National Curriculum for

# INTRODUCTION TO TECHNOLOGIES

## GRADES VI-VIII

## 2009

**GOVERNMENT OF PAKISTAN**
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# 1. Introduction

Education is a categorical imperative for individual, social and national development. It enables all individuals to reach their maximum human potential thereby plays a central role in human capital formation. It raises the productivity as well as efficiency of individuals thereby, produces "human resource" that is capable of leading the economy towards the path of sustainable economic development. 21st century has made economic life more competitive and human expertise development more significant. Only educated workforce equipped with contemporary skills can benefit the society and compete globally.

Technical and vocational education and training is an effective mean for society to develop its individuals' potential to respond to the challenges of the future. It creates opportunities not only for socially and economically underprivileged sections and prepares young people for the world of work but also reaches out to marginalize and excluded groups of the society to engage them in income-generating activities.

Therefore, learning in science and technology is fundamental to understanding the world in which we live and work. It helps people to clarify ideas, to ask questions, to test explanations through measurement and observation, and to use their findings to establish the worth of an idea. Science and technology is not seen as merely objective and value free but is recognized as being part of human experience. As such it is an integral part of daily life and relevant to everyone.

Science, technology, and society are interrelated to each other. While science may act as a catalyst for change, it is also influenced by technological advances, social and economic pressures. The applications of science affect our environment and the way we live our lives.

The Government of Pakistan is fully aware of the national and global challenges and is taking concrete steps to meet these challenges by promoting and strengthening science and technical education in the country. The "Introduction to Technologies" at middle level will not only help to link the education with world of work but will also facilitate learners to opt for any profession of their choice. This will not only assist in increasing skilled human resource but also reducing unemployment and alleviation poverty in the country.

The Ministry of Education, Government of Pakistan, Islamabad, constituted Curriculum Review & Development Committees/Groups whereby these Committees/Groups have been assigned to review and revise the existing Curricula of all core Science and Humanities Subjects (Grades I-XII).

"Introduction to Technologies" is being introduced as separate optional subject for Grades VI to VIII (Scheme of Studies 2006). It is comprised of concepts from Science.

For the "Introduction to Technologies" Curriculum, the committee held several meetings and deliberations on various issues pertaining to the current state of technical education in the country including technical curriculum, textbooks, teaching and learning resources, assessment, and schools' infrastructure. The prime purpose of holding such deliberations has been to appraise the need for technical education at school level in the light of ground realities and to develop a National Curriculum for "Introduction to Technologies" that will serve as a foundation document for the promotion of school technical education in Pakistan according to the demand of learning and knowledge in 21st century.

Need assessment was carried out through interactive consultations with various technical teachers, technologists & technology educators, schools administrators, textbooks writers and other stakeholders. The goal that has been determined is '*To promote, strengthen and broaden technology education in Pakistan'*. Subsequently, to achieve this goal the following aims have been determined for the school technical education:

- e*ncourage students of middle grade level to develop a critical sense for wonder and curiosity about scientific and technological endeavors;*
- *enable students to acquire new knowledge about technologies and use them to solve problems, so that they may improve the quality of their own lives and lives of others;*
- *prepare students to critically address social, economic, ethical, and environmental issues related to technology;*
- *provide students with a foundation in technology that creates opportunities for them to pursue progressively higher levels of study, prepares them for technology-related occupations, and engages them in technology-related activities appropriate to their interests and abilities; and*
- *develop in students, of varying aptitudes and interests, knowledge of wide variety of careers related to modern technologies.*

The accomplishment of these aims within the school context can take place only if certain opportunities are provided for the orientation and exploration of some aspects of technology. This Curriculum provides a systematic approach to students' learning in technology in a well-defined and organized framework. While teachers shall play the most significant role in helping students achieve technical literacy, they will need support from the rest of educational system in terms of necessary training in teaching of technology, teaching aids/material, and creating an enabling and conducive environment, if the challenge is to be met.

The structure of a curriculum demonstrates Coherence by constructing links across the curriculum so that students can make connections between one area of knowledge and skills with other areas and the world of work. The curriculum is designed to be delivered in such a way that students will be able to make connections between what they learn in all subjects, and between school and the

world outside. Learning must be build on students' previous experiences and attainment and prepare them for further learning.

**Objectives**

Following objectives have been defined to achieve the above mentioned aims of technical education at middle school level:

- To provide opportunities for students to develop attitudes appropriate for technological pursuits;
- To promote technology as an activity that is carried out by all people as part of their everyday life;
- To encourage students to consider the ways in which people have used technical knowledge and methods to meet particular needs;
- To develop understanding of the evolving nature of technology;
- To assist students to use technological knowledge to make decisions about the quality and worth of products;
- To help students to explore issues, made responsible and take decisions about the use of technology in their environment;
- To develop students' understanding of the different ways people influence and/or are influenced by technology; and
- To develop students' interest in understanding the knowledge and processes of technology that will form the basis of their career in technology.

Nevertheless, this document is intended to encourage all students to continue their participation in technical education beyond the Grade-VIII. It is expected that many students with ability and interest in technology will further continue their education in technology in the senior school. Some will continue to study technology as an integrated subject, while others may opt for specialized technology education at diploma or higher level.

Hence, in consonance with the above mentioned aims and objectives, this document explains the following:-

- Content Strands, Standards, and Benchmarks
- Student Learning Outcomes (SLOs)

and provides:

- Content Strands, Standards, and Benchmarks, Grades VI-VIII
- Grade-wise Learning Units Distribution Matrix, Grades VI-VIII
- Learning Contents and the Students' Learning Outcomes, Grades VI-VIII

# 2. Selection of Contents

- **Learning Strands, Content Standards, and Benchmarks**
- **Student Learning Outcomes (SLOs)**

The Introduction to Technologies Curriculum is organized around themes that students can relate to their everyday experiences, and to the commonly observed phenomena in nature & environment. The basic aim is to enable students to appreciate the links between seemingly different topics and thus allow the eventual integration of ideas.

## Learning Strands

Learning Strands are the major learning areas, for example, **Knowledge, Skills, Attitudes, and Science, Technology, Society, & Environment (STSE)** that student will be educated to.

In this Introduction to Technologies Curriculum, following Learning Strands of **Knowledge** have been selected for the students of Grades VI-VIII:

1. Agriculture,
2. Natural Resources and Energy
3. Industrial Technology.

These are three **Integrating** Learning Strands, which are:

1. Skills,
2. Attitude, and
3. Science, Technology, Society, and Environment (STSE).

This division into six strands is a convenient way of categorizing the outcomes for technology education in middle schools. It emphasizes that there are a number of aspects to technology, all of which are important. The division does not mean that learning in one strand is to be developed independently from learning in other strands.

The development of technological skills and attitudes is inextricably linked to the development of ideas in technology. Similarly, as students' ideas evolve, they should be acquiring an understanding of the nature of technology and its relationship to society, and the environment. Consequently, when planning and implementing a Introduction to Technologies curriculum, the integrating strands should be interwoven with the three **Knowledge** Strands. Teachers should also seek ways to reflect the integrated nature of technology by linking achievement objectives and learning experiences across the three contextual strands with those of the other objectives of the national curriculum.

## Content Standards

Content Standards are basically the descriptions of the Contextual or Content Strands. Content Standards, outline, what students should know and be able to do

in Technology. This curriculum focuses on the following Content Standards for the Introduction to Technologies Curriculum (Grades VI-VIII):

**Agriculture**

Students will understand and explain the production of useful products from plants and animals including soil cultivation, crops, livestock and the processing activities. They will also differentiate between the structure of tools, machines and their characteristics used in agriculture.

**Natural Resources and Energy**

Students will describe and explain the importance of natural resources in the economy of our country, common properties of natural resources, various types of natural resources and locations of these resources in Pakistan. The students will also be able to know the role of technology in predicting, exploring and managing these resources. The students will also describe and explain common properties, forms and interactions of energy and matter, their transformations and applications in chemical and physical systems.

**Industrial Technologies**

Students will be knowledgeable to understand and evaluate technology. They will be able to know and differentiate tools and machines used in different technologies and their application in relevant tasks. They will also understand the system and technology theories about the origin of a technological system, and explain how we learn about the mechanism involved in the system.

Whereas Standards for following **integrating** learning strands:

1. Skills,
2. Attitudes, and
3. Science, Technology, Society, and Environment (STSE).

are provided in the Chapter 3 of this curriculum document.

**Benchmarks (Key Stage Curriculum Outcomes)**

Benchmarks are the statements that identify the learning outcomes of students; what they are expected to know, be able to do, and value by the end of, for example, Grades VI- VIII, as a result of their Grade-wise cumulative learning experiences.

Also Benchmarks represent what is intended or what learning outcome is expected from students at the end of a grade-cluster. At the end of a particular key-stage or grade-cluster majority of the students will have fully achieved the intended Benchmarks while others may not.

In this curriculum, the benchmarks for the grade-cluster is given for the cluster of VI-VIII, - what learning outcome will be expected from all students at the end of Grade VI-VIII in the Learning Strands (Agriculture, Natural Resources & Energy and Industrial Technology, skills, attitudes, and STSE).

## Student Learning Outcomes – SLOs

Students' Learning Outcomes are the learning statements, specifically describing what students are supposed to learn and able to do at each Grade level in order to achieve the specified benchmarks for every Grade-Cluster. In other words, SLOs are the incremental steps toward accomplishment of benchmarks, which are organized around the Standards and listed for each grade level as students advance in their knowledge, skills, attitudes, and STSE.

Therefore, well-defined SLOs for the Grades VI-VIII have been provided in the following pages, which reflect the desired learning outcomes towards achieving the required Benchmarks for grade-cluster VI-VIII for the learning strands.

### SLOs' and Benchmarks' Achievement Objectives

This Introduction to Technologies Curriculum provides well defined Student Learning Outcomes and Benchmarks for the students of the Grades VI-VIII, for planning and making decisions about curriculum implementation. Teachers should note that benchmarks are broad, and may embody a mixture of knowledge, skills, and attitudes. Consequently, the attainment by students of any particular benchmark will often be dependent upon more than one unit of study, and on units based on several learning strands.

It is equally valid for teachers and students to approach a unit of study from the objectives in any strand or, in some cases, from another subject. However, it is expected that the "technology and its relationship to science, society and environment" strand, and the skills and attitudes strands, will be integrated into other areas of technology. Whenever this is done, the achievement objectives must be specified, and their attainment by students monitored.

The attainment of the broader and more complex Benchmarks, like developing Skills and Attitudes will typically require a longer period of time and involve a wide range of learning experiences.

Thus, the achievement objectives for the SLOs and Benchmarks require a number of school based decisions and actions. In making these decisions, schools and teachers should make full use of the flexibility that exists in how the Benchmarks may be approached. This will result in each school providing a unique teaching and learning program that must recognizes the particular character of their student population, that makes effective use of local resources, and that fits in with other decisions relating to the whole of the schools' curriculum.

What will be common across all schools is that their Introduction to Technologies Curriculum will target the attainment of the same SLOs and Benchmarks, and will describe processes to monitor, for every student, the learning described by these objectives.

At appropriate times the routine and/or annual assessment information are required to be processed by teachers to enable the school to report on students' learning in technology in relation to the SLOs and Benchmarks, and to provide themselves with one type of feedback on the effectiveness of the school's technology programme vis-à-vis this Introduction to Technologies Curriculum.

# 3. Content Strands, Standards, and Benchmarks

## STRAND-1: AGRICULTURE

### Rationale

The Agriculture strand focuses on the production of useful products from plants and animals including soil cultivation, crop and livestock management and the activities of processing and marketing and various factors influence the kind of agriculture practiced in a particular area.

This strand includes the relationship of knowledge and skills with technology, as well as the impact of technological changes on the agriculture and the need for sustainable development. In all grades, students will develop the ability to use appropriate vocabulary and technological terminology related to the agriculture to communicate clearly.

### CONTENT STANDARD

Students will understand, explain and differentiate among various aspects of agriculture and will also investigate the impact and benefits of agriculture for prosper future of this country.

### Benchmarks

***By the end of Grade VI, students will be expected to:***

1. Identify the needs and characteristics of plants and animals;
2. Describe cultivation of vegetables and fruits;
3. Describe domestic poultry farming and poultry feeds, diseases and their control.
4. Distinguish migratory birds, pet birds and hunting birds;
5. State importance of soil moisture and irrigation;
6. Describe problems of agriculture land and its solutions;
7. Describe the growing/propagation of plants Value added items of agriculture products and bi-products;
8. Explain the Agriculture implements, machinery and their uses; and
9. Describe the environmental degradation.

## STRAND-2: NATURAL RESOURCES & ENERGY

### Rationale

This strand focuses on students' understanding of what natural resources are and their importance in national economy. This also focuses on what is energy, forms of energy and their transformations. It also focuses on the description, physical properties and use of minerals. Students will understand importance of minerals products and their role in economic development of a country.

Students will increase their understanding of the characteristics of materials they encounter daily. Students gain an understanding of the nature of matter and

energy, including their forms, the changes they undergo, and their interactions. Students will develop an understanding of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

In all grades, students will develop the ability to use appropriate vocabulary related to natural resources to communicate clearly about technology and technological concepts.

**CONTENT STANDARD**

Students will describe and explain common properties, forms, and interactions of energy and matter, their transformations and applications in chemical and physical systems.

**Benchmarks**

***By the end of Grade VII, students will be expected to:***

1. Explain the importance of natural resources in economic development of country;
2. Distinguish and explain the various types of energy resources (solid, fossil fuels, liquid resources, gases and nuclear resources);
3. Explain various types of renewable energy and their usage;
4. Describe Mining/Exploration of fuels;
5. Describe energy transformations and the uses of energy at school and home;
6. Explain various factors affecting climate; and
7. Explain sustainable development.

**STRAND-3: INDUSTRIAL TECHNOLOGY**

**Rationale**

Industrial Technology aims at developing the manual and technical skills required to work with tools and machinery. It also focuses on the ability to responsibly use appropriate technology to communicate, solve problems and access, manage, integrate, evaluate and create information to improve learning in all subject areas and to acquire lifelong knowledge and skills. Industrial Technology is an umbrella term used to describe an educational programme that features fabrication of objects in wood and metal using a variety of hand, power and machine tools. Students are naturally interested in knowing and doing practical tasks. They will try to understand everything around them and relate theoretical knowledge to any mechanism they observe. This curiosity will lead them to observe, collect, and record information about the objects and machines visible to them. In Grades VI-VIII, students' attention shifts from the properties of particular objects toward an understanding of the mechanism involved in the working of the system. Students grapple with the importance of and methods of obtaining direct and indirect evidence to support current thinking. In doing so, they develop an understanding of the basic laws, theories, and models that explain the world. They will recognize that

new technologies and observations change our explanations about how things in the natural world behave.

**CONTENT STANDARD**

Students will be knowledgeable to understand and evaluate technology and develop a critical thinking skill based on understanding general patterns that transcend specific technologies. They will compare and contrast among various technologies and their importance according to their usage.

**Benchmarks**

***By the end of Grade VIII, students will be expected to:***

1. Explain importance of various professions and dignity of labour;
2. Explain and differentiate between various industrial materials like metals and alloys, non metals, synthetic materials like plastics/ composite materials etc.
3. Describe the structure of wood;
4. Describe various types of wood and their usage**;**
5. Distinguish between measuring, marking, cutting and finishing/ machines and tools used in wood working;
6. Explain various metals and important alloys according to their properties and usage;
7. Explain various types of simple machining processes used in metal working;
8. Casting/Forging of metals and heat treatment;
9. Explain various types of welding materials and welding processes;
10. Define plumbing and its domestic/industrial usage;
11. Explain controls and protective devices used in domestic Electrical Appliances and Wiring;
12. Explain working of domestic/industrial Refrigeration and Air-conditioning system;
13. Enlists different types of Refrigerants used in Refrigeration and Air-conditioning;
14. State importance of industries like automobiles, ships and aircrafts etc. in the economy of a country;
15. Describe safety measures in industrial technology related to health and environment.

**STRAND-4: SKILLS**

**Rationale**

In everyday life, we find ourselves wondering about nature, gathering information, devising and evaluating possible explanations of how things work, and discussing ideas with others.

These characteristically human activities reflect in many ways how technologists think and work.

Inquiry is a way of learning about the natural world and the environment we live in. It involves the use all of the senses to develop the skills of observing, labeling, comparing, describing and sorting, and to wonder about the differences and changes in everyday world. Students will be encouraged to communicate their findings in a variety of ways, including labeled drawings, pictorial graphs, oral and written forms. As their investigative skills develop, they will learn to predict, redesign their investigation, find solutions to their problems, collect data, analyze and interpret data and tell whether the result is expected or not. Students should be encouraged to reflect on their investigations, identify difficulties and suggest improvements.

It is therefore intended that students will develop necessary skills, as they are encouraged to think technically rather than simply memorize and/or study technological facts. Also, it is expected from teachers that they will engage students in inquiry activities to develop such skills.

**CONTENT STANDARD**

Students will develop the skills required for technology inquiry, for communicating ideas and results, for working collaboratively, and for making informed decisions.

**Benchmarks**

***By the end of Grade VIII, students will be expected to:***

1. Ask questions how human ingenuity and resources combine to meet human needs and wants;
2. Understand the concept of technology and its importance in extending human capabilities in local and global environment;
3. Explain how elements, components & devices function in a system and why systems behave as they do;
4. Recognize efficient use of various resources in a particular technology;
5. Identify the components of a system and how they work;
6. Use appropriate knowledge and skills learnt in other areas like maths, general science, etc. to understand the simple systems;
7. Explain how technology affects environments;
8. Explore various means of accessing information including traditional and electronics media;
9. Describe social, occupational and environmental impacts of technology based on his / her own observation / research;
10. Describe how tools and equipment can enhance human capabilities;
11. Know about safe and proper use of tools & equipment;
12. State characteristics and properties of materials;
13. Know how technology affects the agriculture;
14. State how agriculture affects the economy of the country.

## STRAND-5: ATTITUDES

### Rationale

This strand refers to the students' need for developing the attitudes or "habits of mind" that are considered essential for a meaningful study of technology and its relationship to the society.

These include:

1. A commitment to the pursuit of knowledge and achievement of potential, resulting in a disposition towards striving to understand the world and how best one can make a positive contribution towards it;
2. Respect and concern for others and their rights, resulting in sensitivity to and concern for the well-being of others;
3. Social and civic responsibility, resulting in a commitment to exploring and promoting the common goal;
4. Environmental responsibility, resulting in a respect and concern for the natural and cultural environment and a commitment to regenerative and sustainable resource use; and
5. Develop a sense of healthy work ethics and the importance of correct and responsible work practices.

These attitudes have been incorporated into the student's learning outcomes so as to enable them in making informed decisions and demonstrating responsible behaviours.

### CONTENT STANDARD

Students will display a sense of curiosity and wonder about the natural world; they will be encouraged to develop attitudes that support the responsible acquisition and application of technology and technological knowledge for the mutual benefit of self, society, and the environment.

### Benchmarks

***By the end of Grade VIII, students will be expected to:***

1. Develop affinity for technology in general and some specific field in particular for adopting a technology related career;
2. Show interest and curiosity about objects and events within different environments;
3. Willingly observe, question, explore, and investigate;
4. Show interest in activities of individuals working in technological fields;
5. Consider their own observation and ideas as well as those of others during investigation and before drawing conclusions;
6. Appreciate the importance of accuracy and honesty;
7. Demonstrate perseverance and desire to understand;
8. Appreciate the role and contribution of technology in understanding of the natural world;

9. Realize that the applications of technology and its intended and unintended effects;
10. Work collaboratively while exploring and investigating;
11. Develop a sense of responsibility for the welfare of own, other people, living things, and the environment; and
12. Demonstrate an appreciation of healthy work ethics and their importance in careers related to all aspects of technology related occupations.

## STRAND-6: SCIENCE, TECHNOLOGY, SOCIETY, AND ENVIRONMENT (STSE)

### Rationale

Students' natural curiosity about how things work is clear to any adult who has ever watched a child tenaciously work to improve the design of a paper airplane, or to take apart a toy to explore its insides.

Technology tries to understand the natural world. While the intention in technology is on gaining knowledge of the natural world, the emphasis is on finding practical ways to apply that knowledge to solve problems. Technology works in conjunction with nature and environment to expand our capacity to understand the world.

Our world is shaped in many ways by technology and human activity. Because technology effects all living and non-living systems, it is vital that students understand the interrelationship of science, technology, and society.

### CONTENT STANDARD

Students will develop an understanding of the nature of technology and its relationship with other sciences.

### Benchmarks

***By the end of Grade VIII, students will be expected to:***

1. Describe ways that show how technology and science work together in investigating questions and problems in meeting specific needs;
2. Describe applications of technology that have developed in response to human and environmental needs;
3. Describe positive and negative impact of technology on their own lives and the environment;
4. Describe how people use technology in their professions;
5. Explain ways of using materials and tools to solve practical problems; and
6. Undertake personal actions to prevent environmental degradation.

# 4. Grade-wise Units Distribution Matrix

| Grade | Agriculture |
|---|---|
| GRADE-VI | • Introduction to Technologies<br>• Introduction to Agriculture<br>• Crop Production<br>• Agricultural implements, machinery and their uses<br>• Irrigation<br>• Cultivation of vegetables, flowers and fruits<br>• Problems of agriculture land and solution<br>• Rearing of useful birds and insects<br>• Rearing of useful animals<br>• Growing / propagation of plants<br>• Value added items of agriculture products and bi-products<br>• Environmental degradation |

| Grade | Natural Resources & Energy |
|---|---|
| GRADE-VII | • Introduction to natural resources<br>• Renewable Energy<br>• Environment<br>• Sustainable development<br>• Mining<br>• Exploration of fuels |

| Grade | Industrial Technology |
|---|---|
| GRADE-VIII | **Woodwork**<br><br>• Introduction of Industrial Technology<br>• Wood and its kinds<br>• Types of material and usage<br>• Tools for Woodwork (Their types and uses)<br>• Value addition to wood products<br><br>**Electricity**<br><br>• Electricity<br>• Electrical wiring<br>• Safety measures<br>• Linkages of industrial technology to other technologies<br><br>**Metal work**<br><br>• Introduction to metal work<br>• Tools and their description<br>• Simple Machines<br>• Tolerance and fits<br>• Inspection and quality control<br>• Welding and some other industrial processes |

# 5. Learning Contents and Student Learning Outcomes

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 1** | |
| **Introduction to Technologies**<br>• Importance of technology<br>• Usage of technologies (like Agriculture, metal work, wood work and electricity) in daily life | • Define technology.<br>• Explain Importance of technology.<br>• Identify industrial technologies in Pakistan.<br>• Role of industrial technologies in economic development of country.<br>• State importance and usage of technologies in daily life.<br>• Describe advantages and disadvantages of technologies.<br>• Explain the role of technologies in development of country. |
| **UNIT – 2** | |
| **Introduction to Agriculture**<br>• Definition of agriculture<br>• Importance of agriculture<br>• Development of agriculture in Pakistan<br>• Various branches of agriculture<br>• Relationship of agriculture to other technologies<br>• Various crop zones in Pakistan<br>• Agricultural problems in Pakistan | • Define Agriculture<br>• List importance of Agriculture (in foods, clothing and shelters).<br>• Trace Agriculture in past, present and future context in Pakistan.<br>• Explain different branches of Agriculture.<br>• Relate agriculture to other technologies like food, sugar, cotton, chemical and auto & farm technologies.<br>• Identify various crop zones in Pakistan.<br>• Enumerate problems in agriculture in Pakistan. |
| **UNIT – 3** | |
| **Crop Production**<br>• Types of crops<br>• Types of soil<br>• Types of seed | • Classify different types of crops.<br>• Name Rabi and Kharif crops.<br>• Identify types of soils.<br>• Differentiate various types of seeds.<br>• Identify various techniques used in |

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| • Soil fertility<br>• Fertilizers and their types<br>• Problems associated with crop production<br>• Environmental hazards | seed treatment.<br>• State importance of seed treatment in crop production.<br>• Explain soil fertility.<br>• State fertilizers and their types.<br>• Relate effect of fertilizers on the crop production.<br>• List few problems related to crop production.<br>• Predict environmental hazards related to chemical fertilizer use. |
| **UNIT - 4** | |
| **Agriculture implements, machinery and their uses**<br>• Agriculture machinery and its usage<br>• Types of ploughs<br>• Rice transplanting machines<br>• Threshers and land levelers<br>• Harvesters | • Classify agriculture machinery and its usage<br>• Explain types of ploughs<br>• Describe Rice transplanting machines<br>• State the usefulness of Threshers and Land Levelers in agriculture.<br>• Explain Harvesters<br>• Explain different technologies which help to improve the process of harvesting. |
| **UNIT - 5** | |
| **Irrigation**<br>• Irrigation<br>• Importance of water for plants<br>• Various sources of irrigation<br>• Importance of soil moisture<br>• Problems associated with irrigation in Pakistan | • Define irrigation.<br>• Explain importance of water for plants.<br>• Identify sources of irrigation.<br>• Describe importance of soil moisture.<br>• Name major irrigation problems.<br>• Identify the technologies which can be used to overcome the problems associated with irrigation in Pakistan. |

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 6** | |
| **Cultivation of vegetables, flowers and fruits**<br>• Importance of vegetables and fruits<br>• Seasonal vegetables and fruits<br>• Classification of flowers<br>• Economic value of flowers and their marketing<br>• Use of fertilizers<br>• Food preservation technology | • Explain importance of vegetable and fruits in our daily life.<br>• Identify seasonal vegetables and fruits.<br>• Compare conditions for cultivation of various vegetable and fruits.<br>• Explain uses of fruits and vegetable in the preparation of flavors, fragrances, resins and pharmaceutical.<br>• Classify the flowers in respect of annual, biennial, perennial.<br>• Describe economic value of flowers production and their marketing.<br>• Enumerate the role of fertilizers for cultivation of vegetables and fruits.<br>• Identify fertilizers suitable for cultivation of various vegetables and fruits.<br>• Identify the technology used in food preservation.<br>• State various measures to prevent food spoilage. |
| **UNIT - 7** | |
| **Problems of agriculture land and solution**<br>• Common problems of soil and their solutions<br>• Eradication of land problems | • Identify common problems of agriculture (soil erosion, water logging, salinity, alkalinity & weeds) and their solutions.<br>• Identify the ways used to solve land problems.<br>• Explain how technology helps to solve the common problems of soil and land. |

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 8** | |
| **Rearing of useful birds and insects**<br>• Useful birds and their importance<br>• Poultry Farming<br>• Poultry feeds<br>• Poultry diseases and their control<br>• Transgenic birds<br>• Useful and harmful insects<br>• Apiculture and Sericulture | • Distinguish between migratory birds, pet birds and hunting birds.<br>• Explain importance of birds in nature.<br>• Describe domestic poultry farming<br>• Explain poultry feeds.<br>• Enlist major poultry diseases and their control.<br>• Propose a way technology provides the opportunities for transgenic birds and their economic importance.<br>• Differentiate between useful and harmful insects<br>• Explain Apiculture and Sericulture.<br>• Enumerate the importance of apiculture and sericulture in daily life.<br>• Suggest ways technology improves the local apiculture and sericulture.<br>• Explain how apiculture and sericulture contribute in development of country. |
| **UNIT - 9** | |
| **Rearing of useful animals**<br>• Dairy Farming<br>• Goat Farming<br>• Fish Farming<br>• Problems relating to rearing of useful animals | • State importance of Dairy Farming<br>• Define Goat Farming<br>• Differentiate various types of fishes.<br>• Enlist major problems in rearing of useful animals.<br>• Suggest how technologies help to overcome problems associated with rearing of animals.<br>• Explain how transgenic animal fulfill the requirement of society. |

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 10** | |
| **Growing/Propagation of plants**<br>• Propagation of natural and artificial plants<br>• Indoor plants<br><br><br><br><br>• Farm Forestry in its importance<br>• Importance of forestry<br>• Preservation of marketing plants & flowers. | <br>• Differentiate between natural and artificial propagation of plants<br>• Explain cultivation of indoor plants<br>• State soil requirements, fertilizers and proper caring of indoors plants<br>• Identify the ways to look after indoors plants.<br>• Describe Farm Forestry.<br>• Evaluate the importance of forestry in daily life.<br>• Explain how technology helps in the preservation of the marketing plants and flowers. |
| **UNIT - 11** | |
| **Value added items of agriculture products and bi-products**<br>• Preparation of juices, squashes, pickles, etc.<br><br><br>• Marketing of flowers, juices, squashes, pickles, etc. | <br>• Describe preparation of juices, squashes, pickles, jams, jellies and tin food vegetables, honey, etc., and their preservation.<br>• Describe importance of economic value of flowers and their marketing.<br>• Suggest the ways technology impacts the production of juices, squashes, pickles etc. |

| 5.1 Grade – VI (Agriculture) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 12** | |
| **Environmental degradation**<br>• Environmental degradation<br><br><br><br>• Dams and Canals<br>• Environmental impacts on agriculture<br><br>• Importance of Dams and Canals in agriculture | <br>• Describe Environmental degradation especially related to agriculture.<br>• Explain locusts and their impact on agriculture.<br>• Describe Dams and Canals.<br>• Explain importance and environmental impact of dams and canals.<br>• Explain the importance of dams and canals in agriculture.<br>• Explain how technology helps to maintain a clean environment and water resources. |

| 5.2 Grade - VII (Natural Resources and Energy) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 1** | |
| **Introduction of natural resources**<br>• Natural resources<br>• Weather related resources<br>• Natural resources and economic development<br>• Natural resources technologies | • Define natural resources.<br>• Classify natural resources.<br>• Explain weather related resources.<br>• Discuss importance of natural resources in economic development of country.<br>• Suggest technologies that are used in exploration of natural resources. |
| **UNIT - 2** | |
| **Renewable energy**<br>• Type of energy<br>• Type of resources<br>• Renewable energy<br>• Limitation of renewable energy | • Classify major types of energy.<br>• Distinguish and explain various types of resources (solid resources, fossil fuels, liquid resources, gases and nuclear resources).<br>• Define renewable energy.<br>• Explain various types of renewable energy and their usage (bio gas, solar, wind and tidal).<br>• Explain use of various types of renewable energy.<br>• Give example to show limitations of renewable energy. |
| **UNIT - 3** | |
| **Environment**<br>• Climate & environment<br>• Factors effecting climate<br>• Importance of forests<br>• Pollution<br>• Types of pollution<br>• Environmental protection<br>• Waste treatment<br>• Water treatment | • Define climate and environment.<br>• Narrate characteristics of Pakistan's climate.<br>• Explain various factors effecting climate.<br>• Recognize the importance of forests in nature.<br>• Define pollution.<br>• Distinguish various types of pollution.<br>• Describe Environmental protection.<br>• Explain waste disposal and recycling<br>• Describe water treatment. |

| 5.2 Grade - VII (Natural Resources and Energy) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| • Fertilizers and pesticides<br><br>• Global warming. | • Categorize advantages and disadvantage of fertilizers, pesticides and waste disposals.<br>• Explain causes and impact of global warming.<br>• Suggest the technologies which use to overcome the problem related to environment and global warming. |
| **UNIT - 4** | |
| **Sustainable development**<br>• Sustainable Development<br>• Energy and environment<br><br>• Role of energy in development | <br>• Define sustainable development.<br>• Explain relationship of energy and environment.<br>• Explain the role of energy in development.<br>• Identify general measures in energy conservation.<br>• Give general awareness to people about the safe use of energy. |
| **UNIT - 5** | |
| **Mining**<br>• Types of mining<br><br>• Importance of mining (salt, coal, gold, gem stones, copper, marble and iron, etc.)<br><br><br>• Mining technology | <br>• Define mining.<br>• Describe types of mining.<br>• Explain importance of mining and exploration of salt, coal, gold, gem stones, copper, marble and iron, etc.<br>• Enlist advantages & disadvantages of mining.<br>• Name various technologies being used in mining process.<br>• State the maximum employment opportunities in a local and global economy driven by the field of mining. |

| 5.2 Grade - VII (Natural Resources and Energy) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 6** | |
| **Exploration of fuels**<br>• Fuels<br>• Types of hydrocarbon and their usage<br>• Hydrocarbon refinement. | • Define fuels.<br>• Identify major types of hydrocarbon and their usage.<br>• Describe process of refinement for hydrocarbons.<br>• Explain how technology impacts the production of common chemicals. |

| 5.3(a) Grade – VIII (Industrial Technology – Wood Work) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 1** | |
| **Introduction to Industrial Technology**<br>• Importance of various professions.<br>• Dignity of labour.<br>• Respect for professions | • Describe importance of various professions.<br>• Explain dignity of labour.<br>• State respect and usefulness of professions at local and global. |
| **UNIT - 2** | |
| **Wood and its Kinds**<br>• Various sources of wood.<br>• Structure of Wood<br>• Classification of wood<br>• Conservation of timber<br>• Use of different types of timber | • Describe various sources of wood.<br>• State Structure of Wood.<br>• Classify hard and soft wood.<br>• Distinguish natural and artificial timber.<br>• State different methods of conservation of timber.<br>• Identify some Pakistani timbers and explain their characteristics.<br>• Explain properties and usage of different types of timber.<br>• Recognize the importance of technologies in wood industry.<br>• State the employment opportunities in wood work. |
| **UNIT - 3** | |
| **Types of material and usage**<br>• Fastening materials<br>• Clamping devices<br>• Protective materials | • Identify fastening material (Bolts, Nuts, Nails, Hinges, Locks, Stoppers and their usage.<br>• Describe various clamping devices/ clamping vices (Bench/leg/Hand vices, clamps and their usage.)<br>• Explain protective materials like paints, polishes and their importance/significance. |

| 5.3(a) Grade – VIII (Industrial Technology – Wood Work) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| • Synthetic materials | • Identify synthetic materials (Hard board, chip board, plywood, veneers and Glues).<br>• Suggest the ways technologies facilitate in production of synthetic materials. |
| **UNIT - 4** | |
| **Tools for wood work (Their types and uses)**<br>• Measuring and marking tools<br>• Cutting tools<br>• Driving tools<br>• Finishing tools<br>• Carving tools | • Distinguish measuring and marking tools.<br>• Identify cutting/machine tools (Hand saws, Bend saw, Circular saw, planes chisels, Hand (Bench drills, Drill Bits and Braces)<br>• Distinguish various driving tools (Hammers, Mallets, Pincers, Screw Drivers) and their usage.<br>• Identify finishing tools (Files, Rasp, Sand paper, scrapers) and their uses.<br>• Distinguish various carving tools.<br>• Describe importance of carving and sports goods in the economy of a country. |
| **UNIT - 5** | |
| **Value Addition to wood products**<br>• Wood products and their marketing<br>• General safety of wood<br>• Beautification of wood | • Identify and discuss marketing areas for wood products.<br>• State importance of wood safety and processes used in wood safety.<br>• Describe the role of wood work in beautification.<br>• Suggest the ways technologies help in beautification of wood. |

| 5.3(b) Grade – VIII (Industrial Technology – Metal Work) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 6** | |
| **Introduction to metal work**<br>• Importance of metals and alloys | • Distinguish between metals and non metals.<br>• Explain significance and importance of metals and alloys and their usage.<br>• State various important industrial metals and their usage.<br>• Explain how decorative and practical objects containing silver can differ significantly in their properties and durability. |
| • Plastics & synthetic materials | • Describe plastics & synthetic materials and their usage. |
| • Ferrous & non-ferrous metals | • Describe production/formation of metallic items (ferrous & non-ferrous metals, alloy steel, iron sheets). |
| • Properties of metals | • Classify properties of metals (Ductility, Brittleness, Hardness, Toughness, Malleability, and Machinability).<br>• Name few processes of metal extraction. |
| • Types and usage of metals | • Explain types and usage of metals**.**<br>• Explain how technology helps in extraction and processing of different metals. |
| **UNIT - 7** | |
| **Tools and their description**<br>• Measuring and layout tools | • Identify lay out and measuring tools (Steel Rule, Steel Tap, Hook Rule, Squires Punches, Calipers, Dividers) |
| • Fastening tools | • Explain fastening tools (vices, clamps, wrenches, tongs and Holding bar clip).<br>• Suggest the ways technology helps in the working of these fastening tools. |

| 5.3(b) Grade – VIII (Industrial Technology – Metal Work) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 8** | |
| **Simple Machines**<br>• Various types of simple machines | • Define simple machines.<br>• Explain various types of simple machines (drill, shaper, lathe and milling, grinding, copying machine) and their uses. |
| **UNIT - 9** | |
| **Tolerance and fits**<br>• Tolerance and fits | • Define tolerance and fits.<br>• Identify tolerance and fits of a job. |
| **UNIT – 10** | |
| **Inspection and quality control** | • Distinguish among various metals.<br>• Explain various metals according to their properties and usage. |
| **UNIT - 11** | |
| **Welding and some other industrial processes** | • Define welding.<br>• State various types of welding.<br>• Explain the usage of commercial and industrial welding.<br>• State usage of welding in refrigeration and air-conditioning. |

| 5.3(c) Grade – VIII (Industrial Technology – Electricity) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT - 12** | |
| **Electricity**<br>• Types and symbols of electricity<br>• Basic principles of electricity | • Define electricity.<br>• Classify types of electricity.<br>• Recognize symbols of electricity.<br>• Explain basic principles of electricity. |
| **UNIT - 13** | |
| **Electrical Wiring**<br>• Wiring<br>• Types of wiring<br>• Wiring materials<br>• Electrical tools<br>• Protective and control devices<br>• Types of meters<br>• Various types of batteries<br>• Battery charging | • Define wiring.<br>• Identify different types of domestic wiring.<br>• Distinguish wiring materials<br>• Explain electrical tools used for wiring (different pliers, electrical knife, steel rule, hand drill phase tester and electric drill machine).<br>• Enumerate protective devices.<br>• Explain control and protective devises used in domestic wiring (fuses and circuit breakers).<br>• Illustrate the working of metals detectors used for security checks.<br>• Identify various types of meters<br>• Explain the usage of various meters (ammeter, voltmeter, ohmmeter, watt-hour meter).<br>• Define batteries.<br>• State various types of batteries.<br>• Illustrate usages of batteries.<br>• Explain battery charging |

| 5.3(c) Grade – VIII (Industrial Technology – Electricity) | |
|---|---|
| **Contents** | **Student Learning Outcomes** |
| | All the students will be able to: |
| **UNIT – 14** | |
| **Safety Measures** | • State precautionary/safety measures (personal, tools and jobs).<br>• Describe health and environment related safety measures. |
| **UNIT - 15** | |
| **Linkage of Industrial Technology to other Technologies** | • Describe the relationship of industrial technology to other fields of technology and engineering.<br>• Identify factors to consider to making decision about any technical profession.<br>• Identify the consequences/ effects of new technologies. |

# 6. Teaching and Learning

## 6.1 THE ROLE OF TEACHERS

Teacher has highly important responsibilities in implementing vital trends in the Curriculum. Implementing the Curriculum means that when teachers design and develop learning and teaching strategies to suit the needs of their students, they must ensure that these strategies include learning opportunities and enriching experiences for their students aimed at achieving the Learning Outcomes set out in the Curriculum.

It is established that what students learn is fundamentally connected to how they learn it. Therefore there is a need for new forms of classroom organization, communication, and instructional strategies where the teacher is a facilitator of learning whose major tasks include:

i. Creating a classroom environment that reflects a constructive, active view of the learning process and supports the learning and teaching.

ii. Designing effective learning experiences that help students to achieve expected Learning Outcomes.

iii. Stimulating and managing classroom discourse in support of students learning.

iv. Learning about and then using students' motivations, interests, abilities, and learning styles to improve learning and teaching.

v. Selecting teaching strategies from a wide repertoire.

vi. Assessing students' learning and activities involved, and the learning environment to make ongoing instructional decisions.

## 6.2 THE CHANGING NATURE OF TEACHING AND LEARNING

Traditional Instructional Practices generally have shown that:

- The majority of classroom time is spent on teachers lecturing, students listening, students reading textbooks.
- Classrooms appear to be dominated by students filling out worksheets and short-answer activity sheets.
- Teachers use the same set of practices for every lesson. They do not review the previous day's lessons, state their objectives, present, demonstrate, model, check for understanding, provide guided practice, and use closure.
- Fewer connections between school learning and the everyday world.
- Knowledge of subject becomes an exercise in naming and memorizing.

In such an environment, the role of the students is to memorize information, conduct well-regulated experiments, and perform activities using a specific prescribed procedure and is then tested on their ability to repeat these tasks or remember specific facts.

In the light of current understanding about the nature of learners and learning, the roles and responsibilities of students and teachers in the learning process are changing. The way in which learning is defined has expanded from simple recall of facts or definitions to being able to find connections among facts to build conceptual understanding. Teaching for conceptual change calls for knowing the preconceptions that students bring to the classroom and purposefully designing, intellectually engaging explorations that encourage students to confront and refine their own ideas. The teaching strategies described in this Curriculum are intended to support these changing emphases for classroom learning.

At early grades, the purpose of this Curriculum is not to memorize the "right" answer, but for them to move along a learning continuum towards a deeper understanding of concepts and processes. While students engage constructing their own understanding of each concept, the primary role of teaching is not to lecture, explain, or attempt to 'transfer' knowledge, but to create situations for students that will encourage them to develop mental constructions.

## 6.3 THE GUIDING PRINCIPLES OF LEARNING

Teachers need to stay abreast of recent trends in teaching. They need to learn, analyze, and appraise new developments in the teaching and learning. For example, developmentally appropriate instructions describe an approach to education that focuses on the child as a developing human being and lifelong learner. This approach recognises the child as an active participant in the learning process; a participant who constructs meaning and knowledge through interaction with others like friends and family, materials and environment. The teacher is an active facilitator who help the child to make meaning of the various activities and interactions encountered throughout the day. It requires teachers to make decisions in the classroom by combining their knowledge of child development with an understanding of the individual child to achieve desired and meaningful outcomes. Teachers ought to value the basic principles of accelerated learning; some of these are as follows:

1. **Learning Involves the Whole Mind and Body**. Learning is not all merely "head" learning (conscious, rational, "left-brained," and verbal) but involves the whole body/mind with all its emotions, senses, and receptors.
2. **Learning is Creation, Not Consumption**. Knowledge is not something a learner absorbs, but something a learner creates. Learning happens when a learner integrates new knowledge and skill into his or her existing structure of self. Learning is literally a matter of creating new meanings, new neural networks, and new patterns of electro/chemical interactions within one's total brain/body system.

3. **Collaboration Aids Learning**. All good learning has a social base. We often learn more by interacting with peers than we learn by any other means. Competition between learners slows learning. Cooperation among learners speeds it.
4. **Learning Takes Place on Many Levels Simultaneously**. Learning is not a matter of absorbing one little thing at a time in linear fashion, but absorbing many things at once. Good learning engages people on many levels simultaneously (conscious and Para conscious, mental and physical) and uses all the receptors and senses and paths into a person's total brain/body system. The brain, after all, is not a sequential, but a parallel processor and thrives when it is challenged to do many things at once.
5. **Learning Comes From Doing the Work Itself (With Feedback).** People learn best in context. Things learned in isolation are hard to remember and quick to evaporate. We learn how to swim by swimming, how to manage by managing, how to sing by singing, and how to sell by selling. The real and the concrete are far better teachers than the hypothetical and the abstract minded.
6. **Positive Emotions Greatly Improve Learning**. Feelings determine both the quality and quantity of one's learning. Negative feelings inhibit learning. Positive feelings accelerate it. Learning that is stressful, painful, and dreary can't hold a candle to learning that is joyful, relaxed, and engaging.

## 6.4 TEACHING STRATEGIES

Research suggests that high quality student learning is most likely to occur when students are engaged in the construction of personal knowledge and in work that has value (application) beyond the school.

The key intention of this Curriculum is that "Students will value and use their learning as a process of obtaining knowledge based upon observable evidence." Teachers can use a variety of teaching strategies to enhance students' learning; however, these must relate to the outcomes of the Curriculum and be consistent with the teaching role to be adopted. Suggested (not limited) teaching strategies for achieving the outcomes of learning are described as follows.

**A. Inquiry-Based Teaching Method:** Inquiry is an approach to learning that involves a process of exploring the natural or material world that leads to asking questions and making discoveries in the search for new understandings. In other words it provides experiences that help students acquire concepts, skills and abilities of inquiry, and understanding about inquiry. As a student-centered activity, inquiry gives children ownership of the learning process and inspires them to become more independent learners.

| Changing Emphases To Promote Inquiry | |
|---|---|
| **LESS EMPHASIS ON** | **MORE EMPHASIS ON** |
| Activities that demonstrate and verify content. | Activities that investigate and analyze questions. |
| Investigations confined to one class period. | Investigations over extended periods of time. |
| Process skills out of context. | Process skills in context. |
| Emphasis on individual process skills such as observation or inference. | Using multiple process skills (manipulation, cognitive, procedural). |
| Getting an answer. | Using evidence and strategies for developing or revising an explanation. |
| Providing answers to questions about content. | Communicating explanations. |
| Individuals and groups of students analyzing and synthesizing data without defending a conclusion. | Groups of students analyzing and synthesizing data after defending conclusions. |
| Doing few investigations in order to leave time to cover large amounts of content. | Doing more investigations in order to develop understanding, ability, values of inquiry and knowledge of subject content. |
| Concluding inquiries with the result of the experiment. | Applying the results of experiments to scientific arguments and explanations. |
| Management of materials and equipment. | Management of ideas and information. |

**The Inquiry-based Classroom highlights that:**

**Learning is student-focused**

Inquiry shifts ownership of the learning process from teacher to student, making the process through which students learn concepts and develop skills as important as the content. In this setting, teacher acts as a facilitator in the inquiry process.

**Students engage in inquiry by asking questions and devising answers.**

Inquiry requires students to describe objects and events, ask questions and devise answers, collect and interpret data and test the reliability of the knowledge they have generated. They also identify assumptions, provide evidence for conclusions and justify their work.

**Teachers ask questions that encourage inquiry and stimulate thinking.**

To guide students through inquiry, teachers engage in open-ended questions such as "How do you know?" and "How does your data support your conclusions?" in order to encourage further probing and discovery.

**Students are engaged in problem solving, constructing meaningful experiences.**

Because students act as scientists, engaging in meaningful problem solving, they can construct meaning out of their experiences. Endeavours include hands-on exercises as well as critical and logical thinking activities.

**Students gain a greater understanding of the purpose of learning.**

Inquiry lets teachers create a framework where students understand how and why to ask questions. Students reflect on the lesson and explain why it is important and gain a greater understanding about the inquiry process and how it relates to learning.

**Inquiry is a creative learning environment using both group and individual discovery techniques.**

Inquiry involves setting short and long-term goals and adapting them to students' interests. Within this framework, teachers might involve students in hands-on activities, whole class instruction, or group collaboration. This learning environment allows students the freedom to explore and investigate while making connections and drawing conclusions.

**Students interact purposefully with each other and the teacher, leading to effective communications.**

Inquiry teaching encourages students to collaborate with one another, communicate ideas and thoughts, ask questions, justify answers and search for advice from others.

**Assessment is ongoing process.**

Inquiry takes the focus off memorization and instead promotes assessing students' ability to understand reason and use their knowledge. Assessment can be achieved through questioning, observing, using checklists, portfolios, student journals, student work samples, hands-on assessments, etc.

Assessment provides students with feedback on how well they are meeting expectations and in addition gives feedback on how well lessons are going.

**B. Learn-by-doing approach:**

Hands-on activities get children actively involved in science. If they are physically involved, they are likely to be mentally involved too. They are thinking about what they are doing. This is called "hands-on, minds-on" or the "learn-by-doing approach". Therefore students learn to do well only what they practice by doing. If students are expected to apply ideas to novel

situations, then they must practice it by applying them in novel situations. If they practice only calculating answers to predictable exercises or unrealistic "word problems," then that is all they are likely to learn. Similarly students cannot learn to think critically, analyze information, communicate scientific ideas, make logical arguments, work as part of a team, and acquire other desirable skills unless they are permitted and encouraged to do those things over and over in many contexts.

**Why learning by doing approach?**

We remember:

20% of what we read;
20% of what we hear;
30% of what we see;
50% of what we see and hear;
70% of what we see, hear, and discuss; and
90% of what we see, hear, discuss, and practice.

**Advantages of learning by doing approach:**

- Multiple teaching/learning methods can be integrated.
- Very student-centered.
- Process of "discovery" builds self-esteem.
- Learning is more fun for students, teaching more fun for teachers.
- Other life skills can be learned, instead of only science content.

However, this approach requires systematic preparation, patience and guidance by teachers, as there is often no single, "right" answer.

**The Teacher's Role in learning by doing Process**

First, it is important to review the materials and practice the activities to be taught. As a group leader, the teacher should never freely give "the answers" to a problem/question. Instead, the teacher helps to directs the students in this process through which they can determine "solutions" for themselves. Here are the teacher's roles in each of the steps of the learning by doing process:

a. **Experience (Doing)** — Describe the experience or activity students do before they are told or shown how.
b. **Share (What happened?)** - Develop questions teacher will ask the students about their experience and their reaction to it after they have completed the activity.
c. **Process (What's important?)** - Develop questions that teacher will ask the students about something they felt was important about the experience.
d. **Generalize (So what?)**- Develop questions that will ask the students how the experience related to their own lives.

e. **Apply (Now what?)** - Develop questions that ask the students how they could apply what they learned to a similar or different situation.

## C. Demonstrations:

In-class demonstrations are an important part of teaching as demonstrations can make ongoing lessons fun and entertaining, and can also stimulate students' interest and curiosity. To make in-class demonstrations very effective in promoting conceptual understanding, active participation and interaction of students is important during demonstrations.

**Conducting Interactive Demonstration**

- Determine the purpose of the demonstration and what you want to achieve.
- Conduct the demonstration yourself to ensure the results are as you want.
- Prepare curricular materials or worksheets and ensure they are designed to promote student-student as well as student-teacher interaction in the classroom.
- Perform the demonstration

When the demonstration is completed let students complete their worksheet activities.

An interactive demonstration could be made up of a number of conceptually linked mini-demonstration to address important conceptual issues and worksheet activities requires students to write predictions, draw diagrams and answer a set of multiple-choice questions.

Conduct a whole class discussion and provide explanations to clarify or extend students' learning.

A lot of teachers think that they need a lot of fancy, expensive equipment to teach science and other subjects. While teaching and learning does require purchases, e.g. magnets for experiences with magnetism and cells, bulbs, and wire for electricity investigations, or maps, globe for social studies concepts, much General Knowledge Curriculum contents can be taught with simple, inexpensive and readily available materials: such as paper clips, soda straws, paper, balloons, rubber bands, paper cups, clay etc. Similarly, outdoors (farm/garden/park) is a perfect resource for learning. From examining bugs on a sidewalk to observing how a tree changes through the seasons, the outdoors provides a wealth of learning opportunities. Children can learn about plants and animals, shadows, weather, seasons and more right outside classroom.

## D. Cooperative Learning:

Cooperative learning is a strategy in which students work together in small groups to maximize their own and each other's learning.

In cooperative classrooms students have two responsibilities:
- To learn and complete assigned material, and
- To make sure that all members of the group do so as well.

A score of academic, social and psychological benefits are associated with working collaboratively in groups such as improved self-esteem, increased on-task time, increased higher order thinking, better understanding of material, ability to work with others in groups and improved attitudes towards school and teachers. Cooperative learning creates opportunities for students to use and master social skills necessary for living productive and satisfying lives.
An example of cooperative learning structure is described below:

### Think-Pair-Share

To begin Think-Pair-Share teacher have to first pose a question or create a problem situation to the class that requires students to think critically.

- Students 'Think' alone about the answer to the question for a specified amount of time. Students write their answers to show that they thought about the question individually.
- Students 'Pair' up with another student acting as a partner to discuss the question/problem, listen to and expand on one another's ideas.
- Students 'Share' their possible answers/solutions to the question/problem with the entire class.

Think-Pair-Share structures are effective only when students participate equally practice social skills, and individually demonstrate what they have learned from their partners.

Success on the academic task is assessed by randomly asking students questions, checking their work, or through individual tests or quizzes. For the social skills task, students are evaluated through teacher observation and students' evaluation of their own and group effectiveness.

## E. Role-Play

Role-playing is a teaching strategy in which students learn by acting and observing, where some students act out a scenario in front of the class. Students learn the content being presented and also develop problem solving, communication, initiative and social skills. As students examine their own and others' feelings, attitudes and perspectives they develop an understanding of themselves and others. If students are asked to write the

content of role-plays themselves rather than simply enacting roles handed to them it will enable them to collect and process information, and be creative. However, for early grades students, teachers have to facilitate about conducting the role-plays.

**Conducting Role-plays**

i. Determine the purpose of the role-play, appropriateness to the objectives, and its suitability for the age group.

ii. Write a role-play

iii. Teacher or students develop a realistic situation and decide how to portray it (newscast, courtroom scene, press conference, puppet show, talk show, panel discussion, drama).

iv. Define the problem or issues in the situation that the role-players have to deal with.

v. Determine the number of role-players needed.

vi. Develop short, specific roles for each person.

vii. Determine the time for each role-play.

viii. Develop a set of questions for the post role-play discussion.

While students are acting, ensure that the rest of the students sit quietly and observe the role-play. Teacher must allow students enough time to read and understand their roles and prepare to enact it. Also teacher have to involve the rest of the class by having them to suggest questions for the discussions to follow.

After the role-play teacher reviews the role-play with the class. Then open the discussion to the class ensuring they discuss only the role-play's content. If discussing a problem, students can explore alternative solutions to it. Summarize the role-play, focusing on student's understanding of the problem/issue that was being dramatized and/or attempt to solve the problem.

The teacher can assess concept understanding, ability to communicate an issue/problem, etc. through observation and asking questions. The social skills developed in preparing and conducting the role-play can be assessed through a checklist.

## OTHER CLASSROOM TEACHING AND LEARNING PRACTICES

The suggested Classroom teaching strategies are not intended to be exhaustive. It is expected that teachers will also identify other research-based instructional designs and practices that are appropriate to their students and can prompt students to focus on the salient features of their experiences, observations, and the concepts they are working with to support critical engagement and movement towards desired learning outcomes.

Model building, consequence maps, concept mapping, brainstorming, predict-observe-explain, small group research, use of information technology, drill and practice, process writing, storytelling, show and tell, class discussions, creative writing, computer simulations, posters, etc., are some of the practices that may be used to ensure that students have quality learning experiences. How to teach well requires on the part of the teachers the following to note:

1. Thorough mastery of the subject matter which he/she teaches.

2. Scholarly attitude towards teaching/learning in the class and on the campus of the school, i.e., thoughtfully reflective personality.

3. Highly polished communication skills in writing, speaking, and listening.

4. Respectful of the methods of science and mindful of the nature of scientific knowledge.

5. Practicing believer in the core values of science and technology such as: Longing to know, questioning everything, collecting data and looking for meaning in them, demand for verification, respect for logic, consideration of the premise and paradigm, consideration of the consequences.

6. Letting students express their understanding, i.e., their version of what was taught in the class and why.

7. Giving more time to what students think and less time to what teachers think.

8. Realizing that students construct their own knowledge and that this construction is greatly influenced by what the student already knows, i.e., his/her prior knowledge. This implies that no student comes to the class room with empty head and that no information can be transferred intact from the head of the teacher to the head of the student.

9. There are various theories and models available which deal with understanding the process of learning. Teacher must base his practice of teaching on some theory and be able to explain or try to explain what

works in the class room and why.

10. Teacher should realize that teaching is not just drilling information into the head of students nor is it just muddling through to teach as he/she was taught. It is a form of scholarship in which teachers are involved in action research. They look for new examples and non-examples. They sequence information in different ways and look for the best sequence. They diagnose the learning difficulties of students by looking into their prior knowledge where they search for misconceptions and knowledge gaps. They focus on the learning styles of individual students and recognize slow and fast learners.

11. Students watch their teachers and notice so many things about them and they talk about what they like or do not like. Teaching is close to show business and we can borrow much from the people in the show business.

**Safety Practices**

Activity-based, Hands-on processes provide an exciting method of teaching and learning. However, experiments and demonstrations may involve inherent risks for both the teacher and the student. Thus in every subject course, teachers/schools should make every effort to create a positive environment in which risk can be evaluated and reduced to an acceptable, safe level. Fieldwork and field trips require special vigilance with respect to traffic and road safety, safe practices in study areas.

# 7. Assessing and Evaluating Students' Learning

## 7.1 ASSESSMENT AND EVALUATION

Assessment provides a way to measure students' demonstration of learning. It helps us answer the questions: "How much did they learn?" and "How well did they learn it?" and "How well did we teach it?" It determines their progression through their learning experiences and enables them to demonstrate that they have achieved the intended learning outcomes.

Evaluation is an integral part of the teaching-learning process. It involves gathering information through various assessment techniques and making value judgments and sound decisions. Assessment provides information to a teacher about students' achievement in relation to the learning objectives. With this information, the teacher makes informed decisions about what should be done to enhance the learning of the students or to improve teaching methods.

Traditional methods of assessment, such as standardized tests, which require single-answer responses within specified time frames, put enormous pressure on young learners. Pressure can inhibit thinking and decrease the accuracy of assessment; therefore, teachers must come across at alternative ways of educational assessment.

## 7.2 THE CHANGING PARADIGM IN EDUCATIONAL ASSESSMENT

This Curriculum establishes that the ultimate Outcome for the school education is that students will learn the skill and competencies needed to succeed in today's world such as the skills of inquiry, reasoning, problem solving, decision-making and working collaboratively. To meet these outcomes, teachers need to provide students with learning experiences that are more authentic. If we want an accurate appraisal of how well teachers are helping students achieve these outcomes, they must make changes in assessment that reflect the changes in curriculum and instruction.

Traditional assessment, which often uses a 'drive-by' standardized, multiple-choice test, matching items or a short-answer test, although it can adequately assess factual knowledge and basic skills, but it often fails to assess students' acquisition of higher-order thinking skills such as critical thinking, creative thinking, and problem solving. It is also believed that traditional assessment does not evaluate students' learning process. Moreover, this approach may not increase students' desire to learn because they know that what will probably be tested is their factual recall or simple analysis.

Alternative assessment, which uses strategies such as performance, portfolio, students' self-reflections and peer review, is considered as a valuable addition to standardized assessment. The rationale of alternative assessment is to gather

evidence from real-life, use multiple assessment strategies to assess learning, and provide ongoing feedback to students. Alternative assessment is a better way to determine how well students are learning (and how effective instruction is) than traditional forms of assessment. Research on assessment suggests that a constructive alignment between instruction, learning, and assessment is vital.

## 7.3 INCORPORATING ASSESSMENT INTO THE LEARNING PROCESS

Linking assessment to instruction i.e., embedding it in the process of learning is central to full implementation of this Curriculum. To allow students to construct learning in the classroom through authentic experiences, assessment must be:

1. Open-ended, allowing for discussion and revision of new understanding.

2. Tolerant of divergent thinking of students' with naive understanding and promote the notion of no "one right answer."

3. Presented in alternative modes, not just paper-and-pencil responses to limiting questions.

4. Designed to foster analysis, comparison, generalization, prediction, and modification according to the grade and developmental level.

5. Capable of promoting collaboration and team effort in demonstration of competence.

6. Ongoing and cumulative, showing growth over time.

Therefore, assessment should be carried out regularly through the use of different techniques such as oral questioning, observation checklists, and assignments, practical and written tests. When assessment is carried out on a continual basis, the teacher has the feedback required to plan his day-today teaching.

On the basis of assessment data, a teacher can decide whether to proceed to the next teaching lesson/theme, carry out remedial teaching, set enrichment exercises/drills or modify teaching methods. Hence the process of evaluation can help teacher raise students' performance by identifying the needs of students and taking the right steps in meeting these needs.

Assessment practices also communicate what is important and what is valued. For example, assessments that emphasize the acquisition of factual knowledge imply that facts are important, whereas inquiry-centered assessments indicate that scientific inquiry is important. The methods used to gain attainment information should mirror the way teachers teach and should define what students should learn.

The primary purpose of classroom assessment for these grades is not solely to evaluate and classify student performance, but to inform teacher and improve learning, and to monitor student progress in achieving year-end learning outcomes. The intent is to find out whether a student knows and understands sufficiently to apply knowledge and skills effectively after a period of instruction.

## 7.4 THE LEARNING ASSESSMENT PROCESS

In order to apply assessments effectively to determine whether student learning is expanded or improved, an assessment plan needs to be developed that incorporates assessment opportunities throughout the learning process. In the early grades, it needs to be effective, assessment cannot be an afterthought or instructional add-on. It needs to be embedded, contextualized, and executed within the learning process. Effective teachers ought to outline the process for developing and implementing an assessment plan for measuring student learning.

Following is a process, as an example, to follow for the development and implementation of assessments:

1) Select learning outcomes from a Course of study and Grade level.
2) Design assessments to measure learning outcomes.
    i. Determine the outcomes to measure,
    ii. Determine the purpose for the assessment,
    iii. Determine the assessment method to employ, and
    iv. Determine the kind of assessment data you need to collect.
3) Design learning events based upon learning outcomes.
4) Include assessment activities within the learning designs.
5) Deliver learning.
6) Assess learning and learning events/activities.
7) Gather and format data generated from assessment activities.
8) Interpret the assessment data.
9) Use assessment data to make decisions at the student, classroom, and course level.

Teachers can modify this process depending upon their professional competencies and need of the students. However, Assessment should:

- Include a range of practices to allow for diverse learning styles of students;
- Be continuous, productive and constructive;
- Monitor and guide students' progress towards attainment of outcomes;
- Be appropriate to and based on the learning experiences of all students;
- Be comprehensive;
- Be valid and reliable be effective and manageable;
- Promote improved teaching strategies;
- Monitor strengths and areas for further development;
- Be consistent with teaching strategies;
- Involve negotiation between teachers and students;
- Involve also students in their own record-keeping, and
- Take account of student's self assessment and be in understandable language.

## 7.5 ASSESSOR(S)

The teacher, the student doing self-assessment, or the student(s) assessing a peer or group, can do the assessment.

### A. Teacher Assessment

The teacher assesses individual students or groups of students using a variety of assessment tools to implement the various assessment strategies.

### B. Self Assessment

Students apply established criteria to reflect upon or assess their own progress and achievement. Through the development of self-assessment skills, students can learn accuracy and accountability. Other virtues of self-assessment include that:

- The ability to perform self-assessment is a critical programming goal that has implications for lifelong learning.
- Self- assessment helps students to develop understanding of the established criteria. This is particularly true with the respect to movement skills for which a cognitive understanding is a necessary step to good performance.
- Self- reflection is a part of self- assessment and includes personal responses and reflections about oneself or the learning process (e.g., using questionnaires, surveys, interest inventories, descriptions of likes/ dislikes, responses to performance results). These reflections and responses can be recorded and included in student learning logs, journals and portfolios.

### C. Peer Assessment

Peer assessment is an effective way to collect a great deal of reliable information in a short amount of time. Evaluating the work of others is a valuable learning experience for the student who is doing the assessment. While students make systematic judgments about each other's performance relative to stated criteria for the student learning outcomes, it extends the teacher's knowledge about an individual or group. However, peers must be knowledgeable about the criteria for assessment, willing to take their responsibility seriously, and treat others with respect.

In assessing their peers, students need to start with a limited role and use simple checklists, rating scales, and frequency indexes.

### D. Group Assessment

Group assessment is similar to peers' assessment; however, group assessment involves using groups of students to assess other groups or using one student to assess a group.

## 7.6 CLASSROOM ASSESSMENT STRATEGIES

Assessment is a ubiquitous aspect of classroom activity and is rarely a discrete event. It involves observing students at work and listening to what they say. It also involves analyzing student work in light of that criteria and paying attention to what they are thinking, attending as much to their reasoning as to what they don't understand. It involves engaging students as active participants in an assessment activity or conversation, so that it becomes something they do, not merely something done to them.

Classroom assessment strategies provide ongoing feedback for the learner and the teacher on what is making sense and what learners don't understand. They provide information for the teachers on adjustments and modifications that need to be made to a course or learning plan.

Teachers learn about student progress not only through formal tests, but also through moment-by-moment observation of students in action. They often conduct assessment through instructional activities. To assess students' knowledge, skills, and attitudes, teachers require a variety of tools and approaches.

Some of the classroom assessment strategies are described as follows:

### A. Observation

Observation provides a way of gathering information fairly quickly while a lesson is in progress. When used formally the students would be made aware of the observation and criteria being assessed. Informally it could be frequent, but brief, check on a given criterion.

Observation may offer information about students' participation level for a given task, use of piece of equipment or application of a given process. It is important to document observations by keeping records.
Assessment tools that assist with recording information and maintaining records include checklists, rating scales, scoring rubrics, frequency index scales, inventories, anecdotal notes, codes, and self-adhesive notes or grids.
Observation guidelines for teachers:

- Observe a certain number of students per class rather than all students.
- Focus on one skill at a time.
- Display scoring rubrics, rating scales, and checklist criteria
- Use computer/ information technology to assist in recording observations (subject to availability).

**B. Performance Tasks**

Performance tasks (skill demonstrations, games, routines, drawings, projects, presentations) are activity-based tasks used to observe student acquisition and/or application of knowledge, skills, and/ or attitudes where:

- Students perform, create, construct, produce, or do something
- Deep understanding and/ or higher order thinking skills are needed
- Involves significant work that usually takes days to weeks to complete
- Calls on students to explain, justify, and defend Performance is directly observable
- Criteria are specified and explained to students along with the task
- There is no single best product or correct process , - Usually students work with real-world contexts and constraints

**Performance-based Assessments**

- Assess communication, presentation, psychomotor skill
- Through products, can assess performance of process/skill, and also see what learning students got from it.
- Teaching and learning occur during the assessment.
- Students find real-life application and contexts engaging.
- Provide a different way for students to show what they know and can do.
- Students learn how to ask questions, and since such tasks often involve group work, to work effectively with others.
- Emphasis on higher order thinking and application - allows in-depth assessment of main content ideas.
- Forces teachers to establish specific criteria to identify successful performance.
- Encourages re-examination of instructional goals.

Assessing performance is most often achieved through observing. However, assessment tools such as scoring rubrics and rating scales also include performance criteria. These tools, as well as anecdotal notes and checklists

completed by the individual student, peers, groups, and/ or the teacher, help measure the level of student performance, progress and achievement.

**C. Questioning/ interviews**

- Effective questioning (e.g., open-ended, divergent, convergent) promotes critical thinking and allows teacher to identify what the student knows and what the students needs to learn.
- Questions can be delivered formally or informally through interviewing carried out as a station activity or through whole- class questioning.
- Students' responses can be given in writing or through a variety of methods (e.g., human opinion lines, thumbs up/ down/ sideways signals, stand-up/ sit-down indicators).
- Responses can be recorded using class checklists or other record-keeping methods.

**D. Journals/ Learning logs/ Reflections.**

- Journal writing and learning log entries provide opportunities for students to record their personal thoughts, reflections, choices, feelings, progress, and/ or participation, patterns, and changes related to active, healthy living.
- This type of strategy also allows for formative assessments and the development of portfolio products.
- Students can demonstrate their understanding using words, pictures, and labeled drawings. Entries could include active living participation charts, recess participation records, personal goal-setting plans, and so on.

**E. Paper and Pencil Tasks**

- Paper and pencil tasks may involve answering multiple-choice, true or false, open-ended, or matching questions, completing a drawing, or labeling a diagram.
- Test items tend to assess knowledge of factual information and application of basic skills in isolated, de-contextualized ways rather than assessing the application of the knowledge and skills in meaningful, everyday situations.

Because formal written tests have limitations in measuring movement-based learning outcomes, the use of paper and pencil tasks should be limited at early grades.

**Assessing Affective Traits and Dispositions**

Affective traits and dispositions are the attitudes, values, motivation, social relationships, classroom environment, and concept of one's own academic ability. They are those factors (of the student, teacher, and classroom) that affect the way students learn.

Positive, well-developed affective traits motivate students to learn effectively now and in the long-term. Students have a better self-concept, higher productivity and become more involved citizens of their society. In addition, they learn or analyze themselves and refine behaviours and disposition. (All teachers know that students with positive affective traits learn better, are more confident, and enjoy learning. But few, if any, teachers assess affective targets. Reasons include the subject matter-knowledge and skills - are seen as the primary focus education in school; the difficulty of defining affective targets because they are private and different for individual students; assessment is influenced by transient moods especially for younger students; students take self-reporting lightly or take results to please teachers).

Affective traits can assess through self-reporting, teacher's observation and peer evaluation.

## 7.7 SUMMATIVE AND FORMATIVE ASSESSMENT

### SUMMATIVE ASSESSMENT

The purpose of assessment is to measure the extent to which students have achieved the learning outcomes of the programme based on curriculum statements.

A final examination is recommended at the end of session. The syllabus division is suggested as shown below:

### The examination

The theory examination is suggested to consist of two parts each containing a wide variety of types of questions. Together the paper should be designed to examine the candidates' understanding of the whole syllabus and should test the following range of abilities:-

- Knowledge and understanding 60%
- Higher abilities (handling information, application and problem solving, etc.) 40%

| | |
|---|---|
| Final Paper (Part-I) Half an hour (15 marks) | 15 compulsory objective questions. This may include MCQ of various types to evaluate abilities and skills. |
| Final Paper (Part-II) 2½ hour (60 marks) | This paper should consist of two sections. Section-I should contain ten compulsory short questions/ constructed response questions to provide entire syllabus coverage and may consist of equal marks (2 marks per short question) and Section-II should contain 6 essay or comprehensive type questions which may have choice of attempting 4 questions of 10 marks each. |

**Notes:**

(i) Assessment pattern is subject to the requirement, policies, and procedures of the Examination Boards.

(ii) Question paper will be based on the curriculum not on a particular textbook.

(iii) Questions involving unfamiliar contexts or daily life experiences may be set to assess candidates' problem-solving and higher-order processing skills. In answering such questions, sufficient information will be given for candidates to understand the situation or context. Candidates are expected to apply their knowledge and skills included in the syllabus to solve the problems.

(iv) In general, Sl units and terminology will be used.

## FORMATIVE ASSESSMENT

It is suggested that in addition to the conduction of final examination, the teacher should evaluate class work on completion of each lesson/unit. In additional to the end of the session / annual exam, the practice of formative assessment should be used throughout the session. Tasks in the formative assessment should include:

- Homework
- Assignments / Report Writing
- Quizzes
- Frequent written tests
- Group Discussion
- Oral Presentation

Feedback on students' work in the above tasks should be provided to the students.

## ASSESSMENT METHODS

1. The **selected response -** students select the answer to a question from two or more given choices. Such items are easy to develop. Their short response time allows more information to be assessed in a short time. However, since answer choices are provided, students can guess the correct answer without knowing the material. Scoring is quick and objective, since the teacher need only to check if the single correct or best answer was identified for each item.

2. A **constructed response** format requires students to create or produce their own answer in response to a question or task. This allows teachers to gain insight into students' thinking and creative processes, and to assess higher order thinking. However, such items are time-consuming to answer and score. Although they eliminate guesswork, scoring is more subjective and thus clear criteria are necessary to maintain validity.

***Essay Items*** may have students construct restricted-responses that limit the length, content and nature of the answer; or extended-responses that allow greater freedom in response.

***Performance assessments*** **require** students to construct a more extensive response to a well-defined task, often involving real-world application of knowledge and skills.

**Some Commonly Used Formats**

**Selected Response**

***Multiple-Choice Items***

Multiple choice items have a short question, followed by multiple answer choices from which students must pick the correct or the best answer. The question is called the stem, and the answer choices are called options. The options contain one correct or best answer, and two or more distracters.

*Strengths and Weaknesses*

- Relatively difficult to write, especially good distracters
- Having students to pick the 'correct' answer assesses knowledge and understanding
- Having students to pick the 'best' answer measures higher order thinking such as reasoning, and critical analysis
- With answer choices provided, students focus on recognizing information rather than recalling or memorizing it
- By evaluating students' wrong answers, teachers can see what students misunderstood or need clarified

Hints for designing better multiple-choice items (Teachers should be able to answer 'yes' to each checklist question).

- ✓ Does each stem contain a single, main problem stated simply and incorporating all the relevant information?
- ✓ Is each stem a question rather than an incomplete statement? (This prevents different grammar in the alternatives from giving away the correct answer).
- ✓ Have excess wordiness and overly complex language been avoided?
- ✓ Have negatives like "no," "never," "none," "not" been avoided? (Students tend to overlook these, if such words must be used, bold and/or capitalize them).
- ✓ Is the correct answer unquestionably right and complete? Is it the ONLY correct or best choice?
- ✓ Are all the options plausible or reasonable? Have obviously ridiculous options, options that say the same thing, or those that are clearly opposite in meaning, been revised? (Students should not be able to guess the answer by elimination).
- ✓ Are the options arranged systematically, i.e., in alphabetical/ chronological/ numerical order? (This ensures students cannot guess the position of the correct

answer).
- ✓ Are the numbers of options for each item appropriate to the students' age/grade levels? (2 or 3 options for lower grades and 4 or 5 options for older students).
- ✓ Have "clues" to the correct answer been avoided (making the correct option longer, more complex, or grammatically different from other options, using a/an to show if the correct option begins with a vowel)?
- ✓ Are all options for an item as brief and as clearly stated as possible? (Measure knowledge not reading ability).
- ✓ Has "all of the above" been avoided as an option? (If students find one WRONG answer, "all of the above" cannot be correct. If students find two RIGHT answers "all of the above" must be correct).
- ✓ Has "none of the above" been avoided as an option?

***Short Answer***

Short-answer items are questions that call for students to write short answers (3-4 sentences at most), such as definitions or short responses.

*Strengths and Weaknesses*
- Good for assessing knowledge
- Can also assess understanding and reasoning
- Easy to construct since structure similar to instruction (question-and-answer) in class, so natural to teacher and student

Hints for designing better short answer items (Teachers should be able to answer 'yes' to each checklist question).
- ✓ Is it clear to the teacher whether knowledge, understanding or reasoning is being assessed?
- ✓ Are textbook questions avoided?
- ✓ Is the question brief and easy to understand?
- ✓ Is it clear to students that the answer must be short? (Use lines to indicate the maximum length of the answer)
- ✓ Is the specificity of the answer clear?

***Essay Items***

Such items literally have students answer a question by writing an essay. The length, nature and content of the essay are dependent on the question posed, so responses may be restricted or extended.

*Strengths and Weaknesses*
- Require students to sequence and integrate many separate ideas into a meaningful whole, interpret information, give arguments, give explanations, evaluate the merit of ideas, and conduct other types of reasoning
- Help students see themes, patterns, relationships
- Allow flexibility in responses

- Can evaluate students' ability to communicate their ideas
- Reading and scoring answers is time-consuming, especially if done so that meaningful feedback is given to students
- A single person, the teacher, judges the answers, so variations in mood, expectations, the order in which students are evaluated, and other factors, affect the professional Judgments that are made
- Cannot assess lots of information or multiple reasoning skills at once

Hints for writing essay items (Teachers should be able to answer 'yes' to each checklist question).

- ✓ Can the targeted reasoning skill be measured by an essay (e.g., comparison, analysis, deduction, etc.)?
- ✓ Does the question clearly indicate the desired response? (Students should know exactly what and how much information to use and should not be confused as to what aspect is asked for).
- ✓ Does the question allow for more than a right or wrong answer and/or process, justification, examples?
- ✓ Is there enough time to answer the questions?
- ✓ Are choices among several questions avoided?
- ✓ Has the teacher drafted many possible responses so he/she knows what to expect?
- ✓ Are the scoring criteria clear to teachers and students?

# 8. Guidelines for Developing Teaching Learning Resources

In most schools the textbook is the only teaching-learning tool. Rarely do teachers use other resources to support the learning. However, many other resources that can be available, accessible and affordable must be used to achieve desired outcomes.
These are:

- Textbooks
- Teachers guides
- Students workbooks
- Reference books
- Visual aids such as charts, models etc.
- Videotapes
- Computers (Computer software & Internet websites; online libraries etc.)
- Community (Field trip & Guest speaker)

**Guidelines to the Textbook Authors**

A textbook is an important teaching and learning resource and one of the most extensively used resources in our classrooms. The textbooks provide technology information for the acquisition of knowledge. Writing a textbook is an extremely important and technical task in the sense that it requires the translation of curriculum learning outcomes at the proper cognitive level of the students. Textbook authors need to consider, among others, following guidelines.

- Introduction to textbook explaining the structure and format of the book, organization of concepts in connection with the curriculum objectives, and directions to use the textbook must be stated in the beginning of the textbook.
- The textbook must have accurate, authentic, and up-to-date material.
- The language structure should be written in such a way as if talking to audience.
- The material must be sufficient to give students the knowledge they need to understand the concepts, develop the inquiry skills and engage in higher order thinking.
- The material should help students understand the world in which they live, and prepare for lifelong learning.
- The material must be error free so it can be trusted.
- The material must be unbiased.
- The book must be attractive and engaging.
- The textbook should be well Illustrated i.e., illustrations are clearly, accurately, appropriately and neatly drawn. These must be properly labeled and captioned.
- The textbook should have variety of practical and thinking activities to engage students in learning.
- The textbook should be made user friendly by developing colour coding, different levels of headings and subheadings, tidbits and examples from real life applications.

- Exercises should be included to encourage students to think, develop skills, and use information for a variety of purpose.
- The textbook must contain Table of contents. Index and Glossary,
- The textbook must be contextually relevant (feasible to use in Classrooms, affordable, examples from context to increase relevance and meaning).

**Guidelines for Writing a Chapter**

To make the learning of technology interesting and exciting and to provide a strong foundation for higher learning, each chapter in the technology textbooks must have, among others, the following features.

- **Specific Learning Outcomes** at the beginning of each chapter clearly describing the objectives and tasks to be achieved in the chapter.
- **Key words, terms and definitions** to be highlighted in the text.
- **Technology tidbits** to provide snippets of interesting and useful knowledge.
- **Attractive and colorful illustrations** to captivate students.
- **Do You Know?** Questions to recall, think and apply what they have learnt as well as to reinforce the learning of key concepts and principles.
- **Mini-exercise** to provide questions involving technology investigations and relating technology contents with the technology, society and environment.
- **Awareness beyond the classroom** to widen the horizon of the students by providing interesting information and introducing related, more advanced concepts according to grade level in an understandable way.
- **Key Points** to provide a summary of the concepts and principles in the chapter.
- **Review Questions** at the end of each chapter to:
  - Recall and integrate previous learning
  - engage students and develop their creativity
  - Move from lower to higher order thinking
  - Develop process skills
  - Develop multiple intelligences
- **Think-Tank/Investigate** to include open-ended questions to provoke students' thinking, creatively and investigation skills.
- **Test review/Theme Reinforcements** after 2-3 units, as an additional drill to include interactive and useful activities, strengthening students'
  - Vocabulary
  - Understanding
  - Critical thinking
  - Process skills
  - Performance Assessment

**Criteria for Analysis of the Textbook**

Following criteria must be considered for selecting learning material for the textbook. Answers to most of these questions, if in the affirmative, will indicate a good quality textbook.

1. Is the content accurate and up to date?

2. Are important skills developed?
3. Do the illustrations (pictures, drawings, graphs, etc.) help to understand the contents better?
4. Do the end-of-the chapter exercises encourage students:
   a. To think;
   b. To develop their skills, and
   c. To be creative.
5. Are learning activities suitable for the needs of the learner?
6. Do learning activities include student participation in real life issues and promote technology inquiry or investigation?
7. Are varieties of assessment strategies suggested? (e.g., fill-in-the-blank, multiple choice, project work, exhibitions, open-ended and divergent responses, think tank etc.)
8. Do the text, questions and suggested activities stimulate interest that would lead to further study?
9. Are there biases? a) Religion b) nationality c) gender d) occupation e) Class
10. Is it related to the goals of the curriculum?
11. Is a teacher's guide included?
12. Is it attractive and appealing to children?
13. Is the language readable, understandable, and easy to follow? Appropriate for the children who will use it?
14. Are the following adequate:
    - Page size
    - Line spacing
    - Titles and sub-titles
    - Font size
15. Are the contents relevant to the needs, age and level of understanding of the students?
16. Is there an introduction and key points/summary?
17. Does it have?
    a. An introduction explaining its organization;
    b. Table of contents
    c. Glossary, and
    d. Index.

**Teacher's Guide**

Teacher's guide provide detailed explanation of key concepts. Textbooks usually come with a teacher's guide aimed at informing teachers of how the textbook is written and how best to use it to facilitate student learning. It is a way to teach a particular topic, provide further activities and examples that could be given to facilitate learning.

**Guidelines for Writing Workbooks**

Workbooks are books that contain writing activities and exercises that are related to each chapter in the textbook. Workbook exercises help to develop students' conceptual understanding of the concepts dealt within the text, to develop skills and to apply knowledge to new situations. Workbooks should have:

- Many exercises and activities for each chapter, topic, subtopic.
- Exercises and activities that will enable student to develop and practice the content knowledge, skills and higher order thinking.
- Accurate exercises.
- Clear instructions i.e., easy for students to understand and to follow.
- Clear illustrations/ examples/ explanations.
- Enough space for students' responses (where appropriate).
- Relevant material and age appropriate vocabulary.
- Exercises and activities with a variety of purposeful, stimulating, challenging and innovative items to encourage students to review and practice the knowledge and skills they have learnt.
- Exercises that include constructed and restricted response items.

## Estimated Time Allocation and Weighting for Various Units/Chapters

### Grade-VI

| Agriculture | | | |
|---|---|---|---|
| **Unit No.** | **Content** | **Weighting in %age** | **Periods (Theory)** |
| 1 | Introduction to Technologies | 2 | 4 |
| 2 | Introduction to Agriculture | 5 | 6 |
| 3 | Crop Production | 10 | 12 |
| 4 | Agricultural implements, machinery and their uses | 30 | 39 |
| 5 | Irrigation | 9 | 12 |
| 6 | Cultivation of vegetables, flowers and fruits | 10 | 12 |
| 7 | Problems of agriculture and solution | 6 | 9 |
| 8 | Rearing of birds | 4 | 6 |
| 9 | Rearing of insects | 3 | 4 |
| 10 | Rearing of animals | 7 | 10 |
| 11 | Growing / propagation of plants | 6 | 9 |
| 12 | Value added items of agriculture | 4 | 6 |
| 13 | Environmental degradation | 4 | 6 |
| | | 100 | 135 |

### Grade-VII

| Natural Resources & Energy | | | |
|---|---|---|---|
| **Unit No.** | **Content** | **Weighting in %age** | **Periods (Theory)** |
| 1 | Introduction to natural resources | 4 | 6 |
| 2 | Energy | 10 | 12 |
| 3 | Mining | 10 | 12 |
| 4 | Exploration of Fuels | 10 | 12 |
| 5 | Renewable energy | 35 | 48 |
| 6 | Environment | 25 | 36 |
| 7 | Sustainable Development | 6 | 9 |
| | | 100 | 135 |

# Grade-VIII

## Industrial Technology

| Woodworking | | | |
|---|---|---|---|
| **Unit No.** | **Content** | **Weighting in %age** | **Periods (Theory)** |
| 1 | Introduction of Industrial Education | 3 | 6 |
| 2 | Wood and its kinds | 5 | 6 |
| 3 | Type and use of material in woodworking | 8 | 12 |
| 4 | Woodworking tools | 7 | 9 |
| 5 | Value addition | 2 | 3 |
| | | 25 | 36 |

| Metal work | | | |
|---|---|---|---|
| **Unit No.** | **Content** | **Weighting in %age** | **Periods (Theory)** |
| 1 | Introduction to metal work | 2 | 3 |
| 2 | Tools and their description | 4 | 3 |
| 3 | Various Mechanical Process - Introduction | 8 | 9 |
| 4 | Properties of metals & Alloys | 4 | 6 |
| 5 | Non metals and plastics/synthetic materials | 7 | 9 |
| 6 | Simple machines and machining processes | 12 | 15 |
| 7 | Welding and some other industrial process | 9 | 12 |
| 8 | Marketing aspects of metal products | 4 | 6 |
| | | 50 | 63 |

| Electricity | | | |
|---|---|---|---|
| **Unit No.** | **Content** | **Weighting in %age** | **Periods (Theory)** |
| 1 | Electrical wiring | 18 | 24 |
| 2 | Safety measures | 4 | 6 |
| 3 | Linkages of industrial technology to other technologies | 3 | 6 |
| | | 25 | 36 |

*(Note: Periods estimation: As per the Scheme of Studies 3 periods per week and for 45 instructional weeks/year = 135 periods per year)*

# Glossary

This glossary is intended to ensure that terms commonly used in the context of learning outcomes are appropriately interpreted. Words and terms defined in the glossary are found throughout the document. The curriculum review committee provided definitions for users to ensure that the meaning of each term is consistent. These definitions are not vocabulary words to be taught to students in isolation; they represent the terminology students will learn through the lessons prepared by the teacher.

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| **Classify** | Classify requires the students to arrange or organize according to the Grade or category. |
| **Compare** | Compare requires the students to provide both similarities and differences between things or concepts. |
| **Define** | Define requires the students to give a formal statement or equivalent paraphrase being required. |
| **Demonstrate** | Demonstrate requires the students to show clearly their learning. |
| **Describe** | Describe requires the students to state in words (using diagrams where appropriate) the main points of the topic. |
| **Determine** | Determine requires the students to make a firm decision to do something, often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula. |
| **Differentiate** | Differentiate requires the students to perceive or show the difference in or between discrimination. |
| **Discuss** | Discuss requires the students to involve close examination of a subject with interchange of opinions, to give a critical account of the points involved in the topic. |
| **Distinguish** | Distinguish requires the students to make noticeable or difference such a pass. |
| **Enlist** | Enlist requires the students to sign up or enroll. |
| **Enumerate** | Enumerate requires the students to itemize. |
| **Explain** | Explain requires the students to give reasoning or some reference to theory, depending on the context. |
| **Generalize** | Generalize requires the students to simplify or take a broad view. |
| **Illustrate** | Illustrate requires the students to draw. |
| **Inquire** | Inquire requires the students to seek for information by asking |

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|---|---|
| | question, investigating a question or questioning. |
| **Interpret** | Interpret requires the students to conceive significance of what to present or conceptualize the meaning of, by mean of art. |
| **List** | List requires the students to give a sequence of points, generally each of one word, with no elaboration. Where a given number of points are specified, this should not be exceeded. |
| **Name** | Name requires the students to recognize and identity. |
| **Narrate** | Narrate requires the students to describe or tell. |
| **Predict** | Predict requires the students to state a likely future event, process, or situation based on the given information. |
| **Recognize** | Recognize requires the students to know or identify from past experience or knowledge. |
| **Relate** | Relate requires to bring or link of logical or rational association. |
| **Show** | Show requires the students to demonstrate a procedure, concept. |
| **State** | State requires the students to give a concise answer with little or no supporting argument. |
| **Suggest** | Suggest requires the students:<br>a. To provide ideas to problem or a situation.<br>b. To apply knowledge to new situation. |
| **Use** | Use requires the students to apply the concept, idea, and knowledge. |
| **Write** | Write requires the students to put words, figures or signs on something on paper with a pen or pencil. |

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