

Chapter IV

Development and Implementation of Orientation Programme and Intervention Programme

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4.0. Introduction

The present chapter focuses on development of orientation programme, development of intervention program, implementation of orientation programme and implementation of intervention programme. The first section of the chapter deals with development of Orientation Programme and intervention Programme. The second section of the chapter deals with implementation of orientation programme and intervention programme on the selected sample. The intervention programme comprised of various methods and techniques used in the teaching learning process to help student teachers to understand the concepts of Wholistic Approach.

4.1. Development of Orientation Programme

After implementation of series of pre-tests group discussion was conducted. Group discussion was conducted on present reforms in curriculum & its transaction, evaluation and their impact on Science Teaching. For the group discussion researcher had divided class in three groups. They were given topics and time of 30 minutes for discussion and 10 minutes for presentation. All the group representatives presented their group views on the basis of their discussion. Their presentation was further discussed in class and it was concluded.

The researcher developed an orientation programme on the basis of data collected through group discussion, Knowledge and Skill Check up, Story and Crossword. By analysing the data of group discussion, knowledge and Skill Check up, story and crossword the researcher was able to find the awareness of the student teachers about Wholistic Approach.

4.2. Orientation Programme

4.2.1. Meaning of 'Whole'

Complete, Entire.

4.2.2. Meaning of ‘Wholistic’

Wholistic word arrived from the whole. Wholistic refers to the whole, a whole item or whole body of a person or thing. The word defines the consideration of the entire structure or makeup, which includes the body, mind and the spirit in the case of a human being.

The word wholistic is connected to wholism, which focuses on the total entity and the interdependence of the diverse parts of this totality. Wholistic has to do with the healing systems that are considered alternative like homeopathy and Ayurveda that deal with the human body as an interconnected whole.

4.2.3. Wholistic Education

Berg (2010) outlined the components of Wholistic education, such as, active learning, deep understanding, critical and creative thinking, along with an emphasis on social relationships and realising the fullness of human existence. Wholistic education is a philosophy of education and concerned with the development of every person’s intellectual, emotional, social, physical, and spiritual potentials. Report of Kothari commission (1964-66) had recommended cultivating social, moral and spiritual values as one of the important aim of education. Further, Miller (1999) emphasised on “Wholistic education is based on the premise that each person finds identity, meaning and purpose in life through connections to the community, to the natural world, and to spiritual values such as compassion and peace.” The significance of wholistic education places on relationships and primary human values within the learning environment (Martin, 2003).

Forbes & Robin (2004) divided wholistic education into two categories: the idea of Ultimacy and Basil Bernstein’s notion of Sagacious Competence.

Ultimacy

- Religious as in becoming “enlightened”. Spirituality is an important component in wholistic education as it emphasizes the connectedness of all living things and stresses the harmony between the inner life and outer life
- Psychological as in Maslow’s “self actualization”. Wholistic education believes that each person should strive to be all that they can be in life. There are no deficits in learners, just differences.

Undefined as in a person developing to the ultimate extent a human could reach and thus moving towards the highest aspirations of the human spirit.

Sagacious Competence

- Freedom (independence, “inner liberation”).
- Good judgment (self-governance and autonomy).
- Meta-Learning (individuals learn in different way beyond the perceptible).
- Social Ability (learning more than social skills).
- Refining Values (development of character).
- Self Knowledge (encompasses more subtle learning of the nature of oneself).

4.2.4. All round development / Wholistic Development?

Wholistic development means development of all the faculties i.e. Head, Heart and Hand. Cognitive, psychomotor, Affective, spiritual and health & Environment are domains which need to be developed wholistically realizing complete balanced development of child.

4.2.5. Development of a child as a whole

With the help of teaching content in such a manner that helps child in development of cognition, skilled person through development of psychomotor, healthy from body and mind, connect self with environment and fill affection with society and self.

4.2.6. Need of Wholistic Approach

Teaching should be such which provides knowledge in integrated way. Teaching style should be wholistic i.e. taking content as whole not as parts. Indian culture is denoted by values of Wholism. Swami Vivekananda also proposed Wholistic education. In his words “Education is the manifestation of the perfection already in man.” Today’s education system mainly concentrates on cognitive domain and rarely on other domains. Different subjects should be taught keeping in mind the development of cognitive domain, affective domain, psychomotor domain, spiritual and the environmental domain wholistically.

4.2.7. Wholistic Approach

Wholistic Approach is a study of inter-connectedness, inter-dependent and inter-relatedness of various aspects. It is to observe a learning experience as an integration function of all the functional units. Wholistic Approach starts dealing with Education in certain way to achieve Wholistic Education i.e. for making humane, finding inter connectedness and inter dependent of various subjects and analyzing through zoom in (Parts) and zoom out (Whole). Wholistic Development can be achieved through Wholistic Education which is comprised of Cognitive Development (Thinking Skills), Affective Development (Social and Emotional Skills), Psychomotor Development (Mind and Motor Muscles coordination Skills), Spiritual Development (Spiritual control skills, Self-controlling the body and mind & transcending and becoming one with the Self, coexistence of Self and Selflessness), Health and Environment (Skills of observing sound health & universal being, healthy relationship between sound Self and surrounding atmosphere, healthy web of nature and society).

4.2.8. Skills required for Teacher to teach through Wholistic Approach

4.2.8.1. Perception Skill

- 1) Skill of Closure and Pragnanz
- 2) Skill of Proximity
- 3) Skill of Grouping and Classifying

4.2.8.2. Cognitive skill

- 1) Skill of Synthesis and Integration
- 2) Skill of Analysis
- 3) Info-savvy Skills
- 4) Micro Teaching Skills
- 5) Science Process Skills

4.2.8.3. Psychomotor skill

- 1) Mind and Motor Muscles coordination skills

4.2.8.4. Life skill

- 1) Human Development Skill/ Social Skill

- a. Self-awareness
 - b. Empathy
 - c. Inter Personal relationship
 - d. Communication Skill
- 2) Emotional skill/ Affective Skill
- a. Skill of Coping with Stress
 - b. Skill of Coping with Emotion
- 3) Thinking Skill
- a. Critical Thinking
 - b. Creative Thinking
 - c. Problem Solving
 - d. Decision making

4.2.8.5. Health and Environment Awareness Skill

- 1) Skills of observing sound health and universal beings
- 2) Skills for healthy relationship between sound self and surrounding atmosphere
- 3) Skills for healthy web of nature and society

4.2.8.6. Skill of Spiritual Development

- 1) Skill of Differentiation and Reconciliation
- 2) Skill of Interconnecting and Interdependence
- 3) Spiritual Control skill
- 4) Skill of coexistence of self and selflessness

4.2.9. Elements of Wholistic Approach for Wholistic Education

Spiritual	Cognitive	Psychomotor	Affective
Emotional	Health	Self	Whole
Parts	Critical	Environment	Humane
Understanding	Active learning	Thinking	Psychic

Social	Coexistence	Interconnectedness	Physical
Development	Relationship	Peace	Compassion
Humane-co-existence	Intellectual	Creative	Spiritual Qualities
Moral Qualities	Mental Qualities	Physical Qualities	Social Qualities

Table 4.1.: Elements of wholistic approach for wholistic education

4.2.10. Taxonomy of Educational Objectives: Cognitive Domain

Taxonomy Classification	Key Words	
	Examples of Infinitives	Examples of Direct Objects
Knowledge		
<u>Knowledge of Specifics</u>		
Knowledge of terminology	To define, to acquire, to distinguish, to identify, to recall, to recognize	Vocabulary, terms, terminology, meaning(s), definitions, referents, elements
Knowledge of Specific facts	To recall, to recognize, to acquire, to identify	Facts, examples, factual information (i.e. sources, names, dates, events, Persons, places, time periods), properties, phenomena
<u>Knowledge of ways and means of dealing with specifics</u>		
Knowledge of conventions	To recall, to identify, to recognize, to acquire	Form(s), conventions, uses, usage, rules, ways, devices, symbols, representations, style(s), format(s)
Knowledge of Trends, Sequences	To recall, to recognize, to acquire, to identify	Action(s), processes, movement(s), continuity, development(s), trend(s), sequence(s), causes, relationship(s),

		forces, influences
Knowledge of Classifications and categories	To recall, to recognize, to acquire, to identify	Area(s), type(s), feature(s), class(es), set(s), division(s), arrangement(s), classification(s), category/categories
Knowledge of criteria	To recall, to recognize, to acquire, to identify	Criteria, basics, elements
Knowledge of methodology	To recall, to recognize, to acquire, to identify	Methods, techniques, approaches, uses, procedures, treatments
<u>Knowledge of the universal and abstractions in a field</u>		
Knowledge of principles, generalizations	To recall, to recognize, to acquire, to identify	Principles, generalizations, Proposition(s), fundamentals, laws, principal elements, implication(s)
Knowledge of theories and structures	To recall, to recognize, to acquire, to identify	Theories, bases, interrelations, structure(s), organization(s), formulation(s)
Comprehension		
Translation	To translate, to transform, to give in own words, to illustrate, to prepare, to read, to represent, to change, to rephrase, to restate	Meaning(s), sample(s), definitions, abstractions, representations, words, phrases
Interpretation	To interpret, to reorder, to rearrange, to differentiate, to distinguish, to make, to draw, to explain, to demonstrate	Relevancies, relationships, essentials, aspects, new view(s), qualifications, conclusions, methods, theories, abstractions

Extrapolation	To estimate, to infer, to conclude, to predict, to differentiate, to extend, to determine, to draw, to extrapolate, to fill in	Consequences, implications, conclusions, meanings, effects, corollaries, probabilities
Application		
Application	To apply, to relate, to generalize, to choose, to develop, to organize, to use, to employ, to transfer, to restructure, to classify	Principles, laws, conclusions, effects, methods, theories, abstraction, situations, generalizations, processes, phenomena, procedures
Analysis		
Analysis of elements	To distinguish, to detect, to identify, to classify, to discriminate, to recognize, to categorize, to deduce	Elements, conclusions, hypothesis/hypotheses, statements of fact, statements of intent, arguments, particulars
Analysis of relationships	To analyze, to contrast, to compare, to distinguish, to deduce	Relationship, interrelations, relevance, relevancies, themes, evidence, fallacies, consistency, arguments, cause-effects, parts, ideas, assumptions
Analysis of organizational principles	To analyze, to distinguish, to detect, to deduce	Form(s), pattern(s), purpose(s), point(s) of view(s), techniques, bias(es), structure(s), theme(s), arrangement(s), organization(s)

Synthesis		
Production of a unique communication	To write, to tell, to relate, to produce, to constitute, to transmit, to originate, to modify, to document	Structure(s), pattern(s), product(s), performance(s), design(s), work(s), communications, effort(s), specifics, composition(s)
Production of a plan, or proposed set of operations	To propose, to plan, to produce, to design, to modify, to specific	Plan(s), objectives, specification(s), schematic(s), operations, way(s), solution(s), means
Derivation of a set of abstract relations	To produce, to drive, to develop, to combine, to organize, to synthesize, to classify, to deduce, to develop, to formulate, to modify	Phenomena, taxonomies, concepts, schemes, theories, relationships, abstractions, generalizations, hypothesis, perceptions, ways, discoveries
Evaluation		
Judgements in terms of internal evidence	To judge, to argue, to validate, to assess, to decide	Accuracy/accuracies, consistency/consistencies, fallacies, reliability, flaws, errors, precision, exactness
Judgements in terms of external criteria	To judge, to argue, to consider, to compare, to contrast, to standardize, to appraise	Ends, means, efficiency, economy, economies, utility, alternatives, courses of action, standards, theories, generalizations

Table 4.2.: Taxonomy of Educational Objectives: Cognitive Domain

4.2.11. Taxonomy of Educational Objectives: Affective Domain

Taxonomy Classification	Key Words	
	Examples of Infinitives	Examples of Direct Objects
Receiving		
Awareness	To differentiate, to separate, to set apart, to share	Sights, sounds, events, designs, arrangements
Willingness to receive	To accumulate, to select, to combine, to accept	Models, examples, shapes, sizes, meters, cadences
Controlled or selected attention	To select, to postural respond to, to listen, to control	Alternatives, answers, rhythms, nuances
Responding		
Acquiescence in responding	To comply (with), to follow, to commend, to approve	Directions, instructions, laws, policies, demonstrations
Willingness to respond	To volunteer, to discuss, to practice, to play	Instruments, games, dramatic works, charades, burlesques
Satisfaction in response	To applaud, to acclaim, to spend leisure time in, to augment	Speeches, plays, presentations, writings
Valuing		
Acceptance of a value	To increase measured proficiency in, to increase numbers of, to relinquish, to specify	Group membership(s), artistic productions, musical productions, personal friendships
Preference for a	To assist, to subsidize, to	Artist, projects, viewpoints,

value	help, to support	arguments
Commitment	To deny, to protest, to debate, to argue	Deceptions, irrelevancies, abdications, irrationalities
Organization		
Conceptualization of a value	To discuss, to theorize(on), to abstract, to compare	Parameters, codes, standards, goals
Organization of a value system	To balance, to organize, to define, to formulate	Systems, approaches, criteria, limits
Characterization by value or value complex		
Generalized set	To revise, to change, to complete, to require	Plans, behaviour, methods, effort(s)
Characterization	To be rated high by peers in, to be rated high by superiors in, to be rated high by subordinates in	Humanitarianism, ethics, integrity, maturity
	To avoid, to manage, to resolve, to resist	Extravagance(s), excesses, conflicts, exorbitance(s)

Table 4.3.: Taxonomy of Educational Objectives: Affective Domain

4.2.12. Taxonomy of Educational Objectives: Psychomotor Domain

Impulsion
Imitation
Manipulation
Precision
Articulation
Naturalization

Table 4.4.: Taxonomy of Educational Objectives: Psychomotor Domain

4.2.13. Taxonomy of Educational Objectives: Spiritual Domain

Wholistic Perception
Full Immersion
Interrelation
Emerging Action
Universal Development

Table 4.5.: Taxonomy of Educational Objectives: Spiritual Domain

4.2.14. Taxonomy of Educational Objectives: Health & Environment

Awareness of Healthy Self & Environment
Understanding of Wholistic Health
Functional Analysis
Observing Sound Health
Health Development

Table 4.6.: Taxonomy of Educational Objectives: Health & Environment

4.3. Development of Intervention Programme

The researcher selected ten areas of science which are directly related to real life for the development of intervention programme. These ten areas are Tea Preparation, Weight of object in different media, Fountain, Friction, Candle, Crackers, State of Matter, Ignition and combustion, Water purification and Soil Pollution. The intervention programme was developed for the conceptual development of Wholistic Approach. The developed programme was based on the student centred activity based approach. It encompassed group and individual activity, power point presentations, videos, games, experiments and demonstrations. For developing intervention programme guidance was taken from reference books and internet resources. The intervention programme was implemented on the studentteachers of School of Science and Education, Navrachana University in the academic year 2013-2014 and on the student teachers of Waymade College of Education, Vallabh Vidhyanagar in the academic year 2014-2015.

4.4. Implementation of Orientation Programme

Day: 1 Orientation of Wholistic Approach

Time: 90minutes

4.4.1. Objectives of Orientation Programme

- Student teachers will be able to define Wholistic Approach.
- Student teachers will be able to distinguish Wholistic Approach from other approaches of teaching-learning process.
- Student teachers will be able to identify teaching learning process through Wholistic Approach.
- Student teachers will be able to organize teaching point in wholistic way of teaching.
- Student teachers will be able to appreciate teaching-learning process through Wholistic Approach.
- Student teachers will be able to exercise teaching through Wholistic Approach.

4.4.2. Orientation Programme

In the orientation programme researcher raised some question for brain storming of student teachers, such as, explain the terms “whole”, “Wholistic” and “Wholistic Education”, how to develop child as a Whole Person, need of Wholistic Approach, it’s definition, components and assessment. Conclusion was drawn from the discussion that there is difference between traditional approach of teaching learning and Wholistic Approach of teaching learning. Concept map of orientation programme is as follows:

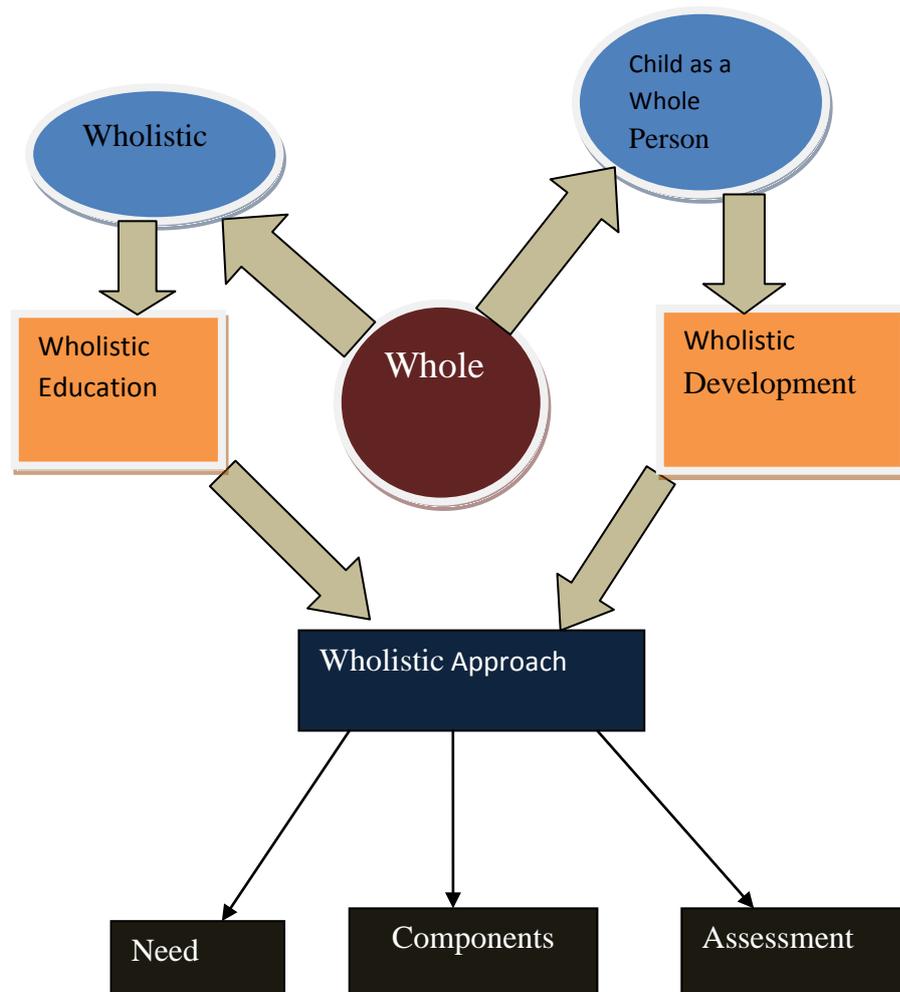


Fig. 4.1.: Concept map for orientation of Wholistic Approach

4.5. Implementation of Intervention Programme

Day: 2 Tea Preparation

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of tea preparation.
- Student teachers will be able to illustrate psychomotor aspect of tea preparation.
- Student teachers will be sensitized towards health aspect of tea.
- Student teachers will be aware of spiritual aspect of tea preparation.
- Student teachers will be able to discuss affective aspect of tea preparation.

Learning Experience

Activity

Researcher distributed blank sheets and Student teachers were asked to prepare concept map for tea preparation. There were 15 minutes for preparation of concept map.

Wholistic Explanation for Tea Preparation

Inputs

For preparation of tea there is a need to gather all the apparatus and ingredients required for the tea preparation, such as, Pan, Milk, Water, Gas stove/Kerosene stove/ Electric coil/ Induction gas, Lighter, Mach box, Pair of tongs/ Cloths used for handling hot pan, Tea leaves container/Tea bags container, Sugar container/Sugar Free Tablets Container, Basil, Elaichi (Cardamom), Ginger, Black Pepper, Sieve, Tea pot, Cup and Saucer/ Tea Mug. Edible materials used in preparation of tea are, such as, Water, Dry Tea Leaves, Ginger, Cardamom, Black Pepper, Basil, Pudina, Green Tea Leaves, Sugar.

Process

After collecting all the ingredients and apparatus for preparation of tea, there is need to exercise choice for pan. After that drinking water is collected. Then the gas is burnt with the help of lighter/match box. There is need to regulate the desired volume of the flame. After boiling water, it's time to add dry tea leaves, basil, grated ginger, black pepper, green tea leaves, Pudina and cardamom. After extraction of these things there is need to add sugar and milk. Boil for some time and pour it in tea pot, serve it in cups and enjoy Tea. This is the simple recipe for Tea.

Emerging Questions

1. What ought to be the characteristics of the Pan use for tea preparation?
2. What is the chemical composition of all the ingredients used in preparation of tea?
3. Why water for extraction of ingredients?
4. What is the chemical composition of the various materials?
5. What are the contents of the prepared tea?

Wholistic Explanation of the content with the help of PowerPoint Presentation
(Appendix I)

Properties of materials and Ingredients

a) Properties of Metals

1. Metals, in their pure state, have a shining surface. This property is called metallic lustre.
2. Metals are generally hard. The hardness varies from metal to metal. They are solids at room temperature, except mercury which is a liquid.
3. Some metals can be beaten into thin sheets. This property is called malleability. Gold and silver are the most malleable metals
4. The ability of metals to be drawn into thin wires is called ductility. Gold is the most ductile metal.
5. Because of their malleability and ductility metals can be given different shapes according to our needs.
6. Metals are good conductors of heat and have high melting points. The best conductors of heat are silver and copper. Lead and mercury are comparatively poor conductors of heat.
7. Metals can form positive ions by losing electrons to non-metals.
8. Metals combine with oxygen to form basic oxides. Aluminium oxide and zinc oxide show the properties of both basic as well as acidic oxides. These oxides are known as amphoteric oxides.
9. The pan should be optimum in size. Handle of Material of Pan should be made from non-conducting, this is insulating material. Most of the pan handles are made from asbestos.

b) Water

Water is the most abundant compound on Earth's surface, covering about 70 percent of the planet. In nature, water exists in liquid, solid, and gaseous states.

Density: 1,000.00 kg/m³

Molar mass: 18.01528 g/mol

Boiling point: 99.98 °C

Formula: H₂O

Melting point: 0.0 °C

IUPAC NAME: Dihydrogen oxide

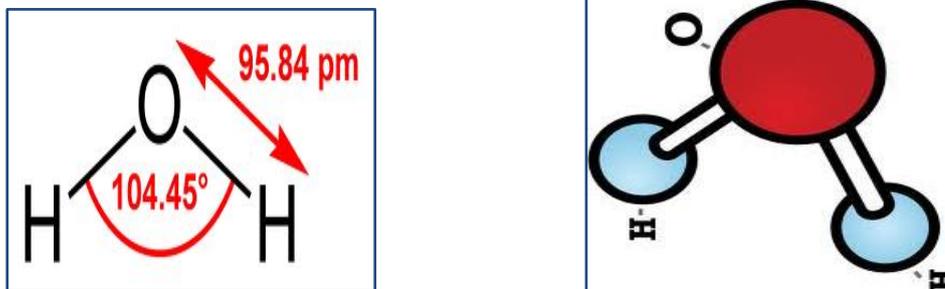


Fig. 4.2.: Molecular structure of water

Water is a tasteless, odourless liquid. At ambient temperature and pressure, it appears colourless in small quantities, although it has its own intrinsic very light blue hue. Water has pH 7.

c) Milk

The constituents of milk are water, lipids, carbohydrates, proteins, vitamins and minerals.

- **Water:** This constitutes about 85-87% of milk. This is the main medium for the suspension of all other components.
- **Lipids:** Milk is an emulsion and the lipids are found in a globular form. The main lipids present in milk are triglycerides, phospholipids and cholesterol. The triglycerides are formed of a number of fatty acids, such as, palmitic acid, stearic acid, lauric acid, and linolic acid. Lecithin, Cholin and many cerebrosides are other forms of fats present in milk. The percentage of fats in milk varies in different breeds; it may vary from 3.5-5%. The fatty substances in milk can be separated in a solid form by applying centrifugal force after it is allowed to get curdled. Butter, the concentrated fat of milk is an important food ingredient in human diet. Ghee is another product obtained by melting the butter.
- **Carbohydrates:** The most important carbohydrate present in milk is lactose. It is commonly called milk sugar. Lactose is a disaccharide formed of two monomers of mono saccharides-glucose and galactose.

- **Protein:** Among the proteins, casein commonly called the milk protein is the most important constituent. In milk, casein combines with calcium forming calcium caseinate. For growing children casein is a very essential protein. Other proteins of milk include lactoalbumins and lactoglobulins.
- **Vitamins and minerals:** Milk contains a number of essential mineral elements such as sodium, potassium, calcium, magnesium, iron, copper, iodine etc. Among the vitamins, milk has B complex and vitamin C and A. Even vitamin D and E are present in milk.

Properties of Milk (Colloidal Solution)

1. Milk is a colloidal solution. A colloid is a heterogeneous mixture.
2. The particles of a colloid are uniformly spread throughout the solution. Due to the relatively smaller size of particles the mixture appears to be homogeneous.
3. But actually, a colloidal solution is a heterogeneous mixture. Because of the small size of colloidal particles, we cannot see them with naked eyes. But, these particles can easily scatter a beam of visible light. This scattering of a beam of light is called the Tyndall effect.
4. They do not settle down when left undisturbed, that is, a colloid is quite stable.

d) Sugar

Sugar is also known as sucrose. Natural source of sucrose are beetroot and sugarcane. Sucrose is a disaccharide constituent of glucose and fructose. During the process of digestion by sucrose enzyme sucrose split into monosaccharide namely, glucose and fructose. Sugar (sucrose) found in two form i.e. powder and crystalline.

Molecular Formula of sucrose: $C_{12}H_{22}O_{11}$

Structural Formula:

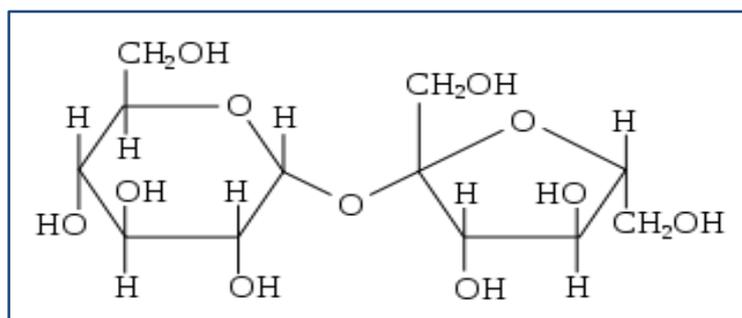


Fig.: 4.3.: Structural Formula of Sucrose

Sugar Free Powder/ Tablet

Sugar Free is a substitute of sugar for diet. Sugar free is used as artificial sweetening agents which are stevia, aspartame, sucralose, neotame, acesulfame potassium, and saccharin. Sugar Free found in different forms i.e. tablet, powder and liquid. Sugar Free is very much useful for diabetic patient and calorie conscious people.

e) Tea leaves

Compounds presents in tea leaves are polyphenols, amino acids, enzymes, pigments, carbohydrates, methylxanthines, minerals and many volatile flavour and aromatic compounds which give aroma, flavour, and taste to tea.

1. Polyphenols

Polyphenols are largely responsible for astringency. There are an estimated 30,000 polyphenolic compounds in tea, flavonoids are arguably the most important group of polyphenols in tea and are the source of the many health claims surrounding tea, and specifically tea antioxidants. A strong cup of tea contains around 180-240 mg of polyphenol compounds.

2. Flavanols

Flavanols are also referred to as tannins, and during oxidation are converted to theaflavins and thearubigins—the compounds responsible for the dark colour and robust flavours notably present in black tea. The major flavanols in tea are: catechin (C), epicatechin (EC), epicatechingallate (ECG), gallic catechin (GC), epigallocatechin (EGC), and epigallocatechingallate (EGCG). EGCG is the most active of these catechins and is often the subject of studies regarding tea antioxidants. Tea flavanols are sometimes collectively referred to as catechins. Besides flavanols, tea flavonoids also include flavonols, flavones, isoflavones, and anthocyanins; all of which contribute to the colour of a tea's infusion and its taste.

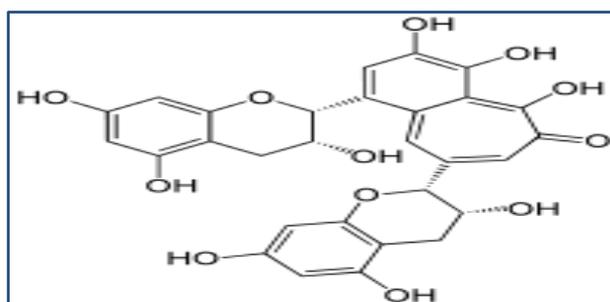


Fig.: 4.4.: Structural Formula of Theaflavin

3. Amino Acids

Tea leaves contain many amino acids, the most abundant of which is theanine. Theanine, more specifically L-Theanine is responsible for promoting alpha brain wave activity which promotes relaxation. L-Theanine in concert with caffeine can induce a state of “mindfulness” in the tea drinker.

4. Enzymes

Polyphenol oxidase and peroxidase are the most important enzymes in tea leaves. They are responsible for the enzymatic browning of tea leaves that takes place when the cell walls in the leaves are broken and the polyphenols are exposed to oxygen – otherwise known as oxidation.

5. Methylxanthines

Methylxanthines in tea include the stimulant caffeine and two similar compounds: theobromine and theophylline. Methylxanthines also contribute to a bitter taste.

Composition of a black tea beverage

Substance	% dry weight
Epi-galloctechingallate	4.6
Epi-galloctechin	1.1
Epicatechingallate	3.9
Epicatechin	1.2
Flavonolglycoides	trace
Bisflavanols	trace
Theaflavins	2.6
Theaflavic acid	trace
Thearbigins	35.9
Caffeine	7.6
Theobromine	0.7
Theophylline	0.3
Gallc acid	1.2
Chlorogenic acid	0.2
Oxalic acid	1.5
Malonic acid	0.02

Succinieaeid	0.1
Malie acid	0.3
Acniticaeid	0.01
Citrie acid	0.8
Lipids	4.8
Monosacchardes	6.9
Peetin	0.2
Polysacchardes	4.2
Peptides	6.0
Theanine	3.6
Other amino aeids	3.0
Potassium	4.8
Other minerals	4.7
Volatiles	0.01

Adapted from Graham (1984)

Table 4.7.: Composition of a black tea beverage

f) Medicinal uses of different herbs used in preparation of tea

1. Name: Ginger

Scientific Name: *Zingiberofficinale*

It is used in preparation of tea to prevent morning sickness, motion sickness, and nausea that accompanies gastroenteritis.

2. Name: Cardamom

Scientific Name: *Elettariacardamomum*

It is used in preparation of tea to prevent infections in teeth and gums, to prevent and treat throat troubles, congestion of the lungs as well as Flavoring agent.

3. Name: Basil

Scientific Name: *Ocimumtenuiflorum*

It is used in preparation of tea as Healing Power, Fever & Common Cold, Coughs, Sore Throat, Respiratory Disorder, Mouth Infections, and Headaches.

4. Name: Black Pepper

Scientific Name: *Piper Nigrum*

It is used in preparation of tea to improve digestion, stimulate appetite, and treat gastrointestinal problems, including diarrhoea, dyspepsia and flatulence. It is also used to treat colds, coughs and sore throats.

5. Name: Pudina

Scientific Name: *Mentha Arvensis*

It is used in preparation of tea for treatment of vomiting and nausea. It is also useful for stomach disorders and as antiseptic.

In the preparation of tea water is used as extraction solvent. Water has PH 7 and neutral in nature, water is a good solvent for extraction.

The effect of Milk on Polyphenols present in tea. The compounds in tea derived from catechins can have antioxidant effects on the body, these could have beneficial effects on cardio vascular health. Casein proteins in milk could bind to polyphenols and as a result prevent their antioxidant effects.

Wholistic Development from tea preparation

- **Cognitive Development**
- ➔ **Science Principles/Mechanism of various materials and apparatus**
- Lever

Types of Lever	Fulcrum	Work	Force	Example
First	Middle	One side	Other side	Scissor, Pairs of tong
Second	One side	Middle	Other side	Screw driver,
Third	One side	Other side	Middle	Forceps

Table 4.8.: Types of Lever with its Fulcrum, Work, Force and Example

- Lighter (Friction)

According to Newton's first law in absence of external force body should maintain its motion with constant velocity. But instead of velocity remaining constant it reduces gradually and after travelling some distance body comes to halt. This force which opposes motion of the body is called as force of friction. When a body moves on a surface, keeping contact with the surface, force exerted by the surface on moving body, which opposes motion of the body is called frictional force.

- Structure of Tea Mug (upper portion of tea mug is broader than lower portion. Broader portion will help to make tea cold earlier due to more surface area is in contact with environment and lower narrow portion kept tea hot due to small surface area in contact with environment.)
- Structure of double layer Tea Mug (outer layer of mug is not in contact with hot tea so its temperature is normal as environmental temperature, inner layer is not directly in contact with environment so it kept tea hot.)
- Brightness of sugar (by passing sugar syrup through activated charcoal it decolourized syrup and increase the brightness of sugar.)
- Stove (combustion converts fluid energy in to heat which will help to prepare food, tea, boil water.)
- conversion of electric energy in to thermal energy e.g. Electric coil, Induction stove
- Shape of Pan (utility of generated thermal energy)
- Size of Pan (utility of generated thermal energy and volume (capacity) to holding material used for preparing tea)
- Metal of Pan (reaction with edible material and conductor of heat)
- Thickness of Pan (transfer of energy)
- Base of Pan for balance on other surface like stove, induction coil, electrical coil
- Surface area of sugar powder and sugar (reaction time will be reduced)
- Crystalline sugar (crystallization)
- **Psychomotor Domain**
 - ➡ Handling of different material and apparatus used in preparation of tea
 - ➡ Handling of Gas stove, lighter, match sticks etc.
 - ➡ Pouring tea from pan to mug or cup
 - ➡ Cleanliness of platform during and after preparation of tea
 - ➡ Handling of hot pan with cloth (which type of cloth is safe for handling hot pan?), or pan has Insulated handle, wooden handle.

▪ **Health and Environment**

- Usefulness of different edible material to human being
- Useful amount of different edible material used in preparation of tea for human being
- Usefulness of used tea leaves for plants
- Milk is wholesome meal
- Excessive tea is harmful for health.

▪ **Spiritual**

- All the materials used in preparation of tea have their own characteristics and importance but they gathering in appropriate manner and made Tea. Separately every materialhavetheir own essence, flavour and fragrance but in Tea there is oneness.
- Water is a good solvent

▪ **Affective Domain**

- Effect of edible material used in tea on human body
- Affection of water towards different material used in preparation of tea
- Affection regarding workers working in different area tea garden, tea factory, gas factory, stove factory, fuel vendors, metal factory
- Affection of person making tea
- Purpose of serving
- Use of dry tea leaves again and again for whole day. (Using dry tea leaves again and again changes chemical composition of tea which harm to human body). Tannin of tea will be converted into tannic acid while it's used again and again for brewing tea.

Learning outcome

Learning outcome was evaluated by post concept map of tea preparation. Student teachers were asked to prepare concept map on tea preparation. They were given 15 minutes for preparation of concept map.

Day: 3 Weight of an object in different media

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of weight of matter in different media.
- Student teachers will be able to illustrate psychomotor aspect of weight of matter in different media.
- Student teachers will be sensitized towards health aspect of body weight.
- Student teachers will be aware of spiritual aspect of weight of matter in different media.
- Student teachers will be able to discuss affective aspect of weight of matter in different media.

Learning Experience

Activity

Student teachers were divided into six groups. All the groups were provided different objects. Different media were air, water and castor oil. They observed weight of different objects in different media, such as, air, water and castor oil with the help of spring balance.



Frame 4.1.: Objects for weighing



Frame 4.2.: Spring balance for weighing objects



Frame 4.3.: Different media



Frame 4.4.: Student Teacher weighing objects

Emerging Questions

1. Why some of the shopkeepers have the tendency to give goods of lesser weight to the customers?
2. Difference between mass and weight of the object.
3. How overloaded trucks and vehicles very often meet with an accident?
4. If a motor driven vehicle is over loaded then how does it affect the vehicle?

In life there is so much important of weight. There are many places where persons have to deal with concept of weight. These areas where people are dealing with concept of weight are, buying fruits, vegetables, other goods, for gaining or losing of body weight, weight of new born baby, weight of equipments used in daily life and weight of school bags, office bags. The unit for weight is Newton (N).

There is difference between mass and weight but many have confusion between them. There are different units for mass Gram, Kilogram and for weight Newtons.

In everyday usage, *mass* is often taken as *weight*, but, scientifically these are different.

The inertial mass of an object determines its acceleration in the presence of an applied force. According to Isaac Newton's second law of motion, if a body of mass m is subjected to a force \mathbf{F} , its acceleration \mathbf{a} is given by \mathbf{F}/m , that is, $m = \mathbf{F}/\mathbf{a}$.

Relation between mass and energy: Relativity provides a relationship between the mass of a body and its energy ($E = mc^2$). Mass is a conserved quantity. From the viewpoint of any single observer, mass can neither be created nor destroyed, and special relativity does not change this understanding. However, relativity adds the fact that all types of energy have an associated mass, and this mass is added to systems when energy is added, and the associated mass is subtracted from systems when the energy leaves. In nuclear reactions, for example, the system does not become less massive until the energy liberated by the reaction is allowed to leave whereby the "missing mass" is carried off with the energy, which itself has mass.

Now, let's focus on concept of weight.

On the surface of the Earth, the weight W of an object is related to its mass m by

$$W = mg,$$

Where, g is the acceleration due to the Earth's gravity, equal to about 9.81 m s^{-2} . An object's weight depends on its environment, while its mass does not: an object with a

mass of 50 kilograms weighs 491 Newton on the surface of the Earth; on the surface of the Moon, the same object has a mass of 50 kilograms but weighs only 81.5 Newton.

The units for mass in the International System of Units (SI), is measured in kilograms (kg). The gram (g) is $\frac{1}{1000}$ of a kilogram.

Other units are accepted for use in SI:

- The tonne (t) is equal to 1000 kg.
- The electron volt (eV) is primarily a unit of energy, but because of the mass-energy equivalence it can also function as a unit of mass. In this context it is denoted eV/c^2 , or simply as eV. The electron volt is common in particle physics.
- The atomic mass unit (u) is defined so that a single carbon-12 atom has a mass of 12 u; 1 u is approximately 1.66×10^{-27} kg. The atomic mass unit is convenient for expressing the masses of atoms and molecules.

Now, let's discuss about concept of mass and weight.

In normal situations, the weight of an object is proportional to its mass, which usually makes it unproblematic to use the same unit for both concepts. However, the distinction between mass and weight becomes important for measurements with a precision better than a few percent (because of slight differences in the strength of the Earth's gravitational field at different places), and for places far from the surface of the Earth, such as in space or on other planets.

Weight, by definition, is a measure of the force which must be applied to support an object (i.e. hold it at rest) in a gravitational field. The Earth's gravitational field causes items near the Earth to have weight. Typically, gravitational fields change only slightly over short distances, and the Earth's field is nearly uniform at all locations on the Earth's surface; therefore, an object's weight changes only slightly when it is moved from one location to another, and these small changes went unnoticed through much of history. This may have given early humans the impression that weight is an unchanging, fundamental property of objects in the material world.

After this explanation of concept some questions were raised and discussed. Questions were such as, What is the relative weight and of a solid in air, water, castor oil and mustered oil?, What is the relative weight of Sun, Moon and Earth?, What is the relative weight of an object on various land forms that is mountain, plain and

valley?, How the stars are found in various constellations?, What is the significant of weight in life and living?, and If a bullock cart is overloaded then how it affects the animal pulling the bullock cart?

From our discussion and practical of weight of an object in different media we found it varied from medium to medium. There are questions: Does medium affect the growth and development of child? How? Can we relate and find out spiritual aspect from the spring of spring balance and effect of weight on health?

The content was taught keeping in mind all the aspects such as, cognitive, affective, psychomotor, spiritual, health and environment.

Learning outcome

Learning outcome was measured by discussion and then concluded.

Day: 4 Fountain

Time: 90 minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of three bottle Fountain.
- Student teachers will be able to illustrate psychomotor aspect of preparation of three bottle fountain.
- Student teachers will be sensitized towards health aspect of fresh water.
- Student teachers will be made aware of the spiritual aspect of different materials used in preparation of three bottle fountain.
- Student teachers will be able to discuss affective aspect of water flow due to different circumstances.

Learning experiences

Student teachers were divided in groups for the group activities. All the groups were given model of three bottle fountain and they were instructed to observe that model and try to identify preparation and process of fountain. They were asked to write down their observation on a blank paper sheet. After that they explained the process and preparation of three bottle fountain.

Materials used for preparation of this fountain are three plastic bottle, stiff straw, plastic tube, cutter, scissors and glue.

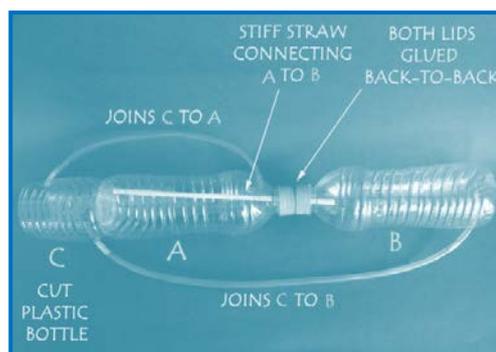
Researcher explained the preparation and process of three bottle fountain.

1. Stick two bottle leads back to back with the help of adhesive or glue. Keep it for some time so glue will dry up and it will stick properly.
2. Cut one plastic bottle from middle (A).
3. Base of this half plastic bottle will be joined to another plastic bottle (B). Keep it away for some time so it will stick properly.
4. Make hole in leads with scissors. Hole size not to exceed than that of stiff straw.
5. Pass stiff straw from this hole of leads.
6. Screw on two leads to join plastic bottles (B and C). There should be no leakage from hole. Long end of the straw must be on the top bottle and short on the bottom bottle.
7. Now make two holes on bottle A one side at top and another side at bottom of the bottle.
8. Make one hole in bottle B which will be at top of the bottle.
9. Make one hole in bottle A which will be at bottom of the bottle.
10. Attached flexi plastic tubes in these holes. Join bottle C top hole with bottle B top hole, bottle C bottom hole with bottle A.
11. Apply glue on all the joints of flexi plastic tube and bottle so it can be leakage proof. Keep it some time for stick properly.
12. Add water to the cut bottle through flexi tube water will enter in bottom bottle.
13. When bottom bottle is filled turn the assemble apparatus.
14. Due to gravitation automatically water will drain to middle bottle.
15. When middle bottle is full again turn the apparatus and add some more water to cut bottle it will go to bottom bottle and air would be expel from there and come to the middle bottle and comes out through flexi tube like a fountain. This fountain will work till water in middle bottle.

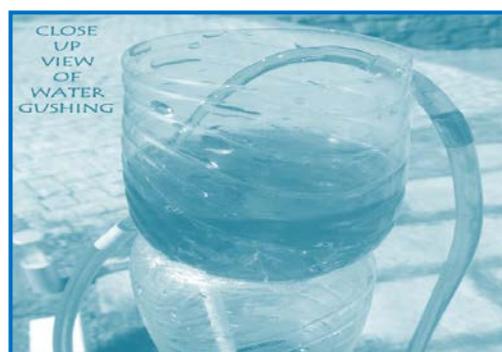
After explanation of preparation and procedure of three bottles fountain researcher showed the working model of three bottle fountain.



Frame 4.5.:material used in preparation
three bottle fountain



Frame 4.6.: Joints of three bottle of
fountain



Frame 4.7.:Working three bottle Fountain

Cognitive aspects covered in three bottle fountain are material used in preparation of fountain and their properties. Science principles used in three bottle fountain are pressure and gravitation force. The amount of water flow is due to the pressure and the gravitational force. The earth's gravitational force pulls the water towards the ground. If there is change in length or shape of bottle or flexi tube it will affect flow of water. Temperature also affects the flow of water because pressure is directly proportional to temperature. In scientific term the force acting on a unit area of a surface is called pressure. Force of gravity or gravity is defined as Objects or things fall towards the earth because it pulls them. This force is called the force of gravity, or just gravity. There are many places around us where we find fountains they are, such as, ponds, hotels, river front, reservoir, fort, and gardens. There are different purposes for placing fountains at different places. The purpose of placing fountain in garden and fort is decoration and making environment pleasant. Purpose of placing fountain in pond is air circulation. In pond water is stagnant so oxygen of pond water is limited. Living beings in pond use this oxygen so amount of oxygen will reduce. When there are fountain placed in pond it will circulate water in air and it capture

oxygen from air. In river fountain were placed for purification of water so human being can get pure water and it will helpful for their health.

Let's answer these questions and justify them

1. If we change size of plastic bottle than what will be the flow of water?
2. If we change diameter of flexi tube than what will be the flow of water?
3. If we change diameter of stiff straw than what will be the flow of water?
4. If we add jet at the end of flexi tube than what will be the flow of water?
5. If we change height of three bottle fountain assembly than what will be the flow of water?

Psychomotor aspect of three bottles fountain is manipulation and assembling of objects for preparation of working model.

Clarify this image of Fountain



Frame 4.8.: Image of Fountain

Affective aspects and spiritual qualities in materials used in three bottle fountain are such as, plastic bottle - holding capacity Tolerance, commitment, glue – bonding, Trust, security, flexi tube - path way for the water, Ethics, regularity, water have tendency to flow in the direction of gravitation. Honesty, discipline, and freedom, real life stress is related to pressure and it is in directly proportionate to feeling and emotion of individual.

Learning Outcomes

Learning outcomes were measured by discussion and then concluded.

Day: 5 Water Purification

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of Water purification.
- Student teachers will be able to illustrate psychomotor aspect of Water purification.
- Student teachers will be sensitized towards health aspect of consuming Purified Water.
- Student teachers will be made aware of the spiritual aspect of Water.
- Student teachers will be able to discuss affective aspect of Water purification.

Learning Experience

Power point presentation

Student teachers were shown power point presentation (Appendix II) made by former president A.P.J. Abdul Kalam. This power point presentation makes student teachers aware about importance of water and sensitize about wastage and pollution of water. From this power point presentation there are some emerging questions.

Emerging Question

1. Why there is need of purifying water?
2. Which are the techniques for water purification?
3. Why there is need to sensitize people to scarcity of water?
4. Importance of water for life.

Water is a ubiquitous chemical substance that is composed of hydrogen and oxygen and is essential for all known forms of life.

In typical usage, *water* refers only to its liquid form or state, but the substance also has a solid state, ice, and a gaseous state, water vapour or steam. Water covers 71% surface of the Earth. The natural sources of usable water are ground water, rivers, lakes, rain water. The manmade sources of usable water are reservoirs, dams and storage tanks of water.

Earth's water distribution

Of the total water present on earth about 97 % is in the oceans, whereas, 3% water out of total water present on Earth is fresh water. In this 3% water the majority, about 69

%, is locked up in glaciers and icecaps, mainly in Greenland and Antarctica. The remaining fresh water, almost all of it is below our feet, as ground water. Of all the freshwater on Earth, only about 0.3 percent is contained in rivers and lakes. Today we have very much crises of fresh pure water which we can consume. Water is polluted. So, we must purify the water.

Water purification is the process of removing undesirable chemicals, materials, and biological contaminants from water. The goal is to produce water fit for a specific purpose. Most water is purified for human consumption (drinking water). Purified water is also required at different places such as medical, pharmacology, chemical and industrial applications. Generally filtration and sedimentation are the methods used for purification of water. The other methods for purification of water are as per biological processes such as slow sand filters or activated sludge, chemical process such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light. Boiling, filtration, reverse osmosis in R. O. plant, and activated carbon filtration are methods of water purification used at home. The purification process of water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi; and a range of dissolved and particulate material derived from the surfaces that water may have made contact with after falling as rain. It is not possible to tell whether water is of an appropriate quality by visual examination. Simple household methods are not sufficient for treating all the possible contaminants that may be present in water from an unknown source.

Sedimentation

Water exiting the flocculation basin may enter the sedimentation basin, also called a clarifier or settling basin. It is a large tank with slow flow, allowing floc to settle to the bottom. The sedimentation basin is best located close to the flocculation basin so the transit between does not permit settlement or floc break up. Sedimentation basins can be in the shape of a rectangle, where water flows from end to end, or circular where flow is from the centre outward. Sedimentation basin outflow is typically over a weir so only a thin top layer exits. The amount of floc that settles out of the water is dependent on the time the water spends in the basin and the depth of the basin. The retention time of the water must therefore be balanced against the cost of a larger basin. The minimum clarifier retention time is normally 4 hours. A deep basin will

allow more floc to settle out than a shallow basin. This is because large particles settle faster than smaller ones, so large particles bump into and integrate smaller particles as they settle. In effect, large particles sweep vertically through the basin and clean out smaller particles on their way to the bottom. As particles settle to the bottom of the basin, a layer of sludge is formed on the floor of the tank. This layer of sludge must be removed and treated. The amount of sludge that is generated is significant, often 3%-5% of the total volume of water that is treated. The cost of treating and disposing of the sludge can be a significant part of the operating cost of a water treatment plant. The tank may be equipped with mechanical cleaning devices that continually clean the bottom of the tank or the tank can be taken out of service when the bottom needs to be cleaned.

Filtration

After separating most floc, the water is filtered as the final step to remove remaining suspended particles and unsettled floc. The most common type of filter is a rapid sand filter. Water moves vertically through sand which often has a layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds, which contribute to taste and odour. The space between sand particles is larger than the smallest suspended particles, so simple filtration is not enough. Most particles pass through surface layers but are trapped in pore spaces or adhere to sand particles. Effective filtration extends into the depth of the filter. This property of the filter is keys to its operation: if the top layer of sand were to block all the particles, the filter would quickly clog. To clean the filter, water is passed quickly upward through the filter, opposite the normal direction (called *back flushing* or *backwashing*) to remove embedded particles. Prior to this, compressed air may be blown up through the bottom of the filter to break up the compacted filter media to aid the backwashing process; this is known as *air scouring*. This contaminated water can be disposed of, along with the sludge from the sedimentation basin, or it can be recycled by mixing with the raw water entering the plant. Some water treatment plants employ pressure filters. This work on the same principle as rapid gravity filters, differing in that the filter medium is enclosed in a steel vessel and the water is forced through it under pressure.

Advantages:

- Filters out much smaller particles than paper and sand filters can.
- Filters out virtually all particles larger than their specified pore sizes.

- They are quite thin and so liquids flow through them fairly rapidly.
- They are reasonably strong and so can withstand pressure differences across them of typically 2-5 atmospheres.
- They can be cleaned (back flushed) and reused.

Boiling: Water is heated hot enough and long enough to inactivate or kill micro-organisms that normally live in water at room temperature.

Near sea level, a vigorous rolling boil for at least one minute is sufficient. At high altitudes (greater than two kilo-meter or 5000 feet) three minutes is recommended. In areas where the water is "hard" (that is, containing significant dissolved calcium salts), boiling decomposes the bicarbonate ions, resulting in partial precipitation as calcium carbonate. This is the "fur" that builds up on kettle elements, etc., in hard water areas. With the exception of calcium, boiling does not remove solutes of higher boiling point than water and in fact increases their concentration (due to some water being lost as vapour). Boiling does not leave a residual disinfectant in the water. Therefore, water that has been boiled and then stored for any length of time may have acquired new pathogens.

Granular Activated Carbon filtering: a form of activated carbon with a high surface area adsorbs many compounds including many toxic compounds. Water passing through activated carbon is commonly used in municipal regions with organic contamination, taste or odours. Many household water filters and fish tanks use activated carbon filters to further purify the water. Household filters for drinking water sometimes contain silver to release silver ions which have an anti-bacterial effect.

Reverse osmosis: Mechanical pressure is applied to an impure solution to force pure water through a semi-permeable membrane. Reverse osmosis is theoretically the most thorough method of large scale water purification available, although perfect semi-permeable membranes are difficult to create. Unless membranes are well-maintained, algae and other life forms can colonize the membranes.

Disinfection

Disinfection is accomplished both by filtering out harmful microbes and also by adding disinfectant chemicals in the last step in purifying drinking water. Water is disinfected to kill any pathogens which pass through the filters. Possible pathogens

include viruses, bacteria, including *Escherichia coli*, *Campylobacter* and *Shigella*, and protozoans, including *Giardia lamblia* and other cryptosporidia.

Chlorination- The most common disinfection method is some form of chlorine or its compounds such as chloramine or chlorine dioxide. Chlorine is a strong oxidant that rapidly kills many harmful micro-organisms. Because chlorine is a toxic gas, there is a danger of a release associated with its use. This problem is avoided by the use of sodium hypochlorite, which is a relatively inexpensive solution that releases free chlorine when dissolved in water. Chlorine solutions can be generated on site by electrolyzing common salt solutions. A solid form, calcium hypochlorite exists that releases chlorine on contact with water. Handling the solid, however, requires greater routine human contact through opening bags and pouring than the use of gas cylinders or bleach which are more easily automated. The generation of liquid sodium hypochlorite is both inexpensive and safer than the use of gas or solid chlorine. All forms of chlorine are widely used despite their respective drawbacks. One drawback is that chlorine from any source reacts with natural organic compounds in the water to form potentially harmful chemical by-products trihalomethanes (THMs) and haloacetic acids (HAAs), both of which are carcinogenic in large quantities and regulated by the United States Environmental Protection Agency (EPA). The formation of THMs and haloacetic acids may be minimized by effective removal of as many organics from the water as possible prior to chlorine addition. Although chlorine is effective in killing bacteria, it has limited effectiveness against protozoans that form cysts in water (*Giardia lamblia* and *Cryptosporidium*, both of which are pathogenic).

Chlorine dioxide is another faster-acting disinfectant. It is, however, relatively rarely used, because in some circumstances it may create excessive amounts of chlorite, which is a by-product regulated to low allowable levels in the United States. Chlorine dioxide is made in water and added/used in water to avoid gas handling problems; chlorine dioxide gas accumulations may spontaneously detonate.

Chloramines are another chlorine-based disinfectant. Although chloramine is not as strong as an oxidant it does provide a longer-lasting residual as free chlorine, and it won't form THMs or halo acetic acids. It is possible to convert chlorine to chloramine by adding ammonia to the water after addition of chlorine: The chlorine and ammonia react to form chloramine. Water distribution systems disinfected with chloramines

may experience nitrification, wherein ammonia is used as a nutrient for bacterial growth, with nitrates being generated as a byproduct.

Ozone (O_3) is an unstable molecule, a "free radical" of oxygen which readily gives up one atom of oxygen providing a powerful oxidizing agent which is toxic to most waterborne organisms. It is a very strong, broad spectrum disinfectant that is widely used in Europe. It is an effective method to inactivate harmful protozoans that form cysts. It also works well against almost all other pathogens. Ozone is made by passing oxygen through ultraviolet light or a "cold" electrical discharge. To use ozone as a disinfectant, it must be created on-site and added to the water by bubble contact. Some of the advantages of ozone include the production of fewer dangerous by-products (in comparison to chlorination) and the lack of taste and odour produced by ozonation. Although fewer by-products are formed by ozonation, it has been discovered that the use of ozone produces a small amount of the suspected carcinogen bromate, although little bromine should be present in treated water. Another of the main disadvantages of ozone is that it leaves no disinfectant residual in the water. Ozone has been used in drinking water plants since 1906 where the first industrial ozonation plant was built in Nice, France. The U.S. Food and Drug Administration has accepted ozone as being safe; and it is applied as an anti-microbiological agent for the treatment, storage, and processing of foods.

UV radiation (light) is very effective at inactivating cysts, as long as the water has a low level of colour so the UV can pass through without being absorbed. ***Disadvantage:*** UV radiation is that, like ozone treatment, it leaves no residual disinfectant in the water. It is sometimes necessary to add a residual disinfectant after they are used. This is often done through the addition of chloramines. When used in this manner, chloramines provide an effective residual disinfectant with very little of the negative aspects of chlorination.

Teacher will discuss the importance of the water in human life. Water is a universal solvent. Water helps in the digestion process and also helps in draw out harmful chemicals from the body. There should be proper timing to take water from the food. Because, water slow down the procedure of digestion. In summer time everyone should take more water in compare to winter because in summer perspiration became more.

The content was explained by keeping in mind all the other aspects such as, affective domain, psychomotor domain, spiritual and health & environment.

Learning outcome

Learning outcomes were measured by discussion and then concluded.

Day: 6 Candle

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of Candle.
- Student teachers will be able to illustrate psychomotor aspect of Candle.
- Student teachers will be sensitized towards health aspect of using Candle.
- Student teachers will be made aware of spiritual aspect of Candle.
- Student teachers will be able to discuss affective aspect of Candle.

Learning Experience

Activity

Researcher will burn a candle with all the care and precaution. Put it on a safe side and instruct student teachers to write their observations. This activity is time bound and time will be of five minute.

Student teachers will note down their observations in their note book.

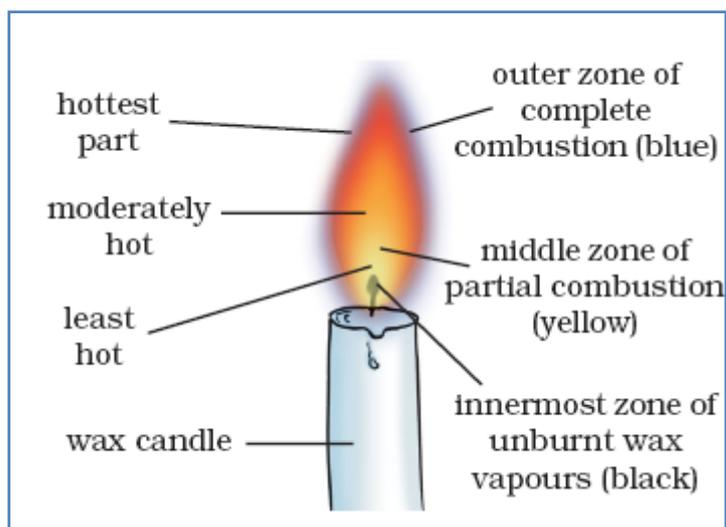
After completion of time researcher will ask how many observation they could make in five minute and discuss their observations in class.

Through this activity researcher will explain importance of observation. Researcher will explain number of observations other than they have noted down.

Researcher will explain procedure of candle preparation. Material used in candle is wax and thread. To burn candle match stick is needed and most important base of candle and support base on which candle can be put straight. Researcher will ask importance of candle's base. If base is enough flat to support whole structure than it will provide inner security and patience. Researcher will explain which precautions must be taken for handling candle.

Illuminate: Don't feel bad if people remember you only when then need you. Feel privileged that you are like a candle that comes to their mind when there is darkness.

Different Zones of Candle flame



Frame 4.9.:Different Zones of Candle flame

1. **Dark zone:** The dark zone is the zone which is formed just around the wick of the candle flame as the candle burns. As the candle is ignited by the matchstick, the melted wax moves up with the help of capillary action through the cotton wick and vaporizes just around the wick creating a dark zone. There is no air present here. It is the least hot of all the zones.
2. **Luminous zone:** The luminous zone is the zone which is moderately hot with limited oxygen supply as the melted wax further vaporizes and burns in the presence of oxygen and soot particles. The colour of this zone is yellowish which is the most associated with the burning of a candle and just above it an orange hue is formed as the candle continues to burn.
3. **Non-luminous zone:** The non-luminous zone is the zone of complete combustion. It looks like an “aura” formed around the candle and is almost invisible. It is the hottest zone as “around” the candle flame, the ample presence of oxygen aids in complete combustion.
4. **Blue zone:** The blue zone is another zone of incomplete combustion found at the base of the flame. Are you wondering why a bluish hue is formed here? This is due to the burning of carbon monoxide which releases carbon dioxide.

While burning candle there is smoke. If the volume of smoke is very high, than it will pollute surrounding environment. The substances which vaporise during burning, give flames. Forexample, kerosene oil and molten wax rise through the wick and are

vaporised during burning and form flames. Charcoal, on the other hand, does not vaporise and so does not produce a flame.

Burning of Fuels Leads to Harmful Products

The increasing fuel consumption has harmful effects on the environment.

1. Carbon fuels like wood, coal, petroleum release un-burnt carbon particles. These fine particles are dangerous pollutants causing respiratory diseases, such as asthma.
2. Incomplete combustion of these fuels gives carbon monoxide gas. It is a very poisonous gas. It is dangerous to burn coal in a closed room. The carbon monoxide gas produced can kill persons sleeping in that room.

The content was explained by keeping in mind all the aspects such as, cognitive, affective, psychomotor, spiritual, health & environment.

Learning Outcomes

Learning outcome was measured by listing down observation by the student teachers, discussion and then concluded.

Day: 7 Cracker

Time: 90 minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of Cracker.
- Student teachers will be able to exemplify psychomotor aspect of Cracker.
- Student teachers will be sensitized towards health aspect of using Cracker.
- Student teachers will be made aware of spiritual aspect of Cracker.
- Student teachers will be able to discuss affective aspect of Cracker.

Learning Experience

Student teachers were shown short films on effect of crackers on environment and society. Student teachers were asked to list down their observation of short film. Then the student teachers were asked some questions related to short film and their observation on cracker.

1. Production & Cracking of a Cracker, namely, Multi-Colour Fountain (ANAR).
2. What are the ingredients of an ANAR?
3. Where from these ingredients are procured and how?

4. What is the ANAR container?
5. What are the determinants of multi-colours and height of the fountain?
6. Which chemical reactions take place when we spark the ANAR?
7. After the ANAR is cracked, how do the evolving gases interact with the environment?
8. What are the effects of cracking ANAR?
9. What are the chemistry, physics, mathematics, economics, environmental Science & Sociology of ANAR?
10. Is it joyful, harmful, or joyfully harmful?
11. What is the status of child labourers who work in factory of crackers?

The content was explained by keeping in mind all the aspects such as, cognitive, affective, psychomotor, spiritual, health & environment.

Learning Outcomes

Learning outcomes were measured by discussion and then concluded.

Day: 8 States of Matter

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of State of Matters.
- Student teachers will be able to illustrate psychomotor aspect of State of Matters.
- Student teachers will be sensitized towards health aspect of different States of Matter.
- Student teachers will be made aware of spiritual aspect of States of Matter.
- Student teachers will be able to discuss affective aspect hidden in different State of Matters.

Learning Experience

Observe different types of matter around you. What are its different states? We can see that matter around us exists in three different states— solid, liquid and gas. These states of matter arise due to the variation in the characteristics of the particles of matter.

The Solid State

Activity

Collect the following articles— a pen, a book, a mobile and a piece of thread. Sketch the shape of the above articles in your notebook by moving a pencil around them. Do all these have a definite shape, distinct boundaries and a fixed volume? What happens if they are hammered, pulled or dropped? Are these capable of diffusing into each other? Try compressing them by applying force. Are you able to compress them?

All the above are examples of solids. We can observe that all these have a definite shape, distinct boundaries and fixed volumes, that is, have negligible compressibility. Solids have a tendency to maintain their shape when subjected to outside force. Solids may break under force but it is difficult to change their shape, so they are rigid. Consider the following:

- What about a rubber band, can it change its shape on stretching? Is it a solid?
- What about sugar and salt? When kept in different jars these take the shape of the jar. Are they solid?
- What about a sponge? It is a solid yet we are able to compress it. Why? All the above are solids as:

A rubber band changes shape under force and regains the same shape when the force is removed. If excessive force is applied, it breaks. The shape of each individual sugar or salt crystal remains fixed, whether we take it in our hand, put it in a plate or in a jar. A sponge has minute holes, in which air is trapped, when we press it, the air is expelled out and we are able to compress it.

The Liquid State

Activity

Collect the following:

- Water, cooking oil, milk, lemon juice, a cold drink. Containers of different shapes. Put a 50 ml mark on these containers using a measuring cylinder from the laboratory.
- What will happen if these liquids are split on the floor?
- Measure 50 ml of any one liquid and transfer it into different containers one by one. Does the volume remain the same?
- Does the shape of the liquid remain the same?
- When we pour the liquid from one container into another, does it flow easily?

We observe that liquids have no fixed shape but have a fixed volume. They take up the shape of the container in which they are kept. Liquids flow and change shape, so they are not rigid but can be called fluid.

The Gaseous State

Activity

- Take three 100 ml syringes and close their nozzles by balloons.
- Remove the pistons from all the syringes.
- Leaving one syringe untouched, fill water in the second and pieces of chalk in the third.
- Insert the pistons back into the syringes. You may apply some Vaseline on the pistons before inserting them into the syringes for their smooth movement.
- Now, try to compress the content by pushing the piston in each syringe.
- What do you observe? In which case was the piston easily pushed in?
- What do you infer from your observations?

We have observed that gases are highly compressible as compared to solids and liquids. The liquefied petroleum gas (LPG) cylinder that we get in our home for cooking or the oxygen supplied to hospitals in cylinders is compressed gas. Compressed natural gas (CNG) is used as fuel these days in vehicles. Due to its high compressibility, large volumes of a gas can be compressed into a small cylinder and transported easily. We come to know of what is being cooked in the kitchen without even entering there, by the smell that reaches our nostrils. How does this smell reach us? The particles of the aroma of food mix with the particles of air spread from the kitchen, reach us and even farther away. The smell of hot cooked food reaches us in seconds; compare this with the rate of diffusion of solids and liquids. Due to high speed of particles and large space between them, gases show the property of diffusing very fast into other gases. In the gaseous state, the particles move about randomly at high speed. Due to this random movement, the particles hit each other and also the walls of the container. The pressure exerted by the gas is because of this force exerted by gas particles per unit area on the walls of the container.

Health and Environment

These gases, especially oxygen and carbon dioxide, are essential for the survival of aquatic animals and plants. All living creatures need to breathe for survival. The aquatic animals can breathe under water due to the presence of dissolved oxygen in water. Solids, liquids and gases can diffuse into liquids. The rate of diffusion of liquids is higher than that of solids. This is due to the fact that in the liquid state, particles move freely and have greater space between each other as compared to particles in the solid state.

The content was explained by keeping in mind all the aspects such as, cognitive, affective domain, psychomotor domain, spiritual and health & environment.

Learning outcome

Learning outcome was measured by post test. Here, post test is same as pre test.

Day: 9 Ignition and combustion

Time: 90 minutes

Objectives:

- Student teachers will be able to acquire cognitive aspect of Ignition and Combustion.
- Student teachers will be able to illustrate psychomotor aspect of Ignition and Combustion.
- Student teachers will be sensitized towards health aspect of Ignition and Combustion.
- Student teachers will become aware of spiritual aspect of Ignition and Combustion.
- Student teachers will be able to discuss affective aspect of Ignition and Combustion.

Learning Experience

Activity

Take two paper cups. Pour around 50 ml of water in one paper cup and rest one will be empty. Burn candle and separately heat both the cups with the help of candle. The Researcher performs the activity with care and precaution. Student teachers were asked to observe carefully and mark the differences.

Emerging Questions

1. What happens to the empty paper cup?
2. What happens to the paper cup with water?
3. Does water in this cup become hot?
4. Relate Spiritual qualities of empty paper cup and paper cup with water.

What is Combustion?

A chemical process in which a substance reacts with oxygen to give off heat is called **combustion**. The substance that undergoes combustion is said to be combustible. It is also called a **fuel**. The fuel may be solid, liquid or gas. Sometimes, light is also given off during combustion, either as a flame or as a glow.

Types of Combustion

Bring a burning matchstick or a gaslighter near a gas stove in the kitchen. Turn on the knob of the gas stove. What do you observe? We find that the gas burns rapidly and produces heat and light. Such combustion is known as **rapid combustion**. There are substances like phosphorus which burn in air at room temperature. The type of combustion in which a material suddenly bursts into flames, without the application of any apparent cause is called **spontaneous combustion**.

What is ignition temperature?

Does a matchstick burn by itself? How does it burn? You must have had an experience of burning a piece of paper. Does it burn when a burning matchstick is brought near it? Can you burn a piece of wood by bringing a lighted matchstick near it? Why do you have to use paper or kerosene oil to start fire in wood or coal? Have you heard of forest fires? Do these experiences tell you that different substances catch fire at different temperatures? The lowest temperature at which a substance catches fire is called its **ignition temperature**.

Health and Environment

Food is a fuel for our body. In our body food is broken down by reaction with oxygen and heat is produced. We have to be careful and take precaution while dealing with fire.

During extreme heat of summer, at some places dry grasses catch fire. From grasses, it spreads to trees, and very soon the whole forest is on fire. It is very difficult to control such fires. It will destroy forest and make environment polluted. Spontaneous

forestfires are sometimes due to the heatof the sun or due to lightning strike.However, most forest fires are due tothe carelessness of human beings. Itis important to remember that thecampfires must be completelyextinguished before leaving a forestafter a picnic, or a visit.

Spiritual

- Fire or flame have tendency to travel against gravity.
- Empty paper cup catches fire but paper cup with water didn't catch fire but it helps to boil water.
- Three essential requirements for fire these are air (to supply oxygen), fuel and heat (to raise the temperature of the fuel beyond the ignition temperature).
- Ignition temperature

The content was explained by keeping in mind all the aspects such as, cognitive, affective domain, psychomotor domain, spiritual and health & environment.

Learning Outcomes

Learning outcomes were measured by discussion and then concluded.

Day: 10Friction

Time: 90minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of Friction.
- Student teachers will be able to illustrate psychomotor activities for Friction.
- Student teachers will be sensitized towards health aspect of Friction.
- Student teachers will be made aware of spiritual aspect of Friction.
- Student teachers will be able to discuss affective aspect of Friction.

Learning Experience

Activity

Gently push a book on a table. You observe that it stopsafter moving for some distance.Repeat this activity pushing thebook from the opposite direction. Does the book stopthis time, too?

Make an inclined plane on a smoothfloor, or on a table. You may use awooden board supported by bricks,or books. Put a markwith a pen at any point A on theinclined plane. Now let a pencil cellmove down from this point. How fardoes it move on the

table before coming to rest? Note down the distance. Now spread a piece of cloth over the table. Make sure that there are no wrinkles in the cloth. Try the activity again. Repeat this activity by spreading a thin layer of sand over the table. Maintain the same slope throughout the activity.



Frame 4.10.: Activity for Friction

Emerging Questions

1. Can you think of an explanation?
2. Can we say that a force must be acting on the book opposing its motion?
3. Can we say that a force must be acting on the pencil cell opposing its motion?
4. Have you not seen a moving ball on the ground stopping after some time?
5. Why do we slip when we step on a banana peel?
6. Why is it difficult to walk on a smooth and wet floor?

This force is called the force of friction.

Friction: A Necessary Evil

Recall now some of your experiences. Is it easier to hold a *KULHAR* (earthen pot) or a glass tumbler? Suppose the outer surface of the tumbler is greasy, or has a film of cooking oil on it; would it become easier or more difficult to hold it? Just think: would it be possible to hold the glass at all if there is no friction? Recall also how difficult it is

to move on a wet muddy track, or wet marble floor. Can you imagine being able to walk at all if there were no friction?

You could not write with pen or pencil if there was no friction. When your teacher is writing with chalk on the blackboard, its rough surface rubs off some chalk particles which stick to the blackboard. Could it happen if there were no friction between the chalk and the board? If an object started moving, it would never stop if there were no friction. Had there been no friction between the tyres of the automobiles and the road, they could not be started or stopped or turned to change the direction of motion. You could not fix a nail in the wall or tie a knot. Without friction no building could be constructed. On the other hand, friction is an evil, too. It wears out the materials whether they are screws, ball bearings or soles of shoes. You must have seen worn-out steps of foot over-bridges at railway stations.

The content was explained by keeping in mind all the aspects such as, cognitive, affective domain, psychomotor domain, spiritual and health & environment.

Learning Outcomes

Learning outcomes were measured by discussion and then concluded.

Day: 11 Soil Pollution

Time: 90 minutes

Objectives

- Student teachers will be able to acquire cognitive aspect of Soil Pollution.
- Student teachers will be able to illustrate psychomotor activities causes for Soil Pollution.
- Student teachers will be sensitized towards health aspect of Soil Pollution.
- Student teachers will be made aware of spiritual aspect of Soil Pollution.
- Student teachers will be able to discuss affective aspect of Soil Pollution.

Learning Experience

Student teachers were shown a short film on soil pollution and its effect on environment and society. Student teachers were asked to list down their observation of shot film. Then the student teachers were asked some questions related to the shot film and their observation on soil pollution.

1. What is the importance of soil in life?
2. How humans are spoiling soil?

3. What are the spiritual qualities of soil?
4. Types of soil pollution.
5. Relation between soil and crops.

Activity for soil erosion was shown to the student teachers then it was related wholistically with different subjects and life.

The content was explained by keeping in mind all the aspects such as, cognitive, affective, psychomotor, spiritual, health& environment.

Assignment

Student teachers were divided into groups and they were asked to make model, chart for soil pollution and explain it wholistically.

Learning Outcomes

Learning outcomes were measured by discussion and then concluded.

Day: 12 Orientation for preparation of lesson plan through Wholistic Approach

for Practice Teaching

Time: 90minutes

The researcher oriented the student teachers to design lesson plans through wholistic approach for practice teaching phase in school. Student teachers prepared lesson plans by keeping in mind wholistic development of students. Lesson ought to be cutting across of all the domains, namely, cognitive, affective, psychomotor, spiritual, health and environment. Following points should be considered for designing lesson through Wholistic Approach:

1. Entry behaviour of students on content
2. Content analysis of topic
3. General objective of the content.
4. Specific objective of the content.
5. Teaching Method
6. Mode, and Media to be used for teaching
7. Psychomotor activities to teach content
8. Relationship of content with different subjects and life.
9. Spiritual attributes covered in content.

- 10.** Affective attributes covered in content. Hidden values of the content.
- 11.** Relation of content with health, environment and living beings.
- 12.** List of wholistic Skills utilized for implementing lesson through Wholistic Approach.
- 13.** Learning experiences provided for teaching content.
- 14.** Evaluation of students
- 15.** Assignment

Modes and Media used for Teaching Content:

Teaching Method:

Activity for Content:

Relationship of Content with different Subjects and Life:

Spiritual Attributes covered in the Content:					
Affective Attributes and Hidden Values in the Content:					
Relation of Content with Health, Environment and Living Beings:					
Learning Experiences:					
Content	Specific Objectives	Teachers Activity	Students Activity	Evaluation	Wholistic Skills utilized for the Content
Evaluation					
Assignment					

Table 4.9.: Format for lesson plans designed through Wholistic Approach