

Biyani's Think Tank

Concept Based Notes

Pedagogy of Biology

[B.ED –I & II Year]

[B.Ed.M.Ed.] [B.Sc.B.Ed.]

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Preface

I am glad to present this book, especially designed to serve the need soft he students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self- explanatory and adopts the “Teach Yourself” style. It is based on question- answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Dr. Rajeev Biyani, Chairman & Dr. Sanjay Biyani, Director (Acad.) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this Endeavour. They played an active role in coordinating the various stages of this Endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

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Pedagogy of Biology INDEX

| S. No. | Title | Page No. |
|--------|---|----------|
| 1. | Unit-I (Nature, Scope and Objectives) <ul style="list-style-type: none"> Nature of science with special reference to Biology. Main discoveries and development in Biology. Place & values of teaching Biology at secondary/senior secondary level. Correlation of Biology with other subjects. Objectives of teaching Biology at secondary/senior secondary level. | 5-10 |
| 2. | Unit-II (Curriculum and Planning) <ul style="list-style-type: none"> Principles of Biology curriculum at secondary/senior secondary level. Modern trends in Biology Curriculum : B.S.C.S., Critical appraisal of Biology syllabus at secondary/senior secondary level prescribed by Board of Secondary Education, Rajasthan. Planning-Daily lesson plan, unit plan & yearly plan. Qualities & responsibilities of Biology teacher. Teacher's role in training students in scientific method and in developing creativity and scientific temper among their students. | 11-22 |
| 3. | Unit-III (Methods and approaches) <ul style="list-style-type: none"> Lecture method, Demonstration method, Lab based methods, Inductive & deductive method, problem solving, Heuristic, constructivism, & Project method. Inquiry approach, programmed instruction, Group discussion, self study, Team teaching, computer assisted learning, seminars and workshops | 23-27 |
| 4. | Unit-IV (Instructional Support System) <ul style="list-style-type: none"> Multi sensory aids: Charts, models, specimen, bulletin-boards, flannel Board, Transparencies slides, projector, OHP, T.V. and Radio etc. Co-curricular Activities: Organization of science club, science fair, trips and use of community resources. Biology Lab: Organization of Biology Laboratory, Arrangement of Apparatus, Care & Maintenance of equipment & specimen, organization of practical work in Biology. Role of state & National Level Instructions & Laboratories Research centers in Botany, Zoology & Agriculture, Characteristics of a good text book and Evaluation of a Text Book. | 28-33 |
| 5. | Unit-V (Evaluation in Biology) <ul style="list-style-type: none"> Evaluation: Concept, Types and purposes. Type of test items and their construction. Preparation of Blue Print & Achievement Test. Evaluation of practical work in Biology. | 34-39 |

SYLLABUS

PAPER:-VIIA/B

PEDAGOGY OF BIOLOGY

Objectives:

To enable student Teacher to

1. Understand the Nature, Place Values and objectives of teaching Biology at Senior Secondary level.
2. Establish its correlation with other subjects
3. Evaluate critically the existing syllabus of Biology prescribed for Secondary/Senior Secondary level in the state of Rajasthan
4. Develop yearly plan unit plan and lesson plan for Senior Secondary classes.
5. Provide training in Scientific method and develop Scientific temper among their students.
6. Use various methods and approaches of teaching Biology
7. Acquire the ability to develop instructional support system.
8. Plan and organize chemistry practical work at the Laboratory.
9. Organise Co-curricular activities and utilize community resources promoting Science learning.
10. Use most appropriate method to assess the progress and achievement of the pupil & thus prepare appropriate test for the purpose (both theoretical & practical)

UNIT-I Nature, Scope and Objectives

- Nature of science with special reference to Biology.
- Main discoveries and development in Biology.
- Place & values of teaching Biology at secondary/senior secondary level.
- Correlation of Biology with other subjects.
- Objectives of teaching Biology at secondary/senior secondary level.

UNIT-II Curriculum and Planning

- Principles of Biology curriculum at secondary/senior secondary level.
- Modern trends in Biology Curriculum: B.S.C.S.,
- Critical appraisal of Biology syllabus at secondary/senior secondary level prescribed by Board of secondary Education, Rajasthan.

- Planning- Daily lesson plan, unit plan & yearly plan.
- Qualities & responsibilities of Biology teacher. Teacher's role in training students in scientific method and in developing creativity and scientific temper among their students.

UNIT-III Methods and approaches

- Lecture method, Demonstration method, Lab.based methods, Inductive & deductive method, problem solving, Heuristic, Constructivism, & Project method.
- Inquiry approach, programmed instruction, Group discussion, self study, Team teaching, computer assisted learning, seminars and workshops.

UNIT-IV Instructional Support System

- Multi sensory aids: Charts, models, specimen, bulletin boards, flannel Board, Transparencies slides, projector, OHP, Computer, T.V., and Radio etc.
- Co-curricular Activities: Organization of science club, science fair, trips and use of community resources.
- Biology Lab: Organization of Biology Laboratory, Arrangement of Apparatus, Care & Maintenance of equipment & specimen, organization of practical work in Biology.
- Role of state & National Level Instructions & Laboratories Research centers in Botany, Zoology & Agriculture.
- Characteristics of a good text book and Evaluation of a Text Book.

UNIT-V Evaluation in Biology

- Evaluation: Concept, Types and purposes.
- Type of test items and their construction.
- Preparation of Blue Print & Achievement Test.
- Evaluation of practical work in Biology.

Sessional Work: (20 Marks)

(1) Class Test 10 Marks

(2) Any one of the following- 10 Marks

- Life sketch & contribution of any one prominent Indian Biologist.
- Preparation of Harbarium (scrap book)

- Prepare any one of the following related to environment education.
- Poster (miniature), (ii) Article, (iii) Story, (iv) Play
- Description of any two teaching models.
- Prepare a Radio or T.V. script.
- Make a list of local (resources useful in teaching Biology and prepared lesson plan using some of them.
- A case study of any one senior secondary lab of Biology.
- Preparation of 10 frames of Linear or Branching type programmes on any topic of Biology.
- Construction and administration of Diagnostic test on any one unit of Biology.

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UNIT-1

Nature, Scope and Objectives

Short Answer Questions

Q.1 What do you mean by Biology?

Ans. Biology is a science that deals with the study of living objects. The term biology was coined by the **Lamarck** and **Treviranus**. It is derived from the two Greek words **bios** and **logos**. Bios stands for life and logos stands for discourse. The study of plants and animals, their structure, functions, nutrition, reproduction, adaptation, distribution, their relationship with one another, life history etc. are some of the contents of biology.

Q.2 Write three main recent discoveries in the field of Biology.

Ans. Three main recent discoveries in the field of Biology-

1. In 2007 Michael Worobey traced the evolutionary origins of HIV by analyzing its genetic mutation.
2. In 2008 Houston based Introgen developed Advexin the first gene therapy for cancer.
3. In 2010, the first full face transplant was carried out by Spanish doctors on a male adult who had injured himself in a shooting accident five years previously.

Q.3 Explain the nature of Biology.

Ans. The biology has 3 fold natures which are-

1. **As a domain of enquiry** - Science involves method of enquiry which tries to give explanations of facts and future statement. This enquiry method is logical, reliable impartial and objective.
2. **Dynamic body of knowledge** -Science is dynamic by nature and not static. The results obtained through the search for truth can be challenged and modified.
3. **As a process of constructing knowledge**— Science is a process as well as the product of that process. In scientific process one can

construct his own knowledge and the acquisition of scientific attitude is one of the most important outcomes of this process

Q4. What values could be developed in students by the teaching of Biology?

Ans. Values emerge from science, both as a process and product. Some of the values are-

1. Intellectual value
2. Scientific value
3. Vocational value
4. Psychological value
5. Utilitarian values
6. Aesthetic value

Q.5 Biological science occupies a significant place in school curriculum, why?

Ans. Biological science occupies a significant place in school curriculum because of the following points:-

- i. Biology influences our daily lives as it is connected with our basic requirements of food, clothing, fuel, timber, fruits, milk, meat etc.
- ii. The study of Biology helps us to understand the structure and functions of different body parts to keep them fit and healthy.
- iii. Our present day human society is facing many burning questions like population explosion, AIDS, food production, global warming etc. These questions can be solved only by the study of biology.
- iv. Biology provides knowledge, skills and measures for the prevention and promotion of better health.
- v. A student of biology stream can help in proper exploitation of economic plants, animals and microbes, through specialization in fields like agriculture, fishery, sericulture, apiculture etc.

Essay type questions-

Q.6 Define correlation. How will you correlate Biology with other subjects? Explain with examples.

Ans. According to Munn “Correlation is a statistical measure on the degree of association between two variables.”

Correlation is very important for unification of knowledge. It involves the combining of two or more academic disciplines into one activity.

Correlation with other science subjects– All the branches of science are interdependent on each other.

- a. **With chemistry**– Correlation of biology with chemistry develops new branch biochemistry. In all the life processes like digestion, breathing, circulation, excretion, photo synthesis, chemical reactions take place.
- b. **With physics** - Correlation of biology with physics develops new branches of physics which are used in study of biological structures, processes and problems instruments like microscope, spectrophotometer, centrifuge etc. All these are contributions of physics. High powered electron microscope was built on the basis of electromagnetic theory of physics. The microscope gave finer details of cells and tissues

Correlation with other school subjects- Biology can only not be studied alone; it can be correlated with other subjects also –

- i. **With mathematics**– Mathematics is the soul of science. We cannot study biology without the help of mathematics. For example, Mendel’s laws are based on mathematical calculation. Mathematics is useful to measure our body temperature, breathing rate, blood pressure root pressure, etc.
- ii. **With geography**- Geography is helpful in studying distribution plants and of animals. Effect climatic factors types of soil on plants growth and distribution are common in both subjects. Study of evolution can be done on the basis of fossils found inside the earth.

- iii. **With language**– Fluency of language is a key factor to express all scientific laws and principles. Language makes the thought clear, concise and correct. Thus Biology and language are correlated.
- iv. **With history**– Biology has direct correlation to history as the history of inventions and discoveries provide useful back ground for the teachers of biology. History of invention of cell, DNA, genes, chromosomes etc. is the basic of genetic engineering.
- v. **With civics**– Both the subjects are taught with the same aim of making pupils good and responsible citizens. Biology helps students to understand healthy life, infections of diseases, and cleanliness of environment and make them responsible citizens.
- vi. **With arts**- Drawing and painting is very essential for a biology student. The preparation of charts, picture, models about the structure of heart, brain, kidney and digestive organs, requires some skill of painting so a biology teacher and a biology student should be perfect in drawing and painting.
- vii. **With craft**- Biology is highly correlated with craft because making herbarium, working and non-working models. Improvised apparatus are all craft.

With social and physical environment- It is very essential to develop positive correlation between biology and environment knowledge of biology is very helpful to develops good environment and healthy environment gives healthy living and awareness about the values and values are required for a healthy social life. A biology teacher should correlate the teaching with social and physical environment by taking the students to a factory , dairy farm, while dealing with the topic concerning these and by quoting examples from the daily life of the student.

Q.7 What is the difference between aims and objectives? Describe Bloom's "taxonomy of educational objectives".

Ans. Differences between Aims & Objectives

| Sr. No. | Aims | Objectives |
|---------|---|---|
| 1 | Aims are directions in education. | An objective is an end point of possible achievement. |
| 2 | Aims are subjective in nature. | Objectives have objectivity. |
| 3 | Aims are broad and general. | Objectives are specific, precise and clearly defined. |
| 4 | Aims are directions encompassing the entire educational system in and out of school. | Objectives vary from subject to subject. |
| 5 | The attainment of aims is beyond the scope of the school as it involves all-round growth. | These are specific, immediate and attainable goals. |
| 6 | EG: Aesthetic sense will be developed | EG. Student will be able to define biodiversity |

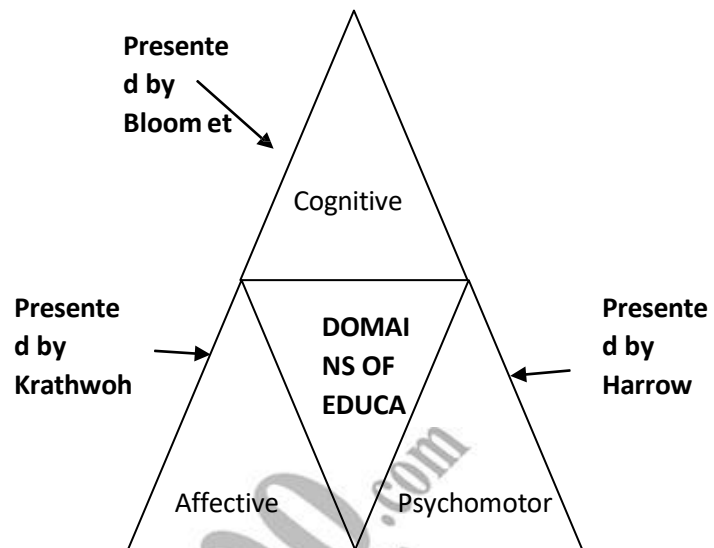
Blooms Taxonomy of Instructional Objectives-

The taxonomy means a system of classification. The Taxonomy of educational and instructional objectives was created in 1956 under the leadership of educational psychologist Dr Benjamin Bloom.

According to Bloom (Bloom ET al.1956) Behavior is divided into three domains:

- i. **Cognitive (Head)** - It is concerned with the development of concepts, ideas, factual knowledge.
- ii. **Affective (Heart)**- It develops attitude, values and ethics.
- iii. **Psychomotor (Hand)**- It is concerned with the development of motor skills of children.

The taxonomy of educational objectives has also been considered to be belonging to these three domains:



| AFFECTIVE DOMAIN |
|------------------|
| Characterization |
| Organization |
| Valuing |
| Responding |
| Receiving |

| PSYCHOMOTOR DOMAIN |
|--------------------|
| Naturalization |
| Articulation |
| Precision |
| Manipulation |
| Imitation |

| COGNITIVE DOMAIN |
|------------------|
| Evaluation |
| Synthesis |
| Analysis |
| Application |
| Comprehension |
| Knowledge |

UNIT-2

Curriculum and planning

Short Answer Questions-

Q.1 Define curriculum.

Ans. The word Curriculum is derived from a Latin word “currier” which means “to run”. Thus, curriculum means a course to run by a student for achieving the aims and objectives of education.

According to Cunningham “**Curriculum is the tool in the hands of the artist (the teacher) to mould his material (the pupils) according to his ideals (aims and objectives) in his studio (the school)**”.

Q2. What is the difference between curriculum and syllabus?

Ans. Difference between Curriculum and Syllabus

| Sr. No. | Curriculum | Syllabus |
|---------|---|---|
| 1 | Curriculum is a continuous developing process. | Syllabus is a part of Curriculum. |
| 2 | Curriculum of education is designed to achieve goal or aim. | Syllabi are prepared to achieve specific objectives. |
| 3 | The Curriculum is teacher centered, child centered, activity centered. | A syllabus is mainly content centered and objective centered. |
| 4 | Curriculum includes co- curricular activities + syllabus. | Co-curricular activities are not the part of syllabi. |
| 5 | Curriculum develop physical, mental, social and all aspect of the personality of child. | A syllabus develops only cognitive aspect of child. |

Q.3 Write five principles of curriculum development?

Ans. Principles of curriculum development are-

1. Principle of suitability to the cognitive level and age of children
2. Principle of need of learner
3. Principle of child centeredness
4. Principle of flexibility
5. Principle of correlation

Q.4 Write a short note on BSCS (Biological Sciences Curriculum Study).

Ans. BSCS (Biological Sciences Curriculum Study)- BSCS is a non-profit curriculum study committed to transforming science teaching and learning since 1958.

VISION- Its vision and work are grounded in research about what makes a difference in education and what a high quality science education could and should be.

Mission- Its mission is to transform science teaching and learning through research and development that strengthens learning environments and inspires a global community of scientifically literate citizens.

Goal- The initial goal of BSCS was the production of classroom material for the average students in first course of biology at the secondary school level produced three versions of text book with coordinated student laboratory manuals and teachers guides.

Q.5 Write difference between unit plan and daily lesson plan.

Ans. Some of the differences between unit and lesson plan are as follows –

| Sr. No. | Unit Plan | Lesson Plan |
|---------|--|---|
| 1. | A unit represents a part of the course which includes 2-7 lessons. | A lesson represents a single segment of the course which can be covered in one period |
| 2. | A unit represents a series of lessons which are inter-related and inter-dependent. | A lesson represents a single topic meant for one period. |
| 3. | Unit plan includes general or specific objectives which are broad in scope. | Lesson plan includes only specific objectives which are limited in scope. |

| | | |
|----|--|---|
| 4. | Unit plan presents a comprehensive view of all components, namely, objectives, learning activities and evaluation. | A lesson plan represents selected instructional strategies, learning activities and test items. |
|----|--|---|

Q6. What is the importance of a good unit plan?

Ans. Importance of unit plan –

- i. The syllabus in terms of contents and leaning experiences to be covered in the whole session is suitably divided into units in view of the time available for the teaching of biology.
- ii. It helps in the proper coverage of the syllabus within the available time and duration of the session.
- iii. The organization of the subject matter and learning experiences into such meaningful whole proves quite advantageous both from the educational as well as psychological angles to the students.
- iv. Unit planning lays proper stress on the formulation of teaching-learning objectives of the unit in the behavioral terms. It makes the students and teacher both clears about their functions and goals of their striving.
- v. In unit planning, a teacher is well informed about the type of methods and strategies used aid material and resources utilized for the teaching- learning of the various sub- units.

Essay type questions-

Q7. What is a lesson plan? Prepare lesson plan on any topic of biology.

Ans. A lesson plan is a blue print, a line of action to be organizing a learning activity for a period. It is a design for action in the classroom.

Lester B. Stands, “A lesson plan is actually a plan of action it therefore, includes the working philosophy of the teacher, her knowledge of philosophy, her information about and understanding of her pupils, her comprehension of objectives of education, her knowledge of the material to be taught, and her ability to utilize effective methods.

Daily Lesson Plan

Topic – Phylum vertebrata

Class- 9th

Date –

Subject – Biology

Period- 2nd

Time: 30 minutes

| S. No. | Objective | Behavioral changes |
|--------|----------------|--|
| 1. | Knowledge | i. Students can recognize the knowledge about Phylum vertebrata. ii. Students can recall the knowledge about Phylum vertebrata. |
| 2. | Under standing | i. Students are able to define the different classes of Phylum vertebrata. ii. Students are able to differentiate between different classes of Phylum vertebrata. |
| 3. | Application | i. Students can use the knowledge of Phylum vertebrata in daily life or in upcoming classes. |
| 4 | Skill | i. Students can draw diagram of members of different classes of Phylum vertebrata. |

Introductory Questions–

| S. No. | Pupil teacher activity | Student activity |
|--------|--|-------------------------------------|
| 1. | Name some living organisms you generally see around you. | Plant, animals, microorganisms, etc |
| 2. | Grouping of these organisms known as? | Classification |
| 3. | How many groups are there in Whitaker's classification? | Five |
| 4. | Which is the 5 th group in this classification? | vertebrata |
| 5. | Name some classes of Phylum vertebrata | Not clear |

Presentation -

| Teaching point | Pupil activity | teacher's activity | Student's activity | Black board activity |
|----------------|---|--------------------|--|----------------------|
| | <p>Developmentary questions–</p> <p>Q.1 Organisms having Backbone are putted in which Phylum?</p> <p>Q.2Which organisms of vertebrata are found in water?</p> <p>Q.3Fishes are putted in which class?</p> | | <p>Vertebrata</p> <p>Fishes</p> <p>Not clear</p> | |

| | | | |
|------------|--|--|--|
| Pisces | <p>Pupil teacher's statement –Pisces are fishes. They are exclusively water living animals. Their skin is covered with scales or plates. Tail is used for movement. They are cold blooded and have two chambered heart. They lay eggs. Some fishes have skeleton made up of cartilage, such as sharks and some have skeleton made up of both bone and cartilage, such as Rohu.</p> <p>Developmentary questions:-</p> <p>Q.1 Name any animal which can be seen during rainy season.</p> <p>Q.2 where does frog live?</p> <p>Q.3 In which class frogs are putted?</p> | <p>Students are listening carefully and writing down the blackboard work</p> <p>Frog</p> <p>Both in water and land</p> <p>Not clear</p> <p>Students are listening carefully and writing down the</p> | <p>Characteristics of Pisces:</p> <ol style="list-style-type: none"> 1. skin has scales or plates 2. two-chambered heart 3. cold-blooded 3. lay eggs <p>Eg. Sharks, rohu etc.</p> <p>Characteristics of Amphibian-</p> <ol style="list-style-type: none"> 1. Lake of scales 2. Three-chambered heart 3. Respiration |
| Amphibian. | | | |

| | | | |
|----------|--|---|---|
| | <p>Pupil teacher's statement-Frogs are putted in class Amphibian. All amphibians begin their life in water with gills and tails. As they grow, they develop lungs and legs for their life on land. They are cold-blooded. They differ from fish in lake of scales, in having mucus glands on skin and a three chambered heart.</p> <p>Example – frogs, toad, salamander etc.</p> <p>Developmentary questions:-</p> <p>Q.1 Name any animal which can be seen on house walls.</p> <p>Q.2 Name some other crawling animals.</p> <p>Q.3 In which class crawling animals are</p> | <p>blackboard work</p> <p>Lizard</p> <p>Snakes, crocodiles</p> <p>Not clear</p> <p>Students are listening carefully and writing down the blackboard</p> | <p>through lungs ,skin and gills</p> <p>Characteristics of Reptiles-</p> <ol style="list-style-type: none"> 1.cold blooded 2. three-chambered heart(crocodile- four chambers) 3.lay eggs |
| Reptiles | | | |

(2) which reptile has four chambered heart-

a) crocodile

b) frog

b) turtle

c) snake

Fill in the blanks-

(3) Pisces have ----- chambered heart.

(4) Crawling animals are putted in class -----.

True or False-

(5) Amphibians are warm blooded animals.

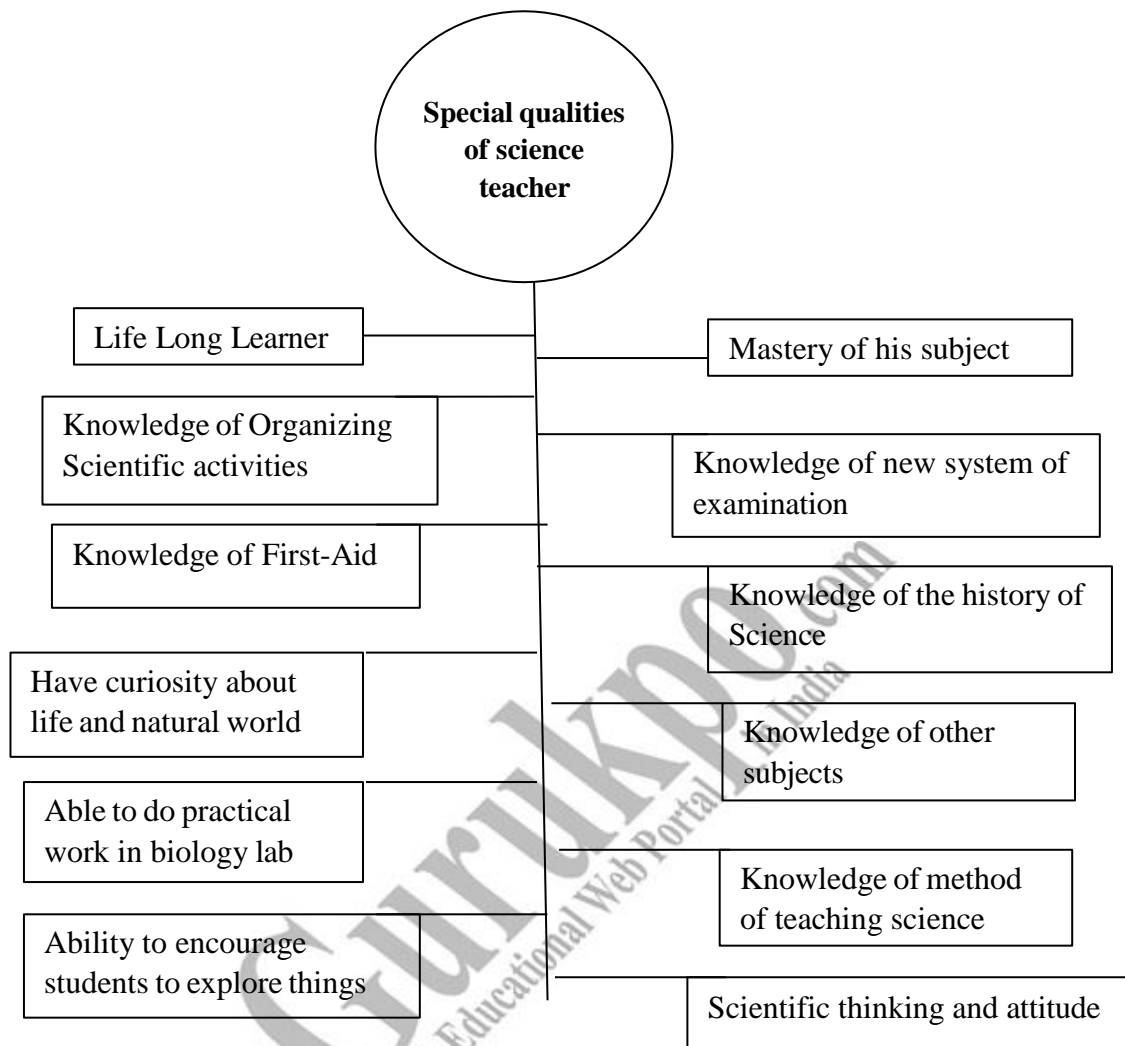
(6) Reptiles lay eggs with tough covering.

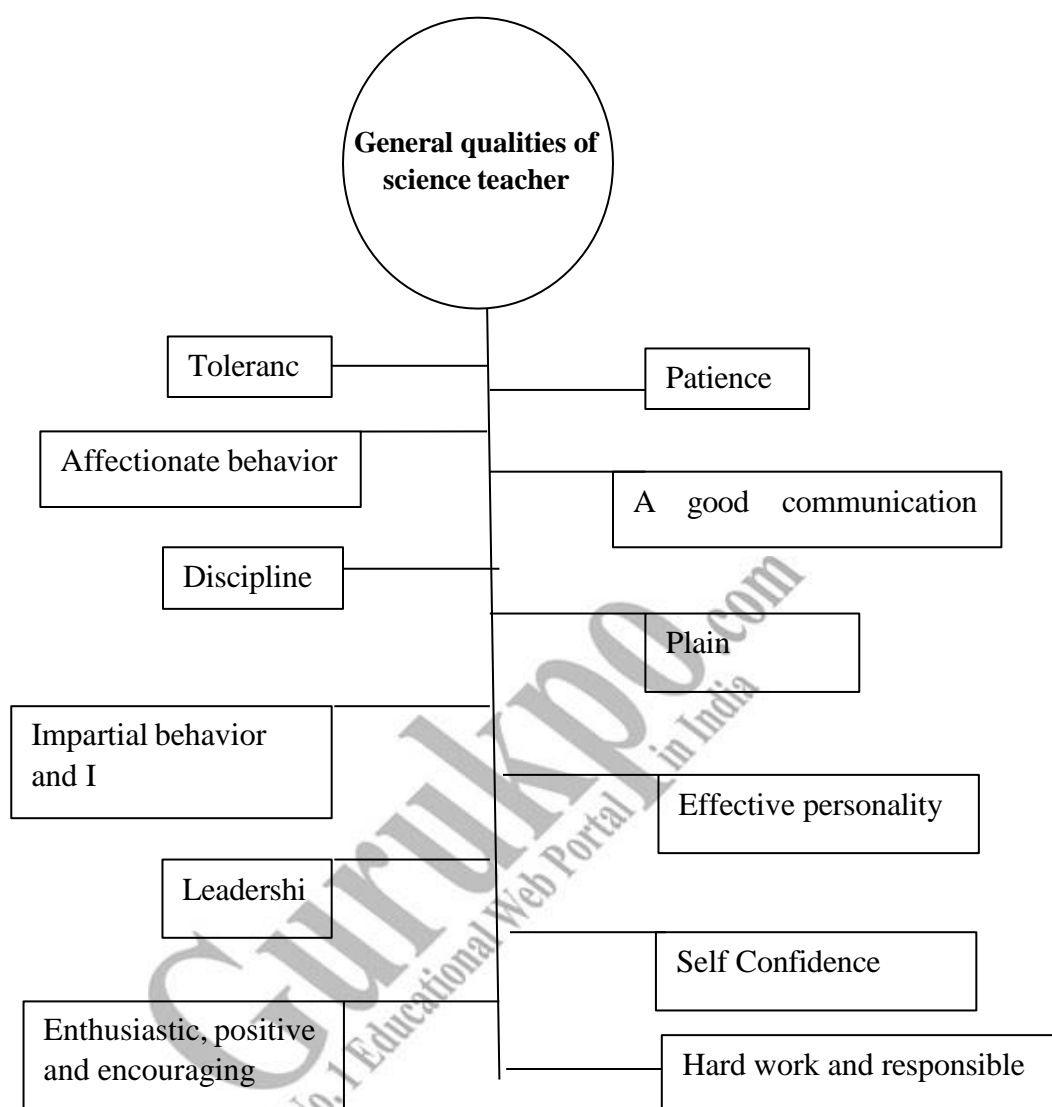
Home work-

Draw the diagrams and write down characteristics of the class amphibian and Pisces.

Q8. Explain the qualities of a biology teacher.

Ans. A biology teacher must possess some additional qualities specific to their chosen subject area –





Q.9 Discuss how will you develop scientific attitude in your students through teaching of Biology.

Ans. To develop scientific attitude teachers must encourage the pupils towards initiative, curiosity and questioning and inspire the pupils towards independent learning and working. Some methods to develop scientific attitude in students are

1. **Satisfy the curiosity of students in a proper manner-** Students have many queries related to their environment. For example “Why water boils after heating? Why we feel cool under a tree?” A teacher needs to satisfy these curiosities in a proper way.

2. **Using proper teaching methods-** A teacher can use many methods and strategies to develop Scientific attitude among students as problem solving, enquiry approach, using a model, biographies of scientists , role playing and small group activities and students should be made to practice and observe science.
3. **Classroom environment-** A democratic classroom environment is very helpful to create scientific attitude among students. In a democratic classroom students are free to question and discuss and get to the prejudices and difficulties removed.
4. **Personality of teacher-** The scientific attitude of teacher encourages students in exploring problem, find out solution and proposing ways of testing data. An enthusiastic teacher can help in developing scientific attitude through the curriculum.
5. **Active learning environment-** A biology student can get active learning environment in a laboratory. In a laboratory they can find out the methods of solving their own problems. For example “growing bean seeds in the laboratory under controlled condition and finding out the condition necessary for growth and factors, which promote growth, will provide an opportunity to the students to develop and insight into the scientific method.
6. **Get rid of the superstitions-** for removing the superstitions and false beliefs, from the mind of students the teacher should usually put such type of questions as “what evidence or proof have you got for this belief?
7. **Scientific literature-** The pupils who engage in reading in scientific literature develop scientific attitude more than those who read only one textbook.

UNIT-3

Methods and approaches

Short Answer Questions

Q.1 What do you mean by teaching methods?

Ans. According to Gage “Teaching methods are patterns of teaching behavior that are recurrent, applicable to various subject matters, characteristics of more than one teacher and relevant to learning”.

Q.2 Write five criteria for selection of teaching method.

Ans. Five criteria for selection of teaching method-

1. The method should be according to the mental age of the student.
2. The method selected should be able to arouse interest and enthusiasm to learn.
3. The method should be selected according to the teaching objectives.
4. The method should have a relevance to the content to be taught and help to make the study of the content interesting.

Q.3 What are the three main categories of teaching methods?

Ans. Methods can be classified under three main categories

1. **Teacher centered method-** In teacher centered method teacher is dominating and students are simply passive. For example Lecture method, Demonstration method.
2. **Pupil centered method-** In these methods students are active in performing activities and participating in discussion. For example Heuristic method, laboratory method, Problem solving method, Assignments.
3. **Group Centered method-** In group centered method groups are dominant and not the individual. For example Discussion and Project.

Q.4 Write short note on problem solving method.

Ans. According to Skinner “Problem solving is the framework or pattern within which creative thinking and reasoning takes place”.

Steps involved in problem solving method are:

1. Identifying and defining problem
2. Formulating hypothesis
3. Testing hypothesis by collecting data
4. Interpreting result
5. Drawing conclusion and preparing records.

Q.5 Write advantages of laboratory method.

Ans. Advantages of Laboratory method are-

1. This method is based on the maxims of learning like “known to unknown, simple to complex, concrete to abstract”.
2. In this method student learns the facts and principles of biology by performing the experiment and observing the process.
3. The knowledge gained through this method is more lasting and permanent.
4. As the students work in groups, there is a spirit of cooperation developed among students.
5. Students imbibe the virtues like truthfulness, honesty and sincerity as they conduct their experiment honestly and record the observations truthfully.

Q.6 What are the principles of project methods?

Ans. According to Kilpatrick “A project is a whole hearted purposeful activity proceeding in a social environment”.

Principles of Project method are-

- i. Learning by doing.
- ii. Learning by observation.
- iii. Learning by trial and error.
- iv. Learning by living.
- v. Principle of readiness.

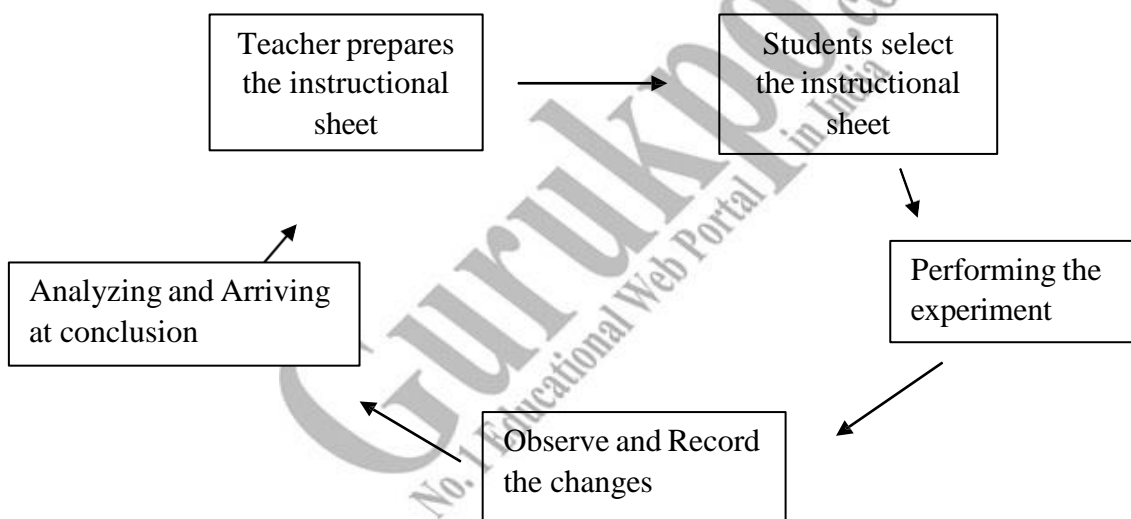
Essay Type Questions

Q.7 Explain Heuristic method in detail.

Ans. This method was given by Prof. H.C. Armstrong (1968). The word Heuristic means ‘to discover’.

According to Professor Armstrong, "Heuristic methods of teaching are methods which involve our placing students as far as possible in the altitude of the discoverer - methods which involve their finding out instead of being merely told about things".

Steps of Heuristic Method



Advantages of Heuristic Method

1. This method helps students to think independently and solve problems.
2. It is based on psychological principle of learning by doing.
3. It helps the child to imbibe good traits of personality like self-confidence, self-reliance, honesty, independent thinking etc.
4. It helps in developing scientific attitude and creativity in the learners.
5. The knowledge gained by this method remains long lasting

Disadvantages of Heuristic Method-

1. It is very time consuming and very expensive method.
2. This method is suitable only for a gifted child.
3. Placing students in a position of independent worker seems to be extraordinary demand for students.
4. This method is not suitable for a large number of students in a class.
5. This method is not suitable for the lower classes.

Q.8 Discuss briefly the advantages and disadvantages of Demonstration method of teaching of Biology.

Ans. According to Weaver and Cencil “The most effective way to teach an occupational skill is to demonstrate it. One of the two most essential teaching skills is the ability to demonstrate; the other is the ability to explain. Both are vital to the success of either an operation lesson or an information lesson”.

Advantages of Demonstration method:-

1. It is economical in Indian context as it requires less equipment and material in comparison with laboratory method.
2. It provides an opportunity for learning biology as an enquiry.
3. It can promote relevant and useful discussion in the class by providing opportunity for questioning and reviewing.
4. It is one of the best means to illustrate and verify facts.
5. It makes the teaching learning process more concrete because students get an opportunity to see, observe and study the real objects.

Disadvantages of Demonstration method:-

1. All the students don't get a chance to participate in the demonstration.
2. In large classes many students can miss a point presented through demonstration.
3. All the students may not be able to observe as the pace of demonstration at time so fast.
4. It is not possible to teach each topic by demonstration method.

5. Lack of prior preparation makes demonstration a failure.

Q.9 What do you mean by Enquiry approach? Write merits and demerits of this method.

Ans. Enquiry approach is based on Richard Schuman's enquiry model.

According to Gagne (1963), “Enquiry is apparently a set of activities characterized by problem solving approach in which each newly encountered phenomenon becomes a challenge for thinking”.

In this method of teaching, biology teacher does a demonstration or draws diagram on the black board from which students get puzzled and ask some questions which have ‘Yes’ or ‘No’ answers and then they make a conclusion.

Advantages of Enquiry approach

- i. In this approach learner tries to learn himself by using his mental processes. It increases his intellectual potency.
- ii. This approach needs external motivation. A sense of achievement and a feeling of discovery give internal motivation which inculcates a positive attitude towards learning and searching.
- iii. By practicing students learn to organize and conduct investigations.
- iv. This approach is very helpful in memory conservation of the learner.
- v. It increases the achievement level of the learner.

Disadvantages of Enquiry approach

- i. Teachers are not properly trained to guide students learning through enquiry.
- ii. This method is slow and time consuming.
- iii. In this method teachers feel difficulty to give answers of diverse questions asked by students.
- iv. As the examinations are knowledge based and questions are recall type thus enquiry skills are de-emphasized.
- v. All the students are not capable to learn by this approach.

UNIT-4

Instructional supporting system

Short Answer Questions

Q.1 Write Criteria for Selection of a Good Biology Text Book

Ans. The general criteria which should be looked into while selecting a biology text book are

1. The level of complexity of the text corresponding to intellectual level of student.
2. The nature of the illustrations.
3. The suggested supplementary activities.
4. The provision for individual differences.
5. The style of writing.
6. The clarity and organization of material.

Q.2 Define Audio –Visual Aids.

Ans. Audio- Visual aids play important role in the concept formation and in permanent learning of students. Audio- Visual aids means all those sources which makes the audio and visual sense organs of the pupil activated and they can understand difficult ideas of the lesson very conveniently.

According to Burton “Audio visual Aids are those sensory objects or images which initiate or stimulate and reinforce learning”

Q.3 What are the advantages of radio as a teaching aid?

Ans. The advantages of radio as a teaching aid are as follows

- i. To inspire the students to gain greater knowledge. This can be achieved by broadcasting the biographies of people like A.P.J. Abdul Kalam, Homi Jahangir Bhabha, Hargobind Khurana etc. who have contribution to advancement of knowledge in specific areas.
- ii. Radio broadcasts provide learning experiences to a large number of persons at a time.

- iii. Radio broadcasts make possible to hear the lectures, communication and debates etc. In these prominent teachers, writers, learned persons and important personalities participate. These occasions provide educational and psychological value to the students.
- iv. They help to bring the school into contact with the world around.

Q4. What are the needs and importance of audio- visual aids?

Ans. The need and importance of Audio- visuals aids are as follows-

1. They provide motivation and curiosity to the pupil in the learning activity by attracting the attention of the pupils.
2. Audio-visual aids help in developing perception.
3. The pupils get various opportunities of doing various activities by using audio-visual aids.
4. The use of Audio-visual aids clarifies the most difficult contents.
5. It helps in developing healthy classroom interaction fostering scientific thinking among the students.

Q.6 Write short note on flannel board.

Ans. This is also a useful aid which can be applied in teaching science. The chief value of this is that the prepared diagrams are ready for use without loss of time. They are available instantly when they are needed and can be used again over a period of years by the teacher. This board is very useful in situations where it is very difficult to draw a complicated diagram in the chalk board within the limited period of class time. For example, stages of embryo development, different organs of nervous system.

Essay Type Questions

Q7. What are the Principles of selection of Audio-Visual aids

Ans. Proper use of teaching aids requires a considerable investment of time and thought. In choosing the best device for use in a particular presentation in a class, the following principles of selection must be considered-

1. **Principle of content relevance-** The teaching aid should be relevant to the content and content relevance can be found through content analysis.
2. **Principle of Objective base-** Teaching aid should be based on the objectives that have to be achieved whether it is knowledge, understanding, skill etc.
3. **Principle of individual difference-** The teaching aid should be chosen according to age, intelligence and the experience of the students.
4. **Principle of cost-** Principle of cost is very important in choosing a teaching aid.
5. **Principle of technical quality-** The technical quality of the teaching aids like photography, color, exposure, sound etc. must be satisfactory.
6. **Principle of availability-** The teaching aid should be available whenever and wherever needed.
7. **Principle of Appropriate time-** Teaching aid should be used at appropriate time. It can be used either at the beginning, middle or at the end i.e. during introduction, explanation or evaluation stage.
8. **Principle of simplicity-** The aids used should be quite simple in its construction and use.
9. **Principle of environment centeredness-** The aid material should suit the requirement of the physical, social and cultural environment of the students.
10. **Principle of participation of students-** While using teaching aid teacher should also see that the students are also participating in the teaching learning process.
11. **Principle of visibility and display-** Teaching aid should be visible to the entire class and should always try to clarify the concept and not making it more complex.

Q.8 Make a plan of a biology laboratory.

Ans. Lecture-room cum laboratory plan - The plan was devised by Dr. R.H. Whitehouse, formerly principal of the Central Training College, Lahore for high schools. It is economical and at the same time provides an atmosphere of science. Its details are as follows—

Layout— Dr. Whitehouse suggested a combined lecture and laboratory of 45'x25' for a class of 40 students in demonstration and 20 in practical work. Half of this is used as lecture-room and half as laboratory.

Walls— The walls are about 1½' thick which is quite common in our country. If it can be afforded some paint or distemper is better than white washing because it does not need annual white-washing and secondly the walls do not look so ugly even if spoiled by some chemical etc.

Floor— The floor should be cemented. Though it costs much in the initial stages yet proves cheaper in the long run The smooth floor can be easily cleaned. A conglomerate floor over lime concrete, covered by cement plaster is recommended. a slight slope in floor is better for it can sweep easily. Round corners avoid any lodging of dirt.

Windows— For side lighting three windows of 6' across and 7' or 6' high are provided. One near the practical benches and two near the seating accommodation. These should open towards outwards so that the inner window-sills can be used as shelves. A system of window blinds can also be used for darkening the room. Wire- gauze screen should be fitted to avoid the flies and mosquitoes etc. If the light is insufficient, sky-light can be resorted to. Proper ventilation is necessary and for this adequate windows should be provided.

Doors— There is two doors on near the lecture-room and another near the laboratory. Like windows they also open towards outside in order to provide an easy and quick exit in case of some accident.

Furnishing— Towards the lecture\room side is provided a wall black-board 10'x4'. It can be simply a cemented area of the wall. At a distance of 3' from it is the teacher's table 6'x2½' high. This table can be used by the

teacher for writing purposes as well as for demonstration. Moreover, no raised platform is required with the table.

The seating area for the class is on the same level and no gallery is provided because it costs much and is difficult to clean. Twenty dual tables and forty chairs are provided for the students. The dimensions of the dual table are 3½' long, 1½' wide and 2' high. A shelf for books can be provided in the table at a sufficient height to allow for pupil's knees to go under the table when sitting. The tables and chairs are made of 'Sheesham' wood and are perfectly polished. The top of the tables is kept plain because the articles placed on it are not liable to fall as is the case in sloping top table.

Notice-boards for assignments of work, results of tests, etc may find a place on the wall between the windows or just inside the doors.

Water supply– The problem of water supply differs from place to place. Whatever may be the source of water-supply it is always better to store it in galvanized iron tanks for regular supply of water in the laboratory.

Q.9. Explain science club with its objectives.

Ans. The formal classroom teaching or laboratory work alone can neither help in providing wider opportunities for the inculcation and development of scientific interest and attitude nor it caters to the development and realization of the scientific talent, therefore for serving the desired purpose there is a need of some other platform. The role of such platform can be played by the science club organized in school. Science club is the place where the pupils can engage in their individual interests, it provides an equal opportunity to the pupils to express their creative abilities and foster development of new ideas. A science club is an out-of-school-hours club that offers children the chance to do science-related activities that extend and enhance the science they experience in the classroom.

Objectives of Science club

The objectives of a science club may be outline as follows:

1. To provide proper incentive and inspiration for the pursuit of scientific knowledge in vigorous way by broadening their scientific outlook.

2. To provide opportunities for bringing school close to the society and to acquaint the people with the services and contribution of the science in their life.
3. To develop among the student the spirit and attitude of healthy competition for the individual and social cause.
4. To help the students in imbibing the habit of self- reliance, self-dependence and love for manual work.
5. To provide opportunity for the development of the constructive, explorative and inventive facilities of the students.
6. To make the students understand the values of time and to help them in the proper utilization to their leisure hours.
7. To create interest in latest inventions and discoveries of science in various fields and to get acquainted with the life history and contributions of great scientists.
8. To develop students, interest and participation in the practical application of the knowledge related to different branches of sciences.
9. To create interest in scientific facts and events related to one's surroundings.
10. To develop training in scientific method of problem solving.

UNIT -5

Evaluation in Biology

Short Answer Questions

Q1. Explain the Concept of Evaluation.

Ans. In instructional processes evaluation plays a very important role to diagnose the effectiveness of teacher performance and pupils learning .Evaluation is a systematic process of determining the extent to which instructional objectives are achieved by pupils. It is a comprehensive term that is not simply concerned with the academic status of the student but with all aspects of his growth which includes both cognitive and non- cognitive aspects.

According to Greenland (1981)– “ **Evaluation is a systematic process of determining the extent to which instructional objectives are achieved by pupils.**”

Q.2 Write the differences between measurement and evaluation

Ans. The differences between measurement and evaluation are

| S.No. | Measurements | Evaluation |
|-------|---|---|
| 1 | It is a process of determining the quantity of something. | It is a process of determining the quality / value. |
| 2. | It is an old concept | It is a new concept |
| 3. | Its scope is narrow. | Its scope is wider and comprehensive. |
| 4. | It does not take too much time | It takes too much time. |
| 5 | It is a part of evaluation | It is a part of whole educational system. |

Q3. Write Characteristics of evaluation.

Ans. Characteristics of Evaluation are

- It involves systematic collection of quantitative and qualitative data.

- ii. It is concerned with all scholastic and co- scholastic aspects of the pupil's growth.
- iii. It is to be conducted continuously as the student passes from one grade to another from one class to other in the form of formative and summative evaluation.
- iv. It involves assessment of all the three domains related with the pupils behavioral changes i.e. Cognitive, affective and psychomotor.

Q4. What is the purpose of Evaluation?

Ans. According to NCF 2005 the purpose of evaluation is –

- 1. To gauge the progress that both learner and teacher have made towards achieving the learning aims that have been set.
- 2. To give feedback on how the teaching process and learning materials need to be improved in order to facilitate children understands of concepts.
- 3. To help the teacher to think about each individual child and review what he has learnt during the term and in which areas he/she needs more support, revision and improvement.

Q.5 Write short note on “Continuous and Comprehensive Evaluation (CCE)”

Ans. Evaluation should measure the child's development in different areas his/her attitude to learning, interest , ability to learn independently, cooperation with peers, social and emotional developments etc. So the evaluation should be Continuous as well as Comprehensive.

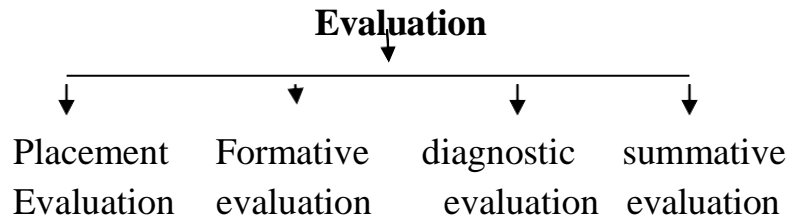
Evaluation should be Continuous: This refers to integrate and regular assessment both inside the classroom and outside such as playground, outdoor activities etc.

Evaluation should be Comprehensive: This refers to the application of a variety of tools and techniques and aims at assessing a learner's development in different areas of learning.

Essay Type Questions

Q.6 Explain the types of evaluation.

Ans. Classroom evaluation can be categorized in the following manners:



1. **Placement evaluation-** The aim of placement evaluation is to determine the position in the sequence of learning activities and the mode of instruction that is likely to benefit the pupil the most.
2. **Formative evaluation-** The goal of formative assessment is to monitor student learning to provide ongoing feedback that can be used by instructor to improve their teaching and by students to improve their learning-

1. It helps students to identify their strengths and weaknesses and target areas that need work.
2. Help faculty recognize where students are struggling and address problems immediately. For example- Formative evaluation includes asking students to -
 - i. Draw a concept map in class to represent their understanding of a topic.

ii. Submit one or two sentences identifying the main point of a lecture.

3. **Diagnostic evaluation-** When learning difficulties persist, diagnostic evaluation is called for. This helps to identify the underlying causes of the problems and to formulate a suitable plan of remedial action.
4. **Summative evaluation-** The goal of summative evaluation is to evaluate students learning at the end of an instructional unit by comparing it against some standard or benchmark. It is designed to

determine the extent to which instructional objectives have been achieved and is used to assign grades and certificates to students. Besides grading this kind of evaluation provides information for judging the effectiveness of the instruction. Summative evaluation includes –

- i. Teacher made achievement tests.
- ii. Models and project reports.
- iii. Evaluation of projects.

Q.7 Explain Achievement test and types of test items

Ans. Teaching effectiveness is evaluated in terms of student's achievement or learning outcome and to measure student's achievement, achievement test is used as a tool . It measures the nature and extent for students learning in a particular subject or a group of subjects.

A biology teacher constructs achievement tests in biology to measure cognitive, affective, and psychomotor abilities. These teacher made tests may be oral, written and practical. The details of these tests are as follows-

A. Oral test – In oral test student and examiner sit face to face and examiner puts questions to students for answering them. The main objectives of using oral examinations are –

- i. To evaluate the students self confidence.
- ii. To evaluate the capacity of rote learning of the students.
- iii. To examine the presence of mind of students.
- iv. To evaluate the depth and mastery of the content of the students.

Disadvantages of oral test –

- i. In this system of examination uniform criterion of evaluation is not used.
- ii. Proper justice is not done in oral examination.
- iii. It is very time consuming system.

B Written test – The written examination are used for measuring cognitive achievement and language expressions. The written tests are of three types which are as follows –

1. **Essay type test** – The essay type test is a type of examination on which the students are asked to discuss, enumerate, compare, state evaluate, analyze, summarize or criticize and involves writing at specified length on a given topic.

Advantages- The advantages of essay type questions are –

- i. They can access higher mental processes.
- ii. They largely eliminate guessing.
- iii. They encourage students to express in effective language.
- iv. They are easy to prepare and administer.

Limitation–

- i. These types of tests are not reliable and their validity is also poor.
- ii. The essay type tests are difficult to evaluate.
- iii. The scoring is time consuming.
- iv. They are highly subjective in nature.
- v. They do not at all exhibit the quality of comprehensiveness in terms of covering the total learning experiences gained by the students.

2. **Objective type tests-** Objective type tests refer to any written test that requires the student to select the correct answer from among one or more of several alternatives.

Advantages of Objective type test-

- i. It can be scored easily and objectively.
- ii. It contains items which cover the entire contain.
- iii. It is reliable.

- iv. There is economy of time both in administering as well as scoring.

Limitations of Objective type test-

- i. Guessing is possible.
- ii. Construction of question is difficult.
- iii. Objectives like ability to organize contain ability to present matter logically and in a coherent way, cannot be evaluated.

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