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UNIT-II: RESOURCES
TO
TEACH BIOLOGICAL SCIENCES

Biological science text Book

- One of the most common resources in the classroom is the textbook; learn the advantages and disadvantages of this tool plus ways to integrate other resources into your teaching.
- New teachers will find this resource particularly valuable. Includes suggestions such as using the textbook as a guide for students, supplementing the textbook with outside readings, and more.

Advantages and Disadvantages

- As you visit classrooms, you probably notice that most, if not all, of those classrooms use a standard textbook series.
- The reasons for this are many, depending on the design and focus of the curriculum, the mandates of the administration, and/or the level of expertise on the part of classroom teachers.

- A **textbook** is a collection of the knowledge, concepts, and principles of a selected topic or course.
- It's usually written by one or more teachers, college professors, or education experts who are authorities in a specific field.
- Most textbooks are accompanied by teacher guides, which provide you with supplemental teaching materials, ideas, and activities to use throughout the academic year.

Textbooks provide you with several advantages in the classroom:

- Textbooks are especially helpful for beginning teachers. The material to be covered and the design of each lesson are carefully spelled out in detail.
- Textbooks provide organized units of work. A textbook gives you all the plans and lessons you need to cover a topic in some detail.
- A textbook series provides you with a balanced, chronological presentation of information.

- Textbooks are a detailed sequence of teaching procedures that tell you what to do and when to do it. There are no surprises—everything is carefully spelled out.
- Textbooks provide administrators and teachers with a complete program. The series is typically based on the latest research and teaching strategies.
- Good textbooks are excellent teaching aids. They're a resource for both teachers and students.

- Some textbooks may fail to arouse student interest.
- It is not unusual for students to reject textbooks simply because of what they are—compendiums of large masses of data for large masses of students.
- Students may find it difficult to understand the relevance of so much data to their personal lives.

Use Textbooks Wisely

- A textbook is only as good as the teacher who uses it. And it's important to remember that a textbook is just one tool, perhaps a very important tool, in your teaching arsenal. Sometimes, teachers over-rely on textbooks and don't consider other aids or other materials for the classroom.
- Some teachers reject a textbook approach to learning because the textbook is outdated or insufficiently covers a topic or subject area.

As a teacher, you'll need to make many decisions, and one of those is how you want to use the textbook. As good as they may appear on the surface, textbooks do have some limitations.

The following table lists some of the most common weaknesses of textbooks, along with ways of overcoming those difficulties.

When thinking about how you want to use textbooks, consider the following:

- Use the textbook as a resource for students, but not the only resource.
- Use a textbook as a guide, not a mandate, for instruction.
- Be free to modify, change, eliminate, or add to the material in the textbook.
- Supplement the textbook with lots of outside readings.
- Supplement teacher information in the textbook with teacher resource books; attendance at local, regional, or national conferences; articles in professional periodicals; and conversations with experienced teachers.

Teachers Hand Book

A **handbook** is a compact compilation. of important facts, principles, theories, and data in each of the various. phases of education ... to stimulate **teachers** and others interested in the. profession to further study in the field of education ...

- The handbook for teachers consists of information required by them with respect to their learners and to their career improvement and advancement. The handbooks also contain details for teachers with respect to the expectations the board has from them.
- The handbook can also be considered as a source of information to the teachers regarding the procedures, policies, roles, responsibilities, awards, and resources which are related to their professional life.

What is the purpose of handbook?

- An employee handbook can be a valuable communication resource for both the employer and the employee.
- It provides guidance and information related to the organization's history, mission, values, policies, **procedures** and benefits in a written format.

What is the importance of teacher's handbook?

For master teachers, the Handbook is aimed at continual improvement and sustaining quality teaching. For others, the tools are designed to help identify areas for performance improvement, and to **focus** support for the important and ongoing process of development.

What are the characteristics of teachers handbook?

- Prerequisites of effective teachers,
- The teacher as a person,
- Classroom management and **organization**,
- Organizing for instruction,
- Implementing instruction, and.
- Monitoring student progress and potential.

- **Laboratory Manuals:**

What is biology lab manual?

- Designed for an introductory **biology** course with a broad survey of basic **laboratory** techniques.
- Experiments and procedures are simple, safe, easy to perform, and especially appropriate for large classes.

- *Why Laboratory Manual is important?*
- A good- quality **practical manual** can engage students, help them to develop **important** skills, help them to understand the process of scientific investigation, and develop their understanding of concepts. ... Students are guided through the **laboratory** practices in science courses as well as the techniques involved.

What is the role of laboratory method in teaching science?

Laboratory teaching assumes that first-hand experience in observation and manipulation of the materials of **science** is superior to other **methods** of developing understanding and appreciation. **Laboratory** training is also frequently used to develop skills necessary for more advanced study or research.

What is the importance of Bio Science Laboratory in bio science teaching?

The main **purpose** of **laboratory** work in **science education** is to provide students with conceptual and theoretical knowledge to help them learn **scientific** concepts, and through **scientific** methods, to understand the nature of **science**.

What are the uses of laboratory in teaching and learning?

Laboratory experiences provide opportunities for **teachers** to model best practices in the **study** of scientific concepts, including **application** of scientific methodologies, respect for life and the environment, inclusion of **learners** of all abilities, and consistent adherence to safety standards.

Student workbook

- **Workbooks** are paperback textbooks issued to students.^{[1][2][3]} Workbooks are usually filled with practice problems, with empty space so that the answers can be written directly in the book.
- **Student workbook** is an education material including components that support learning, help ensuring knowledge and ability to **students** in line with the acquisitions stated in teaching programs. ... Their needs should be satisfied by benefiting from some additional materials in order to make their learning permanent.

What is the use of workbook?

- A **workbook** usually covers important concepts and tasks related to syllabus. **Workbooks** are used for solving extra problems and concepts which students have already studied from textbook.
- **Workbooks** are often used in schools for younger students, either in middle school or elementary school.

Advantages of workbooks.

- They are favoured because students can work directly in their books, eliminating the need for loose-leaf and copying questions from a textbook.
- Workbooks also hold an advantage because they are usually smaller and lighter than textbooks, which equates to less trouble when students bring the workbooks home to complete their homework.

Material resources

- **Material resources** are **materials** found in the natural world that have practical use and value for humans.
- **Material resources** include wood, glass (which comes from sand), metals, edible plants, and plastics (which are made from natural chemicals).
- Renewable **material resources**, like glass, can be re-created easily.

- **Material Resources in school.**

- Material resources include any items the school currently owns. These include school furniture, **equipment**, technology, curriculum materials, manipulatives, textbooks, and any other materials within the school.

What are types of resources?

- Resources are characterized as renewable or nonrenewable; a renewable resource can replenish itself at the rate it is used, while a nonrenewable resource has a limited supply.
- Renewable resources include timber, **wind**, and solar while nonrenewable resources include coal and natural gas.

Reference materials

- **Reference materials** are various sources that provide background information or quick facts on any given topic.

Examples of reference materials?

- While there are many different types of resources, here are a few: almanacs, atlases, bibliographies, biographical resources, dictionaries, encyclopedias (both general and by **subject**), handbooks, indexes, statistics, and citation guides

Types of Reference Resources

- **Almanacs.**
- **Atlas & Maps.**
- **Bibliographies.**
- Biographical Resources.
- **Dictionaries.**
- **Directories.**
- **Encyclopedias.**
- **Handbooks.**

- . What is the importance of reference materials?
- . **Reference materials** are of critical **importance** in establishing comparability and accuracy of analytical results between different locations and over time.

Open educational resources

Open Educational Resources

- . **Open** Courseware.
- . Learning Modules.
- . **Open** Textbooks.
- . Streaming Videos.
- . **Open** Access Journals.
- . Online Tutorials.
- . Digital Learning Objects.

WHAT ARE OPEN EDUCATIONAL ACCESS RESOURCES?

- **Open Educational Resources (OERs)** are freely available pedagogical **resources**, such as lesson plans, activities, media, and supporting materials.
- They're a type of **open access** material, and **open access** materials such as OA journal articles, OA textbooks, and other scholarly materials may support OER lesson plans.

Where we can find open educational resources?

These databases are a good starting point to find a wide variety of open educational resources.

- . OER Commons. ...
- . **Open Textbook Library.** ...
- . **Teaching Commons.** ...
- . HathiTrust Digital Library. ...
- . Merlot. ...
- . **Open Educational Resources**
- . OASIS.

Open educational resources

Open Educational Resources

- **Open** Courseware.
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- Digital Learning Objects.

How many open educational resources are there?

- Currently, more than 200,000 learning **resources** are searchable **in** one portal based on language, subject, **resource** type and age range.

Are open educational resources free?

OER, a part of the global **open** content movement, are shared **teaching**, learning, and research **resources** available under legally recognized **open** licenses -- **free** for people to reuse, revise, remix, and redistribute.

What are the benefits of OER?

Advantages of using OERs include:

- expanded access to **learning**. ...
- augmentation of class materials. ...
- enhancement of regular course content. ...
- quick circulation. ...
- showcasing of innovation and talent. ...
- ties for alumni. ...
- continually improved resources.

. **How is OER used in the classroom?**

- . By using **OER**, faculty can easily supplement their lectures and learning materials with content that is already openly licensed and available for sharing. ...
OER courses allow students to explore materials before enrolling, making them better prepared before they arrive in the **classroom**

Thank you

Audio Visual Aids & Improvised Materials.

CONTENTS

- INTRODUCTION
- MEANING OF TEACHING AID
- CHARACTERISTICS OF TEACHING AID
- NEEDS AND IMPORTANCE
- CONCLUSION

INTRODUCTION

- learning and teaching sometimes challenging
- several approaches to make teaching and learning easier and effective
- Aids inclusive in these approaches
- Effective application of these aids to make teaching and learning easier



Can you define it
in your words?

- ❖ Teaching aids can be anything which is used to facilitate the learning....

It can be linguistic, auditory, visual... Or it can be presented through drama, stimulation, roleplay etc. Even it can be presented in the form of Cassettes, CDs-DVD, powerpoint presentations.....etc.....



TEACHING AIDS



□ A teaching aid is a tool used by teachers, facilitators, or tutors to help learners improve reading and other skills, illustrate or reinforce a skill, fact, or idea, and relieve anxiety, fears, or boredom, since many teaching aids are like games.

TEACHING AIDS

“We remember 20% of what we HEAR
We remember 30% of what we SEE
We remember 50% of what we SEE &
HEAR
We remember 90% of what we SAY &
DO”

“I hear, I forget
I see, I remember
I do, I understand

TEACHING AND LEARNING AIDS

- concrete materials- real life tools used in out-of-school settings,
- artificial material developed for educational purposes
- and games
- materials used by the student or the teacher to help in the processes of learning and teaching.
- examples include maps, prints, models, films, tape recorders etc

Characteristics of good teaching aids:

- ❖ Meaningful and purposeful
- ❖ Motivates the learners
- ❖ Accurate in every aspect
- ❖ Simple and cheap
- ❖ Improvised
- ❖ Large in size
- ❖ Up-to-date
- ❖ Should suit age & experience of students
- ❖ Interesting



•Aids should be:

- simple - do not crowd information onto the page or screen

- to the point, and well related to the lesson plan

- interesting and attractive-The mere use of teaching aid does not arouse interest, they should be accurate & according to age level

- Relevant-Should be directly related to the subject matter.

- Teacher should be well prepared for the use of aids.

NEED & IMPORTANCE

- Clarity
- Attention & interest
- Best motivators
- Use of maximum senses
- Saving time & effort
- Fixing and recalling the knowledge
- Meeting the individual differences
- Encouraging activities
- Development of scientific attitude
- Direct experiences

Need of Teaching Aids

- 1) To retain more concept permanently.
- 2) Students can learn better when they are motivated properly through different teaching aids.
- 3) Develop the proper image when the students see, hear taste and smell properly.
- 4) Create the environment of interest for the students.
- 5) Helps the teacher to make learning permanent.
- 6) Provide direct experience to the students.

What for...???

- ❑ Enhance the interest of students, specially students of quite young age.
- ❑ its quite easy to teach them.
- ❑ much effective than conservative teaching.
- ❑ As well as teen agers also take interest in pictures and practice.
- ❑ They also want to do their work by themselves. So audio video teaching is much effective than conservative teaching.

- ◎ **To enable students to visualise or experience something that is impractical to see or do in real life,**
- ◎ **To engage students' other senses in the learning process,**
- ◎ **To facilitate different learning styles.**



PRINCIPLES OF SELECTION & EFFECTIVENESS IN USE

- 1) Educational value
- 2) Realization of objectives
- 3) Pupil centeredness
- 4) Interest and motivation
- 5) Simplicity
- 6) Relevancy and suitability
- 7) Accuracy
- 8) Encouragement
- 9) Well preparedness
- 10) Avoiding too many aids
- 11) Integration
- 12) availability of resources- size of classroom, finance, facilities, experienced teachers

- **Improvised materials**
- **Improvised materials** are **materials** that are used in the absence of the real, original or delicate objects to bring about the same learning effect that the real or complicated **materials** would have brought. ...
- The use of locally produced instructional **materials** in the teaching learning situation has many advantages.

- **Improvisation** means making of instructional materials by **teachers** and pupils using locally available resources. ... Despite this, many **science teachers** are either unwilling or unable to **improvise teaching** materials for lack of skills or appreciation of the need to do this.

- What advantages does improvisation of teaching materials give to the teacher?
- Here's a list of ways **improv** can help students learn more, improve academic skills, and become more confident as learners.

- **Benefits of Improvisation for the Learner**

- . Fosters Creativity. ...
- . Deepens Learning. ...
- . Makes Learning Concrete. ...
- . Builds Writing Fluency. ...
- . Allows Different Students to Shine.

-
- What are the example of improvised materials?
- **Examples** of these **improvised materials** include replacing D.N.A. models with stripped cardboard for **illustration** in teaching genetics, using clothes hangers (pegs) in place of test-tube holders, replacing measuring cylinders with graduated feeding bottles for measuring liquids and so on
-

THANK YOU!!!



**Laboratory- Equipment
Planning and
organization of practical
work, Laboratory
manual
maintenance of
apparatus, Chemicals
and records.**

SCIENCE LABORATORY

The laboratory is commonly regarded as the heart of science teaching. The science laboratory provides opportunities to the pupils to understand the concepts and different ideas of science.

“Science laboratory is the central place where students get an opportunity to conduct experiments and search principles of science”.

The laboratory helps in the development of objective reasoning and thinking, skills of experimentation, observation, problem solving and scientific attitudes among the students.

Location and Types of Science Laboratories

A science laboratory should be located preferably on the school building if possible so that there is no disturbance of the laboratory. The open space outside the laboratory will be of much use to conduct some of the experiments outside, in sunlight. Biology and general science laboratory should have north-south orientation to provide adequate sunlight exposure.

There are three important plans of science laboratory

1. Lecture room - cum - laboratory plan.
2. Lecture - cum - laboratory plan.

These two plans are a combined one with a lecture room and a laboratory attached side by side. Half of the whole laboratory is used as lecture room and half as a laboratory to arrange practical classes for one or more subjects.

3. All purpose laboratory: The whole laboratory is used for all purposes namely for lecture and laboratory work.

Planning a Science Laboratory

Before constructing the science laboratory, the following factors should be taken into consideration at the planning stage.

- The number of pupils working at a time.
- The minimum space necessary for each pupil for comfortable working.
- Limitations of number of science teachers in secondary schools.
- Need for ancillary accommodation for storage.
- Designing the science class-room and laboratory in such a way that it could be used for science teaching for middle as well as for high classes.
- Imperative need for economy.

Chemistry Laboratory

Location : It should be preferably on the ground floor.

Lay out : It should be 45 feet x 25 feet for a class of 40 students in demonstration and 20 for practical classes. One door should be near demonstration table of the teacher and the other at the other end. Windows preferably with wire gauze should be provided, and should open outside. They should be 6' x 8'.

Ventilation : In chemistry experiments heat is required in carrying out almost all experiments. Moreover gases give nauseating smell. So ventilation should be there. Ventilators should be provided with exhaust fans. Without them conditions might become intolerable for students to work.

Walls : The walls may be about 1½ feet thick. Painting should be done or annual white washing is should be done.

- **Floors** : They should be cemented. Slight slope helps in sweeping. Round corners prevent the dust from being accumulated.
- **Water Supply** : Water supply is different in different places, depending upon the source of water supply. It is preferable if storage tank is built on the roof of science laboratory.
- **Gas Supply** : Gas supply may be provided by means of petrol gas plants which are easy to operate and maintain. The gas plant must be installed outside the laboratory. Each burner should have individual gas control knob.

- **Work Tables** : Single work table of dimensions 1.5m x 0.75m x 0.75m is ideal for individual practical classes. The tables must be arranged so that the teacher can easily see from his demonstration table what every student is doing.
- **Sink** : Sinks must be provided in each work table in the chemistry laboratory where the students would have to clean the test tubes very often.

- **Demonstration Table** : A long table preferably raised by means of a small platform should be provided in each laboratory at one end. The demonstration table must be provided with water supply and gas supply.
- **Blackboard and Bulletin board** : A black board must be fitted on the wall just behind the demonstration table, so that the teacher can use it during demonstration. There must be a notice board inside the laboratory near the entrance door.

- **Cupboards, Fire Extinguishers and First Aid Box**
:There must be enough number of cupboards or almirahs to store things and chemicals. There must be at least two fire extinguishers and one first aid box in the laboratory.
- **Storeroom** :In addition to the materials kept in the laboratory, materials which are costly and needing special care can be stored in the store room.

PURCHASE OF APPARATUS AND EQUIPMENTS

Sufficient materials, apparatus and equipment are essential for any laboratory. A list of all the required apparatus, tools, equipment, chemicals, reagents etc., should be prepared and purchased from the scientific stores.

Procedure for the Purchase

Preparation of the indent

Based on the grant and the immediate requirement either for getting a new laboratory or for a laboratory already established the list of articles equipment are to be prepared and they should be assorted into different categories. The indent should be prepared in duplicate and it should be sent to the concerned higher authorities for approval. The approved indent, with required particulars should be sent to more than three approved scientific companies asking for the price of the articles in the indent which they can supply.

Preparation of comparative statement

After receiving the quotations from at least three companies the comparative statement can be prepared. While considering the quotations the quality also should be compared and considered. Quality should not suffer at the cost of money. The company that has offered the lowest quotation is given the order to supply the materials when asking for quotations we have to give specifications.

For example if we simply say dissection box one may give the rate for that made up of iron while the other may give it for stainless steel. Naturally the rate for the iron will be less and we should be going for the purchase of it and suffer later.

Placement of orders

The teacher through the headmaster should place the order of the articles to the respective companies which have offered the lowest rate. While placing the orders the time specification also should be clearly mentioned, so that they are received in time and utilized by the students.

Receipt of the articles

When the articles are received the price list is to be compared with that of the quotation to find out whether the price is the same. If there is any discrepancy, deficiency or damage it should be immediately communicated to the respective company and arrangement should be made to return the item and get a new one or reduce the price in the bill. It is advisable to get the costly article and glass wares insured against any damage. Then only the bill should be recommended for payment.

Stock registers

The apparatus purchased should be properly checked and entered. A stock register is used for the entry of items received and also to maintain a record of science apparatus. It helps in knowing the position of apparatus, chemicals and also helps while auditing. The science teacher should maintain the following registers in the laboratory.

(i) Accessing register

After receiving and checking the working conditions all the articles irrespective of consumable or non-consumable are entered in this register. The register should have the following format.

Date of purchase	Bill No. and name of company	Description of articles	Qty.	Cost	Page No. in the relevant stock register	Remarks

Non-consumable register

Articles of permanent nature which are not liable to be broken are to be entered in this register. The article such as sonometer, magnets, spectrometer, electrical appliances and instruments, balances etc should be entered in this register. The register should have the following format.

Date of purchase	Bill No. and name of company	Description of articles	Qty. received	No. broken, removed	Balance	Remarks & initial

It is preferable to enter the articles in the alphabetical order. It is better to enter each type of article in separate pages. Articles if broken accidentally or during use should be removed from this register with the permission of the competent authority. Such removal must always have the sanction of the competent authority in writing.

Consumable register

Articles which are likely to be broken very often and articles which have to be thrown out after use can be entered in this stock registers. For example test tubes, glass rods, glass tubes, rubber tubes, litmus paper, corks, chemicals, dry cells, bulbs, extension wire, oil, fuse wire etc. have to be entered in this. The teacher has the power to write off such articles from this register. Any such removal need not have any sanction from the higher authority. The format of the register will be as follows.

Date of purchase	Bill No. and name of company	Description of articles	Qty. Received	Issued or removed	Balance	Remarks and initial

It is better to allot one page to one type of article so that additions and deletions in future can be noted on the same page.

Issue register

Whenever an article is issued to other department or teacher, it should be entered in the issue register with date and number. After it is returned it should be entered after verifying the working condition of the article.

Breakage register

Articles which are broken by the students and others while doing the practical work and demonstration should be entered in this register and later one can be removed from the concerned stock register.

ORGANIZATION OF PRACTICAL WORK

It is essential for a science teacher to complement her class room lessons to the practical work conducted in the lab. The success of the practical work depends on the planning and the organisation. In the organisation of the practical work, time scheduling and the actual practical work are the components.

Time Scheduling

The mental process involved in practical is not different from theoretical work. The time required for each experiment may differ depending on the nature of the practical.

- Time is needed to prepare the material before the practical commences.
- Practical procedures occupy different lengths of time.
- Pupils need time for the preparation of the practical work, to sharpen the scalpels or get the apparatus.
- Time should be allotted for the demonstration.
- Time should be scheduled according to the working rates of the students.
- The facts of the psychological mechanism 'repetitive experiences is often more effective than single experience' should be considered.

Organising the Work of the Practical Class

All the preparatory works should be completed before the practical begins and the students should know before hand what work they are to do and should be prepared with the appropriate instruments, instructional materials such as work sheets and apparatus should be ready. After the arrangements the teacher should demonstrate what is to be done. During the demonstration the purpose should be defined, its method explained and its results shown but during the process itself there should be the cut and thrust of question and answer. When the process is to continue after giving the brief description of the whole process, conveniently it can be done in stages.

Guidelines for Teachers in Organizing Practical Work

- The teacher should conduct demonstrations and also provide the students with instruction cards containing information about the experiments to be performed. It provides clarity to the students and saves time.
- The experiments should be properly done. Accurate readings should be noted down.
- In the record books, the data and the diagrams should be entered. The calculations should be worked out.

- Teacher should check and sign every student's practical book after the completion of the experimental work at the end of the practical session.
- Teachers should explain the care and accuracy of apparatus to the students.
- Teacher may be flexible and innovative in devising new methods or procedures, while working with large groups or with limited supply of chemicals and apparatus.
- Teacher should be cautious about accidents in the lab and in case of accident he should provide first aid to the victims immediately.

Laboratory Records of Students

- The records serve as self learning materials for the students. In the records they are able to condense and organize the matter. The records are the means to convey what they know about the concepts of the experiments. The students should be properly trained to record the experiments that they perform in the laboratory.
- The teacher should make the students to enter each and every observation directly into their fair note books. Recording on the rough notebook and copying later should be avoided.

- The procedures for the experiment should be on the right side while the observed information should be recorded on the left side appropriately. The use of printed records should be avoided as they may contain unnecessary and more information. The method of doing the experiment and the recording pattern may be different.
- Always the procedure should be written in passive voice and not in active voice or in the order form.

Laboratory Manual

- A laboratory manual is an essential guide to laboratory work. It is a book that gives guidelines for doing practical. It gives good practical guidance regarding the procedure, observation and precaution. It is always better to follow the lab manual for systematic conduct of experimental work. The laboratory manual provide
 - the aim of the experiment
 - the apparatus and chemicals required.
 - The method or the procedure followed
 - The formula for analysis
 - Precautions for effective wor
 - Illustration for the experiment
- In the manual the different experiments are described with appropriate figures and tabulations and help the student to complete the record works. Wherever necessary the diagrams of the apparatus and the format of the tabulations and the procedure of the calculations for the different experiments are given.

Instruction Cards

- Instruction cards are small postcard sized cards on which the instructions and guidelines for individual experiments are written. The size of the card is 15cm x 10cm. The instruction card is prepared for each practical and is given to the student before he starts his practical works.
- The instruction cards contain
 - Procedure
 - Method to record the observations / data
 - Formulae and the method for calculations.
 - Precautions to be taken for proper working.
- The instruction card is preferably covered with a polythene cover.

Benefits of instruction card

- Helps to save the time of the teacher and the student.
- Enables the student to go through it when he gets the doubt.
- Helps to enable the systematic procedure for each experiment.
- Helps the learner to become familiar with the concerned experiment.
- Helps to gather the materials before starting the actual practical.

SAFETY PRECAUTIONS

- A laboratory is a dangerous place if not managed properly as it contains explosive chemicals and reagents, glass wares, poisons etc and with the increasing scientific progress, the corresponding hazards are also increasing. Therefore laboratory safety is the most important task that a science teacher should know. Good laboratory practices are prerequisite for the management of safety in any laboratory. For this purpose certain safety rules should be adopted and strictly followed.

General Safety Rules for the Lab

- The science students should follow the following rules to avoid many accidents in laboratories.
- In case of any accident immediately report to the teacher.
- Work should be done only under the supervision of the teacher.
- Equipment should be handled only after reading the instructions.
- Chemicals should be used only after receiving the instructions and precautions from the teachers.
- Laboratory apparatus should not be used without the permission of the teacher.

- Caution should be taken while handling and pouring chemicals and reagents.
- Never pour back the reagents or chemicals into the bottles.
- Chemicals spilled on the skin should be immediately washed with water.
- Working area should be cleaned before and after the experiment.
- In case of accidents or injuries, first aid should be immediately provided.

Therefore, first aid is an important requirement in any science laboratory.

The science teacher should be trained in providing first aid to the injured students.

Safety Equipment

- Along with the first aid box every laboratory should be equipped with the following safety equipment also
- fire extinguishers
- rubber gloves
- asbestos safety screens
- Dust bins
- Thick blankets
- Sand blankets, etc.

Some Common Laboratory Mishaps and their Remedies

Cuts

- If it is a minor cut, the affected portion should be washed with a weak antiseptic lotion such as diluted 1:10 dettol. Then tincture of iodine on a pad of cotton wool may be applied.
- If there is arterial bleeding, a doctor's attention is immediately needed. A thick pad of gauze or cotton wool should be pressed over the wound. Tourniquet may be used to stop the bleeding.

Burns

It is caused by dry heat such as hot iron, hot glass rod, by some acid or alkali, phosphorus or sodium or potassium. For small burns apply sterilized pad of cotton wool or gauze soaked in sodium bicarbonate solution which should be replaced before it gets dried gentian violet jelly may be used. In some cases special procedure is necessary as follows.

Acid burns

Concentrated acids will cause serious burns. The portion affected by acid must be immediately washed with large quantity of water and then treated with a weak solution of sodium bicarbonate to neutralize the acid. Alkali should not be poured over the affected area without washing it with large quantity of water as it will produce excessive heat due to neutralization.

Alkali burns

The affected area must be washed with water and then with 1% solution of acetic acid or lemon juice. Phosphorus burns must be immersed in water and all traces of the substance washed away. The part should then be treated with dilute silver nitrate solution.

Eye injuries

Any injury in the eye must be carefully attended. A drop of oil must be put into the eye.

- **Acid in the eye :** The eye must be washed by a slow stream of water from a wash bottle. It should then be rinsed several times with lime water or 1% solution of sodium bicarbonate.
- **Alkali in the eye :** The eye should be thoroughly washed with water and then with 1% solution of boric acid.
- **Solid in the eye :** Any obvious solid may be removed gently by a camel-hair brush dipped in glycerine.

Poisoning

In all cases of suspected poisoning, the doctor should be consulted soon after the first- aid treatment.

- **Substance taken into the mouth :** If a poisonous substance either solid or liquid has been taken into the mouth, it should be spit out at once and the mouth rinsed with much water followed by a wash with saturated sodium bicarbonate solution if acid or with 1% acetic acid solution if alkali,
- **Substance swallowed :** In this case the poisoning can be classified into two types.
 - Poisoning due to corrosive substances.
 - Poisoning due to non-corrosive substances.

If the substance swallowed is non-corrosive the patient may be encouraged to vomit. A table spoon full of common salt or a tea spoon full of mustard in warm water will encourage vomiting. Then white egg, rice-water etc. should be given.

If the substance swallowed is corrosive, the patient should not be encouraged to vomit. In the case of acids much water, followed by lime water or milk of magnesia should be drunk. If alkalies, much water followed by dilute acetic and or lime juice should be taken.

In the case of poisonous gases the patient should be taken into fresh air at once, clothing must be loosened and a hot stimulant like coffee should be given.

Fainting

It a pupil feels or looks faint after an accident, his clothing must be loosened and fresh air must be allowed to blow on his face. A little cold water or hot stimulant can be given, when he becomes conscious.

Electric shock

The first thing is to switch off the current. If necessary the pupil should be treated for burns and shock. He should be kept quiet and warm and made to lie down flat. In serious cases artificial respiration may be given.

Fire accidents

In the case of fire the following steps should be followed.

- If a pupil's clothes catch fire, he should be wrapped with a blanket immediately.
- Small fires due to oil, sodium etc can often be put out by putting a large amount of dry sand.
- If some inflammable substances catch fire, it can be extinguished and prevented from spreading by pressing a sheet of asbestos.
- If the fire is due to gas or electricity the main source of supply should be cut off first.
- In all cases of emergency fire buckets filled with sand and water and suitable number of fire extinguishers must be kept ready.

Text book

- Meaning of text book
- Characteristics of text book
- Importance of text book
- Functions of text book



Introduction

The textbook is an important source for learning and it plays a key role in effective **teaching and learning**. Therefore it is important that these textbooks do not merely supply information and facts, but also **enable the student to understand and appreciate concepts and principles and their relevance** in our day to day life. A text book should stimulate reflective thinking and develop problem solving ability among students.

Meaning of Text Book

A textbook is a manual of instruction or a standard book in any branch of study. They are produced according to the demand of the educational institutions. Although most textbooks are only published in printed format, some can now be viewed online.

“A text-book is a design for a class-room use carefully prepared by experts”. **-Bacon**

From this definition it is clear that a text book is prepared by experts to fulfill the needs and interest of the learner and helps the teacher to restrict himself to contents to be taught.

**Characteristics of a Good Science
Text- Book :
(Criteria for selection of a Text –
Book)**

The Author

His qualification and experience. He should have teaching experience so that he actually knows the teaching – learning experience. Some minimum qualification should be fixed for a teacher to become author.

Mechanical Features of the Text Book :

- The quality of the paper should be fine
- The printing should be appealing
- The binding of the text book should be attractive.
- The size of the print should be according to the age of the students.
- The book should contain good illustrations with sketches, diagrams pictures etc.,

The Subject Matter – Its Nature and Organization :

Content

- The content of text books for any one subject matter field is remarkable uniform about 85 percent of the content being common to all of them
- The content should be appropriate for the age level and experience backgrounds of the pupils
- The concept should not be too complex for the maturity of the pupils
- The content should be consistent with the pupil's needs and interests
- The statements must be accurate

II Organization

- The subject matter should cover the whole syllabus
- Subject matter should be developed in psychological sequence
- The text book has to be organized into units which are based on student interests and probability of use
- Inductive approach is to be used whenever possible in introducing new topic
- At the end of each units there should be assignments informing to the following

- Application to life situations
- Self assessment test
- Suggestions for further reading
- Numerical questions if necessary
- Assessment for practicing skills
- The text book should be written in simple unambiguous scientific language. Prefer simple and compound sentence to complex sentences

- It should contain a glossary of technical terms used in the books
- It should suggest some good methods of learning's
- Historical development of science should be attempted
- Adequate provision should be made to correlate science with other subject and crafts.

- It is better if the text book contains examples from the local environment
- There should be a detailed table of contents and index text books
- Controversial topics should be treated impartially
- The social significance of science should be stressed
- Headings and sub- headings should be in bold type
- Important principles should be set in italics
- Each text books should be accompanied by a laboratory manual and pupil's work book
- It must be supplemented by a teacher's hand book

III. Literary style and Vocabulary of text book

- Literary style has much to do with the readability of the book. Although style is difficult to judge.
- Length of sentences
- Directness of sentences
- Number of ideas per seconds
- Use of lead sentence or paragraphs

- Presence or absence of irrelevant thoughts \ continuity of thought
- While evaluating a text book the teacher must decide whether or not the vocabulary is excessive or in appropriate text book should be easy to read.

IV Illustrations

- The quality and the quantity of the illustrations should be considered.
- Photographs should be clearly reproduced
- Diagrams should be carefully made attractive
- Colour in the illustrations add to eye appeal and when properly used has considerable teaching value
- The recently introduced transparencies made on plastic sheets are excellent teaching aids but because of cost it can only be used in small quantities in any one book
- Photograph should have relation with content in the text

Teaching aids

- The table of content and index should be comprehensive
- Glossary should be included
- Activities should be given the end of a chapter
- Activities should be closely related to content

Importance of text book

A text book is very helpful for teachers in the following way:

- A text book is written according to syllabus and gives the outline of the course. Therefore it helps the teacher to decide about the limits and depth of the content to be presented to the students while teaching.
- A textbook provide insight to the teacher in planning the lesson, in selecting problems to be worked out, the methods of teaching to be adopted and teaching aids to be used.

- ❖ The text book is written by experienced teachers of mathematics. By using textbooks, a teacher specially beginner, can avail the experience and expertise of the authors.
- ❖ The logical and psychological sequence followed in a textbooks helps the teacher in presenting the subject matter in an orderly and systematic sequence.
- ❖ A good text book presents a variety of worked examples on each topic. This helps the teacher in getting acquainted with different types of problems and the methods to solve them. This gives him more self-confidence while teaching.

- ❖ The well-graded exercise provided after every topic in the textbook help the teacher in assigning suitable home work and assignment to the students to suit their intellectual capacity.
- ❖ A textbook saves a lot of time for the teacher he need not spend time to prepare problems and the solutions as they are readily available in the textbooks.

A textbook is very useful for a students in the following way:

- ❖ It helps to foster the right study attitude among the students since the textbook presents definite and concrete details in a scientific and intensive manner which could arouse the students and curiosity
- ❖ The textbook provides important source of materials for reviewing and recapitulating the lessons taught in the class
- ❖ The textbook helps in pre-preparation of the lesson and gets the students acquainted with lessons to be taught.

- ❖ It provides adequate materials for drill and practice and thus helps in fixing the mathematical principles and formulate in the minds of the students.
- ❖ It saves time and labour of the students as the need not copy the illustrative problems, exercise problems and home work problems.
- ❖ It encourages self-study and independent work among the students.
- ❖ It supplements classroom learning and helps in the realization of the objectives of mathematics education.

- ❖ Textbook helps in clearing the doubts and misunderstanding relating to mathematical concepts principles. It also helps in correcting the mistakes that occur while copying the formulae and problems from the blackboard.
- ❖ The textbook helps in extensive study of subject as it presents different problems and various approaches to problem-solving.
- ❖ New learning activities such as individual projects, laboratory experiments and demonstrations suggested in the textbook can be carried out by the students. It permits each student to read and carry out the activity at his own rate of comprehension.

Functions of textbook

- ❖ It should encourage self-study.
- ❖ It should help in developing scientific attitude.
- ❖ Text book help the classroom discussion to arrive at accurate conclusion.
- ❖ It should develop open-mindedness and co-operative attitude.
- ❖ It should open the gates of interest and develop proper attitude.

- ❖ These help the students for doing homework and the preparatory parts of assignments.
- ❖ It should serve as a guide.
- ❖ It should provide scientific knowledge in logical order.
- ❖ It should serve as a resource book for the teacher.
- ❖ Textbooks help the pupil for systematic and speedy revision of the lesson after it has been finished.
- ❖ The textbook play an important role in rural areas where students may only on textbook to the maximum extent.

- ❖ A good textbook makes the basic concepts and principles clear by giving suitable examples.
- ❖ It should provide scope for the development of basic skills like drawing labelling, collection preservation etc in students.
- ❖ It should help in reinforcing the learning of students.

Workbook

Workbook

Workbooks are paperback textbooks issued to students. Workbooks are usually filled with practice problems, with empty space so that the answers can be written directly in the book.

Student workbook is an education material including components that support learning, help ensuring knowledge and ability to **students** in line with the acquisitions stated in teaching programs. ... Their needs should be satisfied by benefiting from some additional materials in order to make their learning permanent.

A workbook usually covers important concepts and tasks related to syllabus. Workbooks are used for solving extra problems and concepts which students have already studied from textbook.

Workbooks are often used in schools for younger students, either in middle school or elementary school.

Characteristics of work book

1. Content is divided into smaller information
2. This is learning centered
3. Immediate feed back can be given and we can verify the answer
4. This is Self facing
5. Student learn according to their capacity
6. self evaluation
7. learning Effective
8. Learner become very active
9. Varity in learning
10. New knowledge
11. Teaching become very effective

Steps of workbook

1. Selection of Unit
2. Content analysis
3. Writing objectives
4. Organisation of content
5. Providing the material
6. Remedial teaching

Selection of Unit

1. ಘಟಕದ ಆಯ್ಕೆ :-

ಬೋಧಿಸಬೇಕಾದ ಒಂದು ನಿರ್ದಿಷ್ಟ ಅಧ್ಯಾಯ 1 ಘಟಕವನ್ನು ಅಭ್ಯಾಸ ಪಾಠವನ್ನು ಆಯ್ಕೆ ಮಾಡಿಕೊಳ್ಳಬೇಕು.

Content analysis

2. ವಿಷಯದ ವಿಶ್ಲೇಷಣೆ:-

ಆಯ್ದುಕೊಂಡ ಆಧ್ಯಾಯವನ್ನು ಪರಸ್ಪರ ನಿಕಟ
ಸಂಬಂಧವಿರುವಂತೆ ವಿವಿಧ ಉಪಘಟಕಗಳಾಗಿ ವಿಂಗಡಿಸಬೇಕು
ಮುಖ್ಯಾಂಶಗಳು, ಪರಿಚಯಿಸಬೇಕಾದ ಪರಿಕಲ್ಪನೆಗಳು,
ಭಾಷಾಂಶಗಳು ಮತ್ತು ವ್ಯಾಕರಣಾಂಶಗಳನ್ನು ಮಾಡಿಕೊಳ್ಳಬೇಕು.

Writing objectives

3. ಅಭ್ಯಾಸ ಪಾಠಗಳ ಉದ್ದೇಶಗಳು :-

ವಿವಿಧ ಉಪಘಟಕಗಳಿಗೆ ಪ್ರತ್ಯೇಕವಾಗಿ ಭಾಷೆ ಮತ್ತು ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿರುವಂತೆ ಬೋಧನಾಂಶ/ಕಲಿಯಬೇಕಾಗಿರುವ ಅಂಶಗಳನ್ನು ಪಟ್ಟಿ ಮಾಡಿಕೊಳ್ಳಬೇಕು ಇದೇ ರೀತಿ ವಿವಿಧ ಪುಟ ಉಪಘಟಕಗಳ ಬಗ್ಗೆ ನಿರೀಕ್ಷಿತ ಕಲಿವಿನ ಫಲಗಳು ಒದಗಿಸಬೇಕಾದ ಕಲಿಕಾ ಅನುಭವಗಳನ್ನು ವ್ಯವಸ್ಥೆಗೊಳಿಸಿಕೊಳ್ಳಬೇಕು.

Organisation of content

ವಿಭಾಗಿಸಿರುವ ವಿವಿಧ ಉಪಘಟಕಗಳನ್ನು ಸರಳವಾಗಿ ಪರಸ್ಪರ ಸಂಬಂಧವಿರುವ ವಿವಿಧ ಉಪಘಟಕಗಳನ್ನು ಸರಳವಾಗಿ ಪರಸ್ಪರ ಸಂಬಂಧವಿರುವಂತೆ, ಒಂದೊಂದು ಕಲಿಕಾ ಅಂಶಕ್ಕೆ ಒಂದೊಂದು ಅಭ್ಯಾಸವನ್ನು ಕ್ರಮಬದ್ಧವಾಗಿ ವ್ಯವಸ್ಥೆಗೊಳಿಸಬೇಕು ಈ ಅಭ್ಯಾಸಗಳನ್ನು ಮಾಡುವ ಬಗ್ಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೂಕ್ತ ಸೂಚನೆಗಳನ್ನು ಕೊಡಬೇಕು. ಅಭ್ಯಾಸ ವಿಷಯಗಳ ಕೆಳಗೆ ಭಾಷೆ & ವಿಷಯ ಕಲಿಕೆಯನ್ನು ಪರಿಚಿಸಲು, ಅಭ್ಯಾಸ ಮಾಡಿಸಲು ಅನುಕೂಲವಾಗುವಂತಹ ಉತ್ತಮವಾದ ನಿರ್ದೇಶನವಾದಿ ಪ್ರಶ್ನೆಗಳನ್ನು ಬರೆಯಬೇಕು ಹಾಗೆಯೇ ಈ ಪ್ರಶ್ನೆಗಳಿಗೆ ಪ್ರತ್ಯೇಕ ಪುಟದಲ್ಲಿ ಉತ್ತಮ ಸೂಚಿಯನ್ನು ಕೊಡಬೇಕು ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ವಯಂ ತಾವೇ ಅಭ್ಯಾಸಗಳನ್ನು ತಾಳೆ ನೋಡಿಕೊಂಡು ಕಲಿಕೆಯನ್ನು ಸಿರಪಡಿಸಿಕೊಳ್ಳಲು ಅನುಕೂಲವಾಗುವಂತೆ ಈ ಅಭ್ಯಾಸ ವಿಷಯಗಳನ್ನು ಕ್ರಮಬದ್ಧವಾಗಿ ವ್ಯವಸ್ಥೆಗೊಳಿಸಬೇಕು ಇದೇ ರೀತಿ ಎಲಾ ಉಪಘಟಕಗಳಿಗೂ ಅಭ್ಯಾಸ ವಿಷಯಗಳನ್ನು ಕ್ರಮಬದ್ಧವಾಗಿ ವ್ಯವಸ್ಥೆಗೊಳಿಸಬೇಕು ಇದೇ ರೀತಿ ಎಲಾ ಉಪಘಟಕಗಳಿಗೂ ಅಭ್ಯಾಸ ವಿಷಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಬೇಕು ಅಭ್ಯಾಸ ವಿಷಯಗಳೆ ಪರಸ್ಪರ ಸಂಬಂಧವನ್ನು ನಿರಂತರತೆಯನ್ನು ಕಾಯ್ದುಕೊಂಡಿರಬೇಕು.

Providing the material

- 5) ಸಿದ್ಧಪಡಿಸಿದ ಅಭ್ಯಾಸ ಪಾಠಗಳನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಬದಗಿಸುವುದು:-

ವ್ಯವಸ್ಥಿತವಾಗಿ ಸಿದ್ಧಪಡಿಸಿದ ಅಭ್ಯಾಸ ಪಾಠಗಳನ್ನು ಸೂಕ್ತ ಸೂಚನೆ ಮತ್ತು ಮಾರ್ಗದರ್ಶನಗಳೊಂದಿಗೆ ಮಕ್ಕಳಿಗೆ ಒದಗಿಸಿ ಅವರು ಅಭ್ಯಾಸಗಳನ್ನು ಮಾಡುವಂತೆ ಅವಕಾಶಗಳನ್ನು ಕಲ್ಪಿಸಬೇಕು.

Remedial teaching

- 6) ಪರಿಹಾರ ಬೋಧನೆ :-

ಮಕ್ಕಳ ಅಭ್ಯಾಸ ಪಾಠಗಳನ್ನು ಮಾಡಿ ಮುಗಿಸಿದ ಮೇಲೆ ಕಲಿಕೆಯಲ್ಲಿ ಕಂಡು ಬರುವ ಲೋಪದೋಷಗಳನ್ನು ಸರಿಪಡಿಸುವ ಸಲುವಾಗಿ ಪರಿಹಾರ ಬೋಧನೆಯ ರೀತಿ ಸೂಕ್ತ ಮಾರ್ಗದರ್ಶನವನ್ನು ನೀಡಬೇಕು.

Improvised Apparatus (low cost materials)

Improvised Apparatus (low cost materials)

The inculcation of scientific attitudes and training in scientific methods is possible only through instruction, demonstration and experimentation. The complaint of science teachers against effective demonstration and experimentation is the lack of adequate apparatus. If practical skills have to be developed in the school going children, large amount of money has to be invested in building well equipped laboratories. But such a provision may not be possible in the years to come. One way of solving this problem is usage of improvised apparatus.

The term 'Improvisation' refers to those teaching aids, which can be prepared from simple and readily available cheap material in the class, which can be used by the students and teachers.

Characteristics of improvised apparatus

The following are some important characteristics of low cost educational materials.

- They use raw material easily available in local environment either free of cost or at low price.
- Pupils, teachers or members of the community prepare the materials.
- These low-cost materials create interest and stimulate further study.
- Production is economical and saves time.

Process of developing low-cost materials

The development of improvised apparatus or the low cost materials occurs in a sequential manner. The various steps involved in are

Defining the objectives

The objectives of knowledge, skills and attitudes are clearly identified in the light of the need of the user.

Designing the product

The design for the improvised apparatus is developed based on the type of materials used, the cost of production and availability of the resources.

Development of the materials

After designing the apparatus the material is assembled and developed by the teachers and students with the help of each other.

Pilot testing

The teachers and researchers then test the prepared apparatus. Based on the results, necessary improvements are made in the materials.

Mass production

The materials, which successfully pass the pilot testing are finalized for mass production.

Distribution

Adequate number of copies is produced and they are distributed to various schools for academic usage.

Advantages of improvised apparatus

They are freely available, cheap and economical.

- They possess a great educational value.
- Preparation of such apparatus helps the students in gaining a deeper knowledge of underlying principles.
- It develops creative instinct in the learner.
- It inspires young students to design, explore and invent new apparatus.

Disadvantages

- The time and money involved can exceed the limits making it worthless.
- Improvised apparatus are not durable.
- They are crude and they are unable to provide accurate results.

