DIPLOMA IN ELEMENTARY EDUCATION
(D.El.Ed.)

Course-510
Learning Science at Upper
Primary Level

Block -2
Managing & Measuring Science Learning

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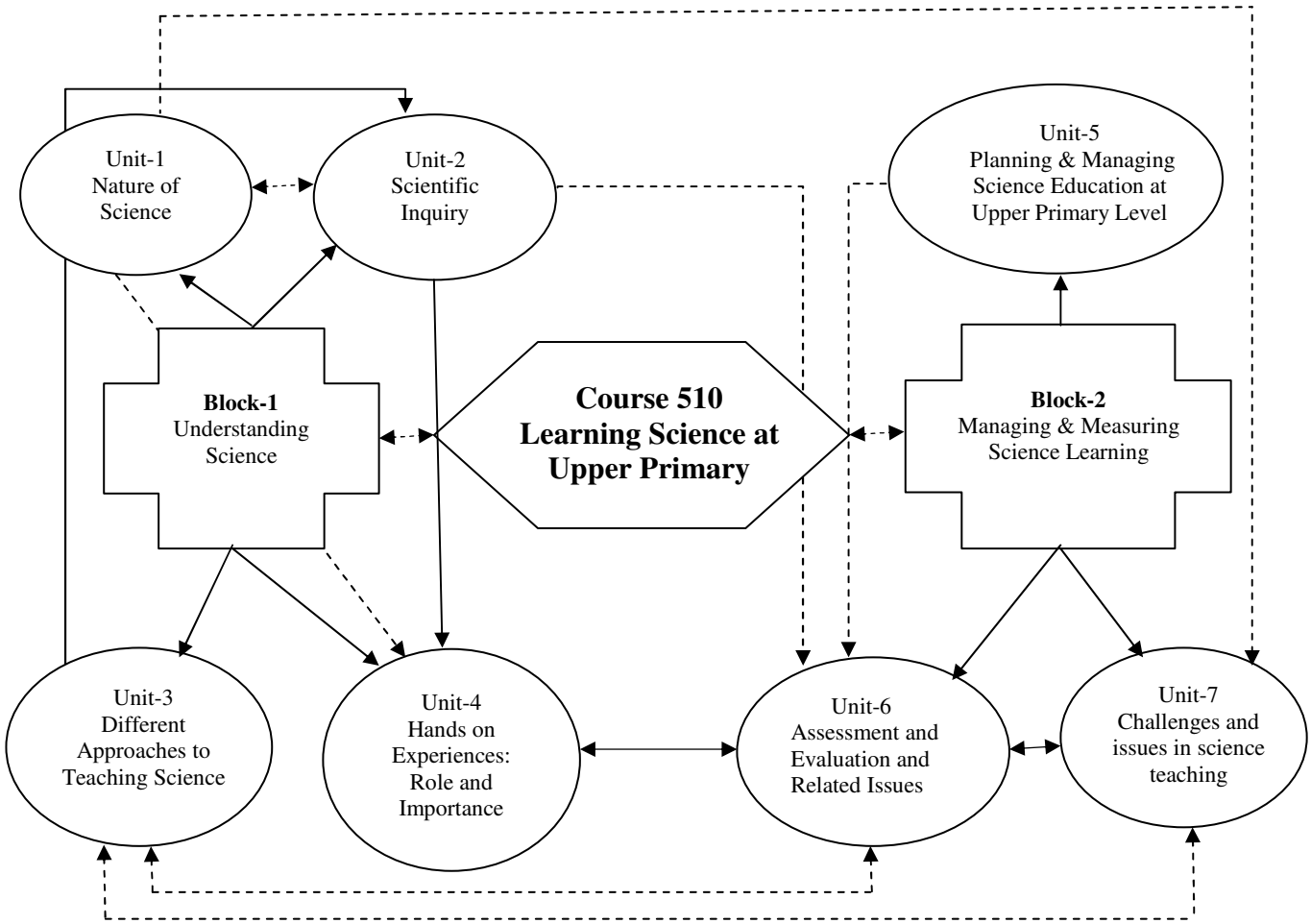
Concept Map for Course 510- "Learning Science at Upper Primary Level"



Credit points (4=3+1)

Block	Unit	Name of Unit	Theory Study hours		Practical Study hours
			Content	**Activity**	
Block-1 Understanding Science	U1	Nature of Science	6	6	1. Project - Developing and implementing material for hands on experiences for the students.
	U2	Scientific Inquiry	5	7	
	U3	Different Approaches to Teaching Science	9	9	
	U4	Hands on Experiences: Role and Importance	4	6	
Block-2 Managing & Measuring Science Learning	U5	Planning & Managing Science Education at	4	6	1. Case Study – Prepare CCE for one student and develop a follow up programme. 2. Project - Evaluation of two scenarios for deciding quality of learning.
	U6	Assessment and Evaluation and Related Issues	3	6	
	U7	Challenges and issues in Science Teaching	4	5	
		Counselling (LC)	10	-	
		Total	45	45	30
		Grand Total	**45+45+30=120 hrs.**		

Block 2

Managing & Measuring Science Learning

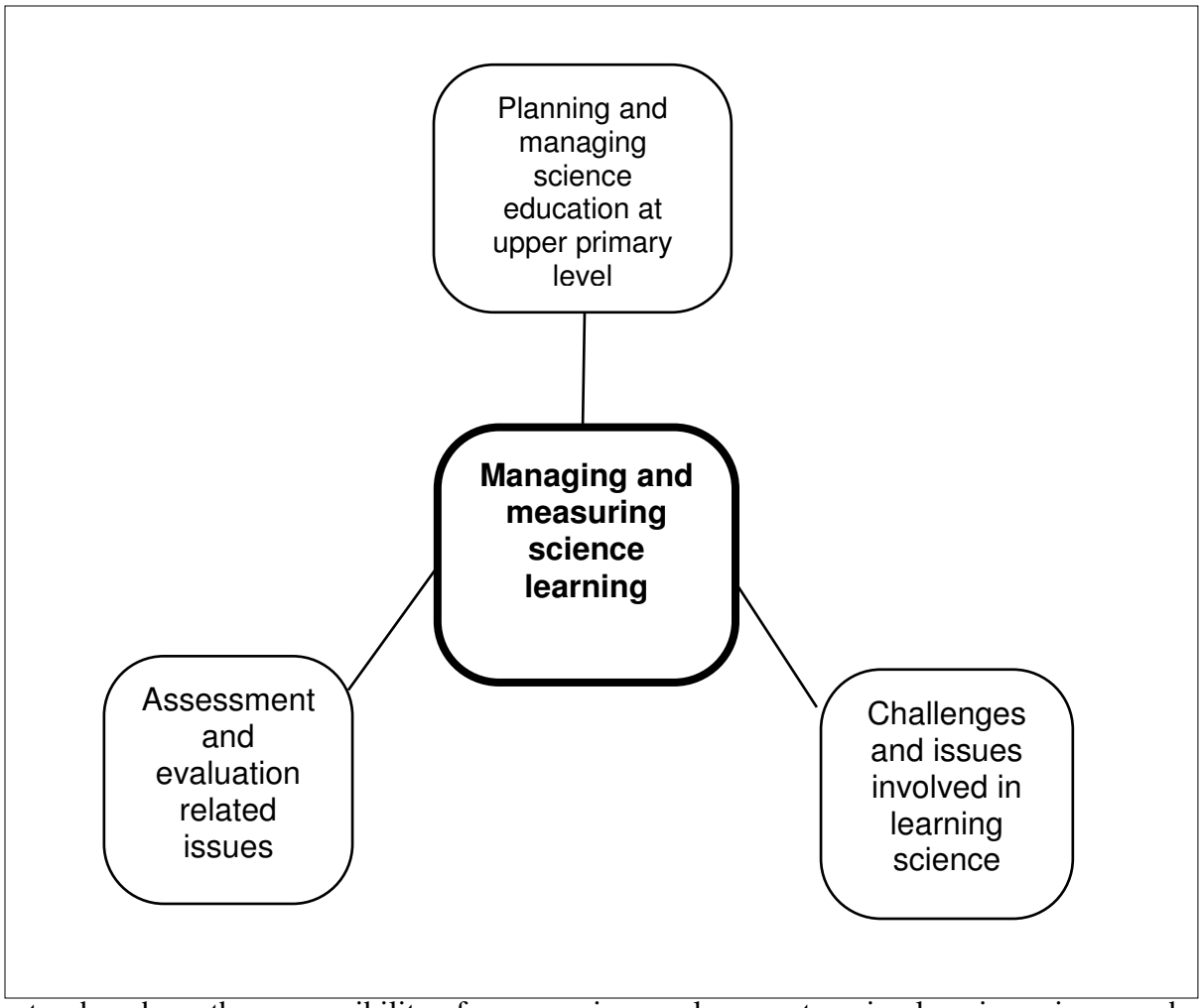
Block Units

CONTENTS

BLOCK INTRODUCTION

This block will empower you to,

- describe the importance of long term and short term planning for teaching science
- identify, compile and develop various resources for teaching science
- explain the of process of evaluation and assessment of learning and teaching of science
- design authentic tasks, tools, procedures and techniques for assessing development and quality of learners performance
- summaries the challenges and issues in science teaching at Upper Primary Level.



We as teachers have the responsibility of empowering our learners to enjoy learning science and make science as a way of life.

Unit five of second block will guide you to plan and manage learning environment. It will also help you to plan your lessons, keeping in mind your own context, availability of resources, and need of your learners.

Unit six will help you to evaluate learners' progress using different approaches including continuous comprehensive evaluation process.

Last unit of this block will help you to voice your own problems and raise issues and find practical solutions.

Friends, you have all gained some experience as teachers. We all look at the craft of teaching by recalling our teachers who thought us during our student-hood. Our elders at home, our friends, our peers who could not attend class always inquire about what our teachers taught us on a particular day or during a particular period in our class. All were really interested in knowing what we learned during the day or during the particular period through the teaching of our teachers. In short all of us are interested in our learning and teaching of our teachers. That is why any person enters into teaching profession considers herself or himself to be as competent and qualified for teaching.

UNIT 5 PLANNING & MANAGING SCIENCE AT UPPER PRIMARY LEVEL

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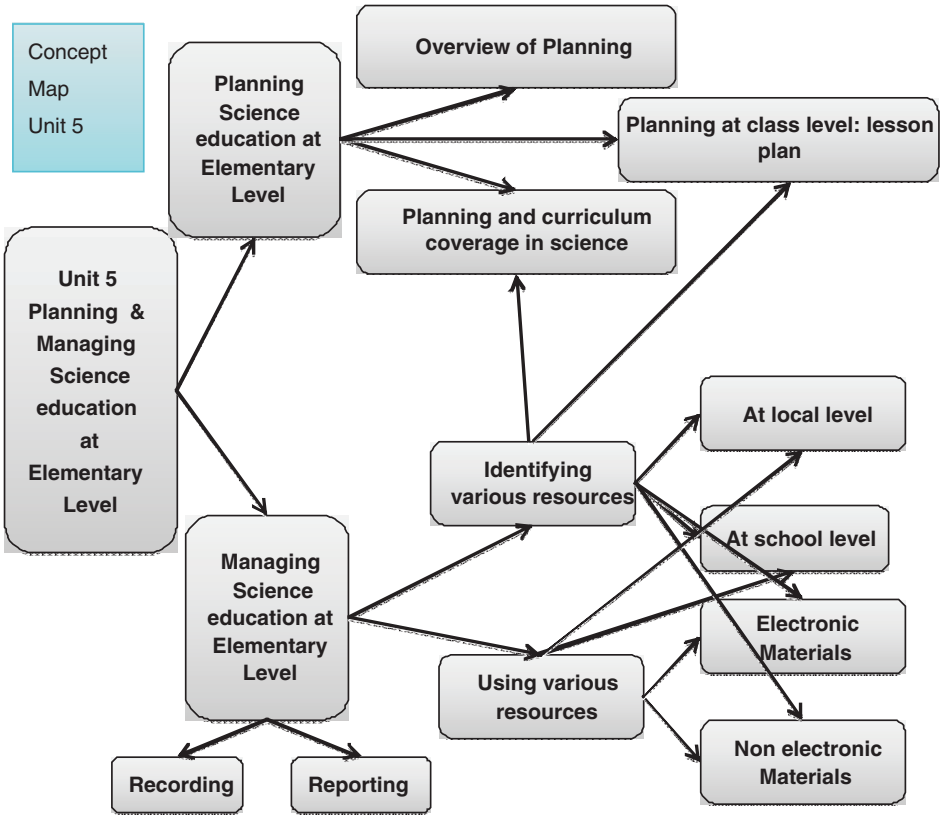
Structure



5.0 INTRODUCTION

Teaching of science, particularly at the elementary level, is an important aspect of present day science education. In the previous block you have studied the nature of the science subject and the different approaches and strategies for teaching science

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with an emphasis on the inquiry-based approach. As a science teacher you must be very much interested in planning and organizing the science curriculum over a period of that time so that you and your students enjoy learning science together and making it a joyful experience.

In this unit we will discuss the whole process of how to plan the curriculum holistically following the approach 'from whole to parts'. This will be done sequentially from year plan to lesson plan using and managing the resources and then recording and reporting the assessment to the stakeholders i.e. students, parents and school authorities.

5.1 LEARNING OBJECTIVES

After going through this unit, you should be able to:

- explain the need for planning curriculum
- prepare a year plan and unit plans based on concept maps for science curriculum for your class.
- plan lessons at the class level.
- identify various resources of teaching science at school and local level.
- assess and select various resources on the criteria of relevancy and age appropriateness.
- use appropriate resources- non-electronic and electronic, in teaching science.
- describe procedure of recording and reporting.

5.2 OVERVIEW OF PLANNING

Imagine that you are suddenly asked to deliver a 30 minute talk on a topic. What will be your thoughts? "Do I know the topic thoroughly? Will I be able to organize my presentation sequentially? Will it sound logical?" so on and so forth. Since you have not planned the talk and not prepared you may have goose bumps on your skin and you may become nervous. But if you know well in advance that you have to make a presentation, you will make notes, organize, practice and will be very confident. A housewife plans the dinner for the guests to the minute details. A lawyer spends hours planning a case before appearing in court. An executive plans his day in advance with specific appointments and assignments. A political leader plans his/her speech before speaking in public. A coach spends hours planning the play. Then when we attempt the complicated teaching-learning process, is it not necessary to plan and prepare for this important activity? You know that the quality of planning affects the quality of results. A careful preparation results in excellence. To be effective in our class we should devote much time and energy in carefully planning and preparing for the whole year for each unit of the syllabus and for the daily lessons.

Year Plan: Year plan is an outline of many units of the whole curriculum and also the time required to realize the curriculum. The syllabus is divided into a number of units and then the time is allocated to each unit which involves teaching, revision and assessment. It is the program of action of curriculum. In the very beginning of the year, your first task is to plan for the whole year by considering the units to be covered in science and the number of periods available for each unit in the whole year. You need to analyze the content and plan for teaching-learning, revising and testing. You also have to consider the holidays and vacations when you allot the time for each unit.

Unit Plan: The unit is an outline of the program of action after determining the sub-units. It is a detailed plan which consists of intended learning outcomes, teaching-learning strategies and activities and assessment tool for the learning outcomes. A detailed analysis of the unit and its sub-units is required while preparing the unit plan.

The formats for year plan and unit plan are provided at the end of this unit as Appendix 1 and 2 as examples for you to go through and prepare for your class and subject.

Lesson Plan: A lesson plan is for a particular period and may be of 30/40 minutes as per your school schedule. It is a very detailed and specific plan consisting of intended learning outcomes, description of teaching- learning strategies and activities and actual tool for assessment of the learning outcomes. This is further described in detail in section 5.4 below.

Figure 5.1 shows the relationship between them:

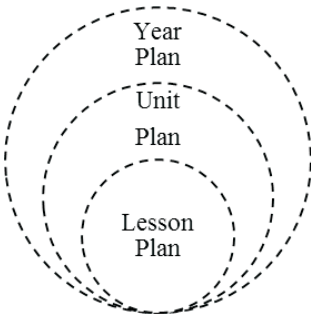

Figure 5.1 Relationship between Year plan, Unit Plan and Lesson Plan

5.3 PLANNING AND CURRICULUM COVERAGE IN SCIENCE

In your school staff room you may have heard words such as the following:

- "There is never enough time to complete the curriculum"
- "The science curriculum is so vast and difficult…"

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- "I found an amazing website for science lessons."
- "I need extra lectures to complete the syllabus."

You may have spoken also such words yourself. Let us be clear and get exact about this concept. The word "Curriculum" is derived from the Latin word *curere* which means the course of a chariot race. However, curriculum means much more than a one track race and claims for an understanding giving functional meaning to education.

It can be perceived as a connective link between the teacher and the students so as to achieve the goals of education. It provides a framework that explains external settings for the learning process. It is concisely defined in Webster's Dictionary as: "A course of study offered by a school".

Curriculum can be considered as —

- **Content:** A body of knowledge that is to be transacted. It is equated with syllabus.
- **Product:** An attempt to achieve certain goals for students. Objectives are set, the content plan is developed and practiced, and the outcomes are determined. Thus, it is a product of a systematic study.
- **Process:** Teachers think critically, about their role, propose activities based on educational goals, modify as per the need of the students, demonstrate in-action, thinking, encourage, dialogue between students and themselves. They continually evaluate the process and what they can see of outcomes.

Doll (1996) defines it as follows "The curriculum of a school is the formal and informal content and process by which learners gain knowledge and understanding, develop skills, and alter attitudes, appreciations, and values under the auspices of that school".

ACTIVITY -1

- *Draw a flow chart /mind map for the above definition of curriculum.*

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- *Decide which aspect of the curriculum you believe - Content, Product or Process? Give reasons for your choice*

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5.3.1 Curriculum and Syllabus

Many a times these words are used interchangeably, however they represent different but connected concepts. A syllabus is an outline of a specific course. It includes the topics to be covered, their order, often the required and suggested reading material, and any other relevant information. A curriculum refers to all the courses offered in a specific program. It is a complete set of taught material in a school system. Curriculum prescribes the objectives while, the syllabus describes the means to achieve them. Hence curriculum is prescriptive while syllabus is descriptive.

5.3.2 Curriculum and Instruction

Curriculum is the goals, the content, and the process of how to teach that content to achieve the set goals. Instruction is a more detailed plan of how to teach that content along with its implementation. The curriculum answers the question what is to be taught. It is designed by state boards of education and is influenced by policies, mandates, and legislation. Instruction answers the question how. For optimum students' learning both should be congruent. Therefore the instructional methods and strategies selected and used by you should be compatible with the curriculum. Instruction is the delivery of the content by you to achieve the set goals making them accessible and attainable to all students using your personal and professional skills.

5.3.3 The Goals of Science Education

The goals of science education at any level can be broadly categorized as:

- development of skills of inquiry,
- nurturance of positive attitudes, and
- acquisition of scientific knowledge about the biological and physical aspects of the world

As a science teacher you should see that the science curriculum is structured in such a way that children can experience all these elements. A shared understanding of the purpose and nature of science will promote a coordinated approach to the planning and teaching of science throughout the school and will also facilitate the evaluation of teaching resources and approaches.

5.3.4 Scientific Concepts at Elementary Level

The nine scientific concepts that elementary school children should learn and understand are given in figure 5.2 below:

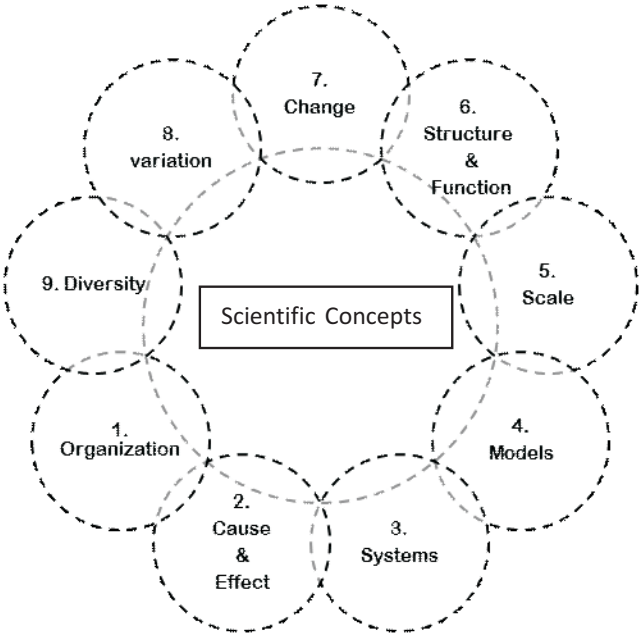

Figure 5.2 The nine scientific concepts for elementary Education

Source: The National Center for Improving Science Education.

Let us see what we mean by each of these nine concepts before working out activity indicated at figure 5.2**.**

These nine concepts are:

1. **Organization**: Science is the study of the natural world. Scientists organize and classify the objects and events they observe to understand how things work such as: Hierarchy-ranking according to some characteristic and Grouping-based on shared characteristic. You can ask your students to collect leaves, flowers, stones etc. and sort according to their characteristics. They can learn the concept of organization through this activity.

2. **Cause and effect**: Science seeks to explain and understand the natural world. Things happen for a reason: there is a cause for every effect. Such as growth of a plant, colours in a rainbow, evaporation etc. You can point out these things to your students by asking them to plant seeds and observe.

3. **Systems**: A system is a group of related, interacting parts that together form an interdependent whole. Students can learn about systems by observing the changes in the various parts of the whole, using familiar things in their lives such as an aquarium or a pond.

4. **Models**: A model is a physical object which represents another thing. You can ask the students to make models from clay and compare it to the actual object.

For example, making a clay model of a plant or a body, and asking them to relate them to actual thing.

5. **Scale**: This refers to size and quantity. Students can demonstrate by actually measuring heights and weights of classmates, temperature of warm and cold water and mixing them.

6. **Structure and function**: There is a relationship between the way things look, feel, sound, etc. and how they act or what they do. Students can observe and analyze the differences in the structure of objects around them and try to relate them to the different functions of those objects for example, human body or plants have different parts to do different jobs.

7. **Change**: The natural world constantly changes. Some of these are quick and easy to observe while others take place over days or months or years. Students can be asked to observe the changes in the world around them. For example, the weather, phases of the moon, day and night temperature, seasons etc. Students can experiment with freezing, melting, evaporating and boiling of water to understand the water cycle.

8. **Variation**: Everything, living or non-living, has a set of characteristics, or properties, different from other. The world is full of variations. Some of these differences are small or insignificant, like hair color while others are much more significant, like the difference between living and non-living things. There are variations between the individuals within a species such as breed of dogs or cats, as well as in an individual as it grows and changes throughout its life like a caterpillar changing into a butterfly. Students can observe these changes and can draw conclusions.

9. **Diversity**: This is the most obvious characteristic of the natural world. You can make your students to understand that diversity in nature is essential for natural systems to survive. Children can explore and investigate a pond, for instance, to learn that different organisms feed on different things.

ACTIVITY -2

Column A has scientific concepts and column B has some examples. Match the example from column B with each concept in column A

Column A: Scientific Concepts *Column B: Examples*

1. Organization	*a. exploring and investigating a pond*
2. Cause & Effect	*b. Making a clay model of a tree*
3. Systems	*c. Plants use leaves for photosynthesis and roots to collect water*

4. Models	*d. collecting and sorting leaves according to their characteristics*
5. Scale.	*e. Different people have different hair colour*
6. Structure & Function	*f. The grass grows because there is water and light.*
7. Change	*g. observing how an aquarium works*
8. Variation.	*h. measuring temperature of warm and cold water*
9. Diversity.	*i. freezing, melting, and boiling evaporating of water*
	j. identifying different plants in garden

You may have identified the correct example for each concept. To be sure you may check their answers given at the end of this unit.

5.3.5 Issues in Planning Science Curriculum

How will you plan for your lessons in science? What are the things you will have to consider before planning? You should be aware of the following issues in planning your science curriculum:

Theme based versus subject-centered approach

An integrated curriculum is particularly suited to younger children, because they view the world and their experiences in a holistic way. Theme teaching and subject integration are important at all levels, but require careful planning. Planning helps to ensure that, within the range of themes used, a comprehensive coverage of the content components is achieved and adequate opportunities are provided for the development of scientific skills and concepts.

One of the most important aspects of the science curriculum is the emphasis placed on the exploration of the local environment of the child and school. If you are familiar with the locality of the school, the range of habitats in the area and other features of the natural environment it will facilitate the planning process.

Textbooks and worksheets

The use of textbooks and worksheets needs to be limited as supportive to active exploratory/investigative work. You all should discuss and evaluate these resources when you plan for science education. Science lessons should not be based only on textbook or worksheet. You should select activities that will assist children in undertaking open-ended tasks.

Safety in science activities

You should be well aware of the safety implications of any exploratory or investigative work to be undertaken. Safety should permeate all aspects of the teaching of science, and children should be encouraged to observe safety procedures during all tasks. Safety precautions cannot remove all risks but should eliminate unnecessary hazards. Science activities at elementary level should not involve the use of chemicals or other hazardous materials.

ACTIVITY-3

Select a topic from science syllabus of class VI or VIII. Decide on a teaching-learning activity as per your choice.

Write the title of the lesson: ..... Std. .....

Fill In the following table with respect to selected activities.

Basic procedures	*Identifiable hazards*	*Precautions to be taken*	*Management of hazards*

5.3.6 Advantages of Planning of Science Curriculum

Planning of science curriculum helps you to ensure a proper provision of the following and many more:

- access to a comprehensive range of scientific concepts
- opportunities to work scientifically
- a balance between the different aspects of the curriculum
- integration of science and technology
- inquiry based activities
- activities to explore and investigate the environment

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- provides for continuity and progression in the development of scientific ideas and in the application of investigative skills.

Besides, there should also be a balance between the development of scientific knowledge and understanding on the one hand and the processes of working scientifically on the other.

5.4 PLANNING AT CLASS LEVEL: LESSON PLAN

To ensure optimum learning, we must carefully select and arrange activities that will produce the desired learning outcomes in our students. Only through careful planning we can be certain that we include all necessary information and have our lesson plan properly organized to achieve the lesson objectives.

A lesson plan is a teacher's detailed description of the course of instruction for one class. Daily lesson plan is developed by a teacher to guide her classroom instruction. Details will vary depending on the preference of the teacher, the topics being covered, and the need of the students.

5.4.1 A Well-developed Lesson Plan

A well-developed lesson plan reflects interests and needs of students. It features best practices of curriculum transaction. The lesson plan correlates with the teacher's philosophy of education what the teacher thinks as a purpose of learning that topic.

The 5 W's and 1 H is a strategy that is regarded as basics in knowing and understanding something. It is a sort of checklist of six questions to get a full story of something. We can use it for our planning of daily lessons. Rudyard Kipling (1902) has put them in one of his poems as:

"I keep six honest serving-men

They taught me all I knew;

Their names are What and Why and When And How and Where and Who".

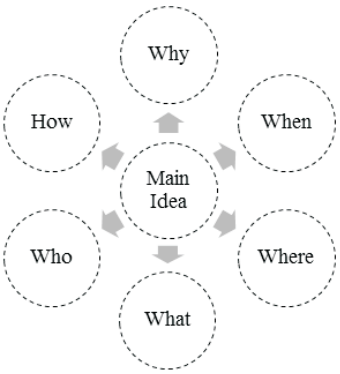

Figure 5.3 5 Ws and 1 H

5.4.2 Planning Science Lessons

Applying the 5Ws and 1 H strategy to planning science lessons requires you to answer the following four basic questions. Try to get the answers. The answers to the remaining two questions are already with you.

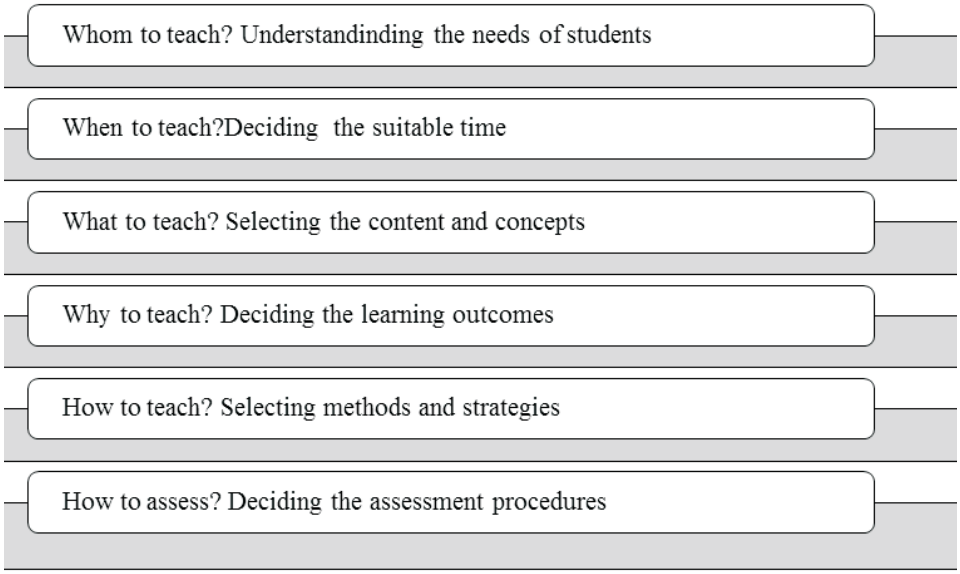

Figure 5.4

Let's explain the above figure in brief.

- **What to teach? (Selecting the content/concepts)**

  The content is decided and is given in the syllabus. The pedagogical analysis of the content will help you in organizing and sequencing of the content. You can develop a concept map of the concepts involved for effective planning.

- **Why to teach? (Deciding the learning outcomes)**

  You need to consider why is a particular content is included in the syllabus. What is expected of a student after learning that content? Those are the intended learning outcomes. While selecting the learning outcomes, you need to consider the abilities of your students. Lesson outcomes anticipated by you are based on the science syllabus you follow. You also will learn about these in detail in the unit "Assessment and Evaluation".

- **How to teach? (Selecting methods and strategies)**

  In the earlier units you have learned about different methods, strategies and approaches. Decide the suitable approaches for the content and the intended learning outcomes. As your teaching practices develop, you will be able to plan

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science lessons that cater effectively for different learning styles. You will also provide for activities catering to the various multiple intelligences. Undoubtedly, you will need to include activities to help students who are lacking behind as well as for the gifted and talented students.

You also need to take into consideration the timeframe while scheduling the activities. Also decide about the resources required. They can be human or environmental.

- **How to assess? (Deciding the assessment procedures):**

  You want to know, whether the learning outcomes which you have started with, are achieved or not. So you need to select appropriate procedures to check students' progress. You will learn about them in detail in the unit "Assessment and Evaluation".

5.4.3 Pedagogical Analysis

This whole process mentioned above is known as "pedagogical analysis" It is done at three stages

Pre-active stage

This stage involves the following activities:

- Ascertaining entry competence
- Stating learning outcomes
- Analyzing content and subordinate concepts
- Identifying types of learning

Interactive stage

This stage involves the following activities:

- Deciding methods/approaches of stimulus presentation
- Deciding on expected learners' responses
- Giving feedback

Evaluative stage

This stage involves the following activity:

- Determining the tools to check for achievement of the intended learning outcomes.

This analysis is translated into action through lesson planning and practiced in the field which is described in the next point.

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5.4.4 Steps of Lesson Planning

When you put all the above stages together you will find that the complete cycle of lesson planning includes eight steps:

1. Determine the objectives
2. Research the topic as defined by the objectives
3. Select the appropriate instructional method
4. Identify a usable lesson planning format
5. Decide how to organize the lesson
6. Choose appropriate support material
7. Prepare the beginning and ending of the lesson
8. Prepare a final outline.

While planning the lesson you need to rigorously focus on the following points:

- **Framing the learning objectives:**

  An objective is a statement of purpose for the whole lesson. It specifies what students will be able to do by the end of the lesson. The statement must use a verb that states the action to be taken to show accomplishment. The objective decides the total lesson.

ACTIVITY -4

Modify the following sentences into proper form of learning objectives and write in the parenthesis.

The student will be able to-

1. *Learn the function of heart (……)*
2. *Understand the concept of adaptation (……)*
3. *Know the difference between breathing and respiration (……)*

- **Selecting the teaching-learning strategy**

  An effective teaching strategy will decrease your classroom management problems and will increase involvement of your students in the teaching–learning process. It will definitely result in a good learning environment. You have already learned about the various strategies and their merits in the previous chapters. These

teaching strategies bring about new dimensions to your science lessons and provide considerable variety for students. A carefully selected strategy is crucial to an effective science lesson.

A teacher may have mastery over the content but may not know how to teach. In that case the teacher cannot be considered an effective teacher. Thus, a teacher requires both the bases: the content base and the pedagogy base. A meaningful integration of both these bases is referred to as pedagogical content knowledge. It provides you ways to engage your students in learning.

- **Selecting teaching learning activities/learning experiences**

Selecting teaching-learning activities for science relates directly to the objectives and the identified scientific concepts involved. It also provides the basis for assessment. You may find numerous activities that could suit to the desired objectives and the content. To decide the most appropriate activities you need to consider the timeframe, health and safety issues, resources, and the suitability of the activity to students' abilities, needs and interests. Also it is necessary to arrange the activities logically and sequentially.

ACTIVITY -5

Let us assume that you have thought of 5 activities for a particular lesson. Decide the topic and the class. But because of time constraint you can select only 3 activities. Answer the following question in this context.

1. *Which three activities would you select and why?*
   - *Activity 1: .....*
   - *Activity 2: .....*
   - *Activity 3: .....*

Selecting Appropriate Resources

You have selected now an activity that requires suitable and manageable resources - human or environmental. Human resources are experts you require to perform the selected activity. Environments are invaluable resources, as they present unique situations for students to learn about science. A classroom environment can be created to construct a "real world" experience. For example, you can set up an aquarium in the class room which will help your students to study the aqua life. Or you can bring in natural objects such as different types of rocks to give hands-on experiences to them. School ground, gardens, local community or more distant locations are environments

beyond the classroom. Students can explore and learn through this investigation as they provide first-hand experiences. For example through the study of flora and fauna in their surroundings they can learn many scientific concepts such as variation, change, diversity etc. Books, journals and magazines, computer programs and the Internet also can be used to aid learning. It is good to have access to as many resources as possible and use them judicially as per the requirement of the activity and the strategy. We will learn more about resources in the next section 5.5.

5.4.5 Design/Format for the Lesson

After selecting an appropriate strategy, activity and resources with consideration of your students' health and safety, you can start designing the structure and form of your lesson. There are many formats for a lesson plan but they contain the following common elements

1. Title of the lesson
2. Duration
3. List of required resources
4. List of learning objectives
5. The set induction to focus students on the learning and to motivate.
6. The direct instruction that describes the sequence of events that make up the lesson, including the teacher's instructional input and guided practice the students use to try new skills or work with new ideas
7. Independent practice that allows students to extend skills or knowledge on their own
8. A closure that concludes the discussion and answers questions
9. An assessment/evaluation tool to check the achievement of the intended objectives.
10. A continuity component which reviews and reflects on content from the previous lesson.

Reflection: This is the most important part that comes after the deployment of the lesson. The teacher reflects on the lesson itself; what worked, what needs improvement etc.

The format for the lesson plan is provided at the end of this unit as Appendix 3 and 4 as example for you to go through and prepare for your class and subject.

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ACTIVITY-6

Suppose you want to prepare a lesson plan of 30 minutes duration for your students.

Prepare a lesson plan based on the above format.

Check your plan on the basis of the following questions

- *At the end of lesson what will be the learning outcomes?*
- *What content needs to be covered to fulfill these intentions?*
- *Which teaching methods are best suited to achieve these intentions?*
- *Which class management strategies will match the students' learning needs?*
- *What resources and audio/visual aids need to be prepared in advance/be available?*
- *How will variety of activity be used to sustain student's interest?*
- *How will learning outcomes be recorded for evaluation?*

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After completing the activity, grade yourself on the following rubric:

Self-Evaluation Rubric for Activity:

A	Lesson plan includes all of the important elements. They are well aligned and appropriate to the target audience.
B	Lesson plan includes almost all of the important elements. They are aligned and appropriate to the target audience.
C	Lesson plan includes some important elements. They show little connection and are not appropriate to the target audience.
D	Incomplete activity.

Careful lesson planning can help you to facilitate students' learning. Incorporating best practices in teaching-learning process will realize the learning outcomes you decided. In Albert Einstein's words "It is the supreme art of the teacher to awaken joy in creative expression and knowledge."

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ACTIVITY -7

Given below is a description of two lessons in brief. Read them carefully. In your opinion which lesson will be more effective for students' learning? Give 5 reasons to support your answer.

Lesson 1	Lesson 2
1. Focus on teaching	1. Focus on learning
2. Sequence of skills: from lower level to higher level skills.	2. No definite structure: posing problems, and exploring possible answers,
3. Specific aims and objectives common to all students	3. Pursuing global goals specifying general abilities such as problem-solving and research skills for individual learner.
4. More Stress on individualized and independent work	4. More stress on cooperative and collaborative group work
5. Emphasis on teaching methods: lectures, demonstrations, worksheets, skill activities	5. Emphasis on learning techniques: exploration of open -ended questions and scenarios, doing research and developing products
6. Assessment using tests with specific expected responses.	6. Assessment using student portfolios, performance checklists, tests with open-ended questions.

Reason1: .....

Reason2: .....

Reason3: .....

Reason4: .....

Reason5: .....

Our school science curriculum needs to be improved and teachers should develop good science lesson plans. You must have realized that every time you investigate science with your students, you also learn more in the process. So continue the process of think- select- adopt- think.

5.5 IDENTIFYING AND USING VARIOUS RESOURCES

As an elementary science teacher you can be very effective when you involve your students - the young children - in the teaching learning process. They will learn better and remember the experiences you have created for them using the resources. As the child progresses from one class to the higher class the impact you have created and the impressions you have made will remain with him forever. Each teacher is different. That means no two classrooms will be the same. Your choice of resources should be

done very carefully to bring about the desired learning outcomes. We have already learned previously in section 5.4 about selecting resources for lessons. Here we will learn in detail about different types of resources and their use.

5.5.1 Meaning of Resources

Learning resources are defined as information represented, accessible, or stored in a variety of media and formats. They can be print and non-print materials, or non electronic and electronic materials that meet the learning outcomes, course content and specific needs. They are available in school as well as locally and globally.

5.5.2 Importance of Resources

A famous quote says "A picture is worth a thousand words." You must have heard the Chinese proverb "I hear and I forget, I see and I remember, I do and I understand" Your experience with your students or your own learning also will substantiate that if a teacher uses visuals, retention increases by 50 percent. If you reflect on your own teaching in the past, you will realize that whenever you have used activities and involved students more, learning is more or less permanent.

You are already aware that we learn through our 5 senses: vision, hearing, smell, taste, and touch. We learn 1 percent through taste, 1.5 percent through touch, 3.5 percent through smell, 11 percent through hearing and 83 percent through sight. Also we retain: 10 percent of what we read**,** 20 percent of what we hear**,** 30 percent of what we see **and** 50 percent of what we see and hear together

We tend to learn more as we:

- Go from concrete to abstract.
- Add more sensory information.
- Make the learning experience more like "Doing the Real Thing".
- Become more involved.

Higher levels of retention can be achieved through active involvement in learning.

Figure 5.5 shows the involvement of the learner from Passive to Active.

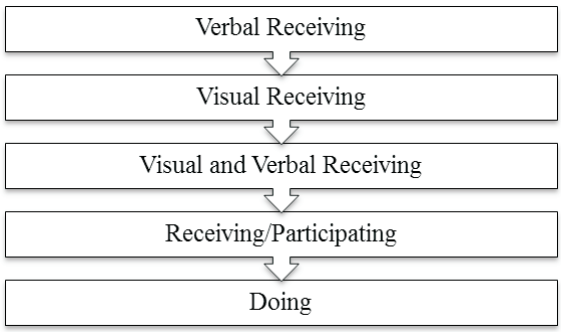

Figure 5.5

Notes

5.5.3 Types of Educational Resources

There are a wide variety of educational resources available for anyone who wishes to learn more about a particular subject. Teachers use educational resources for their professional development and for classroom instruction. Students use them for self-study and often need them to complete their homework, assignments and projects. They can be available in the school, or locally and globally (made available through the internet).

5.5.3.1 Resources at School Level

Library

The school library can be made the hub of all the activities planned and executed in school. It houses both, print and non-print materials(electronic) such as different kinds of **books (**General books, Textbooks, Reference books), **visuals** (pictures, photographs, charts, graphs, maps, atlas, globes etc.), **audio (**CDs, cassettes, records and tapes), **audio visuals** (video CDs, films, tapes, slides, transparencies etc.) and **games and toys** used for interactivity**.** All these are classified and organized in such a way to make immediately available to the library user. Computers and internet facility is also made accessible in the library where ever possible.

Laboratory

The school science laboratory is always been used to promote a wide range of educational outcomes. Students learn how to conduct the practical work by manipulating the equipments and materials. While conducting these experiments, students work in collaboration interacting with each other, communicating ideas. The inquiry based approach enhances conceptual understanding. The scientific investigation process highlights the importance of observations, evidence, arguments, findings, justifications etc. all resulting in inculcation of the core component; "the scientific temper".

Garden

School Gardens can be an excellent resource as a living laboratory to observe, discover, experiment, and learn. Gardening can engage students and help them gain subject specific knowledge. They get involved in the learning process. Garden related activities integrate subjects such as science, maths, social studies, and the environment, and personal skills areas such as leadership, problem-solving, and team building. You can initiate Classroom Projects on garden-related activities along with ideas for hands-on lessons. The objectives are to encourage students to develop more diverse ways of describing everyday objects, processes, and events. They often get involved deeply with plants and nature, which renews and sustains the essential connection between the person, and the environment.

Playground

Many of the science concepts such as gravity, friction, force, momentum etc. can be learned by students playing on slides, swings, spinners, and a number of other standard

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and custom playground equipments. Students can explore the scientific principles of motion, balance, sound, sight, levers and simple machines, as well as about sun, wind and water. Motivating them to mthelook at the science underlying the enjoyable hands-on activities, their playing can be turned into a joyful experiential learning by an innovative teacher like you. You can also encourage them to ask questions, to observe record, predict, and deduce; performing all scientific activities.

5.5.3.2 Resources at Local Level

All the above resources may be available at the local level in the neighbourhood, in the locality, or at nearby places but on a large scale. Apart from these, planetariums, herbariums, vivariums such as aquariums, science parks, science museums, zoos, botanical gardens may be available in the locality. You can arrange excursions and field trips for your students to enhance their learning.

A Planetarium

It is a theatre built primarily for presenting educational and entertaining shows about astronomy and the night sky. It shows simulated movements of stars, planets and other celestial objects on a large dome-shaped projection screen. The accurate relative motion of the sky can be presented using many technologies. The program can display the sky from anywhere and at any time; past, present or future. They can be as huge as accommodating 400 people which are normally a permanent part of science parks or they can be small and portable to be used for small groups.

A Herbarium

It is a place where a collection of preserved plant specimens is stored. These specimens may be whole plants or parts of plants. They are usually dry parts mounted on a sheet or preserved in alcohol or some other preservative. They may preserve an historical record of change in vegetation over a period of time. Some plants become extinct in one area, or may become extinct altogether. Then, in that case, the specimens represent the only record of the plant's original distribution. Environmentalists use such data to track changes in climate and human impact. Specimens housed in herbarium identify the flora of that area. It helps to better understand the variations of forms in the plants and the natural distribution over which the plants grow.

A **Vivarium**

It is an enclosed area for keeping and raising animals or plants for observation or research. A portion of the ecosystem for a particular species is simulated on a smaller scale, controlling the environmental conditions. A vivarium can be small to be kept on a table or large outdoor structure. There are many forms of vivarium depending on the type of habitat.

– Aquarium simulates a water habitat
– Insectarium contains insects and arachnids.

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– Paludarium simulates a rain forest or swamp.

– Terrarium simulates a dry or a jungle-like habitat.

Let us learn about an aquarium in detail and the teaching learning opportunities it can provide. The other vivaria will function in a similar manner.

An Aquarium

It consists of at least one transparent side in which water-dwelling plants or animals are kept. You can keep various kinds of aquatic animals and plants depending on the size. If it is in the school or if students can keep one at home it excites the students, and they become enthusiastic. For them the learning taking place through this activity is fun. They share their learning with family and friends which develops relationships and bonding. An aquarium is a great way for students of all ages to learn about a variety of topics and gain valuable life lessons. It can be used to teach students specific science topics such as different water species, fish anatomy, food chain, water/nitrogen cycle etc. Students collect data from an aquarium by measuring and recording water temperature, pH, ammonia, and nitrate levels. Any event, even the loss of a fish, is an opportunity to discuss possible causes and their effects, preventions, and ways to improve existing conditions. A creative teacher like you can select a number of ways to use aquarium as an excellent hands-on teaching tool. Students get the opportunity to learn directly through experience. Caring for the aquarium kindles a sense of responsibility, achievement, and a genuine desire to learn. The opportunities are endless.

A science center/science museum

It offers interactive exhibits covering a wide range of topics related to science. This interactivity encourages visitors to experiment and explore. They also offer a wide range of enrichment programs for students complementing the school's science education. Visiting a science centre can become an inspiring and exciting experience for students. **Science Parks** are places for scientific research. Usually, they are associated with higher education institutions such as colleges and universities. They differ from science centres as they are interested with future developments in science and technology. They are encouraged by local government, in order to attract new companies to towns. Many resources and facilities are available at one place and sharing them reduces the overhead cost

A botanical garden

It is an area with special collections of a wide range of plants such as cacti, succulent plants, tropical plants, exotic plants, herb gardens, etc. with their botanical names. Their role is to maintain the collection of living plants with proper documentation for the purposes of scientific research, conservation, display and education. The visit to such place offer unlimited opportunities learning plant diversity. It is an excellent medium for communication between the world of botany and students. Nowadays, they also provide visitors, information related to the environmental issues particularly plant

conservation and sustainability. They are very useful in creating an awareness of the threat to ecosystems from human overpopulation and the need for these biological and physical resources to humans.

Zoos

They are maintained to study the animals, like botanical gardens are maintained to study plant kingdom. The natural-like habitat for animals provided in zoos helps to study them in their natural environment. Zoos aim to provide leadership in animal care, science education, and sustainability. They are used to find science-based solutions to conservation problems. Science is essential to understand and reduce the negative effects of environmental change on the survival of species and their habitats. Zoos inspire students to study, understand and care for the world's biological diversity.

5.5.4 Classification of Resources

All these resources can be classified broadly as electronic (requiring electricity) and non-electronic (not requiring electricity).

5.5.4.1 Non-electronic Resources

They can be categorized broadly in two parts: verbal and visual. Their further classification with use is given below.

Verbal (print material) stores and communicates information emphatically in verbal form.

Books: Books are the most common educational resource and most important. We cannot think of learning, today, without books. They can be used by people of all ages; you as well as your students. Even when books are read to children, their speaking, writing, and listening abilities are improved. Encouraging reading may foster love for books at an early age. This can help people in lifelong learning. We can get books almost on any subject and for any level. The local library is a great place to find books that can be used as educational resources. There are a variety of books with different purposes. They are described below.

A **textbook** is designed for classroom use and is written by experts in the field. It is equipped with the usual teaching devices. It is basically used by students for self learning but also is used as a reference point for the syllabus while the **workbook** is used for drill and practice. A **reference book** is designed to be consulted for a specific piece of information rather than to be read through form cover to cover. They contain large number of facts organized for supplementing the content so they are required when extra information is needed to carry out such as project work. A **picture book** focuses on illustrations that carry the essence of the book's meaning. This type of book is more useful for the teachers to build a story, to develop verbal conversations, vocabulary, reading comprehension, etc. It can also develop visual thinking ability.

Periodicals: They are published at a fixed period of time (daily, every 15 days, or every month, or every 3/6 months, or every year) such as **newspapers, magazines**, and **journals**. They contain a variety of edited articles authored by different people. They are very useful to get extra up-to-date information required assignments project etc. The articles there in can also be used for posing question or initiating brainstorm.

Visual material

Boards are used to scribble, to write messages, to list items, to draw diagrams so on and so forth. The **black board/ chalk board** have now become an inseparable part of classroom fixtures. Its best advantage is the re-use. The step by step process/ diagrams can be developed in front of your students. The **flannel board** is a large board, covered with flannel fabric; on which felt or lightweight paper cut-outs can stick. You can use photographs also to stick by gluing a small piece of Velcro at the back. The **magnetic boards** are actually iron boards on which magnets are attached to hold photographs, objects etc. They are used to display previously prepared materials. They can be used to demonstrate a variety of science concepts to young children, like the life cycle of a butterfly, water cycle, classification, diet and nutrition. Students can manipulate the pieces, providing hands-on learning. These boards are most effective in elementary education. They help in gaining attention and arousing curiosity.

Charts and posters are displays on large sheets of papers meant to be clearly viewed by all the students in a large class room. They contain text with illustrations, figures, or pictures that can enhance learning. The content can be presented graphically in the form of Flow charts, Tree charts or Pie charts. A **poster** communicates the message in a symbolic form through pictures, figures etc. and using minimum words. Both can be used to show relationships/comparisons, development, process, classification and organization. A **flip chart** is a sequence of charts bound together by a ring, hook or a bracket.. The charts are flipped one after the other to present information in a logical continuation layer by layer.

Graphs are visual representation of numerical data. This representation can take the form of a line graph, a bar graph, a circle or pie graph or a pictorial graph as the name suggests.

Maps, atlas, and globes: A map is a type of picture of an area as it may be seen from above. It will have symbols and other information to help make it easier to understand. A map can show the street that you live on or it can show the world. It is a drawn to scale diagram showing flat but accurate representation of a part or all of the earth or the universe. It presents the details of boundaries of earth's surface, continents, countries etc. An **atlas** is a document, which contains several maps, and a **globe** is a model (spherical representation) of the earth. It gives the most accurate and relative picture of the shapes and sizes of land and water areas on the earth. Compare to

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globes, Flat maps are cheaper and easier to use. They are designed to show smaller areas in greater detail. Maps help people in finding locations and directions. To use maps effectively, you must teach students how to read them.

Pictures and photographs: Pictures include illustrations, drawings, paintings, prints, reproduction, technical drawings etc. They are a key resource. They provide information which does not require translation and hence avoid long explanations. They set the scene or context. Photographs are pictures taken by a camera. They represent the world as it is. They bring history to life. They are engaging tools of any educational experience. Good photographs can help the students to understand the concepts faster and in a better manner. Aerial photographs provide a useful supplement to topographic maps.

Specimens and models: Specimens are real objects which are preserved such as seals, coins stones, flora and fauna etc. **Models** are the enlarged or diminished replica of real objects which are used to explain the features of real situations. **Working models** are used to explain the processes involved.

5.5.4.2 Electronic Resources

These resources require electricity for their functioning. They can be classified as audio, visuals, audio-visuals, animations or videos (Movies).

Audio resources

Radio, cassettes and audio CDs can be used to enrich and reinforce learning science. Students get benefit of listening to experts' talk on radio. They can be recorded and played again using cassettes and CDs. These resources can also be used to learn many science topics particularly related to "Sound"

Visual resources (projected)

A slide projector is a specialized projector which is designed to be used with slides. **Slides** are small transparencies mounted in sturdy frames. Slide projectors display images onto a screen or wall. It is used to project enlarged images onto the screen or wall for audience to view. It can be adjusted to project at a variety of distances, with the use of focusing tools resulting in high image quality. The use of slide projectors is in decline, as preparing slides is a skilled job and other projection methods have become more popular.

An **overhead projector** is a very basic but reliable form of projector. Teaching materials can be written or printed on plastic sheets (Transparencies) beforehand by anyone. The **transparencies** can be reused whenever required. This saves time and energy. It enables you to face the class and facilitates better communication. It facilitates an easy low-cost interactive at the same time very effective environment. The overhead projector is a common feature now-a-days in most of the developing countries for

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higher education but still a long way for school education. Recently, it has seen a decline in use, as more sophisticated computer based projectors are favored.

Video projectors display videos, images or computer data on a screen or other flat surface. They eliminate the need to create hard copy transparencies. Software like Microsoft Power Point helps us to make animated, interactive presentations with movement and video. These features are not supported by overhead projector.

Audio-visual resources

Films and videos on a wide variety of subjects are available. They provide a visual and auditory experience to students to enhance learning. There are a number of Internet sites such as "You Tube" (http://www.youtube.com/) that offer educational videos which you can easily download for use both in and out of the classroom.

Television is a telecommunication medium for transmitting and receiving moving images. Many television channels offer specialized programmes in a wide range of subjects. Various lessons and demonstrations using models, specimens etc. can be viewed by the students and the teachers. Many important talks, scenes and sights can be seen through it. Channels such as Discovery, National Geographic are very helpful in understanding science for both teachers and students.

ICT tools

Computers have complemented and supplemented the earlier educational resources. They can be used to present content, provide drill and practice, and offer tutorials, present simulations, encourage self-paced learning.

The **Internet** is an excellent source for a wide variety of educational resources for schools, teachers and students, which is particularly useful for explaining key science concepts and interactivity with science at appropriate levels. All the above types of resources in e-form, and many more, are available within reach at the flick of the click. Through the Internet, you can gain instant access to millions of different educational websites from all over the world. A simple online search can lead us to such useful resources in abundance providing a multitude of learning options. The Search Engines like google, yahoo, bing, Wikipedia. altavista are very much in use by the students and teachers.

It is ideal to have access to as many resources as possible. However, the type of the school and its location may impose limitations for accessing resources, such as computers and broadband Internet connections. However, with the advent of ICT, the teacher's role is changing from 'knowledge provider' to 'facilitator of learning'. This requires the ability to guide students in making the best educational and informational use of technology. Under your guidance the students should communicate globally and become lifelong learners, with an intelligent use of the vast information resources available to them.

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ACTIVITY -8

Select any one topic for a particular class and identify the resources to teach it. How best you can use these resources to make your teaching more effective and interesting? Write down in the space given below.

.....

.....

.....

Open Educational Resources (OER)

OER are digital materials that can be re-used for teaching, learning, research and more, and are open to anyone for use. They include courses, course materials, content modules, learning objects, collections, and journals all in digital form. They also include different tools: software that support the creation, delivery, use and improvement of open learning content, searching and organization of content, content and learning management systems, content development tools, and on-line learning communities. They also include materials on best practices such as stories, publication, techniques, methods, processes, incentives, and distribution.

Two such OERs are given below:

"Your Sky" is an interactive planetarium of the Web. You can produce maps for any time and date, viewpoint, and observing location at http://www.fourmilab.ch/yoursky/

"Stellarium" is also a free open source planetarium for your computer. It shows a realistic sky in 3D, just like what you see with the naked eye, binoculars or a telescope. It can be used to investigate astronomy through scientific exploration at www.stellarium.org.

ACTIVITY -9

Search for at least 5 more OERs and describe in brief their use.

.....

.....

.....

Figure 5.6 shows the classification of the material in various forms

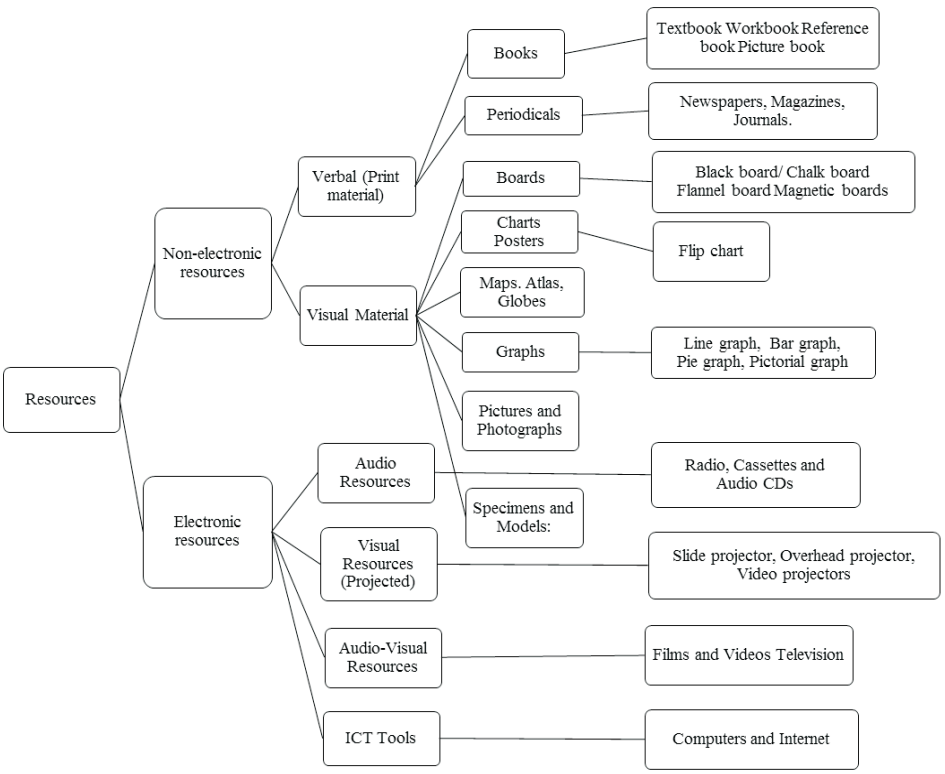

Figure 5.6 Classification of resources

5.5.5 Advantages of Resources

The judicious use of resources by the teacher helps in:

- involving students actively
- giving concrete examples and illustrations
- retaining learning for longer period
- providing variety
- doing things that cannot be done otherwise
- showing things that cannot be seen otherwise.

Abstract methods of teaching require more skills of the learners to interpret the message. The different media and material will hold students' attention for longer period and more retention and transfer of learning is possible. They engage students' other senses in the learning process sending the information to the brain through as many channels as possible, resulting in multi-sensory instruction. 'Multi-Sensory learning' means use of all the five senses at the same time incorporating simultaneously i.e. 'VAKT' (Visual-Auditory-Kinesthetic-Tactile) activities. Thus, the resources are useful to reinforce what you are saying, ensuring that your point is well understood.

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5.5.6 Criteria for Selection of Resources

Usefulness and **appropriateness** are two important criteria for selecting relevant material. It should help both you in teaching and your students in learning. It should help in attaining the lesson objectives and should have a high possibility for permanent learning.

If you select material only because of the availability, it may not serve the purpose. Students will grasp and retain facts and concepts that are enriched with interesting support material and arranged in a way that enhances learning. Some additional criteria are listed below:

- **Clarity:** The learners should easily comprehend what is conveyed and further explanation should not be required.
- **Simplicity:** The language used should be simple and easy to understand. Lengthy sentences and flowery language should be avoided.
- **Relevancy:** The resource should be suitable for the purpose for which it is selected.
- **Specificity:** While providing the resources unnecessary as well as too much material should not be given.
- **Visibility:** should be neat and readable to all; whether individual or group.
- **Practicality:** The resource should be affordable and within the reach of the user.

ACTIVITY -10

Fill in the following table

Resource	*Use*	*Advantage*
1 *2* *3* *4* *5* *6*		

5.6 RECORDING AND REPORTING

It is necessary that the students and the parents should be informed about the progress of the students.

Parents should be aware of what is expected from their child and should have data as proof of it. Some parents want to know the position of their child in relation to all the

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students in the class. Information about their child's attitude towards learning and their achievement is valuable to the parents. Your students also will be motivated to learn further when they know about their progress. The school authorities are also interested in results. Thus a teacher has to assess and evaluate students' learning. This also helps the teacher to get a feedback about her planning and transacting curriculum.

5.6.1 Evaluation of Students Learning

The assessment of children's learning is an essential and continuous part of the teaching and learning process in science, as in the other areas of learning. The continuous and comprehensive evaluation process requires proper planning and execution of activities for achievement of the desired learning outcomes. An important aspect of the school planning for science is to help you understand each child's progress in science. The assessment techniques in science must focus on cognitive objectives, understanding of scientific concepts, competence in the application of experimental and investigative skills and the nurturance of scientific attitudes. Hence the plan itself should provide appropriate methods and strategies for assessment based on the objectives decided. Formulate and summative evaluation need be done as per the requirement. Objective based evaluation need be conducted by adopting paper-pencil tests through essay type, restricted answer/short answer type and objective type test items.

5.6.2 Evaluation of Planned Curriculum

Assessment of the students' learning should facilitate you teachers in evaluating the suitability of the science program you have planned. The following assessment methods can be used to obtain a balanced picture of the child's progress in science:

- teacher observations
- concept-mapping
- performance on teacher-designed tasks
- Products and Processes observed by teacher and presented in portfolios.

This assessment needs to be documented and proper records require to be maintained. Your records of all the above is of great significance. The parents should be informed about the way students' progress is monitored and the results of the assessment. The results should be reported to all the stakeholders.

5.6.3 Role of Teacher

You should

- Mark and record the results of all the assessments and evaluation to accurately assess students' progress
- Report the results of formal assessments as required.

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- Share the results of assessment and progress grades with student
- Develop and implement an appropriate system for recording, analyzing and reporting student assessment and progress data.

The tools and techniques of recording the assessment and evaluation you will be learning in the next unit i.e. **Unit 6: 'Assessment and Evaluation'**.

5.7 LET US SUM UP

We have learned in this unit how to plan and manage science education at upper primary level. We know now the importance of planning, purpose, how to manage the curriculum throughout the year, how to design and develop year plans, unit plans and lesson plans.

We have also learned that science learning can be designed in many forms. The selection of the type of activities is based upon the learners' needs; the age and stage of the group, intended learning outcomes, health and safety requirements, resources, and lesson appropriateness.

We have learned different types of resources in electronic and non-electronic form and their use for providing hands-on experiences and hence, facilitating learning. We have also seen about what are the available resources in the school and in the community, so that they can be utilized in science teaching. Whatever we have learned in earlier units about scientific inquiry and hands-on experiences we can use in planning for science lessons.

We have got acquainted about the role of teacher in recording the progress of the students and reporting it to students, parents and school authorities.

We now have a holistic picture of planning, organizing and managing science curriculum. The details about it such as different domains, the classification of learning outcomes/ objectives, various strategies and activities for teaching and learning, assessment and evaluation techniques, and procedures we will be learning in the **next unit**.

5.8 MODEL ANSWERS TO CHECK YOUR PROGRESS

Key to Activity-2

1 d	2 f	3 h	4 b
5 g	6 c	7 i	8 e
9 a			

5.9 SUGGESTED READINGS AND REFERENCES

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5.10 UNIT- END EXERCISES

1. Let us assume that your friend has just taken up a job as teacher in an elementary school. What advice you will give her for conducting science lessons? Answer in around 300 words.

2. Translate the following activity into a science lesson plan

   - Material required:
     - 3 cups of water (cold, lukewarm, warm)
     - Food colour
   - Activity: Ask students to add 3 drops of food colour in each of the cup one by one observe and record.

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APPENDIX – 1

Format for the Year plan

YEAR PLAN

Name of the teacher (Your name) .....

Class: .....

Subject: .....

S. No.	*Unit*	*Sub-Units*	*No. of periods*				*Month*
			Teaching	*Revision*	*Assessment*	*Total*	
1.	.....	1.	3	2	2	16	July
		2.	3				
		3.	3				
		2.	3				
2.	.....	1.					

APPENDIX – 2

Format for the unit plan

UNIT PLAN

Name of the teacher (Your name) .....

Class: .....

Subject: .....

Unit: .....

S. No.	*Sub-Units*	*Content Analysis*	*learning Objectives/ Learning Outcomes*	*Teaching-learning Strategies/Activities*	*Evaluation*
1.	1.	Terms, Concepts, Facts etc.	Remembering Understanding, Applying Skill Attitude	Inquiry, Observation, etc.	Quiz: Questions Essay SA MCQ
2.	2.				

Notes

APPENDIX – 3

8-Step Lesson Plan Template

LESSON PLAN

Name of the teacher (Your name) .....

Date .....

Class: .....

Subject: .....

Objectives and Goals:

.....

Anticipatory Set (approximate time):

.....

Direct Instruction (approximate time):

.....

Guided Practice (approximate time):

.....

Closure (approximate time):

.....

Independent Practice:

.....

Required Materials and Equipment:

.....

Assessment and Follow-Up:

.....

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APPENDIX – 4

Lesson Plan Format

LESSON PLAN FORMAT

Date Class Time		Period Subject Topic
Teaching Points : Learning Objectives: Pre-Existing Knowledge: Learning Resources: Learning Processes (Strategies) :		
Learning Points	*Sequential Learning Activities*	*Black Board / Test items*
INTRODUCTION PRESENTATION APPLICATION (Evaluation)		

इकाई-3 व्यक्तित्व का विकास एवं मूल्यांकन

टिप्पणी

संरचना

3.0 परिचय

पिछली इकाई में हमने आनुवंशिकता व पर्यावरण की भूमिका पर चर्चा की है। इस इकाई में हम व्यक्तित्व के विकास व उसके मूल्यांकन पर चर्चा करेंगे इस इकाई में हम मुख्यत: व्यक्तित्व की प्रकृति और संकल्पना, व्यक्तित्व की विशेषताएं, व्यक्तित्व के सिद्धांत, व्यक्तित्व का मूल्यांकन व व्यक्तित्व के विकास में शिक्षकों के योगदान पर ही अपना ध्यान केंद्रित करेंगे।

टिप्पणी

3.1 अधिगम उद्देश्य

इस इकाई को पढ़ने के बाद आप

- व्यक्तित्व का अर्थ बता पाएंगे।
- व्यक्तित्व की विशेषताओं की सूची बना लेंगे।
- व्यक्तित्व मूल्यांकन के प्रति जागरूकता विकसित कर लेंगे।
- बच्चों के व्यक्तित्व के विकास में शिक्षकों की भूमिका का वर्णन कर पाएंगे।

'परसनेलिटी' एक लेटिन शब्द 'परसोना' से बना है जिसका अर्थ है रोमन अभिनेताओं द्वारा पहना जाने वाला मास्क। इस प्रकार व्यक्तित्व या 'परसनेलिटी' का अर्थ है दूसरों के नजरिए में कोई व्यक्ति कैसा है। व्यक्तित्व किसी व्यक्ति के बारे में सम्पूर्ण जानकारी है–

उसकी शारीरिक, भावात्मक, मानसिक, सामाजिक, नैतिक व आध्यात्मक बनावट।

साधारण शब्दों में व्यक्तित्व निम्न चीजों से बनता है :

1. हम कैसे दिखते हैं।
2. हम कैसी वेशभूषा पहनते हैं।
3. हम कैसे बात करते हैं।
4. हम कैसे चलते हैं।
5. हम कैसे कोई कार्य करते हैं।

स्वयं परीक्षण-1

व्यक्तित्व से आप क्या समझते है?

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3.3 व्यक्तित्व की विशेषताएं

1. व्यक्तित्व वह है जो व्यक्ति है।
2. प्रत्येक व्यक्ति का व्यक्तित्व अनोखा है।
3. व्यक्तित्व स्थिर नहीं है, गतिशील है।
4. व्यक्तित्व एक संपूर्ण इकाई की तरह कार्य करता है।
5. व्यक्तित्व आनुवंशिकी व पर्यावरण दोनों से मिलकर बना उत्पाद है।
6. व्यक्तित्व पूरी तरह से सामाजिक है।
7. व्यक्तित्व पर्यावरण से लगातार समायोजन है।
8. कुछ विशेष परिस्थितियों में व्यक्तित्व पर्यावरण को प्रभावित करता है।
9. व्यक्तित्व हमेशा कुछ विशेष उद्देश्यों की प्राप्ति के लिए प्रयास है।
10. व्यक्तित्व स्वयं-अनुभूति है। हम पशुओं के व्यक्तित्व की बात नहीं करते।

स्वयं परीक्षण-2

व्यक्तित्व की दो विशेषताएं लिखो।

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3.4 व्यक्तित्व के सिद्धांत

व्यक्तित्व के कुछ मुख्य सिद्धांत इस प्रकार हैं :

व्यक्तित्व का गुण सिद्धांत

जी.डब्ल्यु. आलपोर्ट, आर.बी. कैटल और एच.जे. आइसेंक व्यक्तित्व के गुण सिद्धांत के मुख्य प्रतिपादक हैं। गुण व्यक्तित्व का ऐसा आयाम है जिसे मापा जा सकता है और जो किसी व्यक्ति के अनुरूप व्यवहार का वर्णन करता है। संख्यात्मक तैर पर आयाम के रूप में गुण व्यापक

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सकारात्मक सिरे से चरम नाकारात्मक सिरे तक का व्यापक मापन का पैमाना है। मनुष्य के व्यक्तित्व के अर्थपूर्ण मापन के लिए गुण को किसी व्यक्ति की सबसे विशिष्ट व स्थिर विशेषता होनी चाहिए। गुण सिद्धांतवादकों के अनुसार, यदि हम स्वयं को कुछ मूल विशेषताओं तक सीमित रखे जो मनुष्य के व्यक्तित्व में स्थिर व विशिष्ट हों तो व्यक्तित्व के वर्णन की समस्या सरल हो जाती है। सिद्धांतवादक अक्सर आसानी से दिखने वाले गुणों व उन गुणों में जो गहराई तक और मूल व्यक्तित्व के समीप होते हैं, में अंतर करते हैं। गुण सिद्धांत में एक उपागम आसानी से दिखने वाले गुणों को 'सतही गुण' और गहराई में पाए जाने वाले गुणों को स्रोत गुण कहते है।

बारह मूल हैं :

1.	उत्तेजना विषाद भावनात्मक रूप से अभिव्यक्ति; स्पष्ट, सौम्य	बनाम	अभिविदिलता सुरक्षित, कम बोलना, चिन्तित
2.	सामान्य मानसिक क्षमता बुद्धिमान, स्मार्ट, मुखर	बनाम	मानसिक दोष बुद्धू, सुस्त, दबा हुआ
3.	भावनात्मक रूप से स्थिर विक्षिप्त लक्षणों से दूर, जीवन के प्रति यथार्थवादी	बनाम	भावनात्मक रूप से विक्षिप्त विभिन्न प्रकार के विक्षिप्त लक्षण, काम से जी चुराने वाला, अपरिपक्व
4.	प्रभुत्व स्व-मुखर, आत्मविश्वासी, आक्रामक, संतुष्ट	बनाम	विनम्रता, विनम्र, अनिश्चित;
5.	उद्वेलन हंसमुख, खुशनुमा, विनोदी	बनाम	अवतोलन उदास, निराशावादी, सुस्त
6.	सकारात्मक चरित्र संरक्षक, लोगो को ध्यान देने वाला	बनाम	निर्भर चरित्र, चंचल, सामाजिक कार्यों को अनदेखा करने वाला
7.	साहसिक उत्तेजना विषाद लोगों को मिलना पसंद करना, विपरीत सेक्स में अधिक रूचि	बनाम	पिछड़ी अभिविदिलता शर्मीला, विपरीत सेक्स में कम रुचि
8.	संवेदनशील भावनात्मक रूप से निर्भर, अपरिपक्व	बनाम	परिपक्व, कठोर, संयमित स्वत्रंत विचारों वाला, आत्मनिर्भर, परिपक्व, मिलकर रहने वाला, ध्यान खींचने वाला
9.	सामाजीकृत, सुसंस्कृत मानसिकता सभ्य, ठहरा हुआ, तैयार, अंतर्दर्शनात्मक, संवेदनशील	बनाम	अशिष्टता अनाड़ी, असामाजिक, असभ्य
10.	विश्वसनीय उत्तेजना विषाद, विश्वसनीय, समझदार	बनाम	संविभ्रम; पागलपन शक करने वाला, ईष्या करने वाला

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11.	रूढ़िमुक्त, निश्चिन्तता सनकी, पागलपन जैसी गड़बड़ियां करने वाला	अपारम्परिक, बनाम परम्परागत, व्यवहारिक पारम्परिक, भावमुक्त
12.	दुनियादारी तार्किक मानसिकता, शांत, एकांत पसंद	बनाम सादगी भावुक मन, लोगों पर ध्यान देने वाला

3.4.2 व्यक्तित्व के मनोविश्लेषण सिद्धांत

(अ) व्यक्तित्व का व्यक्तित्व सिद्धांत

सिगमण्ड फ्रायड (1856–1939) मनोविश्लेषण के प्रतिपादक थे। उनका मनोविश्लेषण का सिद्धांत गतिशील है और इस धारणा पर आधारित है व्यक्तित्व और व्यक्तित्व विकास संघर्ष और घटनाओं द्वारा निर्धारित होते हैं जो मुख्यत: अचेतन प्रकृति के होते हैं और गहराई से अध्ययन करने पर ही समझ आते हैं। फ्रायड की व्यक्तित्व रचना ईद, अहं व सुपर अहं पर आधारित है। व्यक्तित्व के यह हर पहलू बाकी दो व्यक्तित्व के पहलुओं से एक तीन स्तरीय प्रणाली में जुड़े हुए हैं–ईद, अहं (ईगो) व सुपर अहं (सुपर ईगो)।

ईद पूर्णत: अचेतन है; अंह (ईगो) आंशिक रूप से चेतन है, और सुपर अंह (सुपर ईगो) पूर्णत: चेतन है। ईद व्यक्तित्व का प्राथमिक पहलू है। फ्रायड मानते हैं कि ईद अंधी प्रवृतियों का समूह है। इसकी कोई तार्किक व्यवस्था नहीं है। वास्तव में कई विरोधाभासी प्रवृतियां एक साथ उपस्थित हो सकती हैं। ईद नीतिहीन है। इसमें मूल्यों का कोई अर्थ नहीं है। यह अच्छाई और बुराई में कोई भेद नहीं कर सकता। इसमें आनंद का सिद्धांत प्रभावी है। ईद की प्रक्रियाएं अचेत है। इसे व्यक्तित्व की क्रियात्मक व अचेतन पहलू के रूप में सबसे अच्छे ढंग से वर्णित किया जा सकता है।

कामेच्छा और शिशु कामुकता

कामेच्छा ईद संरचना का वह भाग है जो शुद्ध रूप से यौन गतिविधि से अपनी संतुष्टि चाहता है। यौन संतुष्टि अन्य संतुष्टियों की भांति ही है और इसे किसी व्यक्ति कि सामान्य आवश्यकता ही मानना चाहिए। फ्रायड इसे जीव के संपूर्ण प्रयास के रूप में मानते हैं। फ्रायड इस बात पर बल देते हैं कि कामेच्छा प्रत्येक जीव में, शिशु में भी उपस्थित होती है। हर बच्चा एक व्यवस्थित रूप से निर्धारित यौन उत्तेजना के साथ पैदा होता है। कामेच्छा निम्नलिखित क्षेत्रों के माध्यम से निर्धारित की जा सकती है :

1. ओरल (मुख) क्षेत्र : जन्म से दो वर्ष तक। इस आयु में बच्चे को होंठ चूसने से मज़ा मिलता है।
2. गुदा क्षेत्र : दो से तीन वर्ष तक। इस आयु में बच्चे को गुदा से निष्कासन व गुदा पर हाथ फेरने में मजा आता है।
3. जननांग क्षेत्र या फैलिक अवस्था : 3 वर्ष से 5 वर्ष तक। बच्चे को अपने जननांग छूने से संतुष्टि प्राप्त होती है।

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4. विलंबता अवस्था (लेटेंट स्टेज) : 6 वर्ष से 13 वर्ष की आयु में सामाजिक दबाव के कारण कामुकता से दूर रहने की विलंबता अवस्था है।

5. फिक्सेशन अवस्था (स्थाई जुड़ाव अवस्था) : किशोरावस्था की इस अवस्था के दौरान समलैंगिक और विषमलैंगिक रूचियों का विकास होता है।

फ्रायड ने पाया कि उसके अधिकतर मशीन यौन संबंधों पर रोक यानि सैक्स की गैर संतुष्टि के कारण पीड़ित हैं। यौन इच्छाओं की संतुष्टि एक समावेशित व्यक्तित्व के विकास में मदद करती है।

(ब) अल्फ्रेड एडलर (1870-1937)

एडलर के अनुसार यौन आवेग नहीं अपितु आत्मस्थापन प्रमुख प्रेरणा है। अल्फ्रेड के सिद्धांत ने यौन की भूमिका को कम कर दिया जिसपर फ्रायड ने इतना बल दिया था। एडलर सोचते हैं कि प्रत्येक व्यक्ति एक अनोखी जीवन शैली विकसित करने का प्रयास करता है जिसमें यौन इच्छा की मामूली भूमिका है। एडलर का मानना है कि बचपन की अपर्याप्तता आरंभ में हीन भावना विकसित करने मुख्य रूप से जिम्मेदार है। हीन भावना का उदय जीवन में अपूर्णता या कमी के कारण होता है। यह विकास के उच्च स्तर की प्राप्ति में सहायक होता है। हमारे पास देमोस्थेनिस का उदाहरण है जो बचपन में हकलाता था लेकिन वह विश्व का सबसे बड़ा वक्ता बना। इसी प्रकार अमेरिका के राष्ट्रपति रूजवेल्ट अपनी युवावस्था में काफी कमज़ोर थे लेकिन बाद में नियमित व्यायाम द्वारा शारीरिक रूप से बलवान व्यक्ति बन गए। अपनी हीनता को दूर करके श्रेष्ठता की भावना प्राप्त करने के प्रयास व्यक्ति की जीवन शैली में उसके व्यवहार द्वारा प्रदर्शित होता है। कई तरीके हैं जिनके द्वारा व्यक्ति श्रेष्ठता प्राप्त करने का प्रयास करता है। जीवन शैली एक सिद्धांत है जिसके द्वारा किसी व्यक्ति का व्यक्तित्व कार्य करता है। यह जीवन शैली दो कारकों से प्रभावित होती है–अंदर का स्वयं (इनर सेल्फ) तथा पर्यावरण को प्रभवित करने वाले बल। व्यक्ति के प्रारंभिक जीवन के अनुभवों का व्यक्ति की जीवन शैली पर काफी प्रभाव होता है।

एडलर मानता है कि प्रत्येक व्यक्ति एक स्वयं की रचना बनाता है जो उसकी आनुवंशिक विरासत व पर्यावरण से प्राप्त अनुभवों पर आधारित होता है। एडलर कहते हैं कि जबकि जीवन शैली यांत्रिक है, 'सृजनात्मक स्वयं' अन्वेषित है और कुछ ऐसा बनाता है जो पहले कथा था ही नहीं। यह 'सृजनात्मक स्वयं' जीवन को अर्थपूर्ण बनाता है। यह पोषण द्वारा प्रभावित होता है। एडलर सामाजिक अंत:क्रिया के प्रभाव पर बल देता है। दूसरों की भलाई के लिए कार्य करना व्यक्ति की अपनी कमजोरियों व हीन भावना को कम करने में मदद करता है। यह उसे अपनी श्रेष्ठ भावनाओं को प्रगट करने में सहायक है।

(स) कार्ल जंग (1875-1961)

जंग ने व्यक्तित्व को अंतर्मुखी व बहिर्मुखी सम्प्रत्यों के रूप में माना है जो हमारी दैनिक भाषा के भाग बन चुके हैं। जंग के अनुसार, मानसिक क्रियाकलाप चार प्रभावी रूप लेते हैं : अनुभूति, सोच, अंतर्ज्ञान और भावना। सोच और भावना एक दूसरे से दो ध्रुवों की भांति विपरीत हैं परन्तु

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दोनों प्रवृत्तियां व्यक्ति में एक ही समय में साथ-साथ पाई जाती हैं। यदि व्यक्ति की प्रभावी मानसिक क्रिया सोचना है तो अचेतन भावना की ओर हो जाता है। इसी प्रकार, अनुभूति और अंतर्ज्ञान एक दूसरे के विपरीत हैं। दोनों व्यक्ति में एक ही समय में कार्य करते हैं।

बहिर्मुखी और अंतर्मुखी की सामान्य विशेषताएं

	बहुर्मुखी		अंत:र्मुखी
1.	वाक कुशलता	1.	बोलने से लिखने में बेहतर
2.	चिंतानमुक्त	2.	चिंतित रहने की प्रवृति
3.	दूसरों के साथ कार्य करना पसंद करता है।	3.	अकेले काम करना पसंद करता है।
4.	मैत्रीपूर्ण	4.	अपने तक सीमित रहता है।
5.	जल्दी शर्मसार नहीं होता	5.	आसानी से शर्मसार हो जाता है।
6.	खेलकूद में रुचि	6.	पुस्तकों व पत्रिकाओं में रुचि
7.	वास्तुनिष्ठ आंकड़ों द्वारा नियंत्रित	7.	विषयनिष्ठ भावनाओं द्वारा प्रभावित
8.	लचीली व अनुकूलन योग्य	8.	लचीलापन रहित
9.	अपनी वस्तुओं व बीमारियों को ध्यान नहीं देते	9.	ध्यान देते हैं।
10.	उत्तेजनात्मक	10.	
11.	लोकप्रिय	11.	लोकप्रिय नहीं।

अधिकतर व्यक्ति बहुर्मुखी और अंत:र्मुखी दोनों प्रकार के लक्षण दर्शाते हैं और उन्हें ..... कहा जाता है।

जहां इतनी सारी विरोधाभासी व भिन्न प्रवृतियां क्रियाशीलता हों वह एक तरफा विकास होना स्वाभाविक है। व्यक्ति के व्यक्तित्व का एक पहलू दूसरे पर प्रभावी हो जाता है और उसे पूरी तरह ढक लेता है। जंग का मानना है कि पूर्ण व्यक्तित्व तीन घटकों से बना है–चेतन अहं (ईगो); व्यक्तिगत अचेतन और सामूहिक अचेतन।

(i) चेतन अहं (ईगो)–यह वास्तव में 'होने' का आभास है जो सोचने, महसूस करने व याद करने के चेतन पहलुओं को सम्मिलित करता है।

(ii) व्यक्तिगत अचेतन–यह व्यक्ति के भूले-बिसरे व दबे हुए अनुभवों को मिलाकर बना है जो चेतन की पहुंच के भीतर हैं। इसमें व्यक्ति के सामाजिक वातावरण में प्राप्त अनुभव भी शामिल हैं।

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(iii) सामूहिक अचेतन–ये प्रकृति में पुराने अनुभव हैं। यह वह भंडार है जिसमें से बाकी सभी व्यवस्थाएं उदय होती हैं।

स्वयं परीक्षण-3

व्यक्तित्व के किन्हीं दो सिद्धांतों के बारे में लिखो।

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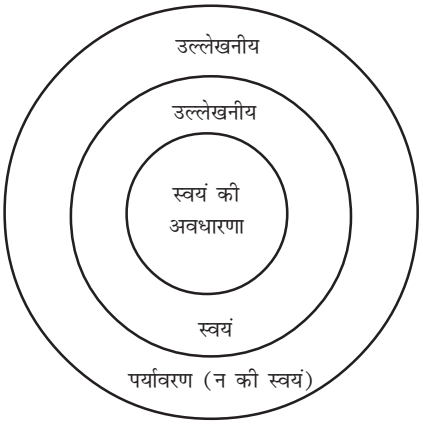
3.5 व्यक्तित्व का विकास

इस भाग में हम चर्चा करेंगे कि व्यक्तित्व के विभिन्न पहलू किस प्रकार विकसित किए जा सकते हैं। इन पहलुओं में स्वयं की अवधारणा, अभिप्रेरणा, अभिवृत्तियां व मूल्य शामिल हैं।

3.5.1 स्वयं की अवधारणा (आत्म-अवधारणा)

किसी व्यक्ति के व्यक्तित्व का विकास काफी हद तक उसके अपने बारे में विचारों पर निर्भर करता है। एक सकारात्मक स्वयं की अवधारणा से एक सौहार्दपूर्वक विकसित, सुविकसित व्यक्तित्व बनता है। इसलिए, यह आवश्यक है कि बच्चों में शुरू से ही एक सकारात्मक स्वयं की अवधारणा विकसित करवाई जाए जो सामाजिक रूप से वांछनीय हो। बच्चे के बपने बारे में विचार को ही स्वयं की अवधारणा कहते हैं। पर्यावरण के उस भाग में जिसमें वह रहता है, उसका उल्लेखनीय स्वयं कहलाता है और बाकी का पर्यावरण जिसकी वह जानकारी रखता है और जिससे वह प्रतिक्रिया करता है, उल्लेखनीय पर्यावरण या महसूस किया जाने वाला पर्यावरण कहलाता है, स्वयं नहीं। स्वयं की अवधारणा वह है जो व्यक्ति अपने वास्तविक स्वयं के बारे में सोचता है। यह 'मैं' है।



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एक नवजात शिशु दुनिया को एक भ्रमित द्रव्यमान के रूप में पाता है। जैसे-जैसे वह बड़ा होता है, वह वस्तुओं में अंतर करना सीखता जाता है। वह अपनी व पराई वस्तुओं में भेद करता है। वह अपने आसपास की दुनिया को महसूस करता है और उससे प्रतिक्रिया करता है। स्वयं की धारणा परिपक्वता के साथ-साथ बदलती है। धारणा में परिवर्तन के कारण व्यवहार में भी परिवर्तन आने लगता है। प्रशंसा और आरोप, पुरस्कार और दंड तथा शिक्षक का व्यक्तित्व बच्चों में स्वयं की अवधारणा को प्रभावित करते हैं। महान व्यक्तियों के जीवन से सकारात्म आत्म-अवधारणा विकसित करने की प्रेरणा मिलती है। इसलिए विद्यार्थियों को उनकी जीवनियां पढ़ने के लिए कहना चाहिए। शिक्षक को उन्हें यथार्थवादी लक्ष्यों को निर्धारित करने के लिए मार्गदर्शन करना चाहिए जो उनकी पहुंच के अनुरूप हैं। अवास्तविक लक्ष्यों के निर्धारण से हताशा एवं निराशा विकसित होने की संभावना रहती है।

3.5.2 अभिप्रेरणा

'अभिप्रेरणा' शब्द का अभिप्राय है एक या अधिक प्रभाव उत्पन्न करने के लिए कार्य करने की प्रवृत्ति जागृत करना। अभिप्रेरणा कार्य को जागृत करने, बनाए रखने व नियंत्रित करने की प्रक्रिया है।

कक्षा में अभिप्रेरणा: विभिन्न तकनीकें

(क) कक्षा अधिगम में विद्यार्थियों को शिक्षक से लगातार अभिप्रेरणा की आवश्यकता होती है ताकि उनकी प्रतिभाओं का अभिप्रेरणा विकसित करने में अधिकतम उपयोग हो सके। बच्चों में उनकी विशिष्ट आवश्यकताओं संबंधी व्यक्तिगत अंतर होते हैं जो उनके व्यक्तित्व के व सामाजिक-आर्थिक पृष्ठभूमि पर आधारित होते हैं। इसलिए शिक्षकों को भी अभिप्रेरणा तकनीकों में विभिन्नता लानी होगी और उन्हें विवेकपूर्ण ढंग से प्रयोग में लाना होगा। दूसरे शब्दों में प्रत्येक शिष्य को व्यक्तिगत रूप से लक्ष्य की दिशा की ओर ले जाना होगा जिसके बारे में वह जानता है कि और उसे प्राप्त करना चाहता है।

(ख) लक्ष्य शिष्यों की पहुंच के भीतर होने चाहिए और उन्हें प्राप्य लगने चाहिए।

(ग) शिष्य यह पता लगाने में सक्षम होना चाहिए कि वह लक्ष्य की प्राप्ति कर पा रहा है या नहीं। यदि नहीं तो कभी कहां है।

(घ) शिक्षक को अभिप्रेरणा की केवल एक तकनीक पर सख्ती से व पक्की तरह चिपके नहीं रहना चाहिए बल्कि उसे विवेकपूर्ण व वैज्ञानिक ढंग से सभी तकनीकों का प्रयोग करना चाहिए।

1. **आकर्षक भौतिक वातावरण :** शिक्षक को कक्षा के भौतिक वातावरण का ध्यान रखना चाहिए। कक्षा के भीतर व बाहर कोई ध्यान भंग करने वाले कारक नहीं होने चाहिए। शोर, तेज प्रकाश व कुछ अवांछनीय नज़ारे बच्चों का ध्यान भंग करते है और रुचि कम कर देते हैं। असाधारण तापमान भी परेशानी उत्पन्न करता है। एक ही प्रकार की क्रियाएं भी बोरियत पैदा करती हैं।

कक्षा कक्ष हवादार व आकर्षक ढंग से सजाए जाने चाहिए। स्कूल परिसर में फूल वाले पौधे होने चाहिए। सफाई पर पर्याप्त जोर देना चाहिए।

2. **जन्मजात आवेगों का बाहर निकलना :** छोटे बच्चों के अधिकतर व्यवहार जन्मजात आवेगों द्वारा निर्देशित होते है। बच्चे स्वभाव से बड़े जिज्ञासु होते हैं। वे बहुत सारी क्रियाएं करना चाहते हैं। हर नई व अजीब वस्तु उन्हें आकर्षित करती है। एक प्रभावी शिक्षक जिज्ञासा के इस आवेग को प्रोत्साहित करेगा। वह नया पाठ हमेशा किसी उसके बहुत ही नए व अजीब पहलू से शुरू करेगा। इसी प्रकार बच्चे कई वस्तुएं बनाना चाहते हैं। शिक्षक को उन्हें नई चीजें बनाने, उनका सर्जन करने के लिए प्रोत्साहित करना चाहिए।

3. **शिक्षक द्वारा प्रोत्साहन रूपांतर :** यह साधारणत: देखा गया है कि बच्चे एक चीज/क्रिया में लंबे समय तक ध्यान नहीं दे पाते। शिक्षण–अधिगम प्रक्रिया की प्रभाविता काफी हद तक निर्भर करती है शिक्षक के व्यवहार में प्रयोग किए गए प्रोत्साहन रूपांतर पर। शिक्षक के व्यवहार में कुछ सामान्य कक्षा में रूपांतर इस प्रकार हैं :

   (i) शिक्षक का कक्षा में गति करना

   (ii) शिक्षक द्वारा किए गए इशारे

   (iii) आवाज के पैटर्न में बदलाव

   (iv) संवेदना केंद्र में बदलाव

   (v) मुद्रा में परिवर्तन

4. **सुदृढ़ीकरण :** प्रशंसा व निंदा (दोष)। इन्हें इस प्रकार से वर्गीकृत किया जा सकता है:

   (क) सकारात्मक मौखिक सुदृढ़ीकरण–शिष्य के उत्तर देने के बाद शिक्षक मौखिक रूप से अच्छा, बहुत अच्छा, सही, ठीक है आदि कहकर खुशी का संकेत देता है।

   (ख) सकारात्मक गैर-मौखिक सुदृढ़ीकरण–इसमें शामिल हैं–सिर हिलाना, मुस्कुराना, शिक्षक का शिष्य की ओर मैत्रीपूर्ण बढ़ना, देखना, शिष्य के उत्तर को शिक्षक द्वारा बोर्ड पर लिखना।

   (ग) नकारात्मक गैर-मौखिक सुदृढ़ीकरण–इसके अंतर्गत 'इशारे' आते हैं जैसे परिहास करना, त्यौरियां चढ़ाना, गुस्सा दिखाना, अधीरता दिखाना।

   (घ) नकारात्मक मौखिक सुदृढ़ीकरण–इसमें शिक्षक द्वारा इस प्रकार की टिप्पणियां आती हैं–नहीं, गलत, अच्छा नहीं है, बुरा उत्तर, बिल्कुल नहीं आदि।

5. **बाह्य अधिगम :** पुरुस्कार और दंड। पुरुस्कार व दंड देने की प्रक्रिया को सुदृढ़ीकरण कहते हैं। पुरुस्कार चाहे सामग्री के रूप में हों या प्रतीकात्मक और मनोवैज्ञानिक हों, बच्चे के सम्मान, आवश्यकताओं, सुरक्षा आदि की पूर्ति करता है व इन्हें बढ़ावा देता है और इस प्रकार प्रोत्साहन के रूप में कार्य करता है। गरीब बच्चों में सामग्री द्वारा पुरुस्कार

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अधिक प्रभावी होता है जबकि अमीर घर के बच्चों को प्रतीकात्मक पुरुस्कार से खुशी मिलती है।

6. **खुशी और दर्द :** व्यवहार के सबसे पुराने सिद्धांत के अनुसार व्यक्ति उन खुशी देने वाले अनुभवों को ढूंढते हैं जिनसे हमें संतुष्टि मिलती है और दर्दभरे अनुभवों से वे दूर भागते हैं। इस सिद्धांत का कक्षा में शिक्षण-अधिगम प्रक्रिया पर पूरा प्रभाव है। शिक्षक को खुशी देने वाले व संतुष्टि प्रदान करने वाले अनुभवों का प्रयोग करना चाहिए ताकि वे आगे सीखने के लिए अभिप्रेरित रहें।

7. **प्राप्त लक्ष्य :** प्रत्येक आठ में एक लक्ष्य होना चाहिए जहां हमें पहुंचना है। तभी विद्यार्थी उस विशेष दिशा में अपने प्रयासों को जारी रख सकते हैं। यह लक्ष्य विद्यार्थियों को स्पष्ट कर दिए जाने चाहिए।

8. **सफलता का अनुभव :** सफलता का अनुभव एक विद्यार्थी को क्रियाकलाप जारी रखने के लिए प्रेरित कर सकता है। इसलिए शिक्षक को स्कूल के कार्य (पाठ्यक्रम संबंधी व सहपाठ्यक्रम संबंधी) इस प्रकार बनाने चाहिए कि उनमें विभिन्नता हो और हर विद्यार्थी को अपने स्तर पर सफलता का अनुभव हो। उसे सफलता के अनुभव या सुदृढ़ीकरण अधि गम के हर स्तर पर नियमित रूप से व अक्सर मिलते रहने चाहिए विशेषकर आरम्भ में व मुश्किल अवस्था में।

9. **प्रतियोगिता और सहयोग :** प्रतियोगिता क्रियाकलाप के लिए एक प्रेरणा है। परन्तु व्यक्तिगत आधार पर प्रतियोगिता असमान हो सकती है और कुछ विद्यार्थियों के लिए खतरनाक हो सकती है। समूहों में प्रतियोगिता से जीत या हार के अनुभव पूरे समूह में बंटने की संभावना बना देती है। सहयोग भी प्रेरणा प्रदान करता है क्योंकि यह शिक्षार्थियों को सामाजिक परिस्थितियां प्रदान करता है जहां उन्हें सामाजिक स्वीकृत व अपनेपन की आवश्यकताओं की पूर्ति से संतुष्टि मिलती है।

10. **प्रगति का ज्ञान :** विद्यार्थियों को अपनी प्रगति का आभास कि वे किस प्रकार अपने लक्ष्य की ओर बढ़ रहे हैं, अभिप्रेरणा का एक प्रभावी रूप है। यह उन्हें अधिक प्रयास करने में सहायक है। प्रत्येक बच्चे का प्रगति चार्ट न केवल बच्चे को उसकी प्रगति के बारे में बताता है, बल्कि उसे अधिगम क्रियाकलापों में लगाए रखता है।

11. **नवीनता :** अपनी प्रतिभाओं को चरम सीमा तक निखारने (आत्म-यर्थाथीकरण) के प्रयास में विद्यार्थी नया और कुछ अलग करने की खोज करते हैं। फील्ड ट्रिप, यात्राएं, नाटक, खेलकूद, साहित्यिक गतिविधियां आदि विद्यार्थियों को अवसर प्रदान करने उनकी 'आत्म यर्थाथीकरण' की आवश्यकता की पूर्ति में सहायक होते हैं। परंतु उनकी सुरक्षा की जरूरत के कारण उन्हें पहले से पता होना चाहिए कि नए अनुभव कब और कैसे प्रदान किए जाएंगे।

12. **बच्चों में व्यक्तिगत विभिन्नताएं :** बच्चों की रुचियां व क्षमताएं भिन्न-भिन्न होती हैं। सभी बच्चों को हर समय, हर पाठ के लिए एक ही ढंग से प्रेरित नहीं किया जा सकता।

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यह शिक्षक की जिम्मेवारी है कि वह बच्चों की रुचियों व क्षमताओं का पता लगाए और उसी के अनुसार उन्हें प्रेरित करें।

13. **शिक्षण कौशल :** शिक्षक के शिक्षण-कौशल अभिप्रेरणा को बहुत अधित प्रभावित करते हैं। कक्षा में विद्यार्थियों को अभिप्रेरित करने के लिए आवश्यक शिक्षण-कौशलों की सही संख्या बताना आसान नहीं है।

शिक्षण-अधिगम प्रक्रिया में प्रयोग किए जाने वाले सामान्य शिक्षण कौशलों की सूची इस प्रकार है :

(i) पाठ को प्रस्तावित करने का कौशल

(ii) प्रश्न पूछने का कौशल

(iii) बच्चों के उत्तरों से निपटने का कौशल

(iv) प्रोत्साहर रूपांतरण का कौशल

(v) चॉक बोर्ड को प्रयोग करने का कौशल

(vi) शिक्षण सहायक सामग्री व अन्य उपकरणों को प्रयोग करने का कौशल

(vii) गैर मौखिक संकेतों का प्रयोग करने का कौशल

(viii) सुदृढ़ीकरण करने का कौशल

(ix) चित्र व उदाहरण प्रयोग करने का कौशल

(x) विषय वस्तु को समझाने का कौशल (विवरण होने का कौशल)

(xi) स्पष्टीकरण करने का कौशल

(xii) नियोजित पुनरावृत्ति करवाने का कौशल

(xiii) सामूहिक चर्चा के लिए प्रेरित करने का कौशल

(xiv) बच्चों से निष्कर्ष निकलवाने का कौशल

(xv) शिक्षक द्वारा खुशनुमा व्यवहार दिखाने का कौशल

(xvi) पाठ को अंत करने का कौशल

(xvii) उपयुक्त शिक्षण विधियां प्रयोग करने का कौशल

14. **शिक्षक की अपनी प्रेरणा और शिक्षण में रुचि**–शिक्षक को स्वयं बच्चों में और वह क्या पढ़ा रहा है (विषय वस्तु) में रुचि लेनी चाहिए। यदि शिक्षक स्वयं कार्य में रुचि नहीं लेता तो वह बच्चों को कभी अभिप्रेरित नहीं कर सकता। कहा जा सकता है कि एक

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शिक्षक जो कई वर्षों से एक ही विषय, उन्हीं कक्षाओं में पढ़ा रहा है, अपनी रुचि खो देता है। परंतु ऐसा होता नहीं है। विषय वस्तु एक ही हो सकती है परंतु बच्चे प्रति वर्ष बदलते रहते हैं। विषय वस्तु भी बदल रही है और अधिक विकसित हो रही है। अनुभव के साथ-साथ शिक्षक एक ही विषय वस्तु को पढ़ाने के नए उपागम व नई विधियां खोज लेता है।

3.5.3 अभिवृति (एटीच्यूड रवैया)

शिक्षा के उद्देश्यों में से एक उद्देश्य है कि बच्चों में ऐच्छिक अभिवृतियों का विकास किया जाए। बच्चई कई अभिवृत्तियां अवश्य विकसित करें जैसे अध्ययन के प्रति अभिवृति, स्वयं, मित्रों व कुछ आदर्शों के प्रति अभिवृति अभिवृति या रवैया एक स्वभाविक तत्परता है जिसे किसी संस्था, व्यक्ति या वस्तु के प्रति एक नियमित रूप से सीखा गया है और वह व्यक्ति का प्रतिक्रिया करने का एक विशेष तरीका बन गया है। उदाहरण के लिए किसी का भोजन या पेय, खेलकूद, गणित या प्रजातंत्र के प्रति रवैया उसकी अभिवृति है। इसमें व्यक्तित्व के कुछ पहलू शामिल हैं जैसे रुचियां, तारीफ, सामाजिक व्यवहार। अभिवृत्तियां सीखी जाती है या ग्रहण की जाती हैं।

3.5.4 मूल्य–मूल्य उन आदर्शों के लिए बने हें जिनके लिए मनुष्य जीता है। वे जीवन के मार्गदर्शक सिद्धांत हैं जो किसी के शारीरिक, सामाजिक व मानसिक स्वास्थ्य के अनुकूल हैं। मूल्यों को हम इस प्रकार परिभाषित कर सकते हैं:

(i) जो हम मानते हैं प्रकट मूल्य

(ii) जो हम व्यवहार में लाते हैं–परिचालन मूल्य

(iii) जिन्हें हम अनुभवों से सीखते हैं ताकि पुरातन पारंपरिक मूल्यों को नीवन परंपराओं में बदल सकतें।

मूल्यों की सूची

1. अनुशासन	20. सहानुभूति	39. परस्पर प्रेम (भाईचारा)
2. कर्तव्य	21. राष्ट्रीय एकता	40. निष्ठा
3. सहिष्णुता	22. नेतृत्व	41. दयालुता
4. समानता	23. श्रम की गरिमा	42. उदारता
5. व्यक्ति गरिमा	24. समाजवाद	43. समर्पण
6. मैत्री	25. समय बद्धता	44. अच्छा चरित्र
7. स्वतंत्रता	26. मानवता	45. नैतिक गुण
8. विनम्रता	27. समाज सेवा	46. अध्यात्मिकता
9. ईमानदारी	28. नियमितता	47. शिष्टता

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10. अच्छा व्यवहार
11. सादा जीवन
12. न्याय
13. राष्ट्रीय चेतना
14. शांति
15. दूसरों के प्रति सम्मान
16. अहिंसा
17. ज्ञान के लिए जिज्ञासा
18. आज्ञाकारिता
19. स्वाभिमान
29. अंत:राष्ट्रीय समझ
30. देशभक्ति
31. आत्म-नियंत्रण
32. धैर्य
33. आत्मविश्वास
34. जिज्ञासा
35. बुद्धिमता
36. उच्च सोच
37. उत्तरदायित्व की भावना
38. निडरता
48. शालीनता
49. अच्छा स्वभाव
50. अंर्तदृष्टि
51. त्याग
52. सादा जीवन और उच्च विचार

मूल्यों को विकसित करने के तरीके और साधन (शिक्षा की भूमिका)

मूल्य विकसित करने के संबंध में इतना ही कहना पर्याप्त होगा कि मूल्य सिखाए नहीं जाते अपितु विद्यार्थी उन्हें स्वयं ग्रहण करते हैं। यदि हम बार-बार विद्यार्थियों को कहें कि सदैव सच बोलो, झूठ बोलना पाप है, तो न तो वे सच बोलना शुरू कर देंगे और न ही झूठ बोलना बंद कर देंगे। परंतु यदि शिक्षक उपदेश देने की बजाय स्वयं सच्चाई का रास्ता अपनाए और विद्यार्थी उसे हमेशा सच बोलते ही पाएं तो शायद इसका प्रभाव उन पर पड़ेगा और वे सच का रास्ता अपना लेंगे। उदाहरण के लिए गांधी जी ने राजा हरीश चन्द्र का नाटक देखा और इस नाटक का उन पर इतना प्रभाव पड़ा कि उन्होंने अपने बाकी जीवन में केवल सत्य का मार्ग अपनाया। इसीलिए मूल्यों के लिए कहा जाता है कि मूल्य पढ़ाए नहीं जाते बल्कि बच्चे उन्हें देखकर अपना लेते हैं। इसलिए विद्यालय और शिक्षक मिलकर यह प्रयास करें कि विद्यार्थियों में ऐच्छिक मूल्य विकास के लिए अवसर दिए जाएं। ये मूल्य स्कूल के वातावरण व शिक्षकों के आचार-व्यवहार में भी झलकने चाहिए।

जो भी कुछ कहा गया है उसके अतिरिक्त विद्यार्थियों को मूल्य शिक्षा विभिन्न माध्यमों द्वारा दी जा सकती है। ये तरीके व माध्यम नीचे दिए गए हैं:

1. **प्रार्थना सभा**–स्कूल में शिक्षण कार्य आरंभ होने से पहले यह आवश्यक है कि प्रार्थना सभा आयोजित की जाए। इसकी अवधि 15-20 मिनट की होनी चाहिए। कोई शक नहीं कि प्रार्थना सभा में ईश्वर की प्रार्थना होनी चाहिए। परंतु इसके अतिरिक्त धार्मिक चर्चाओं, देशभक्ति के गीत, नैतिकता पर भाषण समय के अनुसार शिक्षकों व विद्यार्थियों में द्वारा प्रस्तुत किए जाने चाहिए। इस प्रकार के प्रावधान प्रार्थना सभा में होने चाहिए।

2. **अनिवार्य विषय**–अनिवार्य विषय से अभिप्राय है कि नैतिक शिक्षा के एक विषय के रूप में स्कूलों के अंदर अनिवार्य रूप से पढ़ाना चाहिए। इस विषय में सभी धर्मों से लिया ज्ञान होना चाहिए। इसमें सभी धर्मों के सिद्धान्तों का निचोड़ होना चाहिए। इस विषय को पढ़ाने के लिए सप्ताह में कम से कम दो कालांश जरूर दिए जाने चाहिए।

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3. **पाठ्यक्रम की पुनः व्यवस्था**–मूल्य शिक्षा प्रदान करने के लिए पाठ्यक्रम को पुनः व्यवस्थित करना पड़ेगा। कुछ विषयों में इस प्रकार के परिवर्तन करने चाहिए कि इन विषयों द्वारा सामाजिक, नैतिक, सांस्कृतिक व राष्ट्रीय मूल्य भी विकसित किए जा सकें। इतिहास, भूगोल, सामाजिक ज्ञान, भाषाओं, साहित्य, कला व संगीत द्वारा यह संभव है।

4. **विस्तार व्याख्यान**–संस्था में समय-समय पर ऐसे विद्वान बुलाने चाहिए जिनका नैतिक विषयों से अटूट रिश्ता है। ये बुलाए गए विद्वान विस्तार व्याख्यान के तहत मनुष्य की भलाई से संबंधित अपने विचार प्रकट करें।

5. **भाषण प्रतियोगिताएं**–शैक्षिक मूल्यों पर आधारित विषयों पर स्कूल में भाषण प्रतियोगिताएं करवाई जानी चाहिए। विद्यार्थियों को इनमें भाग लेने के लिए प्रोत्साहित करना चाहिए।

6. **नाटक तथा एकांकी**–नाटक तथा एकांकी द्वारा स्कूलों में मूल्य शिक्षा आसानी से दी जा सकती है। इनके द्वारा नैतिक, सामाजिक और सांस्कृतिक मूल्यों का विकास किया जा सकता है।

7. **जन्मोत्सव मनाना**–स्कूल में उन आदर्श व्यक्तियों के जन्मोत्सव मनाए जाने चाहिए जिन्होंने जीवन भर उच्च आदर्शों के उपदेश दिए और समाज के सम्मुख उन आदर्शों को प्रस्तुत भी किया। उदाहरण के लिए महात्मा गांधी, गुरु नानक, गुरु गोबिंद सिंह, बुद्ध, जवाहरलाल नेहरू, और एस. राजाकृष्णन के जन्मदिन स्कूल में मनाने चाहिए। इनके जन्मदिन मनाने से विद्यार्थियों को इनके मार्ग पर चलने की प्रेरणा मिलेगी।

8. **अंतःराष्ट्रीय दिनों को मनाना**–कई अंतःराष्ट्रीय दिवस हैं जिन्हें स्कूल में मनाना चाहिए जैसे विश्व शांति दिवस, मानव-अधिकार दिवस आदि। ऐसा करने से विद्यार्थियों में विश्व एकता का विकास होगा।

9. **मास मीडिया का प्रयोग**–विद्यार्थियों को मूल्य शिक्षा देने के लिए मास मीडिया का अधिक से अधिक प्रयोग करना चाहिए। अखबारें, पत्रिकाएं, दूरदर्शन और रेडियो विद्यार्थियों में मूल्यों संबंधी जागरूकता उत्पन्न करवाने में सहायक हैं।

10. **राष्ट्रीय सेवा योजना**–विद्यार्थियों में समाज सेवा व राष्ट्रीय सेवा का भाव राष्ट्रीय सेवा योजना द्वारा विकसित किया जा सकता है। समाज सेवा से संबंधित कार्य करते हुए विद्यार्थियों में नैतिक, सामाजिक सं सांस्कृतिक विकास करवाया जा सकता है।

11. **मूल्य परक पत्रिकाएं**–विद्यालयों द्वारा प्रकाशित पत्रिकाओं में इस प्रकार के लेख सम्मिलित करने चाहिए जिसके द्वारा विद्यार्थियों को कुछ शिक्षा मिले जिससे उनके व्यक्तित्व का विकास हो।

12. **शिक्षक की भूमिका**–शिक्षक को शैक्षिक मूल्यों के विकास में महत्त्वपूर्ण भूमिका निभानी चाहिए। ऊपर लिखे सभी संसाधन शिक्षक को प्रयोग करने चाहिए। ऊपर लिखे सभी संसाधन शिक्षक को प्रयोग करने चाहिए। इस संदर्भ में हम शिक्षक की भूमिका पर पहले ही चर्चा कर चुके हैं। इस दुनिया में बच्चा जो भी कुछ सीखता है, दूसरों की नकल करके

सीखता है। बच्चों के लिए शिक्षक उनका आदर्श है और वे शिक्षकों की जीवन शैली की नकल करते हैं। शिक्षकों को बच्चों में मूल्यों को विकसित करने के लिए अपने आदर्श प्रस्तुत करने चाहिए। शिक्षक का रवैया खुला होना चाहिए। एक शिक्षक मूलय परक शिक्षा तभी प्रदान करता है जब वह स्वयं उसमें विश्वास करता हो। शिक्षक का यह प्रयास होना चाहिए कि जब भी मूल्यों के संदर्भ में कोई बात हो, वह उस पर बल देकर मूल्य परक शिक्षा प्रदान करे। समाज में शिक्षक ही एक ऐसा व्यक्ति है जिसके द्वारा बच्चों में सामाजिक, नैतिक, सांस्कृतिक और आध्यात्मिक विकास संभव है। इसलिए शिक्षक का व्यक्तिगत जीवन साफ, सुथरा, बाकी लोगों से ऊचा और नकल करने लायक हो ताकि वह बच्चों के व्यक्तित्व पर गहरा प्रभाव छोड़ सके।

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व्यक्तित्व के विकास के उत्तरदायी कारकों को बनाएं।

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3.6 व्यक्तित्व का मूल्यांकन

मूल्यांकन की विधियों को मोटे तौर पर इस प्रकार वर्गीकृत कर सकते हैं :

(i) वस्तुनिष्ठ विधियां

(ii) व्यक्तिपरक विधियां

(iii) प्रक्षेपी विधियां

पहली बात, विधियां और तकनीकें मानकीकृत और गैर-मानकीकृत में भी वर्गीकृत की जा सकती हैं। कुछ स्वयं रिर्पोटिंग विधियां भी हैं जिसमें जिस व्यक्ति का मूल्यांकन करना होता है वह अपनी रिपोर्ट स्वयं देता है। ऐसी विधियों में आता है आत्मकथा, साक्षात्कार, प्रश्नावली, और व्यक्तिगत सूची। दूसरे, कुछ रेटिंग तकनीकें हैं जिनमें मूल्यांकन इस आधार पर किया जाता है कि लोग किसी व्यक्ति के बारे में क्या कहते हैं। इस विधि में सभी प्रकार के रेटिंग स्केल, जीवनी, केस हिस्टरी आदि आते हैं।

तीसरे, हम व्यवहारगत तरीके प्रयोग करते हैं जिनमें वास्तविक जीवन में किसी व्यक्ति का वास्तविक व्यवहार देखा जाता है।

चौथे, कुछ प्रक्षेपी तरीके हैं जो किसी व्यक्ति के काल्पनिक परिस्थितियों में की गई प्रतिक्रिया को प्रयोग करते हैं।

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अंत में कुछ मशीनें व तकनीकी उपकरण हैं जिनसे कम व्यक्तित्व के चरों का आकलन कर सकते हैं।

व्यक्तित्व मूल्यांकन की विधियां

मानकीकृत टैस्ट वस्तुपरक विधियां	गैरमानकीकृत टैस्ट व्यक्तिपरक विधियां	पक्षेपी तकनीकें
1. उपलब्धि परीक्षा	1. एनेक्डॉटल (वास्तविक रिकार्ड)	1. बी.जी. टैस्ट
2.	2. आत्मकथा	2. ब्लैकी चित्र टैस्ट
3. बुद्धि परीक्षा	3. केस हिस्ट्री या केस स्टडी	3. चिल्ड्रन एपरसेप्शन
4. रुचि परीक्षा	4. संचयी रिकार्ड कार्ड	4. क्ले मॉडलिंग
5. व्यक्तिगत सूची	5. साक्षात्कार	5. क्लाउड पिक्चर टैस्ट
	6. अवलोकन	6. ड्रा ए मैन टैस्ट
	7. अभिभावकों के विचार	7. हस्तलेख का अध्ययन
	8. व्यक्तिगत डाटा बैंक	8. मोसाइक टैस्ट
	9. प्रश्नावली	9. साइकोड्रामा
	10. रेटिंगस्केल या मनोवृति स्केल	10. रॉर्सचाक स्याही ब्लाट टैस्ट
	11. अनुसूची	11. वाक्य पूरा करो टैस्ट
	12. प्राप्तांक कार्ड	12. सोशियो-ड्रामा
	13. समाजमिति	13. Szondi टैस्ट
		14. थीमेटिक एपरसोशन टैस्ट
		15. खिलौना और गुड़िया खेल टैस्ट
		16. वर्ड एसोसिएशन टैस्ट (खुली और नियंत्रित)

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व्यक्तित्व मूल्यांकन की कौन-कौन सी विधियां हैं?

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3.7 विद्यार्थियों के व्यक्तित्व के विकास में शिक्षक की भूमिका

शिक्षकों के लिए कुछ महत्त्वपूर्ण मार्गदर्शन इस प्रकार हैं :

- **ध्यान देना**–निम्नलिखित बातें उल्लेख लायक हैं :

1. व्यक्तित्व विकास के सबसे अच्छे तरीकों में से एक है बच्चों पर पूरा ध्यान देना
2. ध्यान देने की गुणवत्ता महत्त्वपूर्ण है।
3. यदि बच्चे कोई प्रश्न पूछें, शिक्षक को तुरंत जवाब देना चाहिए। वे महत्त्वपूर्ण है और हमारा उनकी ओर ध्यान देना आवश्यक है। यदि शिक्षक उन्हें अनदेखा कर देगी तो वे यह धारणा बना लेंगे कि उन्हें अनदेखा किया जा रहा है और वे आत्मविश्वास खो देंगे।

- **अनुशासन**

1. शिक्षक को सही, खुलकर बोलने वाला, ईमानदार व प्यार करने वाला होना चाहिए परंतु साथ ही अडिग और एकसमान व्यवहार वाला।
2. बहुत हल्के नियमों का कोई पालन नहीं करता और बहुत कठोर नियम निभाए नहीं जाते।
3. अनुशासन को बच्चों की आवश्यकता अनुसार ढाल लेना चाहिए।

- **उदाहरण**

1. बच्चे कार्यों से प्रभावित होते हैं क्योंकि कार्य शब्दों से अधिक जोर से बोलते हैं।
2. शिक्षक को सावधानी पूर्वक रहना चाहिए। हो सकता है कि वह एकमात्र पुस्तक हो जिसे कुछ बच्चे पढ़ते हैं।

- **मजा**

शिक्षक को कभी-कभी बच्चों के साथ मज़े करने चाहिए। इसका अपना एक शैक्षिक मूल्य है।

- **प्रेरणा**

शिक्षकों को प्रेरणा प्रदान करने का राज है–

- वह जाने कि वह क्या कर रहा है।
- वह जो करता है, उसे प्यार करे।
- वह जो करता है, उसमें विश्वास रखे।
- **प्रेम**–यह एक आम कहावत है–'बच्चे से प्रेम करो, वह तुमसे प्रेम करेगा। उससे नफरत करो, वह तुमसे नफरत करेगा।'

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- **धीरज**–एक बच्चे को प्रेम से प्रशिक्षित करने के लिए बहुत धीरज की आवश्यकत होती है।

- **प्रशंसा**

1. बच्चे प्रशंसा पर है पलते हैं। यह शिक्षण का सबसे महत्त्वपूर्ण पहलू है।
2. यदि बच्चा आलोचना के साथ रहता है, वह निंदा करना सीखता है। यदि वह प्रशंसा के साथ रहता है, वह अपनी पूर्ण क्षमता से मेहनत करता है।
3. बच्चे की उसके अच्छे व्यवहार के लिए प्रशंसा करना महत्त्वपूर्ण है बजाय कि उसके बुरे व्यवहार के लिए डांटना।

- **समझ**

बच्चे को समझने के लिए शिक्षक पहले स्वयं को समझे। इस बात को बल देकर कहा जा सकता है कि शिक्षक बच्चे के व्यक्तित्व के विकास में सभी पहलुओं पर ध्यान नहीं देता। शिक्षक से आशा की जाती है कि वह बच्चों के लिए सबकुछ हो–एक चिकित्सक जो उनकी शारीरिक व मानसिक सेहत का ध्यान दे, ताकि उनका मानसिक स्वास्थ्य अच्छा हो, एक दार्शनिक जो मेहनत से उन्हें सच की खोज में मार्गदर्शन करे, एक नीतिज्ञ जो उन्हें अच्छाई ग्रहण करने के लिए प्रेरित करे, एक कलाकार जो उन्हें सुंदरता खोजने में मदद करे। शिक्षक को एक मंत्री होना चाहिए जो बच्चों की हर आवश्यकता की पूर्ति करने का प्रयास करे। ऐसा मंत्रालय समर्पित सेवा की मांग करता है।

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क्या शिक्षक बच्चे के व्यक्तित्व के विकास के लिए जिम्मेवार है? यदि हां, तो कैसे?

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3.8 सारांश

'परसनेलिटी' शब्द लेटिन शब्द 'परसोना' से लिया गया है जिसका अर्थ है रोमन अभिनेताओं द्वारा पहना जाने वाला मुखौटा। इस प्रकार व्यक्तित्व का अर्थ है दूसरों की नजर से किसी व्यक्ति को देखना। व्यक्तित्व वह है 'जो व्यक्ति है'। प्रत्येक व्यक्ति का व्यक्तित्व अलग है। व्यक्तित्व गतिशील है, ठहरा हुआ नहीं है। व्यक्तित्व एक संयुक्त ईकाई के रूप में कार्य करता है। व्यक्तित्व आनुवंशिकता व पर्यावरण के योग से बना है। व्यक्तित्व के कई सिद्धांत हैं जो व्यक्तित्व विकास के बारे में बताते है और उनके महत्त्वपूर्ण शैक्षिक प्रभाव हैं। एक बच्चे की

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अपने बारे में, अपनी अभिवृतियों के बारे में समझ, प्रेरणा जो उसे प्राप्त होती है, मूल्य जिन्हें वह सीखता है सब उसके व्यक्तित्व के विकास में सहायक हैं। बच्चे के व्यक्तित्व के विकास में शिक्षक की एक महत्त्वपूर्ण भूमिका है। व्यक्तित्व को वस्तुपरक, व्यक्तिपरक व प्रक्षेपित विधि यों द्वारा मापा जा सकता है।

3.9 स्वयं परीक्षण के मॉडल उत्तर

स्वयं परीक्षण-1

व्यक्तित्व एक व्यक्ति के बारे में समग्र जानकारी है–उसकी शारीरिक, भावात्मक, मानसिक, सामाजिक, नैतिक व आध्यात्मिक बनावट।

स्वयं परीक्षण-2

प्रत्येक व्यक्ति का व्यक्तित्व अलग है। व्यक्तित्व गतिशील है, स्थिर नहीं।

स्वयं परीक्षण-3

व्यक्तित्व का गुण सिद्धांत और आत्म विश्लेषण सिद्धांत।

स्वयं परीक्षण-4

आत्म अवधारणा, प्रेरणा, अभिवृत्तियां और मूल्य

स्वयं परीक्षण-5

(i) वस्तुपरक विधियां (ii) व्यक्तिपरक विधियां (iii) प्रक्षेपण विधियां

स्वयं परीक्षण-6

हां। शिक्षक को बच्चों की ओर ध्यान देना चाहिए। उन्हें समझना चाहिए और प्रेम व प्रशंसा से बर्ताव करना चाहिए ताकि वे अच्छे व्यक्तित्व का विकास कर पाएं।

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3.11 इकाई अंत अभ्यास

1. व्यक्तित्व को परिभाषित करें।
2. व्यक्तित्व की क्या विशेषताएं हैं?
3. व्यक्तित्व का मापन करने के विभिन्न तरीके क्या है?
4. व्यक्तित्व के किसी एक सिद्धांत को स्पष्ट करें।

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UNIT 6 ASSESSMENT AND EVALUATION AND RELATED ISSUES

Concept - Map of the unit

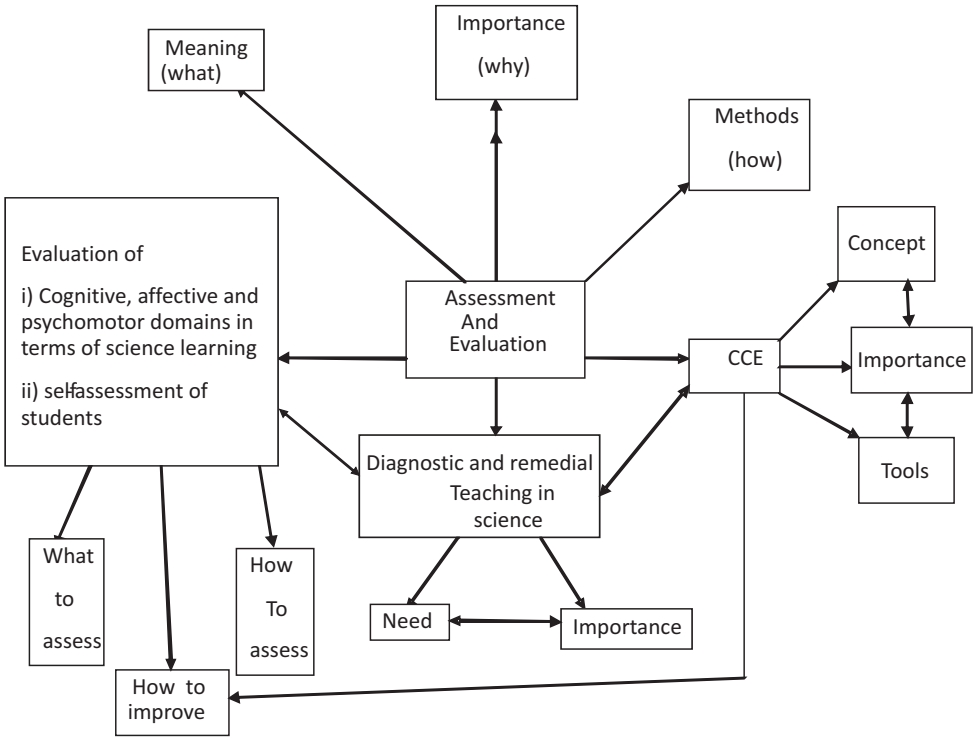

Fig. 6.1: Concept Map of the Unit

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UNIT 6 ASSESSMENT AND EVALUATION AND RELATED ISSUES

Structure

6.0 INTRODUCTION

In this course, so far you have learnt about the nature of science, what is the importance of science as a process? And what are different approaches to teaching of science? You have also learnt about various types of learning experiences we need to provide

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for facilitating learning and how to plan for these experiences. Though all this is very important and essential, as teachers it is equally important to know the effectiveness and the appropriateness of the teaching–learning process carried out in the classroom. Hence, in the present unit, we shall learn about an important and inevitable aspect of the teaching-learning process i.e. assessment and evaluation. You may have a look at Figure 6.1 and see the relationship among various concepts included in this unit.

6.1 LEARNING OBJECTIVES

After goings through this unit, you should be able to:

- differentiate between the concepts of measurement, assessment and evaluation.
- distinguish between objectives and specifications and describe their relationship to the subject matter (content), learning experiences and evaluation.
- explain taxonomy of educational objectives and write objectives and specifications appropriate to your subject area and the topic you are to teach.
- compare formative and summative evaluation.
- justify the importance of internal assessment.
- explain the significance of Continuous Comprehensive Evaluation and its use in teaching-learning.
- establish the need for diagnostic and remedial teaching.
- plan for cognitive, affective and psychomotor domains evaluation.

Any activity that we undertake needs to be evaluated to find its utility, effectiveness, quality and for its future improvement. In case of a manufacturing unit, the finished product is passed through a process of quality control, to check the quality of the finished goods. In case of any defects or drawbacks, the particular piece is rejected. The process is rechecked or assessed for improvement, so that there are no rejections. In case of education what do we do for the quality control? The process of education has to be effective and the end product has to be good. This is because, we deal with human beings, that is, students and hence, no rejection is possible. In this situation, proper assessment and evaluation is of utmost importance to ascertain the effectiveness of the teaching-learning process. The evaluation of the students for their learning outcomes can be used to find out the effectiveness of the teaching-learning process.

6.2 SOME COMMONLY USED TERMS

We often use the terms, 'assessment' and 'evaluation' interchangeably or synonymously. Are they synonymous? Do they mean the same thing? Let us try to understand the

concept of evaluation and see how it is different from assessment. We will now examine some common words, which are used along with evaluation in the field of education.

Test: Test is one of the tools of evaluation. It may consist of a set of questions, which are answered by the learners. Teacher corrects these answers and assigns a numerical value for the correct answers. This numerical value is called as marks.

Measurement: This quantifies the performance of a student in a test, as it assigns the numerical value (marks) to express the performance of the student. It measures the achievement based on a specific test offering numerical value.

We measure quantity of milk, weight of the person or rainfall in a day. Such 'physical' attributes like volume, weight etc. can be measured accurately using some instruments like measuring cylinder, weighing balance, etc. But in case of attributes like academic scholarship we do not get such accurately measuring instruments. We depend on the teacher-made test for this.

Assessment: This term is mainly used when the performance is expressed in qualitative terms. Here the quality of the performance is described.

All these terms are essential to understand the concept of evaluation but are not synonymous with evaluation.

6.2.1 Definitions of the Terms

Measurement: It is a process of quantification of measurable phenomenon.

"In its broadest sense, measurement is the assignment of numerals to objects, or events, according to rules" – Stevens (1951)

"Measurement is the assignment of numerals to entities according to rules" – Stufflebeam (1968).

"Measurement entails certain rules and procedures for assigning numbers to attributes in such a way that the numbers to attributes in such a way that the numbers represent the quantity of the attribute" – A Dictionary of Education (1981).

Assessment

"Assessment is a process of describing certain traits, processes, programmes in qualitative terms. It has to be done in the context of the objectives of the system of education"

Measurement gives the quantitative description, whereas Assessment gives the qualitative description of student's progress. Evaluation is more comprehensive term, which includes both, measurement as well as assessment and goes beyond.

Evaluation

"It is an act or a process that allows one to make a judgement about the desirability or value of a measure".

Stufflebeam and others (1968) define it as, "Evaluation is a process of delineating, obtaining and providing useful information for judging decision alternatives".

Patel (1984) defines it as, "Evaluation is any systematic, continuous process of determining

- The extent to which specified educational objectives, previously identified and defined are attained,
- The effectiveness of the learning experiences provided in the classroom,
- How well the goals of education have been accomplished.

By now you must have realized that the test is a tool which helps in measurement for evaluating various abilities of the students

ACTIVITY -1

1. *Discuss the difference between test, measurement and assessment with the help of suitable examples in about 100 words.*

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2. *Explain the concept of 'educational evaluation' with formal school teaching-learning.*

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6.3 CONCEPT OF EVALUATION

The concept of evaluation can be expressed as follows:

Evaluation	=	Quantitative measure of student's achievement	+	Qualitative description of student's achievement	+	Value Judgement by teacher

To understand this better, have a look at the following example:

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Raju is studying in standard VII. In the first terminal examination he got 89 percent marks in the written examination. From the observation done by the teacher, she writes that Raju is always punctual and very neat in his work. He is a voracious reader and always shows keen interest in curricular activities as well as in elocution, essay writing and in debates. She also observes that ... Raju does not mix around with other students. He prefers to work alone on the project rather than working in a group. On field visit or on excursion he prefers to be on his own to explore the surroundings. Based on this, teacher gives the value judgement that though Raju is very good in curricular activities; his social and emotional development needs to be improved.

From this example you will realize how evaluation is all compassing term and how it goes much beyond measurement and assessment. For instance, in the example given above, 89 percent of marks are the quantitative measure/ description about Raju. 'Raju is neat and punctual in his work, is the qualitative description. 'Raju is very good in curricular activities but his social and emotional development needs to be improved' is the value judgement given by the teacher.

Now, let us read the definition of evaluation given by Dr. Patel (1984) once again (as given below) and try to understand the new terms we have come across.

- Previously identified and defined specified educational objectives.
- Learning experiences.
- Goals of education.
- Systematic continuous process.

For undertaking any activity it is essential to know why that activity is being undertaken. What can be achieved through it? In other words, it is essential to know the objective for undertaking the activity. In the process of education, the aims of education are clear from the 'why' aspect of education. These are broad and long term. 'Objectives' are the smaller steps, achievable through the teaching–learning process in the classroom and the achievement of objectives helps us in moving closer to the aim. Objectives are the well-defined purposes of education which are achieved through various subjects taught in the school.

The subject matter is called as the content. For helping students learn the content, teacher adopts various methodologies as explained in Unit 3 and carries out certain learning activities in the class Ex. teacher may give explanation of certain concept, she may explain with the help of a diagram, or a model. She may demonstrate an experiment. Students, when interact with these, internalize them which result in learning experiences. You have learnt about the learning experiences in the previous chapter. You know that the learning experiences can be direct / first hand or indirect / second hand. Ex: A child touching a hot vessel and getting a burn has the direct or firsthand experience. But for

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his friend, hearing about it and seeing the pain on the face of the child who has got the burnt, it is an indirect or secondary experience. In the teaching – learning process, these learning experiences should result in the desirable modification in the behaviour called learning. Evaluation helps us in confirming the attainment of learning.

At this stage the teacher needs to know the effectiveness and appropriateness of the learning experiences given. Hence, the teacher administers different techniques and methods of evaluation. It is obvious that while choosing various methods and techniques of evaluation, the teacher has to keep in mind the learning experiences given to the students, as the same need to be evaluated. It can be said that the objectives, the content, the learning experiences and the evaluation methods are all interrelated. There are mutually supporting each other. This can be diagrammatically represented in Figure 6.2.

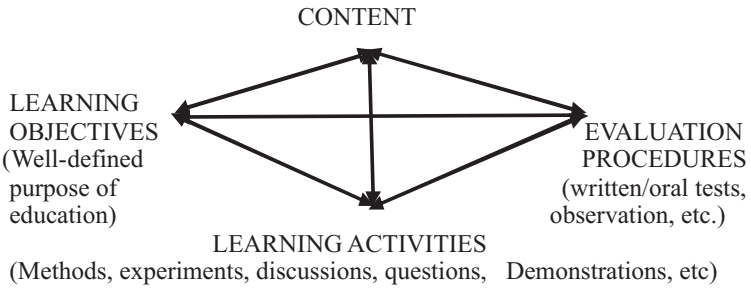

Figure 6.2 Four aspects of educational evaluation (Patel, 2001)

Let us understand this diagrammatic representation with the help of an example.

The science text-book for class VI prepared by NCERT contains a chapter on the 'getting to know plants'. This is the 'content'. What are we to achieve after teaching this content? The answer to this question tells us the 'objectives'.

For standard VI, the specific objectives could be,

1. Pupil *recalls* the parts of a plant
2. Pupil *recognises* the parts of a plant
3. Pupil *describes* the functions of various parts of a plant
4. Pupil *draws* a diagram of parts of a plant
5. Pupil *labels* the parts of a plant
6. Pupil *identifies* the parts of a plant in the given specimen, etc.

Now, for achieving these objectives what are the relevant learning experiences which need to be provided?

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A teacher can:

1. Show the actual specimen of a plant.
2. Draw a diagram on the chalk board and give explanation to it.
3. Show a chart and give explanation to it, and also show it through animation.
4. Take students out in a garden and ask them to observe various plants and identify the parts.
5. Ask students to sow a few seeds and ask them to observe and note down about the development of various parts of a plant on the germination.

After providing the learning experiences, it is essential to know about the effectiveness of those learning experiences. This is done through the evaluation. The following can be done for this:

1. Asking questions orally
2. Giving written test
3. Asking students to draw and label the diagram
4. Showing specimen and asking students to identify the parts
5. Asking students to collect various specimens and stick them in the book and then label the parts.

How do you think teacher should evaluate the students?

We have to note here that teacher has shown diagram / specimen to the students. Hence she can ask students to identify those parts. But if teacher merely describes them, without any visual experience, can the teacher ask students to identify the parts by showing specimen? Teacher cannot include that in the evaluation procedure as she has not given that learning experience to the students.

Let us see another example. The teacher wants to explain the 'Laws of Reflection' in the chapter 'Light'.

Teacher can conduct following learning activities in the class –

1. Draw a diagram on the chalkboard or display a chart and explain.
2. Demonstrate the experiment to prove the law and ask students to observe the demonstration.
3. Instruct students to carry out the experiment themselves and then to note down and verify the results.

If you, as a teacher, adopt the first option during the teaching-learning process, how would you evaluate your students? You know that you can adopt the paper-pencil test

for checking the learning outcome but you cannot ask the students to carry out the experiment (practical test), as they have not undergone the learning experience of handling the apparatus.

Hence, it is seen that there is a direct relationship between the objectives, the content, the learning experiences and the evaluation procedure. Therefore to begin with, teacher must have clear idea about objectives.

6.4 OBJECTIVES AND SPECIFICATIONS

What are objectives in the context of teaching-learning?

Objectives are the achievable targets of the educational process. They are subject-specific and achievable through the classroom teaching–learning processes. Hence, they help the teacher in day-to-day activities. Education is meant for the all-round development of the personality. This means the balanced development of the HEAD (i.e. Cognitive Domain), the HEART (i.e. Affective Domain) and the HAND (i.e. Psychomotor Domain).

Dr. Benjamin S. Bloom had given the objectives of cognitive domain, which were later revised by his student Anderson and colleague Karthwohl. The hierarchy of the affective domain was developed by Dr. Karthwohl and that of the psychomotor domain by Dr. Dave. The hierarchy of educational objectives cover all the aspects of human personality. They are as follows:

1. COGNITIVE DOMAIN	2. AFFECTIVE DOMAIN	3. PSYCHOMOTOR DOMAIN
Remembering	Receiving	Imitation
Understanding	Responding	Manipulation
Applying	Valuating	Precision
Analysing	Organizing	Articulation
Evaluating	Characterization	Naturalization
Creating		

Figure 6.3 Taxonomy of educational objectives

The hierarchy means the difficulty level goes on increasing and when one moves to the higher objective, it means the lower objective is already achieved. Ex., in cognitive domain, if student has understood the concept of effects of force on a body that means he knows what force is.

The cognitive domain includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities

Ex. Developing the understanding of the concept of acids and bases, their properties and selecting the appropriate chemical for cleaning the floor (making use of it in daily life) is a cognitive activity.

In the revised taxonomy of the cognitive domain, two dimensions are considered – the knowledge dimension and the cognitive process dimension

Table 6.1 Anderson and Kartwohl's revised taxonomy of cognitive domain

	Cognitive Processes ⇒					
The Knowledge Dimensions ⇩	1. Remember	2. Understand	3. Apply	4. Analyze	5. Evaluate	6. Create
Factual						
Conceptual						
Procedural						
Metacognitive						

The description of this table is given below:

The Knowledge dimensions can be defined as follows:

Factual Knowledge is knowledge that is basic to specific disciplines. This dimension refers to essential facts, terminology, details or elements students must know or be familiar with in order to understand a discipline or solve a problem in it. Ex. Oxygen is represented by O_2.

Conceptual Knowledge is knowledge of classifications, principles, generalizations, theories, models, or structures pertinent to a particular disciplinary area. Ex: Concept of gravity.

Procedural Knowledge refers to information or knowledge that helps students to do something specific to a discipline, subject, and area of study. It also refers to methods of inquiry, very specific or finite skills, algorithms, techniques, and particular methodologies. Ex: Dissecting the flower to study the internal parts of a flower.

Metacognitive Knowledge is the awareness of one's own cognition and particular cognitive processes. It is strategic or reflective knowledge about how to go about

solving problems, cognitive tasks, to include contextual and conditional knowledge and knowledge of self.

The cognitive process dimensions are the following:

Remember – Retrieving the relevant knowledge from long-term memory.

Understand – Construct meaning from instructional messages, including oral, written and graphic communication.

Apply – Carry out or use a procedure in a given situation.

Analyze – Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose.

Evaluate – Make judgements based on criteria or standards.

Create – Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure.

The revised model lays out the components nicely so they can be considered and used, and so cognitive processes as related to chosen instructional tasks can be easily documented and tracked. This feature has the potential to make teacher assessment, teacher self-assessment and student assessment easier or clearer as usage patterns emerge.

The affective domain includes those objectives which are concerned with changes in interest, attitudes and values and the development of appreciations and adjustment. Karthwohl, et al. (1964).

Ex. Developing scientific attitude, realizing the importance of taking care of the plants and animals in our surroundings, showing concern and helping the needy, taking efforts to keep the surroundings clean, is the part of the affective domain.

The psychomotor domain includes those objectives which deal with manual and motor skills. It covers the aspects of the physical development.

Ex: Handling the apparatus properly, measuring the volume of the given liquid accurately, drawing a neat diagram, planting and taking care of the plant, etc. come under the development of psychomotor domain.

ACTIVITY -2

1. *Write down the levels of objective in cognitive, affective and psychomotor domains with proper illustrations, considering a suitable example in around 350 words.*

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'Taxonomy of Educational Objectives' covers all the three aspects of personality. Ex: when student learns about pollution, (cognitive aspect), he becomes conscious of his activities and takes care that he does not do things to add to the pollution (affective aspect). He cleans his surroundings himself (psychomotor aspect). He may also motivate his friends to keep the surroundings clean (affective aspect). This means, these are not exclusive of each other, they are interdependent and inseparable. The objectives in each domain are arranged in hierarchical order. That means, when one moves to the next level, the difficulty level increases.

The teaching–learning process needs to be properly arranged so that a student finds it easier to go from lower level objective to the higher level objective. Ex: to apply Newton's first law in the real life situation, student needs to understand it first. But to understand it, student needs to first know the statement of the law properly. This hierarchical importance is applicable to all the three domains. Giving proper weightage to the learning experiences provided from all three domains ensures the harmonious development of the personality.

These objectives when written in terms of specific content are called as specifications. The specifications indicate the student's achievement in terms of the specific content by indicating the change in student's behaviour. When you write 'Pupil explains the structure of a plant cell', the word 'explains' shows the action of a student or the overt behaviour of the student and 'the structure of a plant cell' tells us the specific content. You will learn more about this in the following paragraphs.

There are certain norms / criteria followed for writing the statements of specifications. The statement of that for the specification contains the action verb. We will now study, how to write the statements of the specifications.

The statement of specification should

1. contain **action** verb
2. contain worthwhile specification (as per the age and physiological and psychological needs of the learner)
3. be related to the human ability (which can be developed or achieved with the help of education)
4. mention the subject-matter (i.e. content)
5. be in the form of student's achievement and not in the form of teacher's intention
6. be written in the form of achievement of one single pupil and not in the form of the achievement of a group of students
7. contain only one ability which is to be developed, achieved or modified.
8. contain one and only one content.

Ex: 'Pupil recalls types of motion'. In this statement, 'recall' is the action verb and 'types of motion' is the content part.

ACTIVITY -3

Statement of Specification	*Action Verb*	*Content*	*Objective*
Pupil recalls the statement of Newton's first law. Pupil describes the organelles of plant cell. Pupil explains the structure of atom. Pupil discriminates between longitudinal waves and transverse waves. Pupil gives examples of oscillatory motion. Pupil suggests ways to control spread of waterborne diseases. Pupil draws a diagram of structure of leaf.			

6.4.1 Writing Objectives and Specifications for Science

Find below the illustration of writing the specifications. First three, i.e. remembering, understanding and applying are from cognitive domain and skill is from psychomotor domain. The objectives pertaining to affective domain like developing scientific attitude or aesthetic sense take long for the development.

Let us look at the following illustrations:

Remembering:

Pupil recalls scientific terms, symbols, names of scientists, structures, patterns, formulae, etc.

The pupil recognises the portraits of scientists, apparatus, parts of various organ systems, diagrams, etc.

Understanding:

The pupil develops understanding of various principles, concepts, processes, theories, etc.

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The pupil discriminates (compares, contrasts, distinguishes) between –

The pupil explains (gives reason) – cause and effect relationship -

The pupil gives examples (illustrates) -

The pupil detects errors (identifies the mistakes) -

The pupil rectifies the error (corrects the mistakes) -

The pupil generalizes (infers, draws inference) the rule-

The pupil classifies –

The pupil selects proper apparatus, procedure, etc.

The pupil solves problems based on the principles taught –

Applying:

The pupil applies the understanding in new situation

The pupil analyses the problem / question –

The pupil selects proper information or data-

The pupil gives scientific reasons for various statements-

The pupil predicts the probable reasons, effects, etc.

The pupil suggests improvisation in apparatus, process, etc.

Skill:

The pupil develops skill in observation, recording, performance, drawing diagram, etc.

A. Process of Performance

The pupil checks apparatus regarding its working

The pupil cleans apparatus

The pupil sets up apparatus

The pupil draws diagram

The pupil records reading /observations

The pupil measures weight, volume, etc.

The pupil takes proper precaution while performing experiment.

The pupil observes accurately.

B. Product of Performance

The pupil summarizes the observations

The pupil calculates the results (e.g. focal length of lens).

By now, you must have understood the concept and realized the importance of the objectives and specifications. Now, you will be able to plan your lesson effectively, for the given content in such a way that, at the end of the lesson, the set objectives are achieved. This again will help you in planning the evaluation procedures for finding out the achievement of your students.

ACTIVITY -4

1. *Select one unit from the Science textbook. Write down the objectives and specification for the same.*

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2. *Consider any unit of your choice. Decide the objectives you would like to achieve through that. Plan the activities (learning experiences) and the evaluation procedures for the same.*

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6.5 TYPES OF EVALUATION

We have so far seen that evaluation has to be a continuous process for the proper evaluation of a student. This brings us to two types of evaluation. They are

- formative evaluation and
- summative evaluation

6.5.1 Formative Evaluation

Nitko (1983) defines it as, "Formative evaluation is concerned with judgements made during the design and / or development of a programme which is directed towards modifying, forming or otherwise improving the programme before it is completed".

This means that it is an on-going process of systematic evaluation of the learner's achievements. This is done during the instructional phase and helps teacher know about the learner's progress and helps the teacher reflect on the effectiveness of the learning experiences provided. As it gives immediate feedback, it gives the scope of improvement for both the teacher as well as the students.

Ex. while teaching the unit on Magnetism, teacher may ask questions based on the properties of magnet, types of magnet, laws of magnetism etc. during the teaching – learning process, to find out how much the students have understood.

6.5.2 Summative Evaluation

Nitko (1983) defines it as, "Summative evaluation describes judgements about the merits of an already completed programme, procedure or product".

E.g. semester examination or the final examination helps in summative evaluation. During summative examination, teacher can cover larger portions and also check for higher level objectives. Teacher can also check for the integration of the knowledge which was taught as separate subunits, during the teaching – learning process.

For the summative evaluation teacher can ask question of higher difficulty level – application type questions to the students. Ex: on magnetism teacher can ask following question: 'If you are given an iron rod, how will you decide, whether it is plain iron rod or magnetic rod?' In this question, student has to make use of the knowledge of properties of magnet, laws of magnetism.

Formative evaluation is immediate hence considers limited content and short-range objectives. It gives immediate feedback and hence provides scope for the modification of the methods of teaching and provisioning of learning experiences.

Summative evaluation is long-range and comprehensive. It considers the course in its totality and also helps in evaluating higher level objectives.

ACTIVITY -5

1. *Distinguish between formative evaluation and summative evaluation.*

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2. *List any three limitations of formative and summative evaluation.*

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6.6 INTERNAL ASSESSMENT

You are aware that, education aims at all-round development of the personality. Mere acquisition of knowledge is not sufficient for the development of the balanced personality. Development of desired attitudes, interests, skills and various personal and social qualities are equally important. But assessment of these aspects is not possible with external examination, which mainly comprises of a paper-pencil test. Various

personality aspects can be evaluated by the one who is in constant contact with the student. Hence there is need for the evaluation of the student by the teacher who has taught the student, as only she can judge the progress of the student. This evaluation is comprehensive and continuous and is called as the internal assessment.

Internal assessment helps in giving a complete picture of the learner. For this, the teacher has to consciously select tools (e.g. paper-pencil tests, rating scale, and checklist) and techniques (e.g. observation, sociometry) of evaluation. It helps in giving the feedback to the students about their progress in all the three domains. Based on this, the teacher can reflect and introspect on the methodologies used and on the effectiveness of the learning experiences provided. The teacher can employ the diagnostic testing and remedial teaching at the right time.

Internal assessment can be carried out by administering the teacher-made tests, and through the observations of the behaviours of the students in various situations and various activities in which they participate. In the process, the teacher can evaluate the students continuously on cognitive, affective and psychomotor aspects.

As the teacher is continuously in touch with the students, she can monitor their progress individually with the help of internal assessment. Internal assessment also helps the students in developing good and consistent study habits. Because of the continuous evaluation, the student does not depend on the last minute studies. This reduces the undue examination tension and facilitates the overall development of the personality.

For effective internal assessment the teacher needs to use variety of tools and techniques of evaluation. But for the Internal Assessment to be successful, teacher has to be impartial and properly trained.

ACTIVITY -6

1. *List out the areas from cognitive, affective and psychomotor domains, which you will consider for conducting the internal assessment of your class.*

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2. *Prepare a plan of various activities along with the evaluation procedures for evaluating different domains of the personality.*

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From all the discussion done so far, you must have realised that for the proper evaluation all three domains must be given equal importance and evaluation has to be continuous and the integral part of the teaching–learning process.

But, in reality, the evaluation done in the schools is far from what really needs to be done. It is observed that mostly it stresses on the content and the lower level objectives of the cognitive domain only. To improve the present system of evaluation, the system of Comprehensive Continuous Evaluation has been introduced.

6.7 CONTINUOUS COMPREHENSIVE EVALUATION (CCE)

We will try to understand the rationale behind the introduction of CCE:

The Kothari Commission Report (1966) states "the internal assessment or evaluation conducted by schools is of great significance and should be given increasing importance. It should be comprehensive, evaluating all those aspects of students' growth that are measured by the external examination and also those personality traits, interest and attitudes which cannot be assessed by it". (9.84).

National Policy on Education (1986) also states that "Continuous and Comprehensive evaluation should incorporate both scholastic and co-scholastic aspects of evaluation spread over the total span of instructional time (8.24(iii)).

The National Curriculum Framework (2005) has proposed the examination reforms. Its position paper on Aims of Education – NCF -2005, NCERT says,

School based CCE system should be established to...

Reduce stress on children,

- Make evaluation comprehensive and regular
- Provide space for the teacher for creative teaching
- Provide a tool of diagnosis and remediation
- Produce learners with greater skills

Right of children to Free and Compulsory Education Act(RTE -2009)

Government of India adopted a new act – "right to free and compulsory education for children between 6-14 years of age".

This law came into force for the entire country, except for Kashmir with effect from 1st April 2010.

It states that students up to Std. VIII should not be made to appear for any board examination and from the year 2010-2011 a scheme of Continuous Comprehensive Evaluation to be implemented from Standard. I to VIII

You have already learnt about this in your course 1 in 'Elementary Education in India: A Socio-Cultural Perspective'.

Now let us study more about CCE.

What is Continuous Comprehensive Education (CCE)?

CCE refers to a system of school based evaluation of students that covers all aspects of student personality. It is a curricular initiative, attempting to shift emphasis from mere testing to Holistic Learning.

Continuous indicates that the evaluation of identified aspects of students' growth and development is a continuous process and cannot be done in discrete patches. It has to be in-built in the total teaching – learning process and must be done throughout the academic year.

Comprehensive means the scheme must attempt to cover both the scholastic (i.e. considering the objectives of cognitive domain) and the co-scholastic aspects (i.e. the objectives of affective and psychomotor domain) of students' growth and development.

What can be achieved with CCE?

The core objective of CCE is to have continuity in evaluation and assessment of broad based learning and behavioural outcomes.

This can help in achieving the following outcomes –

- To help develop skills (cognitive and psychomotor)
- To lay emphasis on thought process and de-emphasise memorization
- To make evaluation an integral part of teaching learning process
- To use evaluation for improvement of students' achievement
- To guide teaching-learning strategy on the basis of regular diagnosis followed by remedial instructions
- To make the process of teaching and learning a 'Learner Centred Activity'.

How is CCE going to be beneficial to the students and the teachers?

- Elimination of chance factor and subjectivity.
- De-emphasis on memorization.
- Encouragement of comprehensive evaluation covering scholastic and co-scholastic aspects.
- Continuous evaluation throughout the total span of the instructional time.

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- Functional and meaningful declaration of results for effective use.
- Wider use of test results for improvement through diagnosis and remedial/ enrichment programme.
- Improvement in the mechanics of conducting examination.
- Introduction of desired changes in instructional material and methodology.
- Use of grade in place of marks in determining the level of pupils' performance and proficiency.

6.7.1 Tools for CCE

Since CCE is continuous and comprehensive, you need do to evaluate your students for both the short term as well as long term objectives. Hence you need to carry out CCE at both the formative as well as the summative stages.

6.7.1.1 CCE for Formative Evaluation

- Day-to-day observation
- Oral work (question answers, loud reading, dialogues / conversation, role-play, interview, group discussion, etc.)
- Practical / experiments
- Activity (Individual, Group, Self-study)
- Projects
- Tests (Informal small duration written tests, open book tests, etc)
- Homework / class work (Informative, descriptive, essay, report, story and letter. Dialogue, expressing imagination, etc.)
- Others (questionnaire, self-evaluation, peer-evaluation, group work and other similar tools)

6.7.1.2 CCE for Summative Evaluation

- In written, oral and practical form
- At the end of first and second semester

You must have realized that, CCE is a positive step for enhancing the all-round development of a student. But in the present circumstances, it foresees a lot of challenges. They are,

- Large class-strengths
- High pupil /teacher ratio

- Teachers' perceptions and competencies
- Diversity of learners
- Time constraints
- Monitoring and feedback
- Remediation and enrichment
- Teaching-learning resources
- Uniform applicability
- Preventing nepotism and victimization
- Switching from CCE to traditional evaluation in higher class

To meet with these challenges the teacher needs positive attitude, open-mindedness, responsible behaviour and willingness to adapt to new changes.

6.8 DIAGNOSTIC TESTING AND REMEDIAL TEACHING

These two terms, 'remedial' and 'diagnostic' are borrowed from the medical field. When a patient goes to a doctor for the treatment, the doctor asks a few questions to find out the symptoms and then suggests the treatment. He asks the patient to take the treatment for 2-3 days and then report. If the patient reports to be feeling better, he either asks to continue the treatment or to stop it, depending on the condition of the patient. But if the patient does not show any improvement, he changes the treatment or asks for some tests to be done. Doctor knows that though two patients may exhibit same symptoms the root cause of the problem may vary from person to person. By doing this, the doctor is able to pin-pointedly diagnose the problem and recommend the appropriate treatment.

Same is applicable with the teaching – learning process. In a classroom there are so many students, each one with different background, IQ, attitudes and likes and dislikes. The teacher has to cater to all of them. In this process, some students may not be able to cope up. Sometimes, a student may remain absent due to ill health or due to some other reasons and hence may lag behind in the studies. Due to this, students may not be able to keep pace. In that case, teacher needs to know the exact problem faced by the particular student pin-pointedly. This is where teacher can start evaluating the particular student on the specific content with basics and simpler concepts, slowly increasing the difficulty level. Once the blockage in learning is diagnosed, the teacher can use the appropriate remedial teaching.

Ex: The teacher realizes that after teaching the unit on 'Chemical Equations', some students are not able to write them in the balanced form.

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Now, the teacher has to find out why few students are unable to do it.

First step would be to give the equations where all the radicals have the same valancy

1. e.g. $Na^+ + Cl^- \longrightarrow NaCl$.
2. Next she can give the equations where the radicals have different valances, such as Mg^{++} and Cl^- and ask students to write the balanced equation.
3. Slowly she has to increase the difficulty level of the types of equation, whereby she will come to know the exact nature of the problem. She may realize about the variety of problems faced by the students. In one case the student mat not have understood the concept of valance, in other case the student may not know about the valancies of different radicals. In one case, the student may not have the clear concept of 'equation' / 'equality'. After diagnosing the exact difficulty of the student, she can give the appropriate remedial teaching to the student.

The purpose of the diagnostic testing is to find out the problems or the difficulties faced by the student in learning particular content. Here the teacher starts from basics and slowly goes on increasing the difficulty level of the test. This helps her to pin pointedly find out the difficulty or the problem faced by the student in learning. After this she can accurately chalk out the effective remedial programme so that student is able to overcome the difficulties in learning. The teacher can plan individual or group remediation programme by organizing appropriate learning experiences.

ACTIVITY -7

1. *Explain the importance of the diagnostic testing and remedial teaching in science teaching.*

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2. *Explain how diagnostic testing helps in designing suitable remedial teaching.*

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3. *Conduct a diagnostic test for any one student who is facing difficulty in learning particular content in your class. Analyse the test results and prepare a remedial teaching programme for him/ her.*

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6.9 EVALUATION: COGNITIVE, AFFECTIVE AND PSYCHOMOTOR DOMAINS

So far, you have seen that, three domains represent three aspects of personality and though they are not mutually exclusive, they are distinct. The cognitive aspect deals with the development of head, the affective aspect deals with the development of heart and the psychomotor aspect deals with the development of hand and body parts. Hence naturally, the evaluation techniques for each domain are different.

Cognitive domain: This mainly concentrates on the curricular activities and can be evaluated through the paper-pencil tests, oral questions, etc.

Affective domain: As this domain deals with the emotions, attitudes, interest, it takes quite long for the development of the objectives of this domain. But evaluating the development of the students in this domain is a challenging task for the teacher. The teacher can make use of projects, group discussions, debates for this purpose. Field visits can be organized by the teacher and observing the students will help in the evaluation. The teacher can employ the technique of observation for the evaluation of affective domain.

Psychomotor domain: This domain deals with the motor development. Evaluation of the students in this domain is an important aspect for the science teacher. The practical examination is an essential tool for the science teacher for evaluating psychomotor domain.

ACTIVITY -8

1. *Consider any unit of your choice. Prepare a comprehensive plan for evaluating all the three domains through that unit.*

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6.10 STRUCTURING ASSESSMENT OF CHILDREN'S IDEAS, SKILLS AND ATTITUDES

For the teachers of the 21st century the knowledge explosion is a reality. The technological development has made knowledge available at the click of a mouse. Due to this, the first are the students who are very much updated from time to time. Hence, the teachers need to be updated and dynamic. The teacher needs not only the updated knowledge but should also be conversant with the various methodologies of

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teaching. The teacher needs to be creative in her approach. She should be able to improvise on the available resources to inculcate creativity as well as scientific temper amongst the students. The science teachers need to be good in the demonstration skill. They also need to be creative to make use of incidental education for making science education effective, and relate it to the real life situations of the students.

Science is a very practical subject and is applicable everywhere in our daily lives. Naturally, the teacher needs to give the practical and concrete experiences to the students. It cannot be taught with explanation only. The teacher needs also to demonstrate the experiments. In case some instruments and equipment are not available, the teacher needs to improvise on the available material. The science teacher has to be very creative and must make use of indigenous materials to prepare effective teaching aids. The teacher must also look for the happenings in surroundings, which can be effectively used for explaining scientific principles. This is called as 'incidental learning', which is of great significance in the teaching of science. The science teacher must be vigilant and creative in planning and utilizing the available resources.

As a teacher, you need to find out about children's ideas, process skills and their attitudes and link the knowledge to their daily experiences. This calls for proper structuring of evaluation. The teacher may observe the ability of raising probing questions. Similarly, the teacher may create situations wherein the students demonstrate their attitudes, such as, scientific attitude. Therefore, assessment in such cases needs to be a structured observation over a period of time. Many times students come up with the questions of 'why, why not and how'. Even in problem-solving cases, students' ideas and process skills may show new alternatives. And, therefore, the evaluation should include verbal questions, structured written tests and observations.

This will help them to know about the blocks faced in the learning so that they will be able to overcome them.

The teacher should help the students in preparing a simple checklist or a rating scale for this purpose, which will include aspect like punctuality, time schedule, regularity, etc.

ACTIVITY- 9

1. *Enlist the challenging questions/ ideas raised by your students on any topic. Reflect on handling the same by a teacher.*

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2. *Prepare a set of activities for enhancing students' scientific attitude and a scheme for evaluating the same.*

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6.11 LET US SUM UP

So far we have seen why it is important for the science teacher to know about various aspects of personality which need to be developed. Proper evaluation of all three domains, cognitive, affective and psychomotor, is essential and hence the teacher must understand what evaluation is and what the means of carrying it out effectively are.

Proper evaluation acts as a feedback to the teacher on the teaching –learning experiences she provides. It helps students and their parents in knowing the academic development. Evaluation is also important for the principal of the school in finding out about the effectiveness and utility of the activities planned in the school. The curriculum planners, researchers and the controlling authorities are also benefitted by the proper evaluation. The information gathered can be used by them for understanding the effectiveness of the curriculum and the problems faced in implementing the same. This helps the making necessary changes and improvements in the curriculum. You will learn more about this in the next chapter on the Challenges and Issues in Science Teaching.

6.12 KEY POINTS

1. **Test** is a tool used for the measurement of the students' achievement and is not synonymous with evaluation.
2. **Evaluation** is a continuous comprehensive process which consists of the qualitative aspect, the quantitative aspect and the value judgement.
3. **Education** is meant for the all-round development of the personality, which includes all three, the cognitive, affective and the psychomotor aspects.
4. The objectives, the content, the learning experiences and the evaluation are interrelated with each other.
5. The internal assessment is the one which is carried out by the teacher who teaches.
6. Formative and summative evaluations are complementary to each other.
7. The CCE makes the process of teaching and learning a 'Learner Centred Activity'.

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8. For removing the blocks in learning, the **diagnostic testing** should be used, which is to be followed by the remedial teaching.

9. Teacher must do her **self-assessment** to know the effectiveness of the learning experiences provided and for the continuous improvement.

10. Teacher should encourage and guide students to do their **self-evaluation** for developing the analysing skills for better learning.

6.13 GLOSSARY /ABBREVIATIONS

1. Cognitive development – Intellectual development (development of head).

2. Affective development – Emotional development (development of heart).

3. Psychomotor development – Physical development (development of hand and body parts).

4. Taxonomy of educational objectives – hierarchical arrangement of educational objectives.

5. Formative evaluation – Evaluation that is done during the teaching – learning process is going on.

6. Summative evaluation - Evaluation that is done at the end of the teaching-learning process.

7. Internal assessment – Assessment done by the teacher who has teaches the student.

6.14 SUGGESTED READINGS AND REFERENCES

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http://www.scribd.com/doc/933640/Bloom-Revised

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6.15 UNIT-END EXERCISE

1. Select a topic of your choice from the text of any class. Prepare five formative and two summative test item relating to the topic

2. Prepare two learning objectives from each category of remembering and understanding, application, attitude and skill to teach a topic in class VII

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UNIT 7 CHALLENGES AND ISSUES INVOLVED IN LEARNING SCIENCE TEACHING

Structure

7.0 INTRODUCTION

This is the last unit of this course. In the previous units you have learnt about the nature of science, the various skills required for learning science, various approaches to fulfill the objectives of science learning, and how to plan and assess so as to help the students in their science learning.

In this unit, we will see towards science learning with some broader perspective. Is science learning leading to the development of scientific temperament? Even if any student did not continue formal education in science, is he/she able to think scientifically?

Are the learners of science able to solve problems scientifically? Do people, after studying science for many years, gain the power of reasoning? Do these, and the like, stand as challenges in science teaching today?

Therefore, you must teach your students the necessity for application of science in day to day life. It is also essential to establish correlations between various concepts in the curriculum and day to day life experiences of the students. Then only the student will able to reason out rationally about various events that are occurring around him / her.

To achieve this we must know various advancements in science and teaching science. We can optimize the use of different technological gadgets to make the teaching learning process effective. With limited resources, it is challenging to make wide use of technology in actual teaching learning process. It is therefore, necessary to change methods of evaluation accordingly. In this unit we will take up such challenges and issues in science teaching.

It is also necessary to prepare children studying at upper primary level for the adolescence phase in their life. Though it is challenging, teacher can play important role in this context while teaching science subjects.

One thing is sure that, we want to imbibe rational thinking and scientific attitude in the students so that they will become, empowered and also responsible citizen of India. This is our ultimate objective.

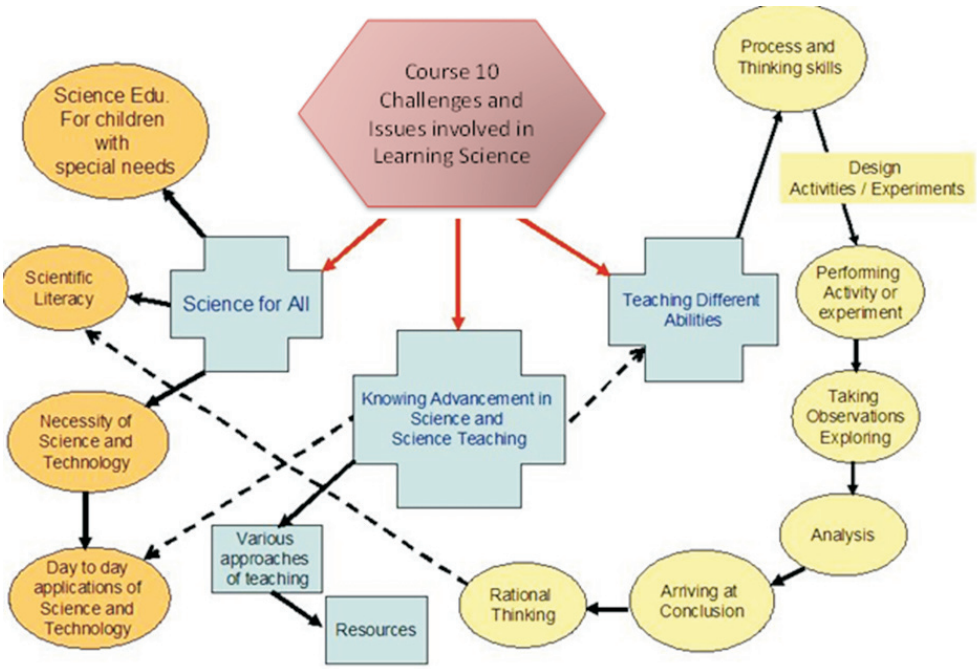

Figure 7.1 Unit Concept Map

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7.1 LEARNING OBJECTIVES

On completion of this unit, you should be able to:

- examine different perspectives about the necessity of science in our day to day life.
- describe the importance of scientific literacy in our day to day life.
- interpret the events in day to day life with a scientific attitude.
- identify the issues involved in learning science teaching.
- explain correlations between various scientific concepts in the curriculum with the day to day life experiences.
- identify various challenges in science learning due to changes in social and cultural patterns.
- explaining how to teach science children with special needs.
- integrate the advancements in science and technology with the process of in science teaching-learning.

7.2 SCIENCE FOR ALL

Science is ultimately a social endeavour. Science is knowledge and knowledge is power. With power can come wisdom and liberation. Or, as sometimes happens unfortunately, power can breed arrogance and tyranny. Science has the potential to be beneficial or harmful, emancipative or oppressive. History, particularly of the twentieth century, is full of examples of this dual role of science. The use of atomic power is an example, as it can be harnessed for either electric power generation or as an atomic bomb.

The benefits of science cannot be limited to a selected few, but it is for the benefit of entire humanity. All can enjoy the fruits of scientific discoveries, inventions, and innovations. The use of mechanical tools in the field of agriculture can be seen everywhere. Similarly, medicine, a contribution from the field of scientific studies, is made available for all.

Science deals with vari-ous aspects of the physical and biological world. Does this mean that understanding science is simply a journey through massive amounts of information and mastery of disconnected concepts? No, it is not. Science education helps us to do much about it.

Humanizing science is essential, as it is a basic aim of science and technology is to make our life easier. The Department of Science and Technology, Government of

India is conducting various programmes and launched various schemes. Innovation in Science Pursuit for Inspired Research (INSPIRE) is a flagship programme of this Ministry / Department which has five components covering entire range of education and research from class 6th to post graduate stage of a student. The first component of this programme is the "INSPIRE Award" which recognizes the talent among students at a very early stage.

Under the scheme, a onetime award of Rs. 5000/- is given to the students for making a science project or model. The scheme envisages selection of 1 million (10 lakh) students during the 11th Five Year Plan that is from 2007-08 to 2011-12 for this award. The basic motive behind this scheme is to trigger innovativeness and creativity at a very early age.

The Department of Science and Technology, Govt. of India has two autonomous wings, one is the 'National Council for Science and Technology Communication' (NCSTC) and the other is 'Vigyan Prasar'. These two organizations are set up with the objectives of communicating science and stimulating scientific temper amongst the people.

These two organizations support research programmes, software development for exhibitions, websites, puppet shows, street theatre, radio and television programmes, presents awards and fellowships to outstanding science communicators, catalyzes local, regional and national level field programmes, encourages international collaboration and supports long , medium and short term training programmes.

The National Children Science Congress (NCSC) is a prestigious project of NCSTC-Network being supported by Dept. of Science and Technology, Govt. of India. The main feature of this movement is any child between the age group of 12 to 17 can participate in this activity, no matter whether he / she is taking formal education or not. Therefore, the name of this project is National CHILDREN Science Congress and not National Students Science Congress.

There are many non-governmental organizations working in different parts of the country in the field of science communication. For example, *Marathi Vidnyan Parishad* is a NGO in Maharashtra, works for imbibing scientific attitude in the society through various programmes. Similarly, *Keral Sastra Sahitya Parishad* is an organization in Kerala works in science communication. Similar work is done by Vikram Sarabhai Community Centre for Science in Gujarat. Centre for Environmental Education is another organization which works nationwide to create awareness about environment and to impart environmental education.

7.2.1 Need and Significance

To understand the need and significance of science, let's go through a small incidence as given below.

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Gopal is studying in 5th class. One day he was going to weekly market with his father. When they were walking, a cat crossed them. Spontaneously, Gopal's father told him to walk seven steps behind.

"Why?" Gopal asked.

"Otherwise we would not complete our work today", father replied.

"Why is it so?" Gopal still had a question in his mind.

"Because, crossing by the cat is considered as a bad omen", father explained.

Gopal was not fully satisfied by the explanation given by his father. However, he followed his father and walked seven steps behind before moving further.

After reading this small incidence few questions come to mind.

- Does a cat really be an obstacle? What do you think?
- If so, then how?
- Is the remedy suggested by Gopal's father was correct or wrong?
- If opinion of Gopal's father is wrong and based on superstition then how can we convince Gopal?
- How can we become successful to remove such superstitions in the minds of elder persons?

If you feel Gopal's father was wrong and the cat cannot cause any obstacle to his work, then you might also be convinced that there is a need for science and scientific awareness to every one of us.

The question is how can it be done? One very powerful tool is with you and it is 'Science Education'. By imparting science education in the right way, we can imbibe certain values in the young minds and a science teacher is the right person to do it in a better manner.

ACTIVITY -1

Through science teaching in the classroom, you can correlate day to day life experiences with scientific concepts. Thus, children may get convinced and start thinking analytically and with scientific attitude. However, can we become successful in convincing elder persons to get rid of their wrong notions through their children? Write your experiences within about 100 words in the space given below.

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7.2.2 Science Education

Science education can be considered as the education in natural and social sciences, mathematics, and technology. This larger vision of science focuses on inquiry about the physical world in the context of society. This vision can be thought of as an interrelationship of several factors: concept understanding; process skills; habits of mind; and connections among science, technology, and society.

An old proverb says that 'given a fish, one can eat for a day; taught to fish, one can eat for a lifetime'.

Think of effective science teaching and let teaching enable learners to fish. Once learners come to understand and use scientific thinking to learn more about the world around them, they have become fishers with a lifetime thirst for knowledge and the skills to seek and learn on their own.

What should science education aim at? Science education needs to prepare citizens to deal with global, national, and local problems such as population growth; loss of resources; and the effects of pollution, disease, and other social issues.

In other words, learning science does not mean reading text, answering textual questions correctly, solving numerical problems, or for that matter just performing experiments given in the books. We must encourage rational thinking through science education. Then only we can find the solution to avoid the situations like the one faced by Gopal.

There is a beautiful word for this and it is – 'scientific literacy'. What do you mean by scientific literacy and how can be achieve it? We will discuss it in our next sub-section. Before that, let's carry out the following activity.

ACTIVITY -2

1. *"Everyone has the ability to learn, but this ability to learn differs from person to person". How will you teach, taking this aspect into consideration?*

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2. *Select and explain any problem that you have solved using the scientific knowledge.*

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7.2.3 Scientific Literacy

Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. This means that a person has the ability to critically observe, describe, explain, and predict natural phe-nomena.

Scientific literacy implies that person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technolog-ically informed. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclu-sions from such arguments appropriately.

Real life connected problems, experiences, interactions, experimentations; innovations etc. need also to form the part of scientific literacy.

You might be aware about the 'garbage problem' in urban areas. As population of our country is growing day by day, more and more garbage is also produced. Garbage produced in a city like Ranchi, Mumbai, Kolkata is collected at one place; it will probably form a tall mountain.

Therefore, it is required each of us to segregate the garbage generated in our homes. Bio-degradable and non-degradable garbage should be separated and treated accordingly. (See figure 7.2).

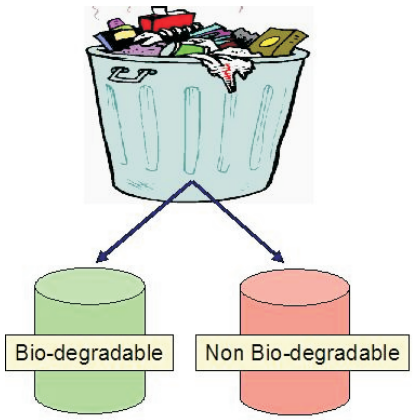

Figure 7.2 Segregation of waste

If we can generate awareness about the garbage problem in the community then it will contribute to scientific literacy.

Similar activity can be given to the students so that they become aware about this problem. As a part of this activity a quiz or debate can be conducted on the topic – "*Plastic: Boon or a curse?*"

In order to achieve scientific literacy, key components should be carefully and creatively integrated into the school curriculum. The components in the school curriculum might include the following -

- A knowledge base emphasizing basic concepts and principles as well as more abstract concepts such as unity and diversity.
- An understanding of the interrelationships of science, technology, and society.
- Strengths and limitations of science as a human enterprise.
- The ability to think and trust the thinking process and to develop problem-solving skills and processes.
- The ability to read and interpret science publications, evaluate argu-ments based on evidence, and apply for conclusions.

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ACTIVITY -3

Analyze the science curriculum which you are teaching, with regard to the components of scientific literacy and find out the examples in which components of scientific literacy are included.

No.	*Component*	*Example in the curriculum*
1.	*Ability to think rationally*	
2.	*Ability to observe*	
3.	*Ability to classify*	
4.	*Ability to analyze*	
5.	*Correlation with day to day events from immediate environment of a child*	
6.	*Applications in daily life*	
7.	*Utility for solving problems*	

7.2.4 Teaching Science to Children with Special Needs

As you know there are children with special needs. Remember, these children may not be necessarily handicapped or disabled children. These children may be having some psychological problems. A child studying at primary level and has a tremendous fright in talking in group or with peer group is also considered as a child with special need. Thus, in broader perspective, the children who need some extra attention to be given or some extra efforts are to be needed to take on them are categorized as children with special needs. Thus, they may include disabled children.

According to NCF 2005, there has to be an inclusive education. Thus, the children with special needs should be taught in the same class along with the normal children. If we believe in the idea that every learner is different than other in all respects, then as a teacher, it's a challenge to teach children having special needs with other children. To teach science to such children is challenging task. Just imagine, in your class there is a blind child who has good understanding abilities. How will you teach such child along with normal children?

You will find that, while teaching such a child, it is required to devote more time on that child. You are required to adapt different teaching methods and you need to explain every small thing in detail. It is now accepted fact that the children learn not only when teacher teaches them, but they learn from their parents, peers and more importantly through there immediate environment and experiences. So to a normal child, it is not required to explain what you mean by a tree. The child can see different types of trees

around, sees different parts of those trees, notes differences and similarities among them. However, you need to explain what you mean by a tree to a child who never had seen the trees. Thus, it's your responsibility to give appropriate teaching learning experiences to such a child so that idea of tree is clear.

ACTIVITY -4

You are explaining different types of rocks in the classroom. If in your classroom there is a child with special needs, then you are required to follow different approach and different method. Match the following columns in this regard.

Column A : Type of child	*Column B: Method*
1. A blind child	*a. Show the chart having pictures of different types of rocks*
2. A deaf and dumb child	*b. Take child to actual field to have a feel of the rock.*
3. A child who cannot walk	*c. Show actual specimen of rocksd... Give description of different types of rocks in the classroom*

Is it advisable to use more than one method for a particular type of child?

Which type of disability is easy to tackle from your point of view? Justify

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Remember there is not a single method or strategy of teaching which is considered as 'the best'. Varying styles of presentation, varying activities on the basis of varied responses of the learners is essential. Sometimes, you need to modify your strategy at the last moment after receiving responses from learners.

Thus, there has to be a mixture of teaching approaches which can match with a range of learning activities. But, you will definitely agree that, "Chalk-Talk-Test" method in teaching science is not advisable while teaching children with special needs and also for the normal children.

It is also necessary to prepare children studying at upper primary level for the adolescence phase in their life. It's a challenge, but a science teacher can play vital role in this context.

Children during adolescence are likely to try to be free of the confines of home and parental care and assert their independence. During this phase, children become suspicious about everybody around them, even about themselves. As a science teacher you need to be sensitive to their explorations of their self and body, as well as the outside world. While science textbooks provide factual information on the human body, reproduction, safe sex, drugs, smoking, etc., but this is not enough.

A science teacher can interact with children and prepare them mentally for the important phase in their life.

ACTIVITY -5

To design science related activities to a blind child, which skills of that child you will utilize? Will you give the same activities to a deaf child or modify them? Justify your answer with examples.

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7.3 TEACHING DIFFERENT ABILITIES

According to Mahatma Gandhi, "True education is that which draws out and stimulates the spiritual, intellectual, and physical faculties of the children". Implicit in this aim is the belief that education has the potential to transform individuals and societies.

What is scientific method? (Recall **unit 1**).

The scientific method is perhaps more easily discerned than defined. But broadly speaking, it involves several interconnected steps: observation, looking for regularities and patterns, making hypotheses, devising qualitative or mathematical models, deducing their consequences; verification or falsification of theories through observations and controlled experiments, and thus arriving at the principles, theories, and laws governing the physical world. There is no strict order in these various steps. Sometimes, a theory may suggest a new experiment; at other times an experiment may suggest a new theoretical model. You have learnt this in **Unit 1**.

You have also learnt various skills of science learning in **unit 2** of the same course. Process and thinking skills are embedded in the procedures of a scientific activity.

The inquiry approach to learning science is rich with process and thinking skills that allow the learner to become active, make use of his / her senses, and become involved emotionally. Thus, the learner is able to make more meaningful connections.

For example, you are teaching concept of floatation of solid substances. If you directly speak about ship and submarines then the students may not understand. Since they don't get a chance to see ship or submarine, they may not even visualize the situation. In this case, what can be the method of teaching so that it encourages the inquiry approach with process and thinking skills? Here is one method – Ask students to put various solid objects such as stone, paper, wooden piece, key, pencil, etc. into a vessel full of water. Ask them to note down their observations. Some solids will float, while some will sink in water. Ask them to classify. Through this activity explain the concept of floatation.

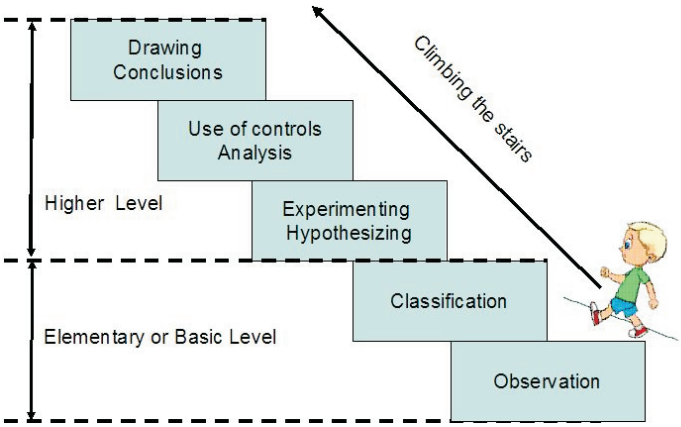

Figure 7.3 Process Skills of Learning Science

7.3.1 Role of Experiments in Science Learning

The goals of elementary school science education require programmes that emphasize experiences designed to further the intellectual, emotional, physical, and social development of a child. Firsthand observation and learning by doing have always been recognized as important in achieving these goals.

It is rightly said that, science cannot be understood without carrying out an experiment. Experiments are the hallmark of science, and for science learning, they are essential. Unfortunately, we are not giving enough weightage for the experimentation in actual classroom teaching.

The characteristic feature of any science experiment is that, if the same experiment is carried out in the same experimental conditions by anybody then the same results should be obtained within the experimental limits, no matter how many times and

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anywhere the experiment is carried out. Thus, within the same experimental conditions, the results obtained should be independent of time, space and the person who carries out the experiment. Here, the 'same experimental conditions' mean all the parameters which affect the experiment. These parameters may include surrounding conditions such as temperature, pressure, humidity, availability of light, concentration, and physical state of chemicals used in the experiment, etc.

While teaching any scientific concepts, experiments should be designed carefully, considering following points:

- Content in the curriculum
- Level of the student
- Availability of material
- Cost of material
- Duration required for the demonstration
- Participation of the student
- Justifiable to the content

Carrying out the experiment does not suffice the objective. It is necessary to teach student:

- To do the same experiment with different experimental conditions that is by changing variables
- To take accurate observations
- To choose right tools of measurement
- To make accurate measurements
- To document the observations in systematic manner
- To study the pattern seen in observations
- To draw inference
- To validate
- To draw conclusion
- To apply the results practically

If we follow the above steps then various skills can be developed in the student. You have already learnt about various skills and their types in the previous units. However, just to recapitulate, see figure 7.4 given below.

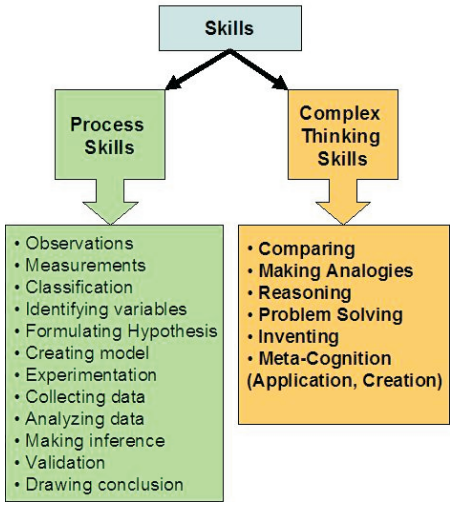

Figure 7.4 Skills of Learning Science

It is observed that, people complain about lack of laboratory facility, availability of instruments and materials, lack of time, etc. when asked for teaching science through experimental method. However, to carry out experiments at school level does not require sophisticated equipments. You can develop your own kit from household objects such as pencil, rubber, balloons, nails, paper, cardboard, glass, etc. The only thing which is required is innovativeness and creativity of utilizing these objects.

ACTIVITY -6

Develop an apparatus from house hold material to demonstrate any experiment in the syllabus that you are teaching. Use this apparatus in actual classroom teaching.

Give it to students to handle. Write your experience in the classroom in about 50 words.

You can write it with the help of following points: materials used, process of developing the apparatus, learning of the concept using this apparatus, time management, classroom management, joyfulness among the students.

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7.3.2 Students' Inquiry in Science Learning

It seems that too much science instruction is based on imparting knowledge to the students and then having them apply this knowledge to solve some day to day problems.

This is what scientists do. They spend their lives answering questions that they ask of themselves.

One of the major factors that influence a student's interest in science is the way that the student is taught. Traditional science instruction often consists of reading, writing, and memorizing facts. In contrast, inquiry-based science provides students with opportunities to explore, investigate, research, and discover.

Children are naturally curious. Given the freedom, they often interact and experiment with things around them for extended periods. These are valuable learning experiences, which are essential for imbibing the spirit of scientific inquiry, but may not always conform to adult expectations.

It is important that any programme of study give children the needed space, and not tie them down with constraints of a long list of 'topics' waiting to be 'covered'. Denying them this opportunity may amount to killing their spirit of inquiry. To repeat an oft-quoted saying: "It is better to uncover a little than to cover a lot."

Our ultimate aim is to help children learn to become autonomous learners.

What kinds of questions are worthy of student inquiry? Well, let's take an example. Have you noticed that, we only see one side of the Moon from Earth?

This is because our Moon rotates on its axis at the same rate it revolves around the Earth. Why is that?

Rather than providing a readymade answer, students will learn far more if they think about this question themselves. Of course, this is an example of a question that has a known answer. A more complex question is based on the following two images (figure 7.5).

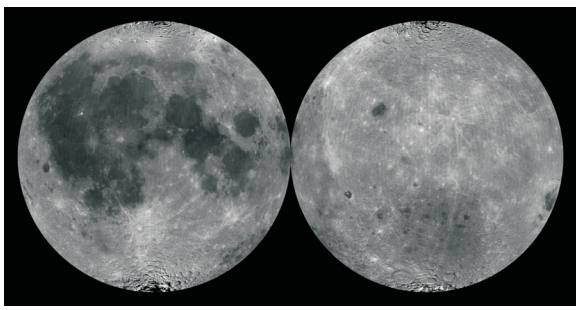

Figure 7.5 Two sides of the moon

The image on the left is the face of the Moon seen from Earth. That on the right is the "far side" of the Moon. There are striking differences in these two images - most notably the virtual absence of mares on the far side. How did these differences come about?

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It turns out that this is still an open question. While a student may not come up with a definitive answer, this project provides a great deal of opportunity for research, and is sure to result in students learning far more about the Moon than they would in any textbook-driven course.

Remember children have their own concepts. For example, when asked about the shape of the earth, some will explain that the earth has to be flat because, if it were round like a ball, people and things would fall off it.

Presented with a globe and told that this is the true shape of the earth, these children may adapt their explanation by saying that the earth is hollow and that people live on flat ground inside it.

What is your experience?

ACTIVITY -7

1. *Enlist three activities that you and your students have enjoyed during teaching of science in the classroom.*

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2. *Studies done in India have found that tribal students' knowledge about the living world is rich and largely reflects their environment and lifestyle. In comparison, urban students' ideas about living things are shaped by knowledge gained through books and stories. Do you like to list few reasons from your own learning?*

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7.3.3 Correlation with Day to Day Life Experiences

You have already learnt in **Unit 2** about the goals of science education can be met through a strong commitment to an inquiry-based science teaching as the means for learn-ing concepts, developing skills, exploring their connection with the day to day life experiences, and practicing scientific habits in real life.

Understanding the relationship of science to technology and society is also a critical component. Interest in science seems to wane when it is not seen as a vital component of our lives.

For example, how can we remove stain of turmeric from the cloth? Whether we should apply soap or tamarind on the cloth for it?

Can you relate this answer with the contents in the science text book?

When a student recognizes connection of what he/she is learning with day to day life experiences, he/she begin to appreciate the value of scientific discoveries and become aware of the strengths and limitations of science in relation to social problems.

It is necessary to connect science content with students' interests and personal lives, with societal issues, and with other school subjects. The question is HOW?

Science teachers can use following techniques to connect content with student interests:

- Connect the concepts and instructions explicitly to learners' personal experiences.
- Make use of specific examples, analogies, and metaphors.
- Plan lessons to emphasize themes of science, technology, and society.
- Ask students to organize data into diagrams, tables, and graphs.
- Ask students to identify patterns and make predictions.
- Ask students develop and role play scenes in which they use scientific thinking or play the roles of scientists.

ACTIVITY -8

Chanda is living in a small hamlet in the hills. She helps her parents in their seasonal work of rice, regional maize farming. She sometimes accompanies her brother in taking the goats to graze in the bush. She walks 5 km every day to attend the nearest school.

Chanda maintains intimate links with her natural environment. She has used different plants as sources of food, medicines, and fuel wood. She has observed parts of different plants used for household purpose, in religious rituals and in celebrating festivals. She recognizes minute differences between trees, and notices seasonal changes based on shape, size, distribution of leaves and flowers, smells and textures. She can identify about a hundred different types of plants around her.

Can we help Chanda translate her rich understanding into formal concepts of biology?

Can we convince her that school biology is not about some abstract world coded in long texts and difficult language: it is about the farm she works on, the animals she knows and takes care of, the woods that she walks through every day? How?

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7.4 KNOWING ADVANCEMENTS IN SCIENCE AND SCIENCE TEACHING

Being a science teacher, it is necessary to know the advancements in science. Also, it is necessary to reflect these advancements in science teaching. Thus, teaching methodologies can be accordingly framed. For example, we can show a film on Antarctica in the classroom while teaching about it. This is possible due to the advancements of various gadgets such as projector, PC, CD ROMs, or Video player. Thus, we can bring different media into the classroom through visuals and sounds. Use of media can help your teaching easier and more exciting.

7.4.1 Advancements In Science

As the time progresses, there are so many discoveries and modifications took place in the sphere of knowledge. In **unit 1**, you have learnt about history and philosophy of science.

With the advancement in technology, our understanding about various aspects became more clear and accurate. For example, before the launching of artificial satellites, ground observations were used to take to predict the stretch of the cloud. However, one could not predict the height of the cloud from ground. This became possible with the help of artificial satellites. Also, we can prepare accurate maps with the help of satellites.

Think about the times when there were no mobile phones or not even STD telephone facility. In this situation if you want to call a doctor who is residing far away from you, how much time it would have taken? Or think of a situation when you want to give urgent message to somebody. Was it possible?

Now a days it is possible as we all are experiencing revolution in telecommunication field. It is possible now to talk with any person, any time in the world even if we are in travel. We can even access internet through mobile phone. Thus, due to the advancements in science and technology, we consider entire world as a *global village*. In a village, every person virtually knows every other person living in that village. Similarly, we can access any person in the world. This is the advantage of advancements in science and technology.

ACTIVITY -9

Science and technology plays vital role in our day to day life. Electricity is one such important application of science. Imagine for a while what would happened if electricity is not there. Which difficulties you might face without electricity?

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Do you think that the use of electricity has increased your efficiency?

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You might be aware that, solar energy can be converted into electricity which can be used for house hold purposes and also for street lighting, for running pumps on the farms, etc.

In our country there are various Non-governmental organizations (NGO) which work in rural areas. They interact with the villagers and explain the benefit of use of solar energy. Our Government and various NGOs also provide financial assistance for installing unit of solar energy.

Have you come across with such situations around you? If yes, just interact with the people who are using solar energy. Find out the changes and benefits they are experiencing while using solar energy.

Progress in science and technology has also reflected in various branches in science education also. There are courses for fundamental science and also for the applications of scientific research through different technologies. See figure 7.6 given below.

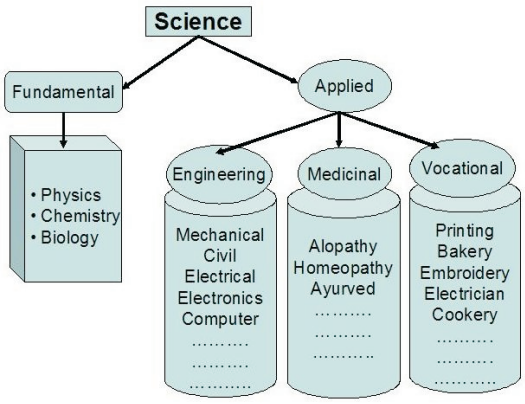

Figure 7.6 Various Branches in Science Education

On broader perspective, there is an inter link between various disciplines of science.

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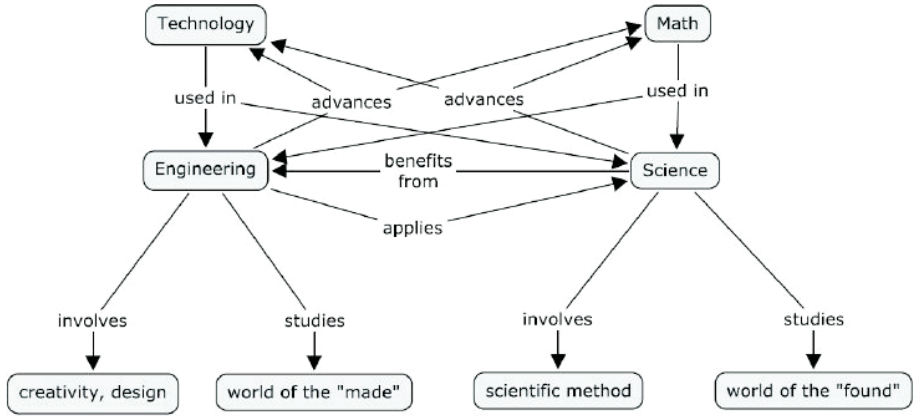
ACTIVITY -10

Study the following concept map carefully. Please interpret various correlations shown in this concept map?



Would you like to add anything in the above concept map?

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7.4.2 Advancements in Science Teaching

Our teaching should also reflect the advancements in science and technology. One important thing that we must remember that, the curriculum has made activity oriented and child centered. The emphasis is given on learning by doing, rather than learning only text.

i) Learning Activity Centre

Investigating and experimenting are great ways for children to form knowledge relating to science and increase their understanding of scientific ideas. In Unit 4 of this course, you have learnt the role and importance of hands on science experiences. Hands on experiences help children think critically and gain confidence in their own ability to solve problems. Young children especially are engaged by things they can touch, manipulate, and change; and by situations that allow them to figure out what happens – in short, events and puzzles that they can investigate, which is at the very heart of scientific study.

If a child learns to learn then our purpose gets fulfilled. This is possible through learning activity centre. The big advantage of such centre is that the child has a freedom to do what he / she likes to do. Thus, the child enjoys the process of learning.

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You can set up a *Learning Activity Centre* in your classroom. What is learning activity centre? It is a small place in the corner of a classroom where children can quietly work and learn at their own pace. All the materials required to carry out various activities are provided to the children at this place. Now it is your innovation power and creativity which will decide which activities are to be set up in learning activity centre. The only care that you are supposed to take is the materials in the centre should be safe for the child to use alone.

The learning activity centre should contain a variety of activities geared to the varying intellectual ability, maturity, and interest levels of the children.

Learning activity centre gives freedom to the children to test all the possibilities come in their mind experimentally. Thus, it helps to provide an opportunity for creativity. After performing the activity children analyze the collected data and draw conclusions.

While hands on science experiences work well, they can also be messy and time consuming. So, before you start, you need to see what is involved in an activity and the duration it will take.

ii) Use of Multimedia in Teaching - Learning Process

Because of the revolution in information technology and telecommunication, most students are aware of some of the areas of science, such as the exploration of outer space, the hunt for the fossils of extinct dinosaurs, newer technological advancements.

Through various media, students are exposed to scientific fictions as well as facts. It is critical that students understand the differences between science facts and science fictions. When students study significant scientific theories, history of science, and the evolution of science, they recognize the value of obtaining and relying on evidence.

Radio, and more recently television, has played a major role in the field of science communication. The SITE experiment in the mid-1970s was probably the biggest social experiment anywhere in the world that established the importance of satellite communication in the field of education.

Ever since, educational technology has come to be regarded as an important means for universalisation of education in India. The widespread use of personal computers (PC) since nearly two decades ago advances in telecommunication, and Internet a decade ago along with convergence of various technologies has, in the form of Information and Communication Technology (ICT), opened up new opportunities and challenges in the field of education. Although the vast potential of ICT in the field of science education has been well recognized, it still remains largely untapped.

The efforts have been piecemeal and sporadic. A beginning for introducing computers in the school system was made through the Computer Literacy and Studies in Schools (CLASS) project in the early 1980s. However, schools faced problems of infrastructure, appropriate software, and lack of trained manpower.

Today, the scenario has changed: with the increasing use of personal computers in schools, homes and workplaces, and internet connectivity, ICT shows renewed promise as a powerful tool for education, but only if these developments are complimented by making available quality software in different disciplines of science.

Appropriate multimedia software both in English and other Indian languages suited for various age groups in schools is still a rare commodity. Development of software is an expensive affair and the Government should make sufficient funds available for the purpose. Software produced should be widely disseminated via Internet and CD-ROMs.

The Internet opens up vast possibilities; it could provide an e-platform for discussion of topics relevant to school children both scholastic and co- scholastic where students and teachers could post queries, provide answers, discuss with experts, and exchange views. Innovative scientific experiments using a PC could be designed for school students through a software and hardware interface to help students to measure common physical parameters (e.g. temperature, luminosity of light, humidity etc.), and also control these parameters. Such applications would serve to introduce the role of computers in industries, laboratories, communication and so on.

On 20 September 2004, an artificial satellite EDUSAT was launched. It is specifically designed for the educational purpose. It provides an interactive satellite-based distance education system for the country utilizing audiovisual medium, and employing Direct-To-Home (DTH) quality broadcast.

With its multiple regional beams covering different parts of India and a beam covering the Indian mainland, it is possible to establish talk-back terminals - one way video and two ways audio - for interactive programmes on science education. These would provide an interactive channel for students with experts and could include talks, lectures / demonstrations, discussions, question-answer sessions, etc. Talkback terminals and receive-only terminals could be set up at selected schools that could also be utilized by other schools in the neighborhood. To fully utilize the capabilities of EDUSAT, necessary hardware would need to be made available and efforts strengthened to produce quality software at regional levels.

The importance of community FM radio in science communication needs also to be emphasized. Such low-range community radio stations could be established at selected schools and the school students encouraged in producing science programmes relevant to the local areas. The audio channels of EDUSAT could beam such programs over wider areas.

Satellite Radio has opened up the possibility of a countrywide digital audio science channel. It can cover the remotest and most interior parts of a vast country like India with the help of a specially designed satellite radio receiver. This digital satellite communication radio system uses geosynchronous communication satellites dedicated

for radio broadcasts and is essentially a direct-to-home radio (currently under the name World Space Radio). Access to news, educational broadcasts, and entertainment from all over the world through its unique global relay capability are the remarkable features of this system.

Two-way interactivity is possible through telephone lines. In particular, production of software is relatively easy and cheaper to produce. Satellite Radio can prove to be an important tool for science communication / education in India.

Since the broadcast is digital, it is possible to download data files along with pictures, sounds, and movie clips into a PC. It is hence possible to transmit and receive slides / visuals, store them in a personal computer, and synchronize with the audio broadcast for a full fledged lecture-cum-demonstration which can be projected on to a large screen to an entire class. Photographs of various things such as bacteria, viruses can be shown on the screen. Visuals can help us to explain abstract concepts so that they become concrete.

Mrs. Sharma is a school teacher. She has to teach a topic related to volcano. Do you think that reading the text book, explaining in terms of words and showing static pictures of volcano will give the correct idea about volcanic irruption?

Surely not! Mrs. Sharma also is well aware of this fact. So she has decided to show a movie clip on volcano. For this she keeps a track on the schedule of Gyan Darshan Channel on Doordarshan. It's her regular practice to show programmes telecasted from Gyan Darshan to the students. Mrs. Sharma also uses Audio-Visual aids in the form of CDs to teach such topics and to give live experience of the text given in the books.

Would you like to adapt the same technique?

Will you find it useful? According to you, which problems or obstructions are there, if you want to implement this technique in regular class room teaching?

You can also demonstrate various experiments through virtual simulations using digital technology. Thus, the difficulties of non-availability of apparatus or resource material can be overcome. Also, certain topics such as dissection of earthworm can be shown through movie clip to explain its anatomy.

Smart Class is a solution designed to help teachers in meeting with new challenges and developing students' abilities and performance. Smart class is an interactive and sophisticated way of teaching. It uses various technologies such as TV, LCD, computers, etc.

It helps the teachers to access multimedia content and information that can be used for teaching students more effectively. It helps the teacher in expressing their views and

teacher ensures that every student is learning. A well designed module of smart class allows a student to visualize the concept much better than static images.

ICT as a tool should be used with care so that it serves to bridge the social divide and equalize opportunity; inappropriate and insensitive use may as easily widen the divide. Given the growing reach of the technology, it is imperative that efforts are initiated to utilize ICT at the school level to prepare children to face the challenges of a society that is fast transforming into information driven society.

ACTIVITY -10

1. *Can a mobile phone be used effectively in actual Teaching – Learning process? How? Share your experiences after using it actually as per your ideas.*

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2. *Apart from simple experiments and hands on experiences, discussions in the class with the teacher, peer interactions, gathering information from newspapers, talking to knowledgeable persons in the neighborhood, collecting data from easily available sources, and carrying out simple investigations in the design of which the students have a major role to play.*

   Biographical narratives of scientists and inventors are a useful practice to inspire students.

   Enlist such innovative methods to engage the students (in groups) in meaningful investigations; particularly about the problems they perceive to be significant and important.

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iii) Where can I Find Resources?

After learning this unit, you might be thinking of utilizing some of the methodologies mentioned in it. However, you may ask where to find the resources in the form of contents, materials, guidance, etc.?

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For this you can contact various organizations working in our country. Some of them are National Institute of open schooling (NIOS), Indira Gandhi National Open University (IGNOU), Homi Bhabha Centre for Science Education (HBCSE), National Council of Educational Research and Training (NCERT) etc. For contacting them, you can go through their web sites on internet. There you will find the addresses, e-mails, and phone numbers. You can definitely get help from resourceful and eminent experts. You will also get material in the form of books, CDs, experimental kits etc. from these organizations.

7.5 LET US SUM UP

In this unit, we learned the fact that, learning science as a 'subject' is not sufficient. It is necessary to have scientific literacy in the society. Our science education should be such that it triggers scientific attitude and rational thinking among the children.

While teaching, we have to keep a wide perspective in our mind that, science education should prove helpful in catering needs of the society. Hunger, malnutrition, poverty, corruption, stress and tensions, superstitions are the challenges in front of us. The science education should help us in finding solutions on these issues.

Due to advancements in science and technology, variety of aids is available for us to make teaching learning process effectively. We must take advantage of it in innovative and creative manner.

7.6 GLOSSARY/ABBREVIATIONS

- CLASS Computer Literacy and Studies in Schools
- DTH Direct to home
- FM Frequency modulation
- ICT Information and Communication Technology
- PC Personal Computer
- SITE Satellite Instructional Television Experiment

7.7 SUGGESTED READINGS AND REFERENCES

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7.8 UNIT-END EXERCISES

1. What is the meaning of Scientific Literacy? Cite two phenomena from your environment to explain quality of a Scientific Literate individual

2. Select a topic of your choice in Science for class-VII. Plan the activities correlating the contents with day to day life experiences.