LEARNING PHYSICAL SCIENCE

LEARNING RESOURSE
ON
BED 202.9: ASSESSMENT FOR LEARNING PHYSICAL SCIENCE

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2015-17

Unit – I
Aims and objectives of Teaching Physical Science

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1.1 Aims and objectives of teaching physical science. Definition, role and function of objectives- specific objectives. Objectives – learning experience – evaluation, objective based instruction, objective based evaluation.

1.2 Taxonomy of educational objectives – Bloom's Taxonomy- Revised Bloom's Taxonomy, Objectives of physical science suggested by NCERT, Taxonomy of Science teaching (Mc Cormack & Yager). Overview of different taxonomies of science education

1.1.1 Definition of objective

In education, learning objectives are brief statements that describe what students will be expected to learn by the end of school year, course, unit, lesson, project, or class period. In many cases, learning objectives are the interim academic goals that teachers establish for students who are working toward meeting more comprehensive learning standards.

Objectives are specific and immediate goals attainable through instruction. They are statement which describe the kind of behavior modification to be brought about in the learner. If objectives are not well defined it is impossible to evaluate a course , a unit , a lesson or a student and there is no sound basis for selecting appropriate materials or instructional method.

Or

An objective is a point or an end-view of the possible achievement in terms of what a student is able to do when the whole educational system is directed towards educational aims.

Or

Objectives are usually specific statements of educational intention which delineate either general or specific outcomes. There are advantages and disadvantages to different types of objectives.

Instructional objectives of teaching science

1.knowledge

2.understanding

3.application

4.skill

5.interest

6.attitude

7.appreciation

8.training in scientific method

9.providing work for leisure

10.providing basis for vocation

Definition of aim

The whole education system is directed towards aims that lead to an all round development of the students.

Aims are general statements that provide direction or intent to educational action. Aims are usually written in amorphous terms using words like: learn, know, understand, appreciate, and these are not directly measurable. Aims may serve as organizing principles of educational direction for more than one grade. Indeed these organizing principles may encompass the continuum of educational direction for entire programs, subject areas or the district.

Difference between aim and objective

aim	objectives
• Aims are directions in education.	• Objectives are end points of possible achievement.
• The attainment of aims is beyond the scope of the school as it involves all round growth.	• These are specific, immediate and attainable goals.
• Aims are directions encompassing the entire educational system in and out of school.	• Objectives are vary from subject to subject.
• If objectives are realized by stages and educational aim may be achieved one day.	• Objectives originate from aims , the attainment of which are steps towards the achievement of educational aims.
• Aims are broad and general. They are not much use to a teacher.	• Objectives are meaning full to teachers as they are specific precise and clearly defined.

1.1.2 The role of learning objectives

To have a precise grasp of the role of learning objectives necessarily implies an insight into the possible relationship between the objectives and the other components of instruction

1.to improve communication

2. To be used in choosing learning activities

3. To facilitate the choice of teaching material)

4. To specify the purpose of evaluation)

We shall deal in detail with each of these points.

Objectives improve communication between the teacher and the students and between the teachers of a given syllabus. The student must know precisely what is expected of him. He will thus devote his time to activities which will enable him to attain the course objectives. He will be in a better position to distinguish what is important from what is less important from among the learning tasks covered by the course. He will thus avoid dwelling on details of the subject-matter which he considers to be less relevant. He will not have to guess from the behaviour of his teacher what the latter considers important and what may be expected to be the subject-matter of the evaluation.

Functions of objectives

While educators use learning objectives in different ways to achieve a variety of instructional goals, the concept is closely related to learning progressions, or the purposeful sequencing of academic expectations across multiple developmental stages, ages, or grade levels. Learning objectives are a way for teachers to structure, sequence, and plan out learning goals for a specific instructional period, typically for the purpose of moving students toward the achievement of larger, longer-term educational goals such as meeting course learning expectations, performing well on a standardized test, or graduating from high school prepared for college. For these reasons, learning objectives are a central strategy in proficiency-based learning, which refers to systems of instruction, assessment, grading, and academic reporting that are based on students demonstrating understanding of the knowledge and skills they are expected to learn before they progress to the next lesson, get promoted to the next grade level, or receive a diploma (learning objectives that move students progressively toward the achievement of academic standards)

Objective based evaluation

Objective based evaluation as a process of determining the degree to which educational objectives are being achieved. This follows the scientific tradition and straitforward to apply ,but does not take account of unintended outcomes,and takes no account of students as individuals with all their differences.

learning experiences

Learning depends on careful planning of learning experiences which in turn is intimately connected with educational objectives that these experiences propose to achieve. True learning is not merely acquisition of certain traits or skills ;it is a change in behavior brought about by training or experiences. In any course of instruction the learner experiences changes in behavior in terms of established goals. The changes that the learner experiences are the direct outcome of the interaction between the learner and his environment . Pupil's participation is a vital factor in planning learning experiences . Learning experiences are thus pupil activities planned with the specific purpose of producing the desired behavior changes in them.

The criteria for good learning experiences are:

1. Appropriateness to behavior changes defined under objectives.

2. Appropriateness to content area prescribed.

3. Adequacy and effectiveness in bringing about the desired changes.

4. Practicability.

Specific learning objectives

These are the statements that describe the results in terms of knowledge, attitude and skill of students after learning content. Specific learning objectives are specific about what the learner would do after an instruction. These objectives are designed to answer questions like what will pupil do at the end of the learning event. It is also known as behavioral or learning objectives.

Characteristics of specific learning objectives

A well written objective should meet the following criteria

1 describe a learning outcome

2 be student oriented

3 be observable

1.2.1 McCormack and Yager Taxonomy

When humans use scientific knowledge and technology, global awareness becomes critical for environmental protection. As the *American Association for the Advancement of science (1990)* stated in science for All Americans, "What the future holds in store for individual human beings, the nation and the world depends largely on the wisdom with which humansuse science and technology. But that in turn depends on the character,distribution and effectiveness of the education that people receive".

Accordingly, scientific literacy has become a major goal of science education. Although there is no consensus regarding what kinds of science content are necessary for scientific literacy, a scientifically literate person is believed to be one who appreciates the strengths and limitations of science and who knows how to use scientific knowledge and scientific ways of thinking in order to live a better life and make rational social decisions.

Learning that fosters scientific literacy should promote development in the following areas:

- Student's inquiry skills and abilities.
- Student's abilities to apply what is learned to new contexts.
- Student's content and conceptual understanding.
- Student's understanding of the nature of science.

McCormack and Yager (1989) proposed that science had been viewed as a body of knowledge consisting of facts, figures and theories and this led to science instruction characterized by presentation of factual information. They believed that science education that stressed what they called the "knowing and understanding" domain limited students in developing the level of scientific literacy demanded by the needs of society and the world. They proposed that science education might be

viewed in the context of five domains.

The Five Domains of Science

The five domains of science according to McCormack and Yager

Taxonomy are

1. Knowledge Domain

2. Process Domain

3. Creativity Domain

4. Application Domain and

5. Attitude Domain

The five domains of science given by McCormack and Yager

Taxonomy is illustrated in the following figure

The five domains of Science given by McCormack and Yager Taxonomy

Five Domains of Science

I. Knowledge

II. Process

III. Creativity

IV. Application

V. Attitude

McCormack and Yager say that too often science education is limited to the first two domains, knowing and understanding and exploring and discovering, which relate primarily to the product and process of science. They content that the other three domains must be included in these times of global environmental problems, complex social and political issues, and general concerns about the future.

To address these concerns, the domain of imaginary and creating emphasizes the creative dimension of using science for the benefit of people. The domain of feeling and valuing looks at human values, feelings and decision making skills. How to use information gained from school science studies in everyday life falls under the domain of using and applying. Characteristics of five domains of McCormack and Yager

Taxonomy are given in the following table.

Characteristics of Five Domains of McCormack and Yager

Taxonomy

A science education programmed, especially, one that is science/technology/society oriented, must focus on all of the interrelated

five domains, but it should stress the vital importance of these domains: imaging and creating, feeling and valuing and using and applying. It is in these domains that students use their acquired science knowledge and skills to clarify and strengthen their values and then apply and act upon them as responsible citizens. The five domains of Science according to McCormack and Yager Taxonomy is explained as follows.

Science Domain	Domain Foci
I. Knowledge(knowing and understanding)	Scientific information-facts, concepts, laws,hypothesis and theories accepted by thescientific community.
II. Processes (exploring and Discovering).	Processes of science, how scientists work and Think.
III. Creativity (imaging and creating)	Idea generation, designing, problem solving
IV. Applications (using and applying)	Applications of what is learned to do science,connections to everyday life, informed decision making.
V. Attitudes (feeling and valuing)	Attitudes, sensitivity, societal issues and Impacts.

1. Knowledge Domain

Science in the classroom has been viewed and practiced for decades as a body of knowledge or facts to be learned or absorbed by students. Classically this occurs through the memorization of facts and concepts from text book. Science facts are clearly important, but to memorize facts as if their acquisition is the sole purpose of science education violates the spirit and nature of science. Science concepts are central to science instruction and student's understanding of these concepts is crucial to successful teaching and learning. Students should have concrete experience with concepts before moving to abstractions, and they need opportunities to try and to do, not just to read about science.

Facts, laws or principles, theories and the internalized knowledge held by students all fall under the umbrella of the concept domain.

2. Process Domain

Science processes, often designated as inquiry skills, are embodied in the terms exploring and investigating. In science, the investigative processes require hands on and minds on activities, laboratory inquires and experiments that provide approaches for helping students understand scientific concepts. The process domain includes the 13 processes identified by the American Association for the Advancement of science (1968). These are the generally accepted processes that scientists use as they accomplish their work.

Process skills used in science are

- Observing
- Using space and time relationships
- Classifying, grouping and organizing
- Using numbers and quantifying
- Measuring
- Communicating
- Inferring
- Predicting
- Identifying and controlling variables
- Interpreting data
- Formulating hypotheses
- Defining operationally
- Experimenting

3. Creativity Domain

Creativity is integral to science and the scientific process and is used in generating problems and hypotheses and in developing plans of action. Creativity plays an integral role in the many processes of science and in doing science. If a science educator wishes to foster a classroom that enhances student's creativity, the classroom should probably become more students centered.

Creative domain Attributes

The creative domain calls for experience that promote.

- visualization - production of mental images.

- generation of metaphors
- divergent thinking
- imagination
- novelty – combining objects and ideas in new ways
- open-ended questioning
- solving problems and puzzles
- consideration of alternative viewpoints
- designing devices and machines.
- generation of unusual ideas
- multiple modes of communicating results and
- representations in various ways and modes

4. Application Domain

A key element in the application domain is the determination of the extent to which students can transfer and effectively use what they have learned to a new situation, especially one in their own daily lives. Students must demonstrate that they not only grasp the meaning of the information and processes but that they can also make applications to concrete situations that are new to them.

Attributes of the Application Domain

- Use of critical thinking
- Use of open-ended questions.
- Use of scientific process in solving problems that occur in daily life.
- Abilities to make interdisciplinary connections – integration of the sciences.
- Abilities to make interdisciplinary connections – integration of science with other subjects.
- Decision making related to personal health, nutrition and life style based on knowledge of scientific concepts rather than on near say or emotions.
- Understanding and evaluation of mass media reports on scientific developments.
- Application of science concepts and skills to technological problems.

• Understanding of scientific and technological principles involved in common technological devices.

5. Attitude Domain

Many times we have heard people say that they were never good at science, mathematics or some other area of study. Attitude is very broadly used in discussing issues in science education and is often used in various contexts. Two general categories that are distinguishable are

a. Attitude towards science (ie. interest in science, attitude toward scientists and attitude toward social responsibility in science) and

b. Scientific attitude (ie, open-mindedness, honesty or skepticism) Interest in science tends to decline as students experience more science classes and progress through school.

Attitude Domain Attributes

The attitude domain calls for experiences that support

• exploration of human emotions.
• expression of personal feelings in constructive ways.
• decision making about social and environmental issues.
• development of more positive student attitude towards science in general.
• development of positive attitude towards oneself and
• development of sensitivity to and respect for feeling of other people.

1.2.2 Bloom's taxonomy

Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and mastery. The three lists cover the learning objectives in cognitive, affective and sensory domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities. As with most theoretical models, they are controversial even while commonly used.

They were named after ***Benjamin Bloom***, who chaired the committee of educators that devised the taxonomy. He also edited the first volume of the standard text, Taxonomy of Educational Objectives: The Classification of Educational Goals.

1.The cognitive domain (knowledge-based)

- **Knowledge**

  "Involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting."

- **Comprehension**

  "Refers to a type of understanding or apprehension such that the individual knows what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications."

- **Application**

  Refers to the "use of abstractions in particular and concrete situations."

- **Analysis**

  Represents the "breakdown of a communication into its constituent elements or parts such that the relative hierarchy of ideas is made clear and/or the relations between ideas expressed are made explicit."

- **Synthesis**

  Involves the "putting together of elements and parts so as to form a whole."

- **Evaluation**

  Engenders "judgments about the value of material and methods for given purposes."

2.The Affective domain (emotive-based)

Skills in the **affective domain** describe the way people react emotionally and their ability to feel other living things' pain or joy. Affective objectives typically target the awareness and growth in attitudes, emotion, and feelings.

There are five levels in the affective domain moving through the lowest order processes to the highest:

Receiving

The lowest level; the student passively pays attention. Without this level no learning can occur. Receiving is about the student's memory and recognition as well.

Responding

The student actively participates in the learning process, not only attends to a stimulus; the student also reacts in some way.

Valuing

The student attaches a value to an object, phenomenon, or piece of information. The student associates a value or some values to the knowledge they acquired.

Organizing

The student can put together different values, information, and ideas and accommodate them within his/her own schema; comparing, relating and elaborating on what has been learned.

Characterizing

The student at this level tries to build abstract knowledge.

3.The Psychomotor domain (action-based)

Skills in the **psychomotor domain** describe the ability to physically manipulate a tool or instrument like a hand or a hammer. Psychomotor objectives usually focus on change and/or development in behavior and/or skills.

Bloom and his colleagues never created subcategories for skills in the psychomotor domain, but since then other educators have created their own psychomotor taxonomies.***Simpson (1972)*** proposed the following levels:

Perception

The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation. Examples: Detects non-verbal communication cues. Estimate where a ball will land after it is thrown and then moving to the correct location to catch the ball. Adjusts heat of stove to correct temperature by smell and taste of food. Adjusts the height of the

forks on a forklift by comparing where the forks are in relation to the pallet. Key Words: chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.

Set

Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets). Examples: Knows and acts upon a sequence of steps in a manufacturing process. Recognize one's abilities and limitations. Shows desire to learn a new process (motivation). NOTE: This subdivision of Psychomotor is closely related with the "Responding to phenomena" subdivision of the Affective domain. Key Words: begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.

Guided response

The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing. Examples: Performs a mathematical equation as demonstrated. Follows instructions to build a model. Responds to hand-signals of instructor while learning to operate a forklift. Key Words: copies, traces, follows, react, reproduce, responds.

Mechanism

This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency. Examples: Use a personal computer. Repair a leaking tap. Drive a car. Key Words: assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.

Complex overt response

The skillful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance. For example, players will often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football, because they can tell by the feel of the act what the result will produce. Examples: Maneuvers a car into a tight parallel parking spot. Operates a computer quickly and accurately. Displays competence while playing the piano. Key Words: assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes,

sketches. NOTE: The Key Words are the same as Mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.

Adaptation[

Skills are well developed and the individual can modify movement patterns to fit special requirements. Examples: Responds effectively to unexpected experiences. Modifies instruction to meet the needs of the learners. Perform a task with a machine that it was not originally intended for that purpose (machine is not damaged and there is no danger in performing the new task). Key Words: adapts, alters, changes, rearranges, reorganizes, revises, varies.

Origination

Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills. Examples: Constructs a new set or pattern of movements organized around a novel concept or theory. Develops a new and comprehensive training program. Creates a new gymnastic routine. Key Words: arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

Definition of knowledge

In the appendix to Handbook I, there is a definition of knowledge which serves as the apex for an alternative, summary classification of the educational goals. This is significant as the taxonomy has been called upon significantly in other fields such as knowledge management, potentially out of context. Knowledge, as defined here, involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting.

Blooms revised taxonomy

Original terms	**New terms**
•Evaluation	• Creating
•Synthesis	•Evaluating
•Analysis	•Analysis
•Application	•Appling
•Comprehension	•Understanding
•Knowledge	• Remembering

Bloom's Revised Taxonomy

A group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published in 2001 a revision of Bloom's Taxonomy with the title *A Taxonomy for Teaching, Learning, and Assessment.* he authors of the revised taxonomy underscore this dynamism, using verbs and gerunds to label their categories and subcategories (rather than the nouns of the original taxonomy). These "action words" describe the cognitive processes by which thinkers encounter and work with knowledge

Creating

Generating new ideas, products, or ways of viewing thingsDesigning, constructing, planning, producing, inventing.

Evaluating

Justifying a decision or course of actionChecking, hypothesising, critiquing, experimenting, judging.

Analysing

Breaking information into parts to explore understandings and relationshipsComparing, organizing, deconstructing, interrogating, finding.

Applying

Using information in another familiar situationImplementing, carrying out, using, executing.

Understanding

Explaining ideas or conceptsInterpreting, summarising, paraphrasing, classifying, explaining.

Remembering

Recalling informationRecognizing, listing, describing, retrieving, naming, finding

Other Taxonomies of Educational Objectives

In addition to McCormack and Yager Taxonomy, Bloom's Taxonomy and Revised Bloom's Taxonomy there were also other Taxonomies of educational objectives .They were

Feisel-Schmitz Technical Taxonomy of learningoutcomes

Marzano's New Taxonomy

Romiszowski Taxonomy

SOLO Taxonomy

Objectives of physical science suggested by NCERT

1. To acquire knowledge of biological,physical and material environment
2. To develop skills of solving problem and their application to life problems,to locate problem as well as to design procedure to solve them,collect proper data and methodically organize them ,observe accurately and interpret results logically.
3. Develop scientific attitudes of mind and inculcate good personal and social habits such as objective and unbiased outlook,love for truth,inquisitiveness, accuracy and presicion, right health habits , habit of enquiry, initiative and logical thinking.
4. Develop interest and appreciation such as interest in scientific phenomena and scientific every day life and society , contributions of the scientist and their sacrificesactivity as well as scientific literature and habits ,understand the impacts of science on.

Unit - 2

Perspectives of Assessment and Evaluation

Unit - 2: Perspectives of Assessment and Evaluation
2.1. Perspective on assessment and evaluation of learning in a constructivist paradigm 2.2. Distinction between 'Assessment of Learning' and 'Assessment for Learning' 2.3. Purposes of assessment in a 'constructivist' paradigm 2.4. Critical review of current evaluation practices and their assumptions about learning and development 2.5. Evaluation as ongoing teaching-learning process and through overall performance of child.

2.1.1 Perspective on assessment and evaluation of learning in a constructivist paradigm

Constructivism is basically a theory — based on observation and scientific study — about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. In the classroom, the constructivist view of learning can point towards a number of different teaching practices. In the most general sense, it usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them. Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become "expert learners." This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students learn HOW TO LEARN.

Dimensions of Learning is a comprehensive model that uses what researchers and theorists know about learning to define the learning process. Its premise is that five types of thinking — what we call the five dimensions of learning — are essential to successful learning. The Dimensions framework will help you to

- maintain a focus on learning;
- study the learning process; and
- plan curriculum, instruction, and assessment that takes into account the five critical aspects of learning.

five dimensions of learning.

Dimension1:AttitudesandPerceptions

Attitudes and perceptions affect students' ability to learn. For example, if students view the classroom as an unsafe and disorderly place, they will likely learn little there. Similarly, if students have negative attitudes about classroom tasks, they will probably put little effort into those tasks. A key element of effective instruction, then, is helping students to establish positive attitudes and perceptions about the classroom and about learning.

Dimension2:AcquireandIntegrateKnowledge

Helping students acquire and integrate new knowledge is another important aspect of learning. When students are learning new information, they must be guided in relating the new knowledge to what they already know, organizing that information, and then making it part of their long-term memory. When students are acquiring new skills and processes, they must learn a model (or set of steps), then shape the skill or process to make it efficient and effective for them, and, finally, internalize or practice the skill or process so they can perform it easily.

Dimension3:ExtendandRefineKnowledge

Learning does not stop with acquiring and integrating knowledge. Learners develop in-depth understanding through the process of extending and refining their knowledge (e.g., by making new distinctions, clearing up misconceptions, and reaching conclusions.) They rigorously analyze what they have learned by applying reasoning processes that will help them extend and refine the information. Some of the common reasoning processes used by learners to extend and refine their knowledge are the following:

- Comparing
- Classifying
- Abstracting
- Inductive reasoning
- Deductive reasoning
- Constructing support
- Analyzing errors
- Analyzing perspectives

Dimension4:UseKnowledgeMeaningfully

The most effective learning occurs when we use knowledge to perform meaningful tasks. For example, we might initially learn about tennis racquets by talking to a friend or reading a magazine article about them. We really learn about them, however, when we are trying to decide what kind of tennis racquet to buy. Making sure that students have the opportunity to use knowledge meaningfully is one of the most important parts of planning a unit of instruction. In the Dimensions of Learning model, there are six reasoning processes around which tasks can be constructed to encourage the meaningful use of knowledge:

- Decision making
- Problem solving
- Invention
- Investigation
- Experimental inquiry
- Systems analysis

Dimension5:ProductiveHabitsofMind

The most effective learners have developed powerful habits of mind that enable them to think critically, think creatively, and regulate their behavior. These mental habits are listed below:

Critical thinking:

- Be accurate and seek accuracy
- Be clear and seek clarity
- Maintain an open mind

- Restrain impulsivity
- Take a position when the situation warrants it
- Respond appropriately to others' feelings and level of knowledge

Creative thinking:

- Persevere
- Push the limits of your knowledge and abilities
- Generate, trust, and maintain your own standards of evaluation
- Generate new ways of viewing a situation that are outside the boundaries of standard conventions

Self-regulated thinking:

- Monitor your own thinking
- Plan appropriately
- Identify and use necessary resources
- Respond appropriately to feedback
- Evaluate the effectiveness of your actions

Benefits of constructivism :

- Children learn more, and enjoy learning more when they are actively involved, rather than passive listeners.
- Education works best when it concentrates on thinking and understanding, rather than on rote memorization. Constructivism concentrates on learning how to think and understand.
- Constructivist learning is transferable. In constructivist classrooms, students create organizing principles that they can take with them to other learning settings.
- Constructivism gives students ownership of what they learn, since learning is based on students' questions and explorations, and often the students have a hand in designing the assessments as well. Constructivist assessment engages the students' initiatives and personal investments in their journals, research reports, physical models, and artistic representations. Engaging the creative instincts develops students' abilities to express knowledge through a variety of ways. The students are also more likely to retain and transfer the new knowledge to real life.

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- By grounding learning activities in an authentic, real-world context, constructivism stimulates and engages students. Students in constructivist classrooms learn to question things and to apply their natural curiousity to the world.
- Constructivism promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas. Students must learn how to articulate their ideas clearly as well as to collaborate on tasks effectively by sharing in group projects. Students must therefore exchange ideas and so must learn to "negotiate" with others and to evaluate their contributions in a socially acceptable manner. This is essential to success in the real world, since they will always be exposed to a variety of experiences in which they will have to cooperate and navigate among the ideas of others.

Unit- 3.

Overview of Assessment and Evaluation

Unit- 3. Overview of Assessment and Evaluation
3.1. Clarifying the terms _ assessment, evaluation, test, examination, measurement _ internal and external evaluation _ formative and summative evaluation _ criterion referenced and norm referenced evaluation _ continuous and comprehensive assessment _ grading. **3.2.** Kinds of tasks: projects, assignments, performances **3.3.** Kinds of tests and their constructions **3.4.** Observation of learning processes by self, by peers, by teacher; Self-assessment and peer –assessment; constructing portfolios **3.5.** Quantitative and qualitative aspects of assessment.

What is the difference between assessment and evaluation?

• Assessment focuses on learning, teaching and outcomes. It provides information for improving learning and teaching. Assessment is an interactive process between students and faculty that informs faculty how well their students are learning what they are teaching. The information is used by faculty to make changes in the learning environment, and is shared with students to assist them in improving their learning and study habits. This information is learner-centered, course based, frequently anonymous, and not graded. Assessment is the systematic collection, analysis and interpretation of information related to a particular outcome and is a long-term process. Assessment is used to evaluate the educational progression and guide us in the decision-making routine.

• Evaluation focuses on grades and may reflect classroom components other than course content and mastery level. These could include discussion, cooperation, attendance, and verbal ability.

Assessment	evaluation
Formative: Ongoing to Improve Learning	**Summative**: Final to Gauge Quality
Process-Oriented: How Learning Is Going	**Product-Oriented**: What's Been Learned
Reflective: Internally Defined Criteria/Goals	**Prescriptive**: Externally Imposed Standards
Diagnostic: Identify Areas for Improvement	**Judgmental**: Arrive at an Overall Grade/Score
Flexible: Adjust as problem clarified	**Fixed:** To reward score
Absolute: Strive for ideal outcomes	**Comparative:** Divide better from worse
Cooperative: Learn from each other	**Competitive:** Beat each other out

External evaluation. This is evaluation that is carried out by someone who is (or was) not directly involved in the development or operation of the system being evaluated, i.e. by someone from outside the project team. Clearly, such an external evaluator has a number of advantages, bringing objectivity, lack of vested interest, and the ability to look at matters from a fresh perspective. An external evaluator also has a number of disadvantages, however, most of which are related to relative value systems and to the lack of involvement the evaluator has had in project-related decisions. Such an evaluator may not, for example, fully appreciate why the development team chose to act in a particular way, or appreciate the thinking that lay behind certain decisions. The project team may also feel threatened by the evaluator, and feel that alien values or a negative, 'nit-picking' approach are being adopted.

Internal evaluation. This is evaluation that is carried out by someone from the actual project team. Clearly, such an evaluator has the advantage of understanding fully the thinking behind the

development, together with an appreciation of any problems that may have arisen, and should also command the trust and cooperation of the other members of the team. On the other hand, such an evaluator may find it difficult to make any criticisms of the work carried out, and, because of their close involvement with the project, may be unable to suggest any innovative solutions to such problems that are identified. Such an internal evaluator will know only too well how the members of the group have struggled to produce their course, curriculum or package, and may shrink from the thought of involving them in more work.

Defining Formative and Summative Assessments

Summative Assessments are given periodically to determine at a particular point in time what students know and do not know. Many associate summative assessments only with standardized tests such as state assessments, but they are also used at and are an important part of district and classroom programs. Summative assessment at the district/classroom level is an accountability measure that is generally used as part of the grading process. The list is long, but here are some examples of summative assessments:

- State assessments
- District benchmark or interim assessments
- End-of-unit or chapter tests
- End-of-term or semester exams
- Scores that are used for accountability for schools (AYP) and students (report card grades).

The key is to think of summative assessment as a means to gauge, at a particular point in time, student learning relative to content standards. Although the information that is gleaned from this type of assessment is important, it can only help in evaluating certain aspects of the learning process. Because they are spread out and occur *after* instruction every few weeks, months, or once a year, summative assessments are tools to help evaluate the effectiveness of programs, school improvement goals, alignment of curriculum, or student placement in specific programs. Summative assessments happen too far down the learning path to provide information at the classroom level and to make instructional adjustments and interventions *during* the learning process. It takes formative assessment to accomplish this.

Formative Assessment

It is part of the instructional process. When incorporated into classroom practice, it provides the information needed to adjust teaching and learning while they are happening. In this sense, formative assessment informs both teachers and students about student understanding at a point when timely adjustments can be made. These adjustments help to ensure students achieve, targeted standards-based learning goals within a set time frame. Although formative assessment strategies appear in a variety of formats, there are some distinct ways to distinguish them from summative assessments.

One distinction is to think of formative assessment as "practice." We do not hold students accountable in "grade book fashion" for skills and concepts they have just been introduced to or are learning. We must allow for practice. Formative assessment helps teachers determine next steps during the learning process as the instruction approaches the summative assessment of student learning. A good analogy for this is the road test that is required to receive a driver's license. What if, before getting your driver's license, you received a grade every time you sat behind the wheel to practice driving? What if your final grade for the driving test was the average of all of the grades you received while practicing? Because of the initial low grades you received during the process of learning to drive, your final grade would not accurately reflect your ability to drive a car. In the beginning of learning to drive, how confident or motivated to learn would you feel? Would any of the grades you received provide you with guidance on what you needed to do next to improve your driving skills? Your final driving test, or summative assessment, would be the accountability measure that establishes whether or not you have the driving skills necessary for a driver's license—not a reflection of all the driving practice that leads to it. The same holds true for classroom instruction, learning, and assessment.

Another distinction that underpins formative assessment is student involvement. If students are not involved in the assessment process, formative assessment is not practiced or implemented to its full effectiveness. Students need to be involved both as assessors of their own learning and as resources to other students. There are numerous strategies teachers can implement to engage students. In fact, research shows that the involvement in and ownership of their work increases students' motivation to learn. This does not mean the absence of teacher involvement. To the contrary, teachers are critical in identifying learning goals, setting clear criteria for success, and designing assessment tasks that provide evidence of student learning.

One of the key components of engaging students in the assessment of their own learning is providing them with descriptive feedback as they learn. In fact, research shows descriptive feedback to be the most significant instructional strategy to move students forward in their learning. Descriptive feedback provides students with an understanding of what they are doing well, links to classroom learning, and gives specific input on how to reach the next step in the learning progression. In other words, descriptive feedback is not a grade, a sticker, or "good job!" A significant body of research indicates that such limited feedback does not lead to improved student learning.

There are many classroom instructional strategies that are part of the repertoire of good teaching. When teachers use sound instructional practice for the purpose of gathering information on student learning, they are applying this information in a formative way. In this sense, formative assessment is pedagogy and clearly cannot be separated from instruction. It is what good teachers do. The distinction lies in what teachers actually do with the information they gather. How is it being used to inform instruction? How is it being shared with and engaging students? It's not teachers just collecting information/data on student learning; it's what they do with the information they collect.

Some of the instructional strategies that can be used formatively include the following:

- **Criteria and goal setting** with students engages them in instruction and the learning process by creating clear expectations. In order to be successful, students need to understand and know the learning target/goal and the criteria for reaching it. Establishing and defining quality work together, asking students to participate in establishing norm behaviors for classroom culture, and determining what should be included in criteria for success are all examples of this strategy. Using student work, classroom tests, or exemplars of what is expected helps students understand where they are, where they need to be, and an effective process for getting there.

- **Observations** go beyond walking around the room to see if students are on task or need clarification. Observations assist teachers in gathering evidence of student learning to inform instructional planning. This evidence can be recorded and used as feedback for students about their learning or as anecdotal data shared with them during conferences.

- **Questioning strategies** should be embedded in lesson/unit planning. Asking better questions allows an opportunity for deeper thinking and provides teachers with significant insight into the degree and depth of understanding. Questions of this nature engage students in classroom

dialogue that both uncovers and expands learning. An "exit slip" at the end of a class period to determine students' understanding of the day's lesson or quick checks during instruction such as "thumbs up/down" or "red/green" (stop/go) cards are also examples of questioning strategies that elicit immediate information about student learning. Helping students ask better questions is another aspect of this formative assessment strategy.

- **Self and peer assessment** helps to create a learning community within a classroom. Students who can reflect while engaged in metacognitive thinking are involved in their learning. When students have been involved in criteria and goal setting, self-evaluation is a logical step in the learning process. With peer evaluation, students see each other as resources for understanding and checking for quality work against previously established criteria.

- **Student record keeping** helps students better understand their own learning as evidenced by their classroom work. This process of students keeping ongoing records of their work not only engages students, it also helps them, beyond a "grade," to see where they started and the progress they are making toward the learning goal.

All of these strategies are integral to the formative assessment process, and they have been suggested by models of effective middle school instruction.

Norm-referenced evaluation:

A norm group is the group of individuals previously tested that provides a basis for interpreting a test score. Thus, in norm-referenced tests a student's score is interpreted by comparing it with how others performed. This provides information about a student's ability or achievement compared with others in the same age cohort. Thus a mark or a grade tells us, for example, that a student is in the top 10 percent for their age. Here, ***a student's performance is compared with others in a norm group***. The advantage of this type of assessment is that it establishes the relative position of students in relation to their peers. When entry into higher education or more prestigious occupations as limited to a relatively small percentage of the population, then this was probably an appropriate way of sorting individuals into a normal distribution curve, where the top percentile alone would be most likely to be recruited into higher education. However, the weakness of norm referencing is that it does not describe what an individual student can actually do, only their position in relation to others' performance.

Criterion-referenced evaluation:

This is where a student's performance is judged against a clear and concrete statement (the criterion) of what is expected. It requires a careful analysis of the course concerned and its learning objectives, leading to unambiguously stated criteria. Criterion referenced tests are standardized tests in which ***the student's performance is compared with established criteria or standards***. They are designed to assess students' skills and knowledge in specific areas, such as English, Math and Science. They may assess whether a student has attained a level of achievement termed proficient or reached a certain percentage level.

Evaluation:

The purpose of evaluation is to make a judgment about the quality or worth of something- an educational program, worker performance or proficiency or student attainment. The term evaluation is used to refer the product or outcome of the process.

Formative evaluation is conducted to monitor the instructional process, to determine whether learning is taking place as planned. Summative evaluation is conducted at the end of an instructional segment to determine if learning is sufficiently complete to warrant moving the learner to next segment of instruction.

The major function of formative evaluation in the classroom is to provide feedback to the teacher and to student about how things are going. Such feedback provides an opportunity for the teacher to modify instructional methods or materials to facilitate learning when feedback indicates things are not going well. Formative evaluation requires the gathering of fairly detailed information on frequent occasions. Information is obtained through teacher observation, classroom oral questioning, home assignments, and quizzes or informal inventories.

However, formal classroom tests, such as unit test or final examinations, are the frequently used tools of summative evaluation. The major function of summative evaluation in the classroom is to determine the status of achievement at the end of instructional segment, to determine how well things went. Relative to formative evaluation, there is greater finality associated with summative evaluation. The information gathered is less detailed in nature but broader in the scope of content or skills assessed.

Criteria	Formative evaluation	Summative evaluation
Purpose	Monitor progress	Check final status
Content focus	Detailed, narrow scope	General, broad scope
Methods	Observations,dailyassignments	Tests, projects
Frequency	Daily	Weekly or every 2-3 weeks

Measurement is the process of assigning numbers to individuals on their characteristics according to specified rule. It requires the use of numbers but does not require that value judgments be made about the numbers obtained from the process. We measure achievement test by counting the number of test items a student answers correctly, and we use exactly the same rule to assign a number to the achievement of each student in the class. Measurements are useful for describing the amount of certain abilities that individuals have.

Tests represent one particular measurement technique. A test is a set of questions, each of which has a correct answer, that examinees usually answer orally or in writing. Test questions differ from those used in measures of attitudes, interests or preference, or certain other aspects of personality. All tests are subset of the quantitative tools or techniques that are classified as measurements. And all measurement techniques are a subset of quantitative and qualitative tools used in evaluation.

Test and examination are used many a times interchangeably, or test is considered a mini examination, for example, monthly test and annual examination. Test is basically a tool (for example, intelligence test, aptitude test, achievement test, etc.) and examination is the process. Measurement is depicted by a numeral and the unit (if need be) in which a quantity is measured, i.e. 5 cm, 10 kg or 15g, etc. After you get the tests conducted in a laboratory, you get a report which contains measurement(s) (numerals + units) of tested parameters. For example, your haemoglobin value is 16 gm/dl (deciliter). Along with these, there is another column in the report, which assigns certain meaning to these measurements, i.e. below normal, normal, above normal, etc. Thus, assigning meaning to a measurement is called assessment, which may be quantitative as well as qualitative, and final conclusion drawn on the basis of several assessments along with value judgement is called evaluation.

Grading

It means translating descriptive assessment information into letters, numbers, or other marks that indicate the quality of a student's learning or performance.

Grading is carried out to communicate meaningful information about a student's learning and achievement. In this process, grades serve four basic purposes :

- *Administrative.* Grades help determine students' class rank, credits for graduation, and whether a student should be promoted to the next grade.
- *Informational.* Grades can be used to communicate with students, parents, and others (such as admissions officers for subsequent schooling) about a student's work. A grade represents the teacher's overall conclusion about how well a student has met instructional objectives and learning targets.
- *Motivational.* Many students work harder because they are extrinsically motivated by a desire for high grades and a fear of low grades.
- *Guidance.* Grades help students, parents, and counselors to select appropriate courses and levels of work for students. They provide information about which students might require special services and what levels of future education students will likely be able to handle.

In educational measurement, grading involves the use of a setof symbols to communicate the level of achievement of the students.

Types of grading

(a) Direct Grading: In direct grading, the performance exhibited byan individual is assessed in qualitative terms and the impression soobtained by the examiner is directly expressed in terms of letter grades.The advantage of direct grading is that it minimises the inter-examinervariability. Moreover, it is easier to use in comparison to indirectgrading. Direct grading, however,may lack transparency.

(b) Indirect Grading: In this method, the performance of an examineeis first assessed in terms of marks and subsequently transformed intoletter grades by using different modes. This transformation may becarried out in terms of both 'absolute grading' and 'relative grading'as discussed below:

(i) Absolute Grading: Absolute grading is based on a pre-determinedstandard that becomes a reference point for assessment of students'performance. It involves direct conversion of marks into grades,irrespective of the distribution of marks in a subject. It is just likecategorisation of students into five groups, namely, distinction (75%and above), first division (60% and less than 75%),

second division(45% and less than 60%), third division (33% and less than 45%) andunsatisfactory (Below 33%).It is possible to divide the absolute grading into any number ofcategories. Though, the range of marks may be the same in differentsubjects in each of the category, the grades so awarded are notcomparable as the marks themselves are not comparable. The number of students placed in different categories will differ from subject to subject and from year to year making them incomparable. An example of absolute grading is given below:

S.No	Letter of Grade	Range of Marks	Description
1.	A	90% and above	Outstanding
2.	B	80% to 89%	Excellent
3.	C	70% to 79%	Very Good
4.	D	60% to 69%	Good
5.	E	50% to 59%	Above Average
6.	F	40% to 49%	Average
7.	G	30% to 39%	Below Average
8.	H	20% to 29%	Marginal
9.	I	Below 20%	Unsatisfactory

This method is simple and straight forward. Meaning of each grade is distinctly understandable. Each student has the freedom to strive for the attainment of the highest possible grade, as the classification of grades is pre-announced. The limitation of this method is that the distribution of scores is taken on its face value regardless of the errors of measurement creeping in due to various types of subjectivity.

(ii) Relative Grading: Relative grading is generally used in public examination. In this system, grade of a student is decided not by her performance alone rather than performance of the group. This type of grading is popularly known as 'grading on the curve.' The curve refers to the normal distribution curve or some symmetric variant of it. This method amounts to determine in advance approximately what percentage of students can be expected to receive different grades, namely, A, B, C and so on with reference to a specific group. If the perceived curve is transformed into a normal curve, it allows us to categorise the obtained scores into any desired number of gradesin a scientific manner. If we decide to use a nine point grade system, we may simply divide the entire measurement scale into nine (5 or 7

or 11) equal parts.

The advantages of relative grading are as follows:

- Performance of individual student is rated in terms of grades andno grade signifies the failure of students, thereby eliminating thenegative effect of pass/fail.

- Grades indicate the relative position of an individual with referenceto her peer group, serving the purpose of norm-referencing, i.e.whether the individual student has performed better or worse thanother students.
- Test difficulty does not affect the distribution of grades.

Self assessment

Since assessment is part of the learning process,students themselves can and also need to play an important role in assessing their own learning and progress in knowledge, skills, interests, attitudes, etc. Teachers can help students assess themselves by enabling them to develop a better understanding of process of learning by involving them in critically looking at their own work and performance.

Peer assessment

Refers to one student assessing other students. This can be conducted in pairs or in groups.

Quantitative studies:

Quantification has been described as a numerical method of describing observations of materials or characteristics. Scientists distinguish among four levels of measurement:

Nominal scale:

A nominal scale is the least precise method of quantification. A nominal scale describes differences between things by assigning them to categories. Nominal data are counted data.

Ordinal scale:

Ordinal scales permit he ranking of items or individuals from highest to lowest. The criterion for highest to lowest ordering is expressed as relative position or rank in a group: 1^{st}, 2^{nd}, 3^{rd}, 4^{th},...n^{th}. Ordinal measures have no absolute values, and the real differences between adjacent ranks may not be equal ranking spaces them equally though they are not equally spaced.

Interval scale:

An arbitrary scale based on equal units of measurements indicates how much of a given characteristic is present. The interval scale represents a decided advantage over nominal and ordinal

scales because it indicates the relative amount of trait or characteristic. Its primary limitation is the lack of a true zero. It does not have the capacity to measure the complete absence of a trait.

Ratio scale:

A ratio scale is the most precise scale of measurement. It has the equal interval properties of an interval scale but has two additional features:

1. The ratio scale has a true zero. It is possible to indicate the complete absence of a property. For example, the zero point on the centimeter scale indicates the complete absence of length or height.
2. The numerals of the ratio scale have the qualities of real numbers and can be added, subtracted, multiplied and divided and expressed in ratio relationships.

Qualitative studies:

Qualitative studies are those in which the description of observations is not ordinarily expressed in quantitative terms. It is not that numerical measures are never used but that other means of description are emphasized. When the researcher gathers data by participant observation, interviews and the examination of documentary materials, little measurement may be involved. However, observations may be classified into discrete categories, yielding nominal data level.

Unit- 4

Tools and Techniques of Assessment for Learning Physical Science

Unit- 4: Tools and Techniques of Assessment for Learning Physical Science
4.1. Performance-based assessment, developing indicators for performance based assessment in physical science, learners' records of observations, field diary; Oral presentation of learners work, Portfolio. 4.2. Assessment of assignment and seminars in physical science 4.3. Assessment of project work in physical science 4.4. Assessment of participation in collaborative learning 4.5. Assessment of experimental work in Physical science 4.6. Construction of test items in Physical Science and administration of tests:Different types of test items-merits and demerits; Consrtuction and administration of Achievement tests and Diagnostic tests; Blue print(Mc Comark& Yager Taxonomy Using Learning outcomes and/or process).Qualities of a good test 4.7. Exploring content areas in physical science not assessed in formal examination system and their evaluation through various curricular channels. Evaluation of non-cognitive areaslike creativity, skill, attitude in science learning contexts

Perfomance based assessment

For a learner-centred approach to assessment, more focus should be given to assess learner's individual performance. The performance of one learner should not be compared with that of other learner. Learner's existing ideas, misconceptions, naive concepts, and her performance should be communicated to her in order to improve her performance. The emphasis should be given to assess learner's individual progress based on her skills, attitude, approach and ability which are changed during learning process. Opportunity for feedback leading to revision and improvement of performance should constantly be available without examination and evaluation being used as a threat to study.

Tasks that are challenging and allow independent thinking, and multiple ways of being solved, encourages independence, creativity and self-discipline in learners. Instead of a culture of

quizzing of answers quickly and always knowing the right answer, we need to allow learners to spend time on deeper and meaningful learning. For this purpose,performance-based assessment (PBA) can be one of the modes of school based assessment. Teacher can devise a number of ways to make such internal assessment more credible. Performance-based assessment provides learners to:

1. get actively engaged in teaching-learning process;
2. develop their critical thinking and problem solving skills; and
3. get encouraged to learn and excel in their performance of task as they are free to originate and apply their own ideas.

Performance-based assessment consists of two parts—a task that is open-ended and a set of learning indicators (LI) for assessment. A well designed performance-based programme focuses on students' ability to integrate what they have learnt creatively; ability to work collaboratively and their written and oral expression skills.

The purpose of assessment is necessarily to improve process and materials of the teaching – learning.

Types of indicators

A number of sets of learning indicators of science have been suggested to facilitate the teachers in continuous and comprehensive assessment in day-to-day teaching. These indicators are only a broad framework. Teacher may select various learning indicators depending on the learner's performance and teaching learning experiences provided to them.

Assessment of collaborative learning

Activities, experimental work, projects, field trips and various other learning experiences provide an opportunity to work in groups and help in developing a positive attitude towards group work, sharing and learning from each other.

The learning indicators are:

- Content knowledge of the activity/project.
- Putting forth her views with reasoning.
- Proper communication skills, i.e. speaking/writing
- Respect for other members of the group.
- Proper body language while interacting

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These can be used for the assessment of learners' proficiency in various activities of learning processes. The indicators can be varied, modified or altered according to the need of the situation. It saves time spent by a teacher on assessment. Assessment is authentic with much scope of flexibility and consideration for a heterogeneous classroom. Performance of the learner can be shown qualitatively or

in terms of grades in each area of learning. It also helps learners to know their strengths and challenges. Different indicators of learning for various learning experiences may be developed with the help of students for providing a sense of ownership of learning to them and giving them opportunity of self-assessment.

Project work

A project work is a planned and definitely formulated piece of study involving a task or problem taken up by the learner either individually or in a group, to supplement and apply classroom and laboratory learning. It follows the approach of *Learning by Doing* and *Learning by Living*. Project work attempts to promote problem solving, creativity and spirit of inquiry in science. Project work is a more or less open-ended activity and its type depends on the nature of the task.

Learning Indicators (LI)	**Tasks specific to indicators**
Creativity	□ How unique is the project? □ Is the project age appropriate and within the cognitive level of the child? □ Is it student's original idea or suggested by parent or a teacher or a senior student.
Understanding of the topic	□ Understanding of the objectives of the project. □ Investigation of the literature for the project. □ Mention of references/bibliography used in the project.

Investigative procedure	□ Suitable answers to the original questions. □ Appropriateness of the procedure. □ Completeness of information collected. □ Accuracy of the conclusions
Quality of the project display	□ How organised is the display of the project? □ Are Tables, graphs and illustrations used effectively in interpreting data? □ Are conclusions justified on the basis of experimental data? □ Is the help of the group members, teachers, parents and others acknowledged?
Presentation	□ Is there clarity in the written and oral presentation regarding their investigation? □ Were they able to communicate clearly the nature of problem and how they could arrive at the conclusion. □ How did they respond to the answers and questions raised by the class and the teacher related to their project?

Each project should be evaluated on its own merits and not in competition with other projects. Ability, interest and background of the student should be given full consideration while evaluating the project.

Field trips and field diary

Field trips are actually the first-hand study of many things which cannot be brought into the classroom. A well organized field trip enriches educational experiences of all students learning with different paces and styles. Students should know well in advance that where they are going; why are they going; and what are they going to do, etc. Some field experiences need only a few minutes for completion and can be done within the limit of a class period. Usually less preparation and planning are required if visits are arranged within school boundaries.

While evaluating, the teacher should:

- see whether the students are able to relate the field experience to the concept that had already been discussed in the classroom. Teacher should set problems, experiments, review content on the basis of field trip;
- check the observations written by the students in their field diary; and
- initiate the discussion about what all they have noted in their field diary and what all they have learnt from the field trip.

Laboratory work

Experiments play a crucial role in the progress of science. A large number of path-breaking discoveries and inventions have been possible through investigations done usually in laboratories. The experimental work is, therefore, an essential component of any course in science.

Following points must be kept in mind while assessing the students regarding laboratory work:

- Collecting and using right apparatus/equipment.
- Drawing ray diagram/circuit diagram and planning appropriate procedure.
- Observing and collecting data systematically.
- Calculating the physical quantity using proper unit and significant figure.
- Interpreting the data and deriving the conclusion.
- Building up essential technical and process skills.
- Recording and reporting data honestly and supported with graph(s) and figure(s).

- Posing inquiry-based questions.

Observing the laboratory rules including safety rules properly.Behaving properly in the laboratory. In addition to oral questions, laboratory notebooks are also used by the teacher to assess learners' experimental work. Oral and written questions can be designed based on the activities, experiments and technological modules for testing students' critical understanding, problem solving and inquiry skills. Their performance in these activities should be assessed as an ongoing process.

Portfolio

A *portfolio* consists of a systematic and organized collection of a student's work that demonstrates the student's skills and accomplishments. A portfolio is a purposeful collection of work that tells the story of the student's progress and achievements .It is much more than a compilation of student papers stuff ed into a manila folder or a collection of memorabilia pasted into a scrapbook. To qualify for inclusion in a portfolio, each piece of work should be created and organized in a way that demonstrates progress and purpose. Portfolios can include many diff erent types of work, such as writing samples, journal entries, videotapes, art, teacher comments, posters, interviews, poetry, test results, problem solutions, recordings of foreign language communication, self-assessments, and any other expression of the student that the teacher believes demonstrates the student's skills and accomplishments. Portfolios can be collected on paper, in photographs, and on audiotape, Videotape, computer disk, or CD-ROM. Assessment expert Joan Herman Says that portfolio assessment has become increasingly popular because it is a natural way to integrate instruction and assessment.

It is a systematic collection of work, often including work in progress, revisions, student self analysis and reflections on what the students has learned.

Written work or artistic pieces are common contents of portfolios, but student include graphs, diagrams, snapshots of displays, peer compliments, neither audio nor video types, laboratory reports anything that demonstrates learning in the area being taught and assessed. . There is a distinction between process portfolios and final portfolios. The distinction is similar to the difference between formative and summative evaluation. Process portfolios document learning and show progress. Final portfolios showcase final accomplishments

Test items

- Asking open-ended questions

Observing the laboratory rules including safety rules properly. Behaving properly in the laboratory. In addition to oral questions, laboratory worksheets are also used by the teacher to assess students' experimental work. Oral and written questions can be designed based on the activities, experiments and worksheets/lab manuals for testing students' critical understanding, problem solving and inquiry skills. Their performance in these activities should be assessed as an ongoing process.

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Test items

Mainly test items can be of two types (1) selected response items and (2) constructed-response items.

Selected-response items

Selected-response items have an objective format that allows students' responses to be scored quickly. A scoring key for correct responses is created and can be applied by an examiner or by a computer. Multiple choice, true/false, and matching items are the most widely used types of items in selected-response tests.

Multiple-Choice Items

A **multiple-choice item** consists of two parts: the stem plus a set of possible responses. The *stem* is a question or statement. Incorrect alternatives are called *distractors.* Th e student's task is to select the correct choice from among the distracters

Strengths

1. Both simple and complex learning outcomes can be measured.
2. The task is highly structured and clear.
3. A broad sample of achievement can be measured.
4. Incorrect alternatives provide diagnostic information.
5. Scores are less influenced by guessing than true/false items.
6. Scoring is easy, objective, and reliable.

Limitations

1. Constructing good items is time consuming.
2. It is frequently difficult to find plausible distractors.
3. The multiple-choice format is ineffective for measuring some types of problem solving and the ability to organize and
express ideas.
4. Score can be influenced by reading ability.

True/False Items A true/false item asks a student to mark whether a statement is true or false The ease with which true/false items can be constructed has a potential drawback.Teachers sometimes take statements directly from a text or modify them slightly when making up true/false

items. Avoid this practice, because it tends to encourage rote memorization with little understanding of the material.

The strengths and limitations of true/false items are

Strengths

1. It is difficult to write items at a high level of knowledge and thinking that are free from ambiguity.
2. When a statement indicates correctly that a statement is false, that response provides no evidence that the student knows what is correct.
3. No diagnostic information is provided by the incorrect answers.
4. Scores are more influenced by guessing than with any other item type.

Limitations

1. The item is useful for outcomes where there are only two possible alternatives (for example, fact or opinion, valid or invalid).
2. Less demand is placed on reading ability than in multiple-choice items.
3. A relatively large number of items can be answered in a typical testing period.
4. Scoring is easy, objective, and reliable.

Matching Items

Matching requires students to connect one group of stimuli correctly with a second group of stimuli . Matching is especially well suited for assessing associations or links between two sets of information. In a typical matching format, a teacher places a list of terms on the left side of the page and a description or definition of the terms on the right side of the page. The student's task is to draw lines between the columns

that correctly link terms with their definitions or descriptions. In another format, a space is left blank next to each term, in which the student writes the correct number or letter of the description/definition. When using matching, limit the number of items to be matched to no more than eight or ten. Using no more than five or six items per set is a good strategy.

Matching tests are convenient for teachers in that (1) their compact form requires little space, thus making it easy to assess quite a lot of information efficiently, and (2) they can be easily scored by using a correct-answer template . But matching tests may tend to ask students to connect trivial information. Also, most matching tasks require students to connect information they have simply memorized, although items can be constructed that measure more complex cognitive skills.

Constructed-response items

Constructed-response items require students to write out information rather than select a response from a menu. Short-answer and essay items are the most commonly used forms of traditional constructed-response items. In scoring, many constructedresponse items require judgment on the part of the examiner.

Short-Answer Items

A **short-answer item** is a constructed-response format in which students are required to write a word, a short phrase, or several sentences in response to a task. For example, a student might be asked, "Who discovered penicillin?"

The short-answer format allows recall and could provide a problem-solving assessment of a wide range of material. The disadvantages of short-answer questions are that (1) they can require judgment to be scored and (2) they typically measure rote learning.

Sentence completion is a variation of the short-answer item in which students express their knowledge and skill by completing a sentence. For example, a student might be asked to complete this sentence stem: The name of the person who discovered penicillin is .

Essays

An **essay item** allows students more freedom of response to questions but requires more writing than other formats. Essay items are especially good for assessing students' understanding of material, higher-level thinking skills, ability to organize information, and writing skills. Here are some examples of high school essay questions:

What are the strengths and weaknesses of a democratic approach to government?

Describe the main themes of the novel you just read.

Argue that the United States is a gender-biased nation.

Essay items can require students to write anything from a few sentences to several pages. In some cases teachers ask all students to answer the same essay question(s). In others, teachers let students select from a group of items the item(s) they want to write about, a strategy that makes it more diffi cult to compare diff erent students' responses.

Suggestions for writing good essay items include these

- *Specify limitations.* Be sure to specify the length of the desired answer and the weight that will be given to each item in determining scores or judgments.

• *Structure and clarify the task.* Make clear what they are supposed to write about. A poorly worded item is "Who was George Washington?" This could be answered in six words: "First president of the United States." In

cases like this, ask yourself what more you want the student to tell. The following more-structured essay item requires more thinking on the part of the student:

Discuss several events in the life of George Washington that confirm or disprove the claim that "he never told a lie." Use the events to support a claim of your own about how truthful Washington was.

• *Ask questions in a direct way.* Don't get too tricky. You might hear the term *rubric* used in regard to scoring students' responses on essays and other tests.

Strengths

1. The highest level of learning outcomes (analysis, synthesis, evaluation) can be measured.
2. The integration and application of ideas can be emphasized.
3. Preparation time is usually less than for selection-type formats.

Limitations

1. Achievement may not be adequately sampled due to the time needed to answer each question.
2. It can be difficult to relate essay responses to intended learning outcomes because of freedom to select, organize, and express ideas.
3. Scores are raised by writing skill and bluffing, and lowered by poor handwriting, misspelling, and grammatical errors.
4. Scoring is time consuming, subjective, and possibly unreliable.

Characteristics of a good test

1. Valid: it means that it measures what it is supposed to measure.
2. Reliable: if it is given twice to same students under the same circumstances, it will produce almost the same results. In this case it is said that the test provides consistency in measuring the items being evaluated.
3. Practical: it is easy to score without wasting too much time or effort.
4. Comprehensive: it covers all the items that have been taught or studied.
5. Relevant: it measures reasonably well the achievement of the desired objectives.
6. Balanced: it tests linguistics as well as communicative competence and it reflects the real command of the language. It tests also appropriateness and accuracy.

7. Appropriate in difficulty: it is neither too hard nor too easy. Questions should be progressive in difficulty to reduce stress and tension.
8. Clear: Questions and instructions should be clear. Pupils should know what to do exactly.
9. Authentic: The language of the test should reflect everyday discourse.
10. Appropriate for time: A good test should be appropriate in length for the allotted time.
11. Objective: If it is marked by different teachers, the score will be the same. Marking process should not be affected by the teacher's personality. Questions and answers are so clear and definite that the marker would give the students the score he/she deserves.
12. Economical: It makes the best use of teacher's limited time for preparing and grading and it makes the best use of the pupil's assigned time for answering all items. so , we can say that oral exams in classes of 30+ students are not economical as it requires too much time and effort to be conducted.

Unit-5

Technology in assessment

Unit-5 Technology in assessment
5.1. Technology in Assessment: Computer Assisted Assessment, online assessment, e-portfoliodownloading Online tools and rubrics for e-materials and activities

Computer assisted assessment

Computer Assisted assessment (CAA) is a common term for the use of computers in the assessment of student learning. "computer-assisted assessment" is a term that covers all forms of assessment, whether summative (i.e. tests that will contribute to formal qualifications) or formative (i.e. tests that promote learning but are not part of a course's marking), delivered with the help of computers. This covers both assessments delivered on computer, either online or on a local network, and those that are marked with the aid of computers, such as those using Optical Mark Reading (OMR).

Computer-aided assessment can be viewed in a few different ways. Technically, assignments that are written on a computer and researched online are computer-aided assessments. One of the most common forms of computer-aided assessment (in terms of e-learning) is online quizzes or exams. These can be implemented online, and also marked by the computer by putting the answers in.

It is also envisaged that computer-based formative assessment, in particular, will play an increasingly important role in learning, with the increased use of banks of question items for the construction and delivery of dynamic, on-demand assessments. This can be witnessed by current projects such as the SQA's SOLAR Project.

Implementation

Computer Based Assessment is commonly directly made via a computer, whereas Computer Assisted Assessment is used to manage or support the assessment process. Examples are the optical mark reader used to score MCQs and database programs used to record student marks.

Formative versus Summative

Computer Assisted Assessment is typically formative, in that it helps students to discover whether they have learned what the educator intended and provide timely feedback on how best to teach a subject. Increasingly, it can be summative, with limited feedback typically being given at the end of a course and serving to grade and categorise the student's work. It can also be diagnostic, eg. by testing for pre-knowledge.

Norm Referenced versus Criteria Testing

Assessment techniques are usually either norm referenced or criterion referenced. Computer Assisted Assessment is usually criterion referenced.

Advantages

Well-written computer assisted testing is more likely to be objective testing: testing that can be marked objectively and thus offer high reliability. The benefit is that the tests can be marked quickly and easily, and adapted to meet a wide range of learning outcomes. Tests have the following potential:

- To incorporate a wide range of media;
- To link online assessments to feedback;
- To incorporate hints into test questions;
- To assign other learning activities based on the test result;
- To make randomised selection can be made from large question banks;
- To be administrated easily, allowing better test management.

Disadvantages

CAA can have the following limitations:

- It is usually associated with testing knowledge skills rather than conceptual understanding, because of the frequent use of MCQ formatting, which is believed to test at a lower level of understanding when related to Bloom's Taxonomy;
- Construction of good objective tests requires skill and practice and so is initially time consuming;
- Implementation of a CAA system can be costly;
- Hardware and software must be carefully monitored to avoid failure during examinations;
- Security issues can be a problem in Web based CAA;
- Students require adequate IT skills and experience of the assessment type;

- Assessors and invigilators need training in assessment design, IT skills and examination management;
- A high level of organisation is required of all parties involved in assessment (academics, support staff, computer services, administrators).

Recent Developments

Computer assisted assessment of higher order skills such as comprehension, application and reasoning is difficult. Recent research has produced an improvement in CAA's ability to test these skills, and allowed for its implementation of the tools on the Web. Areas for development include graphical hotspot questions, which involve selecting an area of the screen by moving a marker to the required position. Text assessment is also being developed.

A number of institutional Computer Based Assessment development projects (many funded by higher education initiatives) offer free or relatively inexpensive assessment tools, which do not require the purchase of costly licences. One example is the CASTLE toolkit, part of the Book of Talent, which has been developed so that Tutors and Course managers can create on-line interactive assessment tools quickly and easily without any prior knowledge of HTML, CGI , or scripting languages.. Its aim is to provide a High Level Authoring Shell for online Interactive Tutorials and Assessment, by developing a comprehensive courseware authoring tool, which will enable tutors to produce and maintain on-line Web pages. This should enhance the learning resources available to the student, whilst requiring a fairly minimal time investment on behalf of the tutor or course developer.

Can I use it in my subject area?

It is important to consider whether CAA technology is the appropriate method of assessment. If the decision is taken to implement CAA, it should probably only be used for part of the course's assessment strategies. Identify the pedagogical approach and don't rely on one method of assessment. Though there is a bias towards science and technology subjects in the use of CAA, there are increasing examples of its employment in other disciplines.

Online assessment

Online assessment is the process used to measure certain aspects of information for a set purpose where the assessment is delivered via a computer connected to a network. Different types of online assessments contain elements of one or more of the following components, depending on the assessment's purpose: formative, diagnostic, or summative. Instant and detailed feedback, as well as flexibility of location and time, are just two of the many benefits associated with online assessments. There are many resources available that provide online assessments, some free of charge and others that charge fees or require a membership. Online Assessments consist of several tests or questionnaires to be completed by the candidate. . For example, an Online Assessment could consist of tests for memory and concentration as well as for language skills and could also include a personality questionnaire. It is often possible for you to choose the order in which you do the tests. It is usually not necessary to complete all the tests in one sitting, but rather you can take breaks between the tests.

Types of online assessments

Online assessment is used primarily to measure cognitive abilities, demonstrating what has been learned after a particular educational event has occurred, such as the end of an instructional unit or chapter. When assessing practical abilities or to demonstrate learning that has occurred over a longer period of time an online portfolio (or ePortfolio) is often used. The first element that must be prepared when teaching an online course is assessment. Assessment is used to determine if learning is happening, to what extent and if changes need to be made.

Uses of online assessments

Pre-Testing - Prior to the teaching of a lesson or concept, a student can complete an online pretest to determine their level of knowledge. This form of assessment helps determine a baseline so that when a summative assessment or post-test is given, quantitative evidence is provided showing that learning has occurred.

Formative Assessment - Formative assessment is used to provide feedback during the learning process. In online assessment situations, objective questions are posed, and feedback is provided to the student either during or immediately after the assessment.

Summative Assessment - Summative assessments provide a quantitative grade and are often given at the end of a unit or lesson to determine that the learning objectives have been met.

Practice Testing - With the ever-increasing use of high-stakes testing in the educational arena, online practice tests are used to give students an edge. Students can take these types of assessments multiple times to familiarize themselves with the content and format of the assessment.

Surveys - Online surveys may be used by educators to collect data and feedback on student attitudes, perceptions or other types of information that might help improve the instruction.

Evaluations - This type of survey allows facilitators to collect data and feedback on any type of situation where the course or experience needs justification or improvement.

Performance Testing - The user shows what they know and what they can do. This type of testing is used to show technological proficiency, reading comprehension, math skills, etc. This assessment is also used to identify gaps in student learning.

New technologies, such as the Web, digital video, sound, animations, and interactivity, are providing tools that can make assessment design and implementation more efficient, timely, and sophisticated.

Academic Dishonesty

Online classroom environments are no exception to the possibility of academic dishonesty. It can easily be seen from a student's perspective as an easy passing grade. Proper assignments types, meetings and projects can prevent academic dishonesty in the online classroom. However online assessment may provide additional possibilities for cheating, such as hacking.To prevent identity fraud in an online class, instructors can use proctored exams through the institutions testing center or require students to come in at a certain time for the exam. Correspondence through the phone or video conferencing techniques can allow an instructor to become familiar with a student through their voice and appearance. Another option would be personalize assignments to students backgrounds or current activities. This allows the student to apply it to their personal life and gives the instructor more assurance the actual student is completing the assignment. Lastly, an instructor may not make the assignments heavily weighted so the students do not feel as pressured.

Plagiarism is the misrepresentation of another person's work. It is easy to copy and paste from the internet or retype directly from a source. It is not only the exact wordage, but the thought or idea. It is important to learn to properly cite a source when using someone else's work.

Various websites are available to check for plagiarism for a fee.

www.canexus.com, www.catchitfirst.com, www.ithenticate.com, www.mydropbox.com,

e- portfolio

"In general ,an ePortfolio is a purposeful collection of information and digital artifacts that demonstrate development or evidences learning outcomes, skills or competencies. The process of producing an ePortfolio (writing, typing, recording etc.) usually requires the synthesis of ideas, reflection on achievements, self- awareness and forward planning ; with the potential for educational , development or other benefits. Specific types of ePortfolios can be defined in part by their purpose (such as presentation , application, reflection, assessment and personal development planning) ,pedagogic design, level of structure (intrinsic or extrinsic) ,duration (episodic or life-long) and other factors."An electronic portfolio is also known as an eportfolio, e-portfolio, digital portfolio, or online portfolio .It is a collection of electronic evidence assembled and managed by a user, usually on the Web.. E-portfolios are both demonstrations of the user's abilities and platforms for self-expression, and, if they are online, they can be maintained dynamically over time.An e-portfolio can be seen as a type of learning record that provides actual evidence of achievement. E-portfolios, like traditional portfolios, can facilitate students' reflection on their own learning, leading to more awareness of learning strategies and needs. Results of a comparative research, by M. van Wesel and Prop, between paper-based portfolios and electronic portfolios in the same setting, suggest use of an electronic portfolio leads to better learning outcomes.

Types

There are three main types of e-portfolios, although they may be referred to using different terms:

- developmental (e.g., working)
- assessment
- showcase

A developmental e-portfolio can show the advancement of skill over a period of time rubrics. The main purpose is to provide an avenue for communication between student and instructor. An assessment portfolio will demonstrate skill and competence in a particular domain or area. A showcase portfolio highlights stellar work in a specific area, it is typically shown to potential employers to gain employment. When it is used for job application it is sometimes called career portfolio. Most e-portfolios are a mix of the three main types to create a hybrid portfolio.

Usage

Today. electronic portfolios are gaining popularity in:

- Schools
- Higher education
- Continuing professional development
- Job applications/professional advertisements
- Therapy groups
- Assessment
- Accreditation
- Recognition of prior learning (RPL)

E-portfolios in Education

In education the electronic portfolio is a collection of a students' work that can advance learning by providing a way for them to organize, archive, and display work. The electronic format allows an instructor to evaluate student portfolios via the Internet, CD-ROM, DVD, or zip disk. Electronic portfolios have become a popular alternative to paper-based portfolios because they provide the opportunity to review, communicate and give feedback in an asynchronous manner. In addition, students are able to reflect on their work, which makes the experience of creating the e-portfolio meaningful. A student e-portfolio may be shared with a prospective employer or used to record the achievement of program or course specific learning outcomes.

In education e-portfolios have six major functions:

- Document skills and learning;
- Record and track development within a program;
- Plan educational programs;
- Evaluate and monitor performance;
- Evaluate a course;
- Find a job

In general e-portfolios promote critical thinking and support the development of technology literacy skills. Faculty now use e-portfolios to record course or discipline designs that may be shared with

colleagues to promote teaching and learning. A teaching e-portfolio is used to showcase career accomplishments.

Best practices have been developed to guide e-portfolio use in college classrooms. Faculty is encouraged to use e-portfolios to foster collaborative learning environment where more competent students can provide feedback to peers. When students are given the opportunity to guide others it facilitates peer –to-peer learning and deeper understanding of the lesson. Next generation education e-portfolios like *Digication* can assist students to archive information that is specific to each lesson in a course. Using e-portfolios in this way promotes data and knowledge curation and assists students in conducting research in an organized and discriminating way.

E-portfolios also help to foster an independent and autonomous way of thinking, according to Strivens. This is in large part because people must focus on their collective work, think about how it will be portrayed, and what the work says about them as an individual. The individual is then in charge of their learning and the choice of where to demonstrate their proficiency. People are also forced to reflect on what they have learned and how they plan to build and improve in the future. This helps people to become better critical thinkers and helps them to develop their writing and multimedia skills. Today, many students are using multimedia such as Facebook, Twitter, and texting—all informal settings. The electronic portfolio, on the other hand, is a more formal setting where students must apply both their knowledge of how the web works and the message they want to convey. In this sense, students' use and comfort with the web at times can he a hindrance if they are not taught to use electronic portfolios in the correct fashion, suggests Lane.[7] Many universities and schools are currently working to make sure that students are gaining practice and experience with electronic portfolios so that they are able to use them to the best of their ability.

Downloading online tools and rubrics for e-materials and activities

In education terminology, *rubric* means "a scoring guide used to evaluate the quality of students' constructed responses". Rubrics usually contain evaluative criteria, quality definitions for those criteria at particular levels of achievement, and a scoring strategy. They are often presented in table format and can be used by teachers when marking, and by students when planning their work.

A scoring rubric is an attempt to communicate expectations of quality around a task. In many cases, scoring rubrics are used to delineate consistent criteria for grading. Because the criteria are public, a scoring rubric allows teachers and students alike to evaluate criteria, which can be complex and subjective. A scoring rubric can also provide a basis for self-evaluation, reflection, and peer review.

It is aimed at accurate and fair assessment, fostering understanding, and indicating a way to proceed with subsequent learning/teaching. This integration of performance and feedback is called ongoing assessment or formative assessment

Several common features of scoring rubrics can be distinguished ,they are

- focus on measuring a stated objective (performance, behaviour, or quality)
- use a range to rate performance
- contain specific performance characteristics arranged in levels indicating either the developmental sophistication of the strategy used or the degree to which a standard has been met.

Elements of a scoring rubric are :

- One or more traits or dimensions that serve as the basis for judging the student response
- Definitions and examples to clarify the meaning of each trait or dimension
- A scale of values on which to rate each dimension
- Standards of excellence for specified performance levels accompanied by models or examples of each level.

There's something special about connecting with somebody live through the internet via video. Watching pre-recorded videos is a great educational technique. Teaching classes online through live video is good because it can show things that can't express through words.

Unit 6

Data Analysis, Feedback and Reporting

Unit 6: Data Analysis, Feedback and Reporting
6.1. Statistical tools—Percentage, graphical representation, frequency distribution, central tendency, variation, normal distribution, percentile rank, correlation and their interpretation 6.2. Feedback as an essential component of formative assessment, Use of assessment for feedback, For taking pedagogic decisions, Types of teacher feedback (written comments, oral), Peer feedback 6.3. Reporting- Place of marks, grades and qualitative descriptions-Developing and maintaining a comprehensive learner profile- Purposes of reporting-Reporting a consolidated learner profile.

6.1. Statistics:

Statistics is a body of mathematical techniques or processes for gathering, organizing, analysing, and interpreting numerical data. It is a basic tool for measurement, evaluation and research.

Parametric and non-parametric data:

In the application of statistical treatments, two types of data are recognized:

1. Parametric data: Data of this type are measured data, and parametric statistical tests assume that the data are normally, or nearly normally distributed. Parametric tests are applied to both interval and ratio scaled data.
2. Non-parametric data: Data of this type are either counted (nominal) or ranked (ordinal).

Statistical measures:

Several basic types of statistical measures are appropriate in describing and analysing data in a meaningful way:

1. Measures of central tendency or averages

- Mean
- Median
- Mode

2. Measures of spread or dispersion
    - Range
    - Variance
    - Standard deviation
3. Measures of relative position
    - Standard scores
    - Percentile rank
    - Percentile score
4. Measures of relationship
    - Coefficient of correlation

Mean:

The mean of a distribution is the arithmetic average. It is computed by dividing the sum of all the scores by the number of scores.

Mean = sum of scores in a distribution / number of scores

The man is probably the most useful of all statistical measures, for in addition to the information that it provides, it is the base from which many other important measures are computed.

Median:

The median is a point in an array, above and below which one half of the scores fall. It is a measure of position rather than of magnitude and is frequently found by inspection rather than by calculation. When there are an odd number of untied scores, the median is the middle score. When there are an even number of untied scores, the media is the mid-point between the two middle scores. If the data include tied scores at the median point, interpolation within the tied scores is necessary. Each integer would represent the interval from halfway between it and the next higher score.

One purpose of the mean and median is to represent the 'typical' score; most of the time it is satisfactory to use the mean for this purpose. However when the distribution of scores is such that most scores are at one end and relatively few are at other (known as skewed distribution), the

median is preferable because it is not influenced by extreme scores at either end of the distribution. Thus, in skewed distributions, the median is the more realistic measure of central tendency than the mean.

Mode:

The mode is the score that occurs most frequently in a distribution. It is located by inspection rather than by computation. In grouped data distributions the mode is assumed to be the mid-score of the interval in which the greatest frequency occurs.

Measures of spread or dispersion:

Range:

The range is the difference between highest and lowest scores.

Variance:

The sum of squared deviations from the mean, divided by N, is known as the variance. The variance is a value that describes how all of the scores in a distribution are dispersed or spread about the mean. This value is very useful in describing the characteristics of a distribution. However, because of the deviations from the mean have been squared to find the variance, it is much too large to represent the spread of scores.

Standard deviation:

The standard deviation, the square root of the variance, is most frequently used as a measure of spread or dispersion of scores in the distribution.

Frequency distribution:

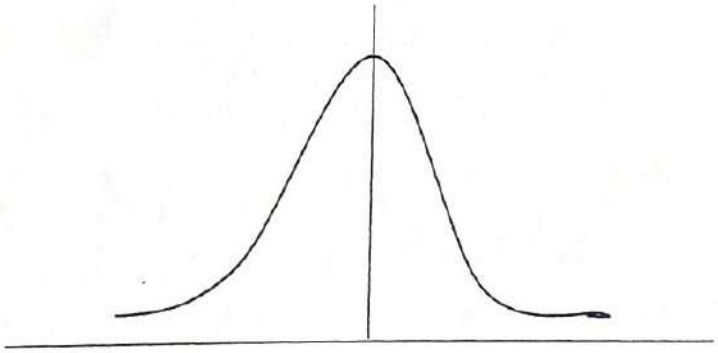
A frequency distribution is a two column list that describes a set of scores in a concise and systematic manner. One column lists all possible scores in the set from highest to lowest, and the other column, the frequency column, shows the number of examinees that obtained each score. This distribution of cores is a useful visual aid for identifying the relative position of any one student in the group and for obtaining a picture of overall group performance at a glance.

The information summarized by a frequency distribution can also be represented pictorially by a frequency polygon or a histogram. The frequency polygon is also known as a line graph. Frequency polygons and histograms are equally useful for describing a set of test scores efficiently.

Normal distribution:

A normal distribution is a mathematical model- an idealization- that can be used to represent data collected in behavioural research. It can be represented by a bell shaped curve with definite characteristics:

1. The curve is symmetrical around its vertical axis- 50% of the scores are above the mean and 50% below the mean.
2. The mean, median and the mode of the distribution have the same value.
3. Most scores are near the mean, median and mode with fewer scores as the score is further from the centre.
4. The curve has no boundaries in either direction, for the curve never touches the base line, no matter how far it is extended. The curve is a curve of probability, not of certainty.
5. The curve is a smoothed, curved version of a bar graph that represents each possible score and the number of persons who get the score.



Mean

Median

Mode

Percentile rank:

The percentile rank is the point in the distribution below which a percentage of scores fall. If the 80^{th} percentile rank is a score of 65, 80% of the scores fall below 65. The median is the 50^{th} percentile rank, for 50% of the scores fall below it.

$$percentile\ rank = 100 - \frac{100RK - 50}{N}$$

Where RK= rank from top

Measures of relationship:

Correlation and its interpretation:

Correlation is the relationship between two or more paired variables or two or more sets of data. The degree of relationship is measured and represented by the coefficient of correlation.

Students who have high intelligence quotients tend to receive high scores in mathematics tests, whereas those with low IQs tend to score low. When this type of relationship is obtained, the factors of measured intelligence and scores of mathematics tests are said to be positively correlated. Intelligence and academic achievement are positively correlated: as one increases, the other tends to increase.

Sometimes variables are negatively correlated when a large amount of one variable is associated with a small amount of the other. As one increases, the other tends to decrease. Academic achievement and hours of watching TV per week are negatively correlated: as one increases, the other tend to decrease.

When the relationship between two sets of variables is a pure chance relationship, we say that there is no correlation. Intelligence and body weight have no correlation.

The degree of linear correlation can be represented quantitatively by the coefficient of correlation. A perfect positive correlation is +1.00. A perfect negative correlation is -1.00. A complete lack of relationship is zero. A definition of perfect positive correlation specifies that for every unit increase in one variable, there is proportional unit decrease in the other. The perfect negative correlation specifies that for every unit increase in one variable, there is a proportional unit decrease in the

other. The sign of the coefficient indicates the direction of the relationship and the numerical value its strength. The criterion for evaluating the magnitude of correlation:

Coefficient(r)	Relationship
0.00 to 0.20	Negligible
0.20 to 0.40	Low
0.40 to 0.60	Moderate
0.60 to 0.80	Substantial
0.80 to 1.00	High to very high

Feedback is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding. A teacher or parent can provide corrective information, a peer can provide an alternative strategy, a book can provide information to clarify ideas, a parent can provide encouragement, and a learner can look up the answer to evaluate the correctness of a response. Feedback thus is a "consequence" of performance

6.3. Reporting:

Reporting is the process of communicating students' achievement of the curriculum expectations and the demonstration of Learning Skills and Work Habits. The Provincial
Report Card represents a summary of a teacher's professional judgements about student achievement; it gives students descriptive feedback in comments, indicating what they have learned and need to learn, as well as providing guidance to help students improve their learning. To make the best possible use of educational facilities and student talents, it is essential that each student's educational progress be watched carefully and reported as accurately as possible. The most basic use of test scores is to report them to all who need to know, along with a simple interpretation of what they mean. They should be reported to students as well as their parents because both are key ingredients in school learning. Parents that are informed are likely to be more involved- at home and at school- with their children's learning and are more likely to work cooperatively with teacher. Students too, must be informed about their own results because they make countless decisions about their own instructional involvement- whether to participate, how much to participate, how much effort to devote, and what kind of personal standards to adopt. And unless students are made aware of their scores, they are likely to be less motivated to take the next standardized test seriously. When

students develop the impression that test scores do not get used or that the scores are not importa to other, efforts diminish and test scores lose their usefulness.

Score reports that are marked by simplicity in visual presentation and explanation are most ideal for reporting to others. For example individual performance profile report is ideal for reporting to parents during a parent-teacher conference. This report has several strengths that permit a comprehensive and comprehensible interpretation of results:

1. Percentile ranks, the easiest type of derived score to understand, are used.
2. Percentile bands allow the idea of error to be incorporated in the interpretation.
3. The arrangement of test and skill profiles permits an easy identification of relative strengths and weaknesses.
4. The presentation of test and skill scores on the same report provides opportunities for diagnosing within areas of weakness within each.
5. Percent-correct scores allow for criterion-referenced interpretations of skill scores.

Students' progress in learning science needs to be consolidated on the report card. Each student can also assess herself and include this as self-assessment in the report card. Analysis of various areas of learning, such as process skills of science and scientific attitude, interest and inquiry can also be included in the report card. This would assist students by pointing out the areas of study that they need to focus on, and also help them by providing a basis for further choices that they make regarding what to study further.

Purpose of reporting:

Details achievement of curriculum expectations for each semester or term

- reports the student's overall development of learning skills and work habits
- includes next steps for future student learning
- provides an opportunity for parents/guardians to comment on student achievement, student goals, and shared responsibilities of home and school to support improved student learning

LEARNING PHYSICAL SCIENCE

LEARNING RESOURSE
ON
BED 202.9: ASSESSMENT FOR LEARNING PHYSICAL SCIENCE

EDITOR

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2015-17