- **Principle of learner-centredness:** According to this principle, learner should be in focus while constructing curriculum. It is very much important to emphasise on the needs and requirements in a curriculum. The reasons is students are the ones for whom curriculum's being made. Therefore, learning outcome of students is the indicator of a good curriculum.

- **Principle of social needs:** A man is a social being. The learner needs to make adjustments with the environment. Therefore, it is important to include the social needs of a learner.

- **Principle of integration:** It means that the disciplinary knowledge should not be isolated. There should be interdisciplinary elements in the curriculum and all the aspects of learning must be covered like environment, engagement, correlation and others.

- **Principle of adaptability:** Every learner must adapt to the environment surrounding him/her. One should be flexible enough to participate in all activities and the school processes. In the curriculum too, there must be all the elements which takes care of the whole personality of the learner.

- **Principle of utility of resources:** In an educational setup, there is a budget for the activities and other processes. Sometimes, there is budgetary constraint at different levels. The curriculum must be designed in order to utilise all the resources effectively. Utility is a value which should be taught to students in order to have the greater good.

- **Principle of individual differences:** we are very well aware of the fact that every learner is unique and moves at his/her own pace of learning. We should not compare students as the individual difference exist. This principle says that we should respect the diversity existing in our learners and design the curriculum to include the same.

- **Principle of inclusion of learning experiences:** The curriculum should have enough space for including learning experiences. For instance, it may be done that conceptual knowledge must be supplemented by experiential learning. It will result in better understanding, application, retention and analysis of the concept.

- **Principle of continuous assessment:** To make a curriculum successful, continuous assessment of students as well as the curriculum is necessary.

Continuous assessment gives feedback to further improve and bring desired modifications.

- **Principle of inclusion of constitutional values:** Whenever we make a curriculum, we should keep in mind that the learner after going through the curriculum will land up in the society. To be a better citizen, it is important to inculcate constitutional values in the citizen. Therefore, the curriculum from a very basic level should strive to develop constitutional values in the learners in order to make them responsible citizens.

Self-Check Exercise-1

Q.1 State any two principles of curriculum construction in life science.

3.4 APPROACHES OF CURRICULUM CONSTRUCTION

Curriculum construction is important for the development of curriculum and make it engaged to include all sorts of necessary perspectives, principles and other elements. That's why curriculum construction is a process and needs proper assessment. In order to fulfil this requirement, certain methods of curriculum construction must be included which are as follows:

1. Concentric Approach
2. Topical Approach
3. Unit Approach

3.4.1 CONCENTRIC APPROACH

This approach is also called central or spiral approach. Here, the main element is focus. When the curriculum is designed, focus is main point which

is emphasised din curriculum so that the learner can centralise his/her attention.

Here the content is organised in simple to complex order. It means that firstly simpler concepts are taught, followed by the complex concepts. In simple terms, the learner is expected to progress from easy to difficult.

The teachers while teaching should keep in mind that the portion of topic which they are teaching should neither be too short or too long.

At every point, something new should be added to enrich the curriculum.

Although, this approach is effective but if the topic is too large, it becomes boring for the learners to discuss the topic with this approach.

The topic needs to be divided into sub-topics. If this is not done, it will have negative consequences on the learning of student.

Also, if the topic is very small, it will not lead to good impressions on student in terms of learning the concerned topic.

While using this approach, the teachers need to be very cautious as the topic need not to be very large or small. In such scenarios, the concentric approach becomes irrelevant.

3.4.2 TOPICAL APPROACH

As the name suggests, this approach is focussed on topic. It says that the concerned topic is to be discussed in a class. Other things except the topic and related issues, should not be discussed in the class.

Topical approach treats the topic as the central theme of that particle class. It says that the topic needs to be covered in the concerned time. This approach is specific in nature.

This approach calls to look the related topics and study by creating such interlinkages between topics that create interest and motivate students to learn.

Topical approach calls for development of curriculum as per the stage. It means that the difficulty is determined as per the age and level of students.

The topical approach is stage specific. This is also reflected in National Education Policy 2020 and National Curriculum for Schools Education 2023 as the documents call for stage specific provisions. NCF talks about giving concrete knowledge in preparatory stages which later on will shift to abstract and real life experiences in higher grades.

3.4.3 UNIT APPROACH

This approach focuses on the unit i.e. a unit is taken as the central theme. The unit is broken into subunits, chapters and topics. Here, the related content is arranged in a sequence and a unit is made out of it. It focuses on the totality of experiences where things are not studied in isolation.

The unit is divided into themes, sub-themes, sub-units. It calls to bring together different elements related to a theme and arrange them. This approach is focused on studying in depth, covering all the related aspects.

Self-Check Exercise-2

Q.1 What is the other name of concentric approach.

3.5 SUMMARY

In this unit, we learnt about the curriculum construction, the principles and scope. Curriculum construction is important since it determines the approaches of a curriculum. Curriculum is the most important thing to decide the actual transaction of educational processes. Therefore, the principles and approaches of curriculum construction must be focussed upon.

3.6 GLOSSARY

Curriculum Construction: It is the process of making curriculum by understanding related principles and approaches.

3.7 ANSWERS TO SELF-CHECK EXERCISE

Self-Check Exercise-1

Answer1: 1. Principle of adaptability 2. Principle of utility of resources

Self-Check Exercise-2

Answer1: Spiral approach.

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3.9 TERMINAL QUESTIONS

Q.1 Explain the topical approach of curriculum construction.

Q.2 Discus the principles of curriculum construction in detail.

Q.3 What do you understand by the unit approach of curriculum construction?

UNIT-4

EVALUATION OF CURRICULUM OF LIFE SCIENCE

4.1 INTRODUCTION

Evaluation is the process of measuring the learning outcomes and check for the present status. This is done so to get the idea of present situation, so that we can modify or change the curriculum to make it appropriate. In this unit, we shall look for the evaluation of curriculum of life science at school level. Life science is the study of living organisms and related life processes. To teach life science well, teacher needs to plan activities in order to make the lecture effective. This depends upon the curriculum if it is flexible enough to include adjustments. In this unit, we shall look for all such adjustments and elements of curriculum evaluation at school level.

4.2 LEARNING OBJECTIVES

After reading this unit, students will be able to:

- Understand the process of evaluation.
- Know the process of curriculum evaluation.
- Understand the process of curriculum evaluation of life science at school level.
- Discus the curriculum evaluation of life science.

4.3 EVALUATION

The process of evaluation is more than just measurement. It looks for qualitative aspect as well along with the quantitative aspect. Evolution means to check if the aims and objectives determined earlier are being fulfilled or not. It also looks for a deep analysis and calls for feedback which guides to act further. On the basis of determined aims and objectives in a curriculum, students are evaluated using the same criteria. Evaluation also looks for the learning experiences that are included in the curriculum. Learning experiences need to be precise and correlated to the content. This is determined by doing evaluation of learning experiences.

Evaluation is done to know if the educational objectives are fulfilled or not, to what extent it is fulfilled and what more could be done to fulfil it to full extent. For instance, a general objective of teaching science is to raise curiosity in learners. If a curriculum is completely dependent on books and lecture method, students may not be curious enough to learn science. However, if the curriculum offers space for field trips, visits, experiments, demonstrations and appropriate teaching aids, students will develop curiosity to learn science. This could be known by doing evaluation.

Evaluation is a process of knowing the progress and development of students in the subject. It is something that measures the behaviour and suggests if it needs to be change or modify. Evaluation is that process which determines if the goal is fulfilled or not.

Evaluation is not just limited to teacher rather it can be done by the learner itself. Evaluation occurs at various levels - school, teacher, student, peer. At school level, the evaluation is done by the administrators. This includes the decisions at school level that affects the students. It includes the school environment, school processes and committees etc. At teacher level, the evaluation is done by teacher. Teacher is the facilitator in the process of teaching-learning. To transact this process effectively, a teacher must have

the knowledge of all students, their level, backgrounds and pre-exposures in order to plan the curriculum effectively. In mainstream education, we have been greatly focusing on teacher level evaluation. The other level of evaluation is at the student level where the students themselves do evaluation either individually or in peer groups. The biggest advantage in peer evaluation that one gets a comprehensive coverage in terms of evaluation. However, many experts believe that students at this level are not capable enough to represent the exact picture.

Self-Check Exercise-1

Q.1 What do you understand by evaluation?

Q.2 State the different levels at which evaluation can be done.

4.4 PROCESS OF EVALUATION OF LIFE SCIENCE CURRICULUM AT SCHOOL LEVEL

Evaluating life science curriculum is a vital process as it affects the learner and the process of learning.

There are different aspects in a curriculum which needs to evaluated. These are as follow:

1. Physical development
2. Personality development
3. Academic development
4. Social development

Physical development:

It is very important to measure physical health from time to time. We know that physical development is not the same everytime. There are continuous

changes in the body, its structure and functioning. Certain key aspect of physical development are as follows:

- Growth: It refers to increase in size, such as weight, height, measurements.

- Motor skills development: it refers to the coordination that improves as the muscles get strong and a mind-body connection is developed. At different stages of life, it is manifested differently. Various skills include writing, walking, running, dancing, etc.

- Balance: In the body, balance and coordination is must as it is responsible for sound movements.

There must be regular checkups of students at least once in a year. All the records of checkups needs to be stored. The curriculum should make sure that all the students are taking part in sports, games and other physical activities. There must be proper use of tools to measure the physical ability. There must be provision of dispensary for the students.

Personality development:

To Create a curriculum for personality development of students, it involves designing a well structured program that caters to different aspects of personal development and interpersonal skills. Following are the key steps to develop such kind of curriculum:

1. Define Objectives
The objectives must be very well cleared which are -
Self-Awareness
Communication Skill

Emotional Intelligence
Interpersonal Skill
Confidence and Self-Esteem
Leadership Skills
Time Management
Stress Management

2. Identify Target Audience

Here, we need to define our targeted population. It could be children, teenagers, adults or professionals.

3. Design the Curriculum Framework

Firstly, we need to break down the curriculum into key modules, each focusing on a specific aspect of personality development.

Then, the length of the program and the duration of each session must be determined.

Choose the format of the program

4. Develop Content for Each Module

Self-Awareness: Activities like self-assessment, reflective journaling, and personality related tests.

Communication Skills: group discussions, public speaking, and active listening drills, debates.

Emotional Intelligence: empathy exercises, anger management, emotions regulation techniques.

Interpersonal Skills: Team-building activities, conflict resolution classes, relationship-building exercises.

Confidence and Self-Esteem: Affirmation exercises, goal-setting classes, and confidence-building.

Leadership Skills: Leadership simulations, problem-solving techniques, decision-making exercises.

Time Management: Time management tools and techniques, prioritisation exercises, and productivity techniques.
Stress Management: Relaxation techniques, mindfulness meditation, stress management workshops, and wellness activities.

5. Incorporate Assessment and Feedback
- Include pre-assessments and post-assessments to measure the progress.
- Provide regular feedback and guidance to the participants.

6. Utilise Various Teaching Methods
7. Evaluate and Revise the Curriculum
- Take feedback from participants to know the effectiveness of program.
- Make required revisions and updations based on the feedback and emerging needs.

Academic development:
In most of the curriculums, this element is heavily focused. Traditionally too, academic development of a learner is emphasised for which teacher's role is greatly stressed. In modern day curriculums, the role of teacher is seen as that of a facilitator who guides students. In such curriculums, the learner is at the centre whose needs and requirements are considered mainly while designing the curriculum. So, academic development of learners is the one which is focused in the curriculum.

To plan academic development in the curriculum, content selection is one important criteria. Finding a suitable content is the task of experts. The content made should be free from biases and must address all the key aspects of topic.

After content selection, the teaching methods are also need to focussed upon. The teachers need to prepare well in advance the lecture. Although

there are lot of ways of teaching a topic or subject, the teacher has to find the best possible way to teach keeping in mind the needs and level of students.

One important concern is the assessment of students. Assessment is mainly of two types - formative and summative. Formative assessment is the one which takes place regularly after intervals or during the process of teaching learning. It includes debates, discussions, quiz, oral tests, etc. it is a kind of assessment which is there to supplement the learning. That's why it is also called assessment for learning. The other kind of assessment is summative assessment which takes place at the end of a lecture or unit or course. The main objective of this type of assessment is to know the extent to which the learning objective is fulfilled. It is done to know the current status of learning of students. It includes achievement tests. While having assessment at different levels, it should be kept in mind that the type of questions asked should be fulfilling the learning objectives of curriculum. For instance, there should be a mix of essay type questions, short answer type questions and multiple choice questions. Long essay type questions are there to test the analytical understanding of a topic, short answer type questions are to test the knowledge and understanding while multiple choice questions are to test the factual knowledge along with the application level skills.

Social development:

It is well said that man is a social being who lives in society and contributes to it as well. To survive in society and to do good for the society one needs to have social skills like communication, relationships, adjustments, changes and modifications temporally and spatially.

School level curriculum has a lot to contribute in raising such students who are well versed with social skills. Every discipline has different ways of inculcating social skills in students. For instance, humanities can teach values and social skills by giving past examples, and by explaining multiple

perspectives of reality. Sciences can teach inclusion, non-discrimination and bias free nature along with being objective and fair. Life science teaches us to respect the aesthetics and diversity. It tells us to accept the reality as the way it is.

In school curriculum, inculcating social skills has always been a challenge. It has now become more important since the society is gradually moving towards a very complex setup. We are heading towards a society where the concept of joint family is vanishing and newer concepts like extended family, weekend family and holiday family are emerging. Everyday, a new social problem is emerging. You have also witnessed yourself getting involved in social phenomenas and situations. In such scenario, it is very much important to create a curriculum which is catering to the demands of social development of student.

The curriculum should be designed to include such activities where social exposure is obvious. There must be interlinkages with the other subjects too in order to get a multidisciplinary overview. The biggest advantage of multidisciplinary curriculum is interactions among different disciplines. One would not be limited to its own subject's perspective and technicalities.

Self-Check Exercise-2

Q.1 Name any two indicators of physical development.

Q.2 What are the components of personality development?

4.5 SUMMARY

In this unit, we went through the concepts of assessment, evaluation and curriculum. A curriculum should always be catering to the needs of its

stakeholders. A curriculum must be comprehensive and include all the necessary elements like physical development, personality development, academic excellence and social development. Nowadays, there has been emerging demand of making multidisciplinary curriculum as recommended by National Education Policy 2020.

4.6 GLOSSARY

Assessment: It is the process of making judgements about something. It demands a deep level analysis and comprehension.

Curriculum: It refers to all the subjects, activities, content, processes and learning experiences that are to be given to the students in order to fulfil the educational objectives.

4.7 ANSWERS TO SELF-CHECK EXERCISE

Self-Check Exercise-1

Answer1: Evaluate is the process of assessing something in detail and giving feedback accordingly.

Answer2:.School level, teacher level, self level, peer level.

Self-Check Exercise-2

Answer1: Growth, balance.

Answer2: Communication, adjustments, adaptability, self-awareness, interpersonal skills

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4.9 TERMINAL QUESTIONS

Q.1 Explain the process of evaluation in detail with respect to school curriculum.

Q.2 Discuss in detail the process of curriculum evaluation of life science.

UNIT-5

TEACHING METHODS IN LIFE SCIENCE

5.1 INTRODUCTION:

In this unit we will learn about various teaching methods in life science such as lecture method, lecture-cum- demonstration method, project method, heuristic method and laboratory method. In this unit, we will also study the merits and limitations of these methods.

5.2 LEARNING OBJECTIVES:

1. To study the meaning, advantages and limitations of lecture method.

2. To study the meaning, advantages and limitations of lecture – cum – demonstration method.
3. To study the meaning, advantages and limitations of project method.
4. To study the meaning, advantages and limitations of heuristic method.
5. To study the meaning, advantages and limitations of laboratory method.

5.3 LECTURE METHOD:

Lecture method is the most used methods in teaching of life sciences. Lecture method follows the philosophy of idealism. Lecture method is usually used to teach students of higher classes. In Lecture method, students listen passively while teacher is active in the classroom. The teacher delivers instructions to multiple students. In this method, students learn mainly through memorization and listening. Teacher continues with the subject matter at his own pace. A lot of information is delivered quickly with the help of this method. Teacher is the main speaker while the students prepare their own notes. Lecture method is regarded as the simple method of teaching as it does not need any special arrangements on the part of the teacher. Teaching aids can be used by the teacher to make lecture more effective. The content should be presented in a systematic manner by the teacher. In Lecture method, Students and teachers are in a close and face to face contact with each other. Lecture method has the following basic purposes:

a. To expand the knowledge of the students.
b. To motivate the students.
c. To clarify the concepts to the students.
d. To review the progress of the students.

ADVANTAGES:

1. Lecture method is convenient and easy method.
2. It provides extra content to the students other than what is written in textbooks.
3. Knowledge flows logically and clearly in lecture method.

4. Teacher and students are in direct contact with each other.
5. Content can be delivered to the large audience in the limited time.
6. Lecture method decreases the possibility of misunderstandings.

LIMITATIONS:

1. Students are passive listeners.
2. Individual needs of students are not fulfilled in lecture method.
3. It focuses only on theory.
4. Lecture method is mainly based on one-way communication.

SELF CHECK EXERCISE-1

1. In lecture method, students are _____ listeners.

2. Lecture method is also called_____.

5.4 LECTURE- CUM- DEMONSTRATION METHOD

Lecture-cum-demonstration method is considered as a superior method of teaching as compared to the lecture method. Lecture-cum-demonstration method is also called Chalk and talk method. This method can be used to impart concrete experiences to the students i.e. learners can visually observe the subject matter. The teacher also asks various questions from the students so the students observe carefully each and every step of the experiment performed by the teacher. In this way, students remain active in the class and

they observe actively. Students show more curiosity in this method. This method can also be used to impart knowledge about new procedures to the students. Knowledge being imparted in lecture-cum-demonstration method is mainly related to the life experiences of the students. Both theory and practice are being imparted in lecture – cum – demonstration method of teaching. Confidence level of the students is being enhanced by this method. This method also enhances the observational skills of the students.

CHARACTERISTICS OF DEMONSTRATION:

1. It should be visible to all the students present in the class.
2. It should be simple and accurate.
3. The role of teacher is to act as a performer.
4. Proper teaching aids should be used while demonstrating a topic.

ADVANTAGES:

1. This method is more psychological as it makes use of visual representations.
2. Both theory and practice are being integrated in this method.
3. Sense organs of the students are stimulated by the use of this method.
4. It enhances various skills of students.
5. Complex principles and procedures can be understood easily with the help of this method.
6. It is helpful in the process of discussion.

LIMITATIONS:

1. It is time consuming method.
2. It requires a lot of efforts.
3. Laboratory skills are not developed in students through this method.
4. Experiment is performed by the teacher at his own pace.
5. The process of demonstration might not be visible to all the students.

6. This method is not useful for the development of scientific attitude among the students.

SELF CHECK EXERCISE -2

1. What is the other name of Lecture-cum-demonstration method

2. Lecture-cum-demonstration method involves ____and practice.

5.5 PROJECT METHOD

This method is based on the principle of learning by doing and philosophy of Pragmatism. Project method of teaching is very effective method of teaching. It is mainly based on experience - based learning and it helps students to socialize easily. Project method of learning is based on realistic and purposeful activities that promotes learning. It emphasizes on practical application. Project - based method of teaching, can be used to explore various problems and challenges. Authentic and direct experiences are provided by project- based method of teaching. It develops the spirit of scientific inquiry among the students. It provides the students with great degree of freedom and also provide psychological boost to the students. Students are encouraged to express themselves freely in project - based method of teaching. It develops practical skills and practical abilities among students. This method is mainly democratic in nature. Project method involves discovery, investigation and finding out something that was not known priorly to the students. In project method, students are provided with a wide range of opportunities to clarify their doubts. Teacher acts as a friend, guide and philosopher but not a commander or a dictator. Teacher

encourages students to work in a cooperative manner and maintains a democratic atmosphere.

Various types of projects are:

a. Simple and Complex projects

b. Individual and Social projects

c. Group projects.

d. Constructive projects.

ADVANTAGES:

1. Critical thinking is developed among students with the help of project method.
2. This method develops democratic atmosphere.
3. Coordination between mind and body can be developed with the help of project method.
4. It is used to provide answers to practical problems.
5. It develops social skills among students.

LIMITATIONS:

1. This method is time consuming.
2. This method can only be effective, if the teacher is highly knowledgeable.
3. This methos is suitable only for practical subjects and the subjects such as literature and arts may not benefit from this method.

SELF CHECK EXERCISE-3

1. Who gave the Project method of teaching.

2. Project method is based on _____ philosophy.

5.6 HEURISTIC METHOD:

Henry Edward Armstrong introduced Heuristic method. Heuristic method is based on practical knowledge and practical experience. Heuristic method is an instructional approach that allow students to solve problems as well as to make judgements efficiently and quickly. Heuristic method makes use of various approaches such as discovery learning, problem solving abilities and experiential learning to enhance the learning abilities of the students. Students act as independent discoverer in this method. Students solve a number of problems experimentally which leads to the development of creative abilities among the learners. They are encouraged to explore new ideas and concepts instead of memorizing information. There is no provision of teacher's help or guidance in this method. Habit of self – direction and self – study is developed through this method. Heuristic method helps to achieve cognitive, psychological and emotional goals. It develops self – confidence and the ability of self – control among the learners. Heuristic method develops the habits of inquiry and investigation among the students.

ADVANTAGES:

1. This method aims to develop overall aspects of individual personality i.e. cognitive, affective and psychomotor aspects.
2. Scientific thinking is developed.
3. It promotes the habit of self- learning, self – control and self – direction.
4. It develops the habit of investigation and inquiry among the learners.
5. Students learn by self- experience.

LIMITATIONS:

1. Heuristic method is not used in primary levels.

2. Most of the times experiments are performed only for the sake of doing them.

SELF CHECK EXERCISE-4
1. Who gave Heuristic method?
2.Heuristic method of teaching is based on:
a. Practical knowledge and Practical experience
b. Theoretical knowledge
c. Both a and b
d. None of these

5.7 LABORATORY METHOD

The laboratory method is the most commonly used method. Laboratory method is based on the process of observing, learning by doing and moving from concrete to abstract concepts. Laboratory methods focus on discovery, solving the problems and on mastery of skills. Laboratory method is psychologically sound method. First hand experiences are provided to the students through this method. Through this method, students are actively involved in the teaching learning process. Laboratory activities develop new interests, values and attitudes among the students so that they can further explore and further investigate their queries. This method utilizes material things or raw data in order to produce better understanding of the content. Students are provided opportunities to discuss, think about and solve real life problems. This method develops a sense of curiosity. Scientific attitude is developed among the students with the help of laboratory method. The

teacher supervises and guides the students wherever needed. Knowledge gained through laboratory method is permanent and long lasting.

ADVANTAGES:

1. This method is based on reality instead of symbols.
2. First hand experiences are dealt upon with the help of laboratory method.
3. Knowledge gained through laboratory method is permanent and long lasting.

LIMITATIONS:

1. The main limitation is non – availability of sufficient resources.
2. All the individuals cannot be attended by the teacher in the laboratory method.
3. This method requires only well experienced and well qualified teachers.

SELF CHECK EXERCISE- 5
1.Laboratory method is mainly used in the field of
a. Science and Mathematics
b. History
c. Geography
d. All of the above
2. Laboratory method develops _____ attitude among the students.

5.8 SUMMARY:

In this unit, we have learned about various methods and approaches to teaching of life sciences. Teaching methods are the techniques to help the students to achieve learning outcomes. This unit deals with various teaching methods such as Lecture method, lecture – cum- demonstration method, Project method, heuristic method and Laboratory method.

5.9 GLOSSARY:

Abstract Concepts: Emotions, Ideas and principles that cannot be directly being experienced.

Cooperation: To work in group with somebody in order to achieve the goal.

Scientific thinking: Process of reviewing ideas with the use of observations, science and investigations.

Demonstration: To make something clear with the help of evidence.

5.10 ANSWERS TO SELF – CHECK EXERCISES

SELF CHECK EXERCISE :1

Answer 1. B

SELF CHECK EXERCISE-2

Answer 1. Active

Answer 2. Transmissive

SELF CHECK EXERCISE :3

Answer 1. Chalk and Talk method

Answer 2. Practice

SELF CHECK EXERCISE :4

Answer 1. William H. Kilpatrick

Answer2. Pragmatism

SELF CHECK EXERCISE :5

Answer 1. Henry Edward Armstrong

Answer 2. A.

SELF CHECK EXERCISE :6

Answer 1. A.

Answer 2. Scientific

5.11 References/ Suggested Readings

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5.12 TERMINAL QUESTIONS:

Q1. What do you understand by Heuristic method?

Q2. Write down the advantages and disadvantages of Lecture method.

Q3. Give a detailed description of Laboratory method.

Q4. What do you understand by Project method?

UNIT-6

APPROACHES IN LIFE SCIENCE

6.1 INTRODUCTION:

In the previous unit, we have learned about various teaching methods in life science. Teaching methods are the patterns of the behaviour that are applicable on various subject matters. Methods are systematic techniques, procedures and methods employed in a particular discipline. In this unit, we will learn about various approaches in life science. An approach refers to a pedagogical method or strategy in the learning process. An approach refers to theoretical perspective and a philosophy that guides the teaching practice.

6.2 LEARNING OBJECTIVES:

a. To understand the concept of Inductive – Deductive approach.

b. To define the problem- solving approach.

c. To explain the concept of computer assisted instructions.

d. To understand the concept of web - based instructions.

6.3 INDUCTIVE DEDUCTIVE APPROACH

INDUCTIVE APPROACH:

Inductive approach is most suitable for the teaching of science due to the fact that almost all the principles of science are the results of induction. In inductive approach, a person moves from particular to general, concrete to abstract, complex to general. Inductive approach focuses on learning from experiences. This method focuses on discovery and lead the student from specific to general theories. This method is a type of student – driven form of instructional method. Inductive approach is a student – centered approach as the students actively engage in the teaching – learning process. With the help of Inductive approach students can develop their concepts by identifying the patterns in order to arrive at solutions. Inductive approach is a unique approach as it is not based on prior knowledge, strict lesson plan or guidelines.

ADVANTAGES OF INDUCTIVE APPROACH:

a. It encourages participation of the students.

b. It builds curiosity in the students.

c. It promotes “learning by doing” approach.

d. It develops scientific attitude among the students.

e. It is based on thinking, actual observation and experimentation.

LIMITATIONS OF INDUCTIVE APPROACH:

a. It is time- consuming approach.

b. This approach is not sufficient in solving all the topics of science.

c. Students may arrive at incomplete generalizations it the provided examples are not sufficient.

DEDUCTIVE APPROACH:

Deductive approach is the opposite of inductive approach. This approach is merely teacher- centred approach in education. The deductive approach is more explanatory. Concepts are introduced in the class, followed by activities and examples to support learning. In the deductive approach, the students proceed from abstract to concrete and general to particular. In deductive approach, the facts are analyzed with the help of experimentation or established formulas. This approach is generally suitable for slow learners and students of lower classes.

ADVANTAGES OF DEDUCTIVE APPROACH:

a. Students are encouraged solve the problems efficiently.
b. It is a time saving technique.
c. Students have to memorize all the rules.
d. It is suitable for the students of lower classes.

LIMITATIONS OF DEDUCTIVE APPROACH:

a. This method is not scientific method.
b. It do not improve the reasoning abilities of the students.
c. Prioritization is given to memory instead of intelligence and understanding.

SELF CHECK EXERCISE – 1

Q1. In Inductive approach, a person generally moves from:
a. Particular to general
b. General to particular
c. Both a and b
d. Abstract to concrete

Q2. In deductive approach, a person moves from:
a. Particular to general
b. General to particular
c. Both a and b
d. None of these

6.4 PROBLEM SOLVING APPROACH:

Problem solving method is one in which the problems are solved scientifically. Problem solving is an approach with the help of which a problem is defined and is followed by the implementation of a solution for solving that particular problem. Problem solving approach is one of the mostly used techniques by the people in order to solve the problems which they face in their life. It is a method which disciplines the individual mind to approach all problems in a scientific manner and in the same way. It is also known as scientific approach. In this approach, we pre- suppose the existence of the problem. A problem can be defined as an obstruction of some kind for the attainment of objective, a sort of difficulty faced by an individual and which does not allow the individual to reach the goal easily. The solution of these gives the individual a better hold on the environment, develops his intellectual powers,

increases his storage of knowledge. Problem solving is a technique where students and teachers attempt to arrive at some solution and helps in explanation of an educational difficulty. Problem solving is critical skill used in various fields and helps in making decisions and helps in effectively overcoming obstacles.

Characteristics of a Problem:

a. Problem should be interesting and meaningful.

b. Problem should be related with life.

c. Problem should be based on real needs of students.

d. Students should strive to find out the solution of the problem by their own under the supervision and guidance of the teacher.

e. The student should have knowledge of the background of the problem, which is to be discussed by them.

Various steps of problem - solving approach:

1. Locating and sensing the problem
2. Defining the problem
3. Analyzing the problem
4. Collecting the data
5. Interpreting and analyzing the data
6. Formatting of hypothesis
7. Drawing conclusion and framing principles.

ADVANTAGES OF PROBLEM - SOLVING APPROACH:

a. It helps in the stimulation of thinking.

b. Discipline is maintained.

c. It makes learning more interesting.

d. It develops good study habits among children.

e. It makes students self – dependent.

f. It enhances the reasoning power of the students.

g. Critical judgement power is developed among children.

LIMITATIONS OF PROBLEM - SOLVING APPROACH:

a. Problem solving only makes use of mental activity.

b. Students may not have appropriate sources books and reference.

c. Problem solving approach may require a lot of time.

d. Students do not always possess background information.

e. Very capable teachers are required in problem solving approach.

SELF CHECK EXERCISE-2

Q1. What is the other name of problem – solving approach?

Q2. Which of the following is not an advantage of problem - solving approach?

a. Discipline is maintained.

b. It makes learning more interesting.

c. it develops good study habits among children.

d. It is time - consuming.

6.5 Computer Assisted Instruction and Web Based Instruction

The most evident innovation in the field of education is the use of computer. Computer assisted instruction means using of computers by an individual to support learning materials and to support learning process. The main objective of computer assisted instruction (CAI) is to provide flexibility into the educational process. It includes the use of digital resources for imparting instructions and to review the performance of students. Computer assisted instruction helps to track the progress of the students and allows the educators to monitor the development of students. It has multimedia elements such as sound, animations and interactivity which makes the learning process more engaging and which motivates the students to participate actively in the educational process. Computer assisted instruction provides instant feedback to the students and it provides a variety of resources such as articles, videos, e-books etc. which supplements the traditional learning materials. Computer assisted instruction often includes lessons which are interactive enough to engage students through various activities such as games, quizzes and simulations. Various examples of computer assisted instruction includes math tutoring software, language learning apps, educational games and online courses.

WEB BASED INSTRUCTION:

Web based instruction is also known as web- based training. Interesting and meaningful learning environment can be created with the help of web - based instruction. Web based instruction makes use of internet for delivering instructions and for various learning activities. Web based instruction offers convenience and flexibility to the learners in order to access content regardless of any place or time. It can use a range and a variety of delivery methods such as live instruction, text, video and even games in order to engage the students. Various examples of web – based learning are:

Webinars

Online Tutoring

Characteristics of Web-Based Learning:

1. Students can assess educational materials with the help of internet connection regardless of place,

2. Students are not forced complete their coursework in a limited time period.

3.Various interactive elements like discussion forums, quizzes and multimedia content such as animations, videos and simulations are included in Web based instruction.

4. It enriches the learning experiences of the students.

SELF CHECK- EXERCISE: 3

Q1. Which of the following are the examples of web - based learning:

a. Online Tutoring

b. Teleconferencing

c. Webinars

d. All of the above

6.6 SUMMARY

In this lesson, we had learned about different methods and approaches to teaching of life sciences. The use of these methods or approaches is relative and context and situation specific. It depends upon the nature of the content matter that which method or approach is to be adopted for imparting learning experiences to the students. Hence, as a teacher, you should carefully examine the teaching-learning situation in its totality and then decide about the method or approach to be followed to teach your children in the class.

6.7 GLOSSARY

Manipulation: To control or to influence others.

Stimulation: An action that makes a person active.

Complexity: Being difficult or being complex to understand.

6.8 ANSWERS TO SELF CHECK EXERCISES

Self - Check Exercise-1

Answer 1. A

Answer 2. B

Self - Check Exercise-2

Answer 1. Scientific Approach

Answer 2. D

Self - Check Exercise-3

Answer 1. D

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6.10 TERMINAL QUESTIONS:

1. Explain the nature, merits and demerits of lecture method.
2. What do you understand about lecture-cum-demonstration method.
3. How problem - solving approach can be used in teaching life sciences at school
4. Differentiate between heuristic method and laboratory method of teaching life sciences.
5. Explain the procedure of employing project method in the teaching of life sciences.
6. Discuss computer assisted instruction along with web-based instruction.

UNIT-7

Visualizing, Organizing and Contextualizing Learning Situations

7.1 Introduction

Science cannot be told or read from the printed words. It is always experimented, observed and experienced through a number of practical activities done inside and outside the school by the learner themselves. Science laboratories and practical work in the subject physical science as explained in chapter seven done in these laboratories or demonstrated and experienced in the physical science classes is not sufficient either for meeting the individual needs of the learners for helping in the proper realization of the instructional objectives at various levels and situations of life science teaching.

7.2 Learning Objectives

a. To explain field trips and their importance for teaching life sciences.

b. To discuss science fair and exhibitions and its significance.

c. To differentiate between museum and aquarium.

d. To explain science club and their importance.

e. To discuss concept mapping.

7.3 Field trips

For the effective understanding of Life Science one needs first hand experiences through natural events and real objects. Field trips mean educational outings which are organized by educational institutions such as schools and colleges. A visit to any area which is away from the normal classroom which provides exposure to the children to try new things, to have new experiences and to learn various useful and valuable lessons is known as a field trip. In a field trip, students experience a lot of new sights and have hands on experience. The main purpose of field trip is observation, non – experimental research and experiences outside the classroom such as camping. Field trips lead to the observation of subject matter in its natural state and to collect samples. With the help of Field trips students can understand the application of theoretical concepts into the real - life

situations. Learning through Field trips can help in memory retention. Popular sites for field trips include nature centres, zoos, community agencies like hospitals and fire stations, local business, science museums, amusement parks, factories etc. Field trips are conducted in three steps:

a. Preparation

b. Activities

c. Follow – up activity

Characteristics of field trips

1. Help to clarify the subject matter.
2. Create interest.
3. Provide entertainment.
4. Establishes contact with others.
5. Develops scientific attitude.
6. Supports the curriculum.
7. Learning through Field trips can help in memory retention.

SELF – CHECK EXERCISE -1

Q1. Community agencies for field trips include:

a. Local business

b. Science museums

c. Hospitals and fire stations

d. Factories.

Q2. Which of the following are the characteristics of field trips?

a. Contact with others is established.

b. Clarify the subject matter

c. Supports the curriculum.

d. All of the above

7.4 Science fairs and exhibitions

Science fairs and exhibitions are mainly organized by schools, science centres, private or government agencies. SCERT, NCERT and other state departments of education are working together for the encouragement and promotion of science fairs and exhibitions at the district, regional or state levels by providing essential guidance, financial aids, and all other official assistance. These may prove a good platform for the display of various activities whether formal or informal in nature and which are of great value in the field of science education. A lot of skills such as time management, problem solving, critical thinking, communication etc are developed by frequent visits to science fairs and exhibitions. The primary aim of science fairs and exhibitions is to foster creativity, encourage scientific inquiry and develop presentation skills and research abilities among the students. Science fair and exhibitions act as a valuable - educational tools helping in developing scientific concepts.

Features of Science fairs and Exhibitions:

1. Science fairs and exhibitions include displays that help visitors to engage with various new concepts and in turn keeps them updated. These displays may include various models, various experiments and various demonstrations.
2. Science fairs and exhibitions may be based on various subjects like human biology, renewable energy. Climate change and space exploration.
3. A large content such as live demonstrations, informative panels, guided tours and videos is provided.
4. These can demonstrate the effect of science on our life and on the world we live in.
5. Science fairs and exhibitions can foster creativity among the students.

6. Students can learn communication skills and they get the chance to present their respective projects before the teachers, audience and peers.
7. Self – confidence can be developed among the students by participating in science fairs and exhibitions.

SELF CHECK EXERCISE-2

Q1. Science fairs and exhibitions can include formal and _____ activities.

Q2. Name the various skills that can be developed among the students with the help of science fairs and exhibitions?

7.5 Botanical Garden

A botanical garden is a type of garden with a collection of plants which can be used for the purpose of research. These botanical gardens play a major role in meeting the needs of human beings and well - being of humans. Botanical gardens also have various health benefits such as relieving stress of the mind and relaxation of mind and body. Botanical gardens are mainly run by research institutions as well as by universities. Most of the botanical gardens can be visited as they are accessible to the public. These play a great role in preserving endangered species of plants. Botanical gardens also consist of seed banks. They mainly work as fresh air laboratories. Botanical gardens provide for ex-situ conservation of plant species. Ornamental plants can also be found in botanical gardens.

Indian Botanical Garden is the largest Botanical Garden of India. Royal Botanical Gardens is the largest Botanical Garden of the world. It is located in

England. In Botanical Gardens the plant species are labelled with their scientific names.

SELF CHECK EXERCISE-3

1. **Write the name of the largest Botanical Garden of India.**
2. **Write the name of the largest Botanical Garden of the world.**

7.6 Museum

A museum is a very valuable part of the science department in the school. Museum is dedicated towards conserving and interpreting the witnesses of human existence and that of the environment. A museum is different from the library. In simple terms, a museum can be called as an institution dedicated towards preserving, collecting and displaying objects of cultural, artistic, scientific and historical significance for enjoyment and for public education. Museums are also known as repositories of culture and knowledge which provides opportunities to the people to learn and explore about various aspects of art, human history, natural world and science.

The staff of museums consists of scientists, historians, curators, researchers and educators. Following are the purposes of museum:

a. To provide for recreational activities.

b. To provide for scholarly venues.

c. To provide for educational resources.

d. To contribute towards the quality of life.

e. To attract tourism in a particular area.

f. To promote nationalistic endeavour.

g. To transmit ideological concepts.

The museum should consist of:

a) Dry exhibits such as roots, weeds, leaves, specimen of minerals and ores.

b) Snakes, fishes, water-weeds etc.

c) Insects, butterflies and shell-fishes.

SELF CHECK EXERCISE– 3

Q1. Which of the following is not available in museum:

a. Leaves, roots
b. Food and snacks
c. Butterflies, insects
d. Water - weeds

Q2. Which of the following are the purpose of museums:

a. To transmit ideological concepts.
b. To attract tourism
c. Both a and b
d. None of these

7.7 Aquarium and vivarium

The term Aquarium was derived from the Latin word “aqua” which means water and “rium” which means place. Thus, Aquarium means place for water.

Aquarium is also known as the Artificial ecosystem. Aquarium is miniature replica of terrestrial habitat containing specimen plants animals representing that habitat. An aquarium refers to a vivarium of any size which consists of aquatic animals and plants. Aquarium can be used to keep and to conserve various invertebrates, fishes, aquatic reptiles such as turtles, amphibians, plants etc. Bowl shaped aquaria are known as Fish bowls. Aquariums in modern times are made up of glass which are bounded by 100% silicone sealant. Aquarium require intensive care.

Components of aquarium:

The components of the aquarium include:

a. Filtration system

b. Heater or chiller

c. Artificial lighting system

d. Pump

e. Air diffuser

Aspects for the maintenance of aquarium:

1. Sufficient tank size.

2. Maintaining and monitoring of parameters of water such as ammonia, pH, nitrate, nitrite and temperature.

3. Proper filtration systems.

4. Appropriate lightning.

5. A balanced diet for the species kept in the aquarium.

6. Compatibility of the species in terms of environmental needs, size and temperature.

Uses of Aquarium

1. Students study about different varieties of plants and animals.

2. It helps students in understanding the inter-relationship of factors affecting the life of animals and plants.

3. It helps students in understanding the living and feeding habits of animals.
4. It acts as a decorative element in the public spaces, home and office.
5. It facilitates scientific studies.

Limitations of Aquarium:

a. Aquarium provides limited space to the species as compared to the natural habitat.

b. Poor conditions of water quality can lead to the health problems of the inhabitants.

c. Setting up of Aquarium can be expensive.

d. In Aquarium, disease can spread easily due to limited space.

Vivarium

Vivarium is an area which is used for raising and keeping animals or plants for research or observation. Vivarium provides a controlled environment for research. A vivarium could be small and can easily fit on a desk or table. Maintaining the temperature is an important and main task in vivarium.

Types of vivarium are:

a. Aquarium

b. Terrarium

SELF CHECK EXERCISE-5

1. Cuboid shaped aquaria are also known as_____.

2. Bowl shaped aquaria are also known as _____.

7.8 Biological clubs

Biological clubs are the groups of students with same interests in the field of biological sciences such as ecology, biology, botany, zoology, conservation etc. Biological clubs provide students with hands on experience and trips to various biological establishments. Through biological clubs, interest of students can be developed in biological sciences. Biological clubs provide students the opportunities to connect with those peers who share same interests and same career aspirations. The students can participate in wildlife monitoring, citizen science initiatives and habitat restoration efforts.

Biological clubs focus on latest developments in the field of science, career opportunities and participation of students in scientific research. Biological clubs may play an important role in fostering passion, curiosity and engagement in biological field. Biological clubs are informal where a student chooses what he wants to do unlikely in classroom where he is directed what to do. Biological clubs offer various workshops to develop various skills related to biology such as DNA analysis, microscopy and scientific writing.

Characteristics of Biological Clubs:

a. Members show interest for the study of living organisms, biological processes and ecosystems.

b. Biological clubs attract students of different backgrounds and interests.

c. They provide a stimulating and supportive environment where members can engage in discussions, explore new topics and enrich their understanding of biology.

d. Students can gain practical experience through fieldwork, laboratory experiments, hands on activities and research works.

e. It develops leadership abilities among the students.

SELF – CHECK EXERCISE - 6

Q1. Biological clubs are related to:

a. Maths and reasoning

b. Biological sciences

c. History

d. All of the above

Q2. Biological clubs are the group of students with:

a. Varying interests

b. Same interests

c. Both a and b

d. None of these

7.9 SCIENCE EXCURSIONS:

A science excursion can be referred to a trip in the field of science. It helps them to understand things in better way. Books only provide theoretical knowledge to the students while science excursions advocate to provide practical knowledge to the students. It refers to visiting a place away from the classroom settings. It allows the learners to contact with the outside world. It helps to clarify the subject matter. Science excursions help to supplement the lessons. Science excursions should be an integral part of instruction. In science excursion, students can visit several locations such as zoos, botanical gardens, research facilities, nature reserves, museums or environmental centres. Science excursions often refer to interactive exhibits, guided tours, demonstrations and activities for supporting the classroom

learning and foster critical thinking. Inquiry – based learning and curiosity. It involves a visit to the project facilities and interaction with experts. It develops concrete skills among the learners. Interactions in science excursions help the students to accept differences. These allow them to learn from stranders and to form unbiased opinions.

Characteristics of Science excursions:

a. Students are provided opportunity to observe natural ecosystems, natural phenomena and other scientific phenomena.
b. It often integrates concepts from different disciplines such as geology, ecology, biology, astronomy and environmental science.
c. These focus on experiential learning.
d. These encourage students to make observations, ask questions and draw conclusions which leads to the development of problem - solving skills and fostering critical thinking skills.
e. Students can develop awareness of environmental issues, environmental sustainability and environmental conservation.

Benefits of science excursions:

a. It develops critical thinking among the learners.
b. It boosts performance of students in the academic field.
c. Students develop good bonding with their teachers and classmates.
d. It enhances knowledge of the students.
e. It enhances understanding of the students.
f. Social skills and self- confidence is built among the students.

SELF – CHECK EXERCISE – 7

1. Science excursions can be known as a trip in _____.

2. Science excursions provide:

a. Practical knowledge to the students.

b. Theoretical knowledge to the students.

c. No knowledge to the students.

d. All of these.

7.10 Concept mapping

Through concept mapping relationships between ideas and concepts can be represented visually. Concepts are often linked by phrases and words and these explain the connection between various ideas, which help the students to structure and organize their thoughts to understand the information and to discover new relationships between various ideas. Concept maps are in the form of a diagram which shows the inter-linkage or relationship between different components of a concept. It enables the students to understand or to learn the concepts more accurately and easily. Concept mapping helps students to relate new ideas with the previous ideas. Concept maps can occur as Venn diagrams, tables, realistic coordinators, outlines, timetables, flowcharts and T-graphs. Concept mapping is usually used in research, education, brainstorming, problem solving and decision - making processes. Concept maps are mostly beneficial for visually impaired children but they can also benefit normal students.

Some types of concept maps are:

a. System maps

b. Hierarchy maps

c. Spider maps

d. Flowcharts

Concept mapping serves several purposes for learners:

· Help the students to brainstorm and to generate new ideas

· Students can discover new concepts.

· It provides opportunity to the students to clearly communicate ideas, thoughts and information.

· Helps the students to integrate new concepts with the existing concepts

· To structure and organize complicated information.

· To promote deeper understanding.

· To identify the patterns between the concepts.

· To share and to communicate knowledge in an effective manner.

Benefits of concept mapping:

a. It helps to synthesize information by linking old and new concepts.

b. It encourages high – level thinking and brainstorming.

c. It leads to the discovery of new concepts and establish connections among them.

d. It encourages collaborative learning.

e. It promotes creativity.

Steps of concept mapping:

1. Identifying concepts.
2. Creating nodes.
3. Establishing relationships.
4. Adding Descriptors.
5. Organizing and structuring

SELF – CHECK EXERCISE -8

1. Concept mapping depicts relationship between _____ and ideas.

2. Which of the following is not a type of concept mapping?

a. Air maps

b. Flowcharts

c. System maps

d. Hierarchy maps

3. Concept maps are also called _____.

7.11 Summary:

So, in this unit we have learnt about visualizing, organizing and contextualizing learning situations through various methods such as Field trips, biological associations, Science fairs and exhibitions, Botanical gardens, Museum, Aquarium and vivarium, biological clubs, Science excursions and concept mapping. All these methods proved to be useful in fostering creative abilities among the children.

7.12 Glossary:

Unsatisfactory: feeling that something is not good enough or not enough.

Climate change: Change in weather patterns which define local, Global and regional climate

of the earth.

Renewable Energy: It is the energy which is derived from natural resources which can

extinguish if consumed at a higher rate.

Creativity: The use of skills to produce something new.

7.13 Answers to Self- Check Exercises

Self - Check Exercise-1

Answer 1. C

Answer 2. D

Self - Check Exercise-2

Answer 1. Informal

Answer 2. Communication skills, creativity, problem solving, critical thinking, time Management.

Self - Check Exercise-3

Answer 1. Indian Botanical Garden

Answer 2. Royal Botanical Gardens

Self - check exercise-4

Answer 1. Fish tanks

Answer 2. Fish bowls

Self - Check Exercise-5

Answer 1.

Answer 2.

Self - Check Exercise-6

Answer 1. B

Answer 2. B

Self - Check Exercise-7

Answer 1. Science

Answer 2. A

Self - Check Exercise-8

Answer 1. Concepts

Anwers 2. A

Answer 3. Conceptual diagrams.

7.14 References/ Suggested Readings:

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Kohli, V.K.(2006): How to Teach Science. Ambala : Vivek Publishers,.

Sharma, P.(2007): Teaching of Life Science, New Delhi: APH Publishing Corporation,.

7.15 Terminal Questions:

Q1. What do you understand about the term Concept mapping?

Q2. Write down briefly the advantages of Botanical Garden.

Q3. Write briefly about aquarium and vivarium.

Q4. What are the merits of field trips?

Q5. What are the limitations of biological clubs.

Q6. Write about Science Fairs and exhibitions.

UNIT-8

FACILITATING LIFE SCIENCE LEARNING

8.1 Introduction:

In this unit, we will learn about collaborative learning, peer learning and the ways of dealing with students in heterogeneous classes. In today's interconnected world, there is a paramount ability to work with others in an effective manner. Peer and collaborative learning harness the power of mutual support, teamwork and knowledge to enhance learning. These approaches also help in the development of various life skills such as problem – solving, critical thinking and communication.

8.2 Learning Objectives

1. To explain the concept of collaborative learning.
2. To understand the concept of facilitating life science learning though peer learning.
3. To explore the ways of dealing with students in heterogeneous classes.

8.3 Facilitating Life Science Learning through Collaborative Learning

Collaborative learning is a technique which the teachers use to divide students into a group so as to impact learning in a positive manner. Collaborative learning means learning in groups rather than learning alone. Collaborative learning emphasizes on active participation and interaction of all members of the group. Collaborative learning can include only two students or a large group of students. Collaborative learning enhances the educational experiences of the children working in groups. In Collaborative learning, students are grouped on the basis of their skills. Collaborative learning focuses on communication, cooperation and mutual support between the students. Students learn together in collaborative learning. Collaborative learning leads to the development of critical thinking abilities, communication abilities and teamwork abilities among the students. Collaborative learning is opposite of traditional classroom learning as it is student – centred. Regular interaction in collaborative learning improves non – verbal and verbal communication skills of the learners. Collaborative learning can be in various forms such as peer review sessions, discussion forums, study groups and group projects. Collaborative learning can motivate the students and they can feel the sense of community as well as support.

Benefits of Collaborative Learning:

a. Students can gain a more comprehensive and deeper understanding of the subject matter through group discussions.

b. Exposure to different perspectives leads to the development of critical thinking abilities.

c. Collaborative learning can help in tackling complex problems.

d. Collaborative learning is more engaging as well as more motivating.

e. It can boost the confidence of the students.

f. Collaborative learning involves discussion, shared inquiry and problem – solving.

Challenges in Collaborative Learning:

a. Only some students can dominate the discussion.

b. Conflicts can be developed due to differences in working styles and opinions.

c. Performance of entire group can be affected, if any one member has not completed the work.

d. It is difficult to coordinate meeting times and schedules.

e. Each member of the group cannot contribute equally in the group project.

SELF CHECK EXERCISE -1

Q1 Collaborative learning is a/an:

a. Individual learning

b. Group learning

c. Teacher learning

d. All of the above

Q2. Which of the following is not a challenge in collaborative learning?

a. It develops confidence among students.

b. Only a few students can dominate the discussion.

c. It is difficult to coordinate the timings of meetings.

d. Conflicts can be developed among group members

8.4 Facilitating Life science Learning through Peer Learning

Peer learning is also called Peer- to - Peer learning. Peer learning is an instructional strategy in which the students can learn with each other and

from each other, without the involvement of the teacher. Peer learning is a versatile approach of learning which enhances understanding, student engagement and collaboration. This method is based on the idea that students can improve their understanding and the retention of knowledge by discussion, interaction and explanation among each other. In Peer learning, students share skills, knowledge and experiences which enhances their understanding of the concepts and subject matter. Peer learning is more engaging than traditional methods of teaching in the classroom. Peer learning makes the educational experience more inclusive, effective and interactive. Peer learning can be used for mutual learning as the participants are interdependent on each other. Through peer learning, students develop their own skills as they organize and plan various learning activities by themselves. Peer learning is used in a variety of contexts and in various disciplines in almost all the countries.

Peer learning represents a two – way learning process. Peer learning is a kind of collaborative learning method. Each peer brings their unique experiences in the learning process. Peer learning allow the students to develop large of skills such as collaboration, communication and critical thinking. Peers can encourage other peers and can provide constructive feedback to others in peer learning.

Various forms of peer learning are:

a. Peer tutoring
b. Peer Teaching
c. Collaborative learning
d. Cooperative learning
e. Reciprocal Peer teaching
f. Discussion Groups
g. Problem based learning
h. Mentoring

Benefits of Peer Learning:

a. It can enhance understanding of the concepts.

b. Regular interaction with others can develop communication skills and boost self- confidence of learners.

c. Exposure to a variety of viewpoints can lead to a deeper understanding of the concept.

d. It develops the skills of problem solving among the students.

e. It develops leadership qualities among the learners.

f. Students learn their own responsibilities.

Challenges of Peer Learning:

a. Accurate explanations cannot always be provided by peers.

b. It can be challenging to determine the effectiveness of peer learning.

c. Lack of participation or dominance by a member can hinder the progress.

d. Misinformation can spread through Peer learning.

e. Poor communication skills can affect Peer learning.

f. Only some students might dominate the discussion other might not even participate.

SELF CHECK EXERCISE-2

1. The given statement is true or false?

In Peer learning, students learn by spoon feeding from their teachers.

2. Name the various forms of Peer learning.

8.6 Dealing with Students in Heterogeneous Classes

A heterogeneous class is a class with different kinds of learners, as compared to a ‘homogeneous’ class, where the learners have similar interests, aptitudes and abilities. There is no such thing as a ‘homogeneous’ class, since no two individuals are similar, in fact the twins are not similar to each other, therefore all the classes consisting of more than one learner are heterogeneous classes. A heterogeneous classroom has learners with different abilities, different styles of learning, different languages etc. Different characteristics of students can be the cause of heterogeneity such as study skills, prior knowledge, motivation, language skills, work experience, performance level, preliminary training etc. In heterogeneous classroom, students can learn from each other’s differences. It may involve use of differentiated instruction, individualized support, flexible grouping, inclusive classroom culture. The teacher’s role is to provide different kinds of learning experiences to the students with the purpose that their specific learning needs can be achieved. Peer tutoring, personalized support and group activities can address individual needs in heterogeneous classroom. Teacher should assess the progress of students regularly and should provide feedback accordingly. The teacher should develop an inclusive environment where all the students can see their worth and can feel valued. The main goal of heterogeneous classroom is to provide opportunities to all the students so that they can learn in a better way and to ensure their success.

Following are the various strategies to deal with the students in heterogeneous classes:

1. Differentiated instruction.
2. Flexible Grouping.
3. Scaffolding
4. Use of Technology
5. Peer Learning
6. Varied Instructional Strategies.

7. Regular assessment and feedback.

8. Individualized Support.

9. Cultural sensitivity and Inclusivity.

10. Promoting a growth mindset.

Benefits of dealing with students in heterogeneous classes are:

a. It promotes inclusivity.

b. It enhances communication and collaboration skills.

c. It leads to improved academic achievement.

d. It provides personalized learning opportunities to children.

e. It encourages critical thinking abilities of students.

f. it helps in breaking down the stereotypes.

Limitations of dealing with students in heterogeneous classes are:

a. It is a challenging approach.

b. It can be difficult to maintain the instructional pace.

c. Challenges in management of behaviour.

d. It may require additional resources.

e. It requires specialized training on the part of the teacher,

f. Students in heterogeneous classroom may face low self – esteem.

SELF CHECK EXERCISE-3

Q1. In heterogeneous classes, learners are:

a. Similar

b. Different

c. Both similar and different

d. All of the above

Q2. Whether the following statement is true or false:

A heterogeneous class is composed of learners with distinct learning abilities, distinct learning styles and distinct language.

8.6 Summary

In this lesson, we studied about the various ways and means of improving learning among the students through organizing different kinds of activities. In order to maximize learning among the students, it is imperative that a teacher should firstly visualize the situation, the availability of resources and other related factors and then plan for the activities to be organized for betterment of learning among the students. An effective life science teacher should make efforts for establishing biological associations and clubs in the schools to promote scientific attitude and aptitude among the students. He should take the students to different agriculture farms, gardens, museums and other important places of science learning to provide real and varied kinds of experiences to the students. He should promote collaborative learning and peer group learning in the class which is the most effective way of enhancing learning among the students. By using such strategies, the individual differences in the class can be met out successfully and effectively.

8.7 Glossary

Learning styles: The way in which a person understands, remembers and expresses information.

Implications: Something that happens or is suggested.

Proficiency: Having a skill, ability or an experience.

Versatile approach: An approach that can be used in various disciplines and various subjects.

Personalized support: It is a type of learning which aims to improve student's skills and strengths.

8.8 Answers to Self - Check Exercises:

Self - Check Exercise-1

Answer 1. B

Answer 2. A

Self - Check Exercise-2

Answer 1. False

Answer 2. Peer tutoring, Peer Teaching, Collaborative learning, Cooperative learning, reciprocal Peer teaching, Discussion Groups, Problem based learning, Mentoring.

Self - Check Exercise-3

Answer 1. B

Answer 2. True

8.9 References/ Suggested Readings

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Venkataish, S.(2002): Science Education in 21st century, New Delhi: Anmol Publications.

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Arnold M.A.(2024): The Future Of Collaborative Learning: Nova Publishers.

8.10 Terminal Questions:

1.What do you mean by peer learning?

2. What do you mean by collaborative learning?

3.Write down the points of difference between peer learning and collaborative learning.

4. What are the limitations of peer learning?

5. What do you understand by heterogeneous classroom

6. Describe the ways of dealing with children in heterogeneous classes.

7. Explain the meaning and disadvantages of collaborative learning?