

**DEVELOPMENT OF SOURCE BOOK IN
LIFE SKILLS EDUCATION THROUGH THE
TEACHING LEARNING OF SCIENCE STREAMS
FOR XII STANDARD STUDENTS AT
SENIOR SECONDARY LEVEL**

PAC Report

DR. GEETHA G. NAIR
Professor in Botany
and Programme Coordinator



REGIONAL INSTITUTE OF EDUCATION

(National Council of Educational Research and Training)

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*"Karaagrey vasathi lakshmi
karamadhye saraswathi
karamooley cha vishnu
Prabhaathe kara darshanam"*

From

Samyochitha Padyarathnamala

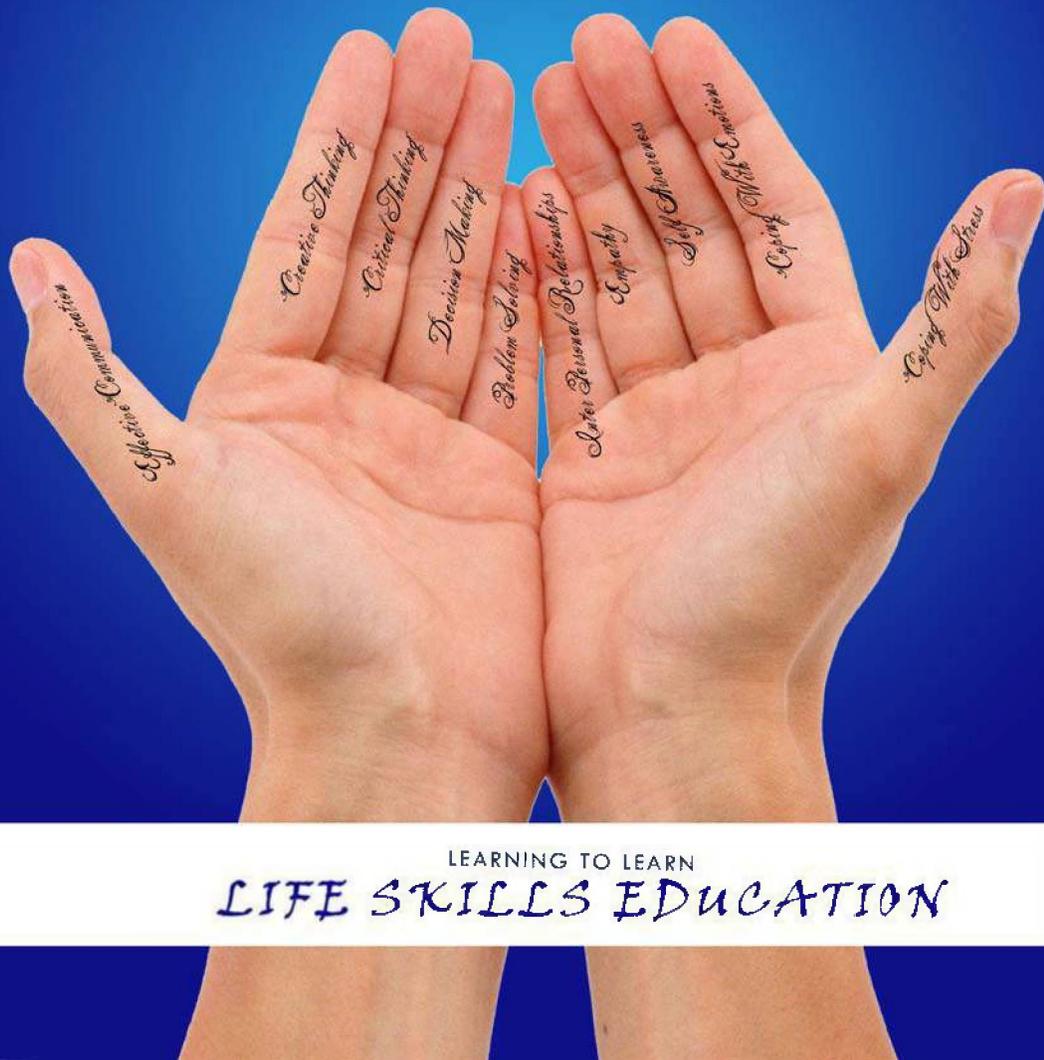
*Dedicated To
My Grandfather
Sri. K.P. Sreedhara Menon*



*B.E. (Civil)
Tharoor Puthan Veedu
Chittillanchery
Palghat Dist.
Kerala*

LIFE SKILLS

(VAO, 1994)



LEARNING TO LEARN
LIFE SKILLS EDUCATION

FOREWORD

Life skills have been defined as the abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life (WHO). Life Skills Education is a behavior development approach designed to address a balance of three areas, viz. knowledge, attitude and skills.

Today's world demands higher skills for every level of job. The skill development programme in early years of schooling can be the most appropriate tool for youth to get shaped to enter into the desired promising career and not just career alone, in all aspects like education, healthy life and social as well as economic status too. In recent years, there has been increased usage of life skills viz. Understanding skill (Self-awareness and Empathy), Solving skills (Problem solving and Decision making), Relationship skills (Interpersonal relationship and Effective communication), Thinking (Creative thinking and Critical thinking) and Coping skills (Coping with stress and Coping with emotions). Life Skills play a vital role in competence building, it has to be initiated among school children at the earliest possible occasion.

Life Skills Education will go a long way in providing direction and benefits to the adolescents include prevention of behavioural problems such as substance abuse, immoral activities, negative peer pressure and improvement in self-development, self-esteem, academic competency and social acceptability.

In this context, RIEM had made some efforts earlier and brought out a Life Skills Training Package for teacher educators and an ERIC Report on Biology Curriculum of XI Standard (New Class XI Textbooks Only) vis-à-vis the Development of Life Skills at secondary level. At present DESM of the Institute has developed a Source Book on Life Skills Education through the Teaching Learning of Science at senior secondary level to help one to learn from the physical environment around us (in Mathematics and Science) and apply life skills to social situations, and to promote science and scientific thinking and practices through Life Skills and their deployment.

I appreciate and congratulate the efforts of Dr (Ms.) Geetha G Nair, Associate Professor in Botany and Programme Coordinator and other colleagues of the Institute for the successful completion of the programme and bringing out the source book.

Prof. D.G. Rao
Principal, RIE, Mysore

PREFACE

Success is ninety-nine percent perspiration and one percent inspiration. The inspiration for writing a source book came from our earlier science education projects wherein we set about analysing attainment of scientific lab skills of XI standard students of Demonstration Multipurpose School. A number of process skills required in carrying out experiments in Botany Laboratory classes were identified and analysed statistically. A follow-up project suggested Remedial Interventions for the difficult to attain skills in practicals. The practicals involve besides process skills, skills of critical thinking (for drawing inferences), creative thinking (for setting up an experiment), problem solving (for giving explanation) and decision-making (for drawing conclusions). These are generic skills mentioned by WHO (1994, 1997) which we chanced upon during the course of literature survey. This provided the basis for an ERIC project by the author on Biology Curriculum of XI standard NCERT Textbooks vis-à-vis the development of life skills (ref. www.riemysore.ac.in). A number of life skills are integrated into the textbook content but as there is no curriculum in Life Skills Education introduced into schools so far, and as development life skills is reported to enhance scholastic abilities, it was considered worthwhile to bring out a source book in life skills education through science for XII standard students who are at the threshold of career education.

This is a modest effort on our part to infuse life skills into the selected content areas of science using different life skill teaching techniques and constructivist pedagogy. As life skills education is primarily the development of knowledge, attitude and skills in a culturally appropriate way and as all three culminate in behaviour change, we hope this book will facilitate both teachers and students alike in transforming themselves and the community around them through the teaching-learning of science and scientific concepts.

Dr. (Ms.) Geetha G. Nair
Professor in Botany & Programme Coordinator
Regional Institute of Education (NCERT), Manasagangothri, Mysore

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It is with a deep sense of gratitude I thank our esteemed Principal, Prof. D.G. Rao, for encouraging me in undertaking this programme and facilitating the completion of the same through the administrative machinery. I thank him for his patient hearing and the precious time given for discussing modalities of the programme.

I place on record my thanks to Prof. Premlata Sharma and Prof. K. Dorasamy, Former Principals of RIE, for encouragement and help at every step of execution of the three workshops, from planning to review stages. Discussions were highly enlightening and have given a fresh and new twist to approaches to Life Skills Education.

It would be remiss on my part if I fail to thank Prof. C.S. Nagaraju, Former Principal, RIE, Mysore, who has been a constant source of inspiration and guidance to me in my research undertakings in life skills. I would like to extend my thanks to him and to Prof. V. Rajsenan Nair, Deputy Director, Nehru Yuva Kendra, Trivandrum, for making it to the Review Workshop despite other pre-occupations to give finishing touches to the source book material.

I thank Prof. C.G.V. Murthy, who was there with us at the planning stage along with the others above for giving a concrete shape to the format of the exemplars in Science and format of Source Book.

My sincere thanks to Prof. Ramaa, S., who was always there for me and to Prof. G.V. Gopal, for making me take up a PAC programme in 2013.

My sincere thanks to Dr. M.U. Paily, Professor of Education, for updating my ERIC Report on RIE website.

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who were present throughout for making the exemplars and writing the chapters. Thanks to each one of you for making this programme a success.

My sincere thanks to Mr. B.K. Venkatesh, who has been doing my computer typing, printing and compilation work all along, for his untiring, patient, prompt and efficient endeavours towards bringing out the final volume of this report.

Dr. (Ms.) Geetha G. Nair
Professor in Botany & Programme Coordinator
Regional Institute of Education (NCERT), Manasagangothri, Mysore



RESOURCE PERSONS

Analytical work

Biology

Dr. GV Gopal, Professor of Botany, DESM, RIE, Mysore-6

Dr. C Padmaja, Associate Professor in Zoology, DESM, RIE, Mysore-6

Dr. V Tangpu, Assistant Professor in Zoology, DESM, RIE, Mysore-6

Dr. I. Baig, Assistant Professor in Zoology, DESM, RIE, Mysore-6

Ms. Mary, PGT in Biology, DMS, RIE, Mysore-6

Chemistry

Dr. M Srimathi, Associate Professor in Chemistry, DESM, RIE, Mysore-6

Dr. Tamil Selvam, Assistant Professor in Chemistry, RIE, Mysore-6

Physics

Dr. Stella Mary, Associate Professor in Physics, DESM, RIE, Mysore-6

Ms. P V Sinimol, PGT in Physics, DM School, DMS, RIE, Mysore-6

Mathematics

Dr. TV Somasekhar, Associate Professor in Education, DE, RIE, Mysore-6

Dr. Anil Kumar, Assistant Professor in Education, DE, RIE, Mysore-6

Ms. Meera, TGT, DMS, RIE, Mysore-6

Planning

Dr. Premlata Sharma, Professor of Education, DE, RIE, Mysore-6

Dr. S. Ramaa, Professor of Education, DE, RIE, Mysore-6

Dr. CGV Murthy, Professor of Education, DE, RIE, Mysore-6

PREPARATION OF EXEMPLARS

MATHEMATICS RESOURCE TEAM

1. Prof. K. Dorasami, Retired Principal, RIE, Mysore-6.
2. Dr. G. Viswanathappa, Associate Prof. of Education, RIE, Mysore-6.
3. Dr. Somashekhar, Associate Professor in Education, RIE, Mysore-6.
4. Dr. Anil Kumar, Assistant Professor in Education, RIE, Mysore-6.
5. Ms. Meera, TGT, DM School, RIE, Mysore-6.
6. Mr. P. Sunilkumar, II M.Sc.Ed. (Maths)
7. Ms. M.S. Kruthika, II M.Sc.Ed. (Maths)

CHEMISTRY RESOURCE TEAM

1. Dr. G.R. Prakash, Associate Professor, DESM, RIE, Mysore-6.
2. Dr. Tamil Selvam, Assistant Professor, DESM, RIE, Mysore-6.

BIOLOGY RESOURCE TEAM

1. Prof. Sabita Pattnaik, Retired Prof. of Education, RIE, Bhubaneswar
2. Dr. L. Srikantappa, Retired Professor of Zoology, DESM, RIE, Mysore-6.
3. Dr. G.V. Gopal, Professor of Botany, DESM, RIE, Mysore-6.
4. Dr. C. Padmaja, Associate Professor in Zoology, RIE, Mysore-6.
5. Dr. V. Tangpu, Assistant Professor in Zoology, RIE, Mysore-6.
6. Dr. I. Baig, Assistant Professor in Zoology, RIE, Mysore-6.
7. Ms. Mary, PGT, DM School, RIE, Mysore-6.

PHYSICS RESOURCE TEAM

1. Prof. M.N. Bapat, Professor of Physics, RIE, Bhopal.
2. Dr. Stella Mary, Associate Professor in Physics, DESM, Mysore-6.

REVIEW PROCESS

Resource team

1. Prof. D.G. Rao, Principal, RIE, Mysore
2. Prof. C.S. Nagaraju, Former Principal, RIE, Mysore and Former Head, DERPP, NCERT, Sri Aurobindo Marg, New Delhi
3. Prof. K Dorasamy, Former Principal, RIE, Mysore and Former Head, Teacher Education Department, NCERT, Sri Aurobindo Marg, New Delhi
4. Prof. Premlata Sharma, Former Principal, RIE, Mysore
5. Prof. L. Srikantappa, Retd. Prof. of Zoology, DESM, RIE, Mysore
6. Prof. V.Rajsenan Nair, Social Psychologist and Deputy Director, Nehru Yuva Kendra, Trivandrum
7. Dr. G.R. Prakash, Associate Prof. in Chemistry, DESM, RIE, Mysore
8. Dr. G. Viswanathappa, Associate Professor of Education, Dept of Education, RIE, Mysore
9. Prof. G. Gurumurthy, Former Principal, RIMSE, Mysore and Director, Vijaya English Academy, Hassan, Karnataka
10. Ms. Veena Kumar, i-point consulting services, Bangalore

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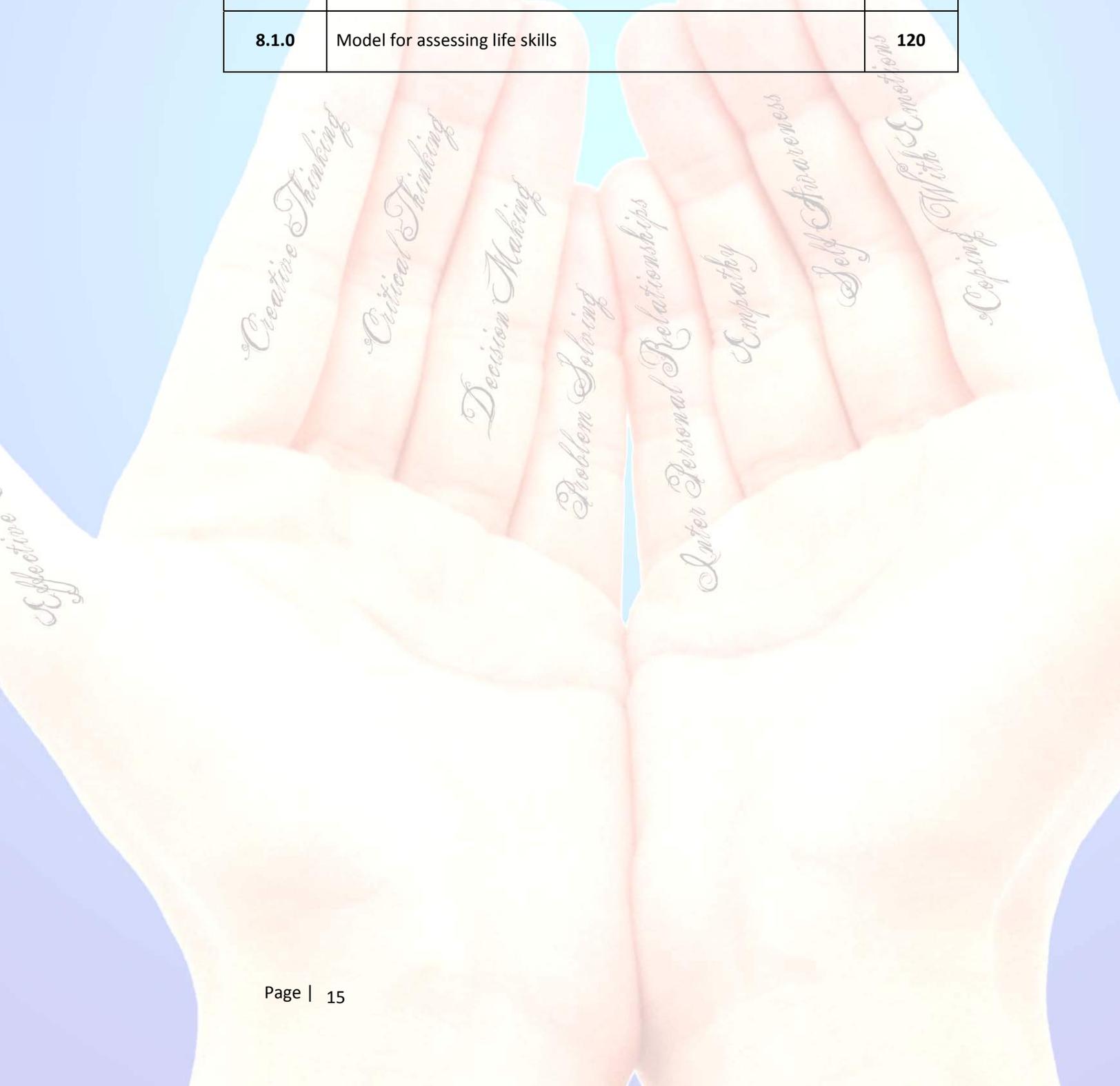
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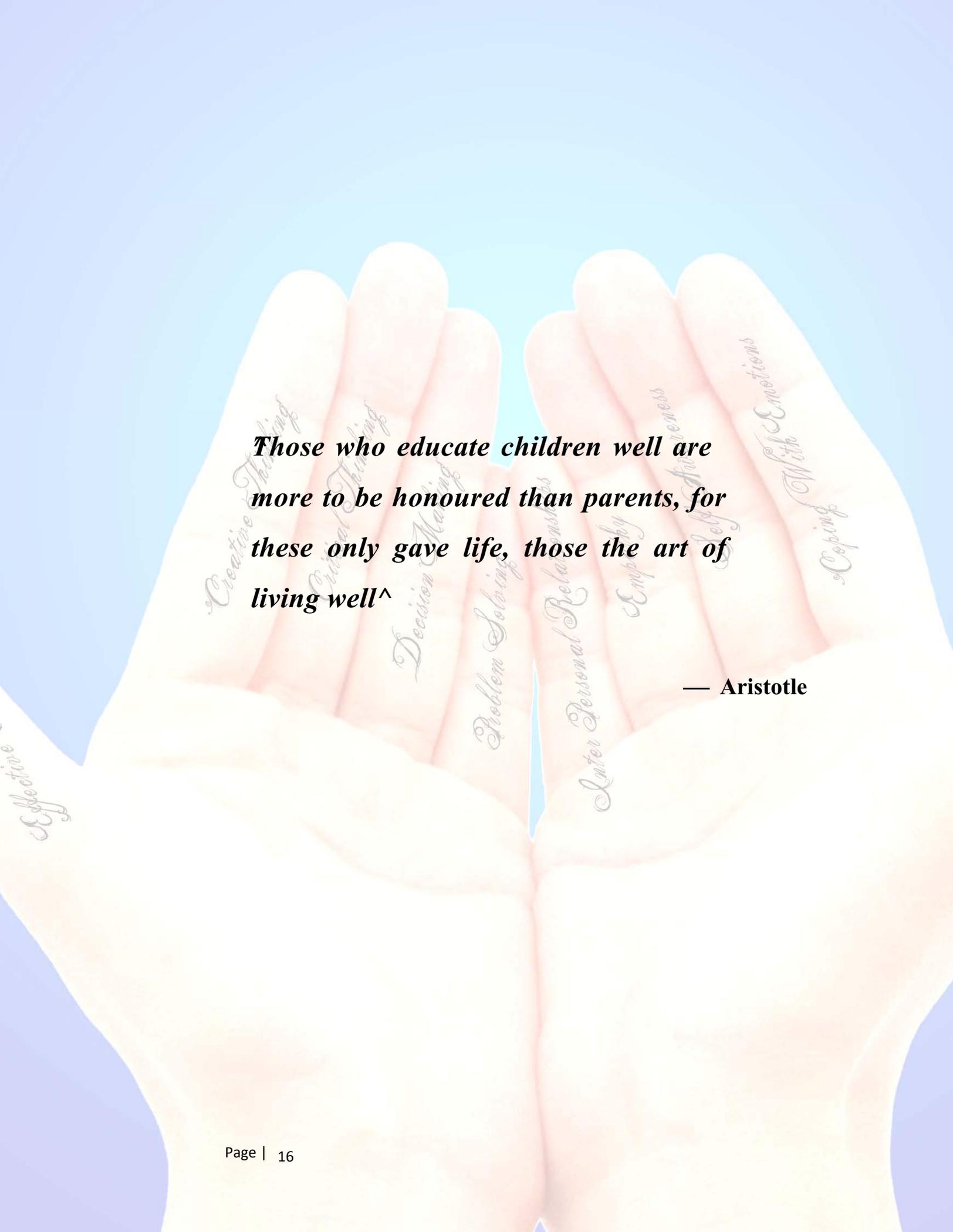
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The image shows two hands held open, palms up, against a light blue background. The fingers are spread, and various skills and concepts are written in cursive on them. On the left hand, the thumb has 'Effective', the index finger has 'Creative Thinking', the middle finger has 'Critical Thinking', the ring finger has 'Decision Making', and the pinky has 'Problem Solving'. On the right hand, the thumb has 'Coping With Emotions', the index finger has 'Self Awareness', the middle finger has 'Empathy', the ring finger has 'Inter Personal Relationships', and the pinky has 'Self Awareness'.

***Those who educate children well are
more to be honoured than parents, for
these only gave life, those the art of
living well^***

— Aristotle

THEORETICAL ASPECTS

Section

I

Note to the Teachers

LIFE SKILLS

Life Skills mean the positive behaviour and ability to adjust with the needs and challenges of everyday life. The strength of the positive behaviour depends on the depth of the skill acquired by the individual. The total reflection of one's behaviour is the sum total of the appropriate combination of different skills. Scientifically, it is the psychological competency and consistency of the concerned individual. The most appropriate intervention for the promotion of psychological competence of children in schools are by enhancing competencies through the optimum use of available resources by the process of Life Skills Education and Training. Life skills can change on mental set up and style of functioning. It will improve the perception of others about us. This enhanced ability will improve utilisation of human resources and increase productivity. Finally, it will lead to self-development, family development, social development and development of the nation.

The Skill Development Process

The skill development process starts when the child is born. Heredity, health and environment influence this natural process of development. Here, environment means the socio-economic and related human conditions. In this natural process of skill development, interventions are made to accelerate the speed of acquiring the skills and thereby the development of the individual. Skills equip us to do a job effectively when compared to others who are not having the skill. There are mainly four groups of skills. These are Personal skills, Conceptual skills, Technical Skills and Managerial skills.

- 1. Personal skills:** Personal skill is the natural skill of a person that helps him to live in the society.
- 2. Conceptual skills:** Conceptual skill is the ability of a person to conceive an idea or concept that depends on the mental framework of the person. The development of the personal skill always promotes the conceptual skill.
- 3. Technical skills:** Technical skill relates to the technical expertise of a person in one or more fields where some minor or major technology is applicable.

4. Managerial skills: Managerial skill is the ability to manage some group of persons and their related activities. This may vary from managing small group to large group.

The combination of the above skills enables us to work effectively in different situations. The appropriate combinations of the Personal, Conceptual, Technical and Managerial skills results in Life skills, Institutional skills, and Specialised skills.

1. Life skills: Life skill are the improved form of Personal skills. This skill helps us to do the day-to-day activities effectively. The quality of the Personal skill improves our interventions in the area of health and environment (social, economic, and related human conditions) with the support of improved conceptual skills and imparting training and practise to make the skills qualitative.

2. Institutional skills (Organisational skills): Institutional skills are the skills needed to function in an organisation. This emerges by the combination of technical and managerial skills at the appropriate level. Technical skills are more prominent in some institutions and managerial skills are prominent in some other institutions. This skill helps us to become prominent in an institution or organisation. This skill is always supported by Life skills.

3. Specialised Skills: Personality and Leadership are specialised skills. When the life skill improves to a higher level by incorporating various personality traits then personality development starts. Effective institutional skill and personality development will lead to leadership.

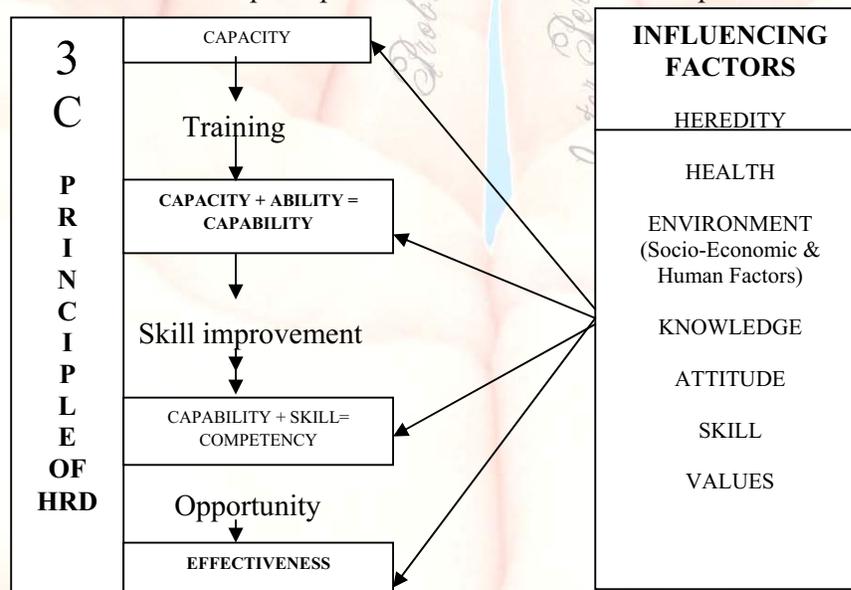
Role of Life Skill in Human Resource Development

Life skill development is the primary area of development in the process of Human Resource Development. Identification of the capacity of the individual is necessary to find out the life skill level of the individual. Capacity is the embellished and embedded basic qualities and unidentified talents in an individual, which needs proper promotion and development. Acquisition of basic life skill and institutional skill enhances the capacity of the individual to capability. Capability is the ability to do an activity in a moderate way. When an individual becomes more skilled to do an activity equal to many others in the field, then he becomes competent. At this stage, he will be in a position to compete with others to prove his merit. When many competent people do an activity, the persons who do it at the optimum level have effectiveness in the activity. Identification of capacity and the promotion of capability and competency to effectiveness in all operations, results in human

resource development and proper utilisation of it, which will in turn lead to overall development.

The 3C Principle of HRD

The 3C principle of Human Resource Development of an individual shows the inter-relation between capacity, capability and competency which leads to effectiveness of the individual and there by resulting in human resource development. Capacity is the basic skill available in an individual which may be out of sight or visible. To start with, the first stage for the development process is the identification of the capacity of the individual. Capacity can be subjected to training and there by adding ability to it to make the person Capable. (Capacity + Ability = Capability). Some advanced skill training to the capable person will make him competent (Capability + Skill = Competency) to do some specific work in a better way when compared to many others. When opportunity comes to the competent person, he will be in a position to prove his Competency. Opportunity to prove the Competency will improve his Constructs (application of intelligence and conceptual framework), Expectations (Learned perception about self and others), Values and Self-Regulatory Plans (Growth plans). Finally, this will converge into remarkable effectiveness in the particular work. Many influencing factors control the stages of development. At every stage, heredity, health, environment, knowledge, attitude and values, influence the development process. The diagram below shows the process and the interaction between the influencing factors that promote the competency development in the individual based on the 3C principle of Human Resource Development.



Definitions and Interpretations

There are many different interpretations of Life Skills but no definition is universally accepted. Different organisations attach different meanings to the term

based on their applicability. Life Skills defined in a general way mean a mix of knowledge, behaviour, attitudes and values and designate the possession of some skill and expertise to do something, or achieve an objective. Some of the general definitions and interpretations are below.

1) The World Health Organisation has defined Life Skills as the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life.^

2) UNICEF defines Life Skills as a behaviour change or behaviour development approach designed to address a balance of three areas: knowledge, attitude and skills^

3) Living skills refer to the personal competence that enables a person to deal effectively with the demands and challenges confronted in everyday life (Yarham, 1991)

4) The International Bureau of Education (IBE) derived its understanding from the Delores four pillars of learning (learning to know, learning to do, learning to be and learning to live together) and defined life skills as personal management and social skills that are necessary for adequate functioning on an independent basis.

5) Rychen and Salganik (Nair, 2010) defines Life Skills on three general criteria, a) they are the key competencies that contribute to an overall successful life and a well-functioning society, b) they are instrumental to meet important challenges in a wide spectrum of relevant contexts, and finally, c) they are relevant to all individuals. These key competencies are: a) functioning in socially heterogeneous groups, b) acting autonomously and c) using tools interactively.

6) Dohmen (Nair, 2010) says: a) They include the abilities necessary to apply the conceptual thinking and reflection in concrete situations. b) They imply capacities to be involved in effective interaction with the environment and provide an appropriate motivational attitude.

c) They involve psychological prerequisites for successful performance.

Considering all the definitions and different views, Life skills can be defined as ***the competency that can be imbibed and improved through practise, to translate the knowledge, attitude, and values into positive behaviour, in order to deal effectively and efficiently with the needs and challenges of everyday life.^***

Illustration

Competency: Capacity+ ability (Through training) = Capability; Capability+ Specific Skills training= Competency.

Effectiveness: To do at the apt time and complete with in the time frame

Efficiency: The quality and perfection of the work

CORE LIFE SKILLS

World Health Organization has identified ten skills as core Life skills. They are Self-awareness, Empathy, Inter-personal relations, Effective communication, Critical thinking, Creative thinking, Decision making, Problem solving, Coping with emotion and Coping with stress.

Self-Awareness

Self-awareness is a probe into one's own self, in relation to the surroundings in which he lives. It is an unbiased assessment about one's character, capacity, capability, competency, desire and dislikes. Character assessment shows how a particular person behaves in the society. His capacity is the basic unexplored talents available in him. Capability is the acquired or developed skills, which he developed due to training or experience. But all capable persons need not be competent. Competency can be proved only when several capable persons engage in a particular activity. From this we can identify his competency. Desires and dislikes influence all these developmental processes. All these characteristics are inter-related with the prevailing situations in the society in which he lives. Thus, self-awareness is an unbiased assessment about oneself and his surroundings, which constitutes three major factors.

- a. Awareness about the person
- b. Awareness about the surroundings in relation to the person
- c. Awareness about the area of work in relation to the person

Self Esteem

Self-esteem is the personal status of an individual supported by self-awareness in social groups such as family, school, friends, office, association, etc... There are few major factors for the improvement of self-esteem of an individual. They are connectiveness, uniqueness, power and models. Self-esteem is closely related with self-respect. Self-respect of an individual is the reflection of his self-esteem. It is the place we assign to ourselves considering qualities in small and big social groups such

as family, friends, school, college, society, etc. It is the perception of the individual, his abilities, character, attitudes, traits, appearance, aims and deeds.

In order to develop and maintain high self-esteem four conditions are needed. They are;

- a) Connectiveness: This is the satisfaction and consideration that an individual receives from others in the group.
- b) Uniqueness: This is the maintenance of specific personality qualities by the individual by deriving respect, acknowledgement, approval or appreciation from peers or elders in the social group.
- c) Power: This is the influence that the particular person can exert in his own life and the life of others when opportunity comes.
- d) Models: When the individual seeks the quality of other life models to improve his personality traits which helps him to improve his qualities, etc... it is called model^

How is it formed?

Self-esteem is formed through interactions with people. When interactions are going on, people assign some position or recognition to us based on our virtues. From this we make concepts about us and fix the position in the society on comparison with others. We also enlist the capabilities that can be achieved by us. Thus it improves based on our effort to improve the value based position.

Empathy

Empathy starts with our ability to understand and accept different kinds of people around us who are different from us in many respects. Empathy is our mental capacity to accept without emotional disturbances, people in distress as if we are in such a distress situation. It is the imaginative transposing of one's self to the thinking, feeling and acting of another^It is the quality in us to avoid discrimination and prejudice towards others who are not on par with us in one way or other. This is nothing but putting our leg in another person's shoe. If we can develop empathy, it encourages positive behaviour towards people in need of care and assistance. It will initiate a patronizing attitude to people with AIDS, mental retardation and disability. It also helps us not to laugh at others who are in need of care and patronage. This inculcates tolerance and consideration for people in distress, people with ailments or those who are stigmatised or ostracized by society.

Empathy is very distinct from sympathy. Sympathy is feeling pity and tenderness towards a person. It need not always extend into an action. But empathy is always followed by an action. If people have this feeling, it encourages sincere assistance to people who need care and support. Thus, empathy encourages positive behaviour towards people, who are in need of care and assistance.

Interpersonal Relations

Interpersonal skill is the skill to initiate and maintain positive relationships with other individuals and de-link unconstructive relationship, with minimum disturbances to both. Interpersonal conflicts arise from a variety of sources such as personality clashes, difference in value, threats to status, difference in perception and lack of trust.

Sources of conflict between individuals

1. Personality clashes: All people will not think, feel, or act alike. People should learn how to comply with these differences when dealing with people.
2. Difference in the style of functioning: People may have different views over the direction to go, routes to take, the resources to be used and the probable outcome while doing an activity.
3. Value clash: Since people hold different value systems, disputes may arise when they interact together.
4. Threats to status: When ones status is threatened, conflicts are bound to arise.
5. Difference in perception: As a result of difference in experience and expectations, people may perceive things differently. This can trigger conflicts.
6. Lack of trust: It takes much time to build trust between persons. But it can be destroyed within a short time.

Outcome of interpersonal conflict

Conflict may produce four distinct outcomes depending on the approaches taken by the people as follows:

- a) Lose ^lose outcome: Here the interpersonal conflict deteriorates to the worst level and both parties get damages.
- b) Lose ^win outcome: Here first person is defeated and the other gains over the conflict
- c) Win ^lose outcome: Here the first person wins and the second person loses
- d) Win ^win outcome: In this situation, both the parties perceive, that they are in a better position, than they were before when the conflict began.

Resolution strategies

Resolution strategies are influenced to a great extent by the intention of the parties involved. The strategies implemented will have a substantial impact on the outcome. There are four different strategies that can be employed.

- a) Avoiding: This includes physical or mental withdrawal from the conflict by avoiding the other.
- b) Smoothing: This means softening the other person to get the conflict resolved.
- c) Forcing: This relies on dominance over the other with pressure tactics to achieve personal goal at the expense of the other.
- d) Confronting: This means facing the conflict directly and working it through to a mutually satisfactory resolution. Only this strategy is truly viewed as an appropriate resolution strategy, since this method addresses the basic differences involved and removes them through creative problem solving.

Effective Communication

Communication is the process by which information and understanding are transferred from one person to another. Effective communication is an efficient tool for the establishment and maintenance of good social and working relationships with people. It is a way of reaching others by transmitting ideas, facts, thoughts, feelings and values. Hockt advocates four different styles to meet the needs of the intended receiver. They are; (1) forecaster, (2) associator, (3) systematizer and (4) energizer. In all the above four categories effective communication is characterised by;

- i. Self-disclosure (not to conceal faults and feelings)
- ii. Clarity of expression
- iii. Coping with feelings (refrain from anger and not to hurt others)
- iv. Self-concept (clear ideas and objective) and
- v. Listening capacity

Importance of listening in communication

Listening can be described as a combination of learning, understanding, remembering and acting. Bennett and Wood say that there are three listening styles called results, reasons and processes. Results style listeners want to hear the bottom line only. Process style listeners want to be led into a subject with some background on how it all came about, before getting to the bottom line. Finally, reasons style listeners need to be convinced that whatever is being proposed is reasonable, logical and suit the situations.

Good listening habits: (i) listen without evaluating, (ii) don't intercept or anticipate, (iii) don't try to get everything, (iv) don't fake attention and (v) reveal.

Research shows that poor communication is probably the most frequently cited sources of interpersonal conflict. Because individuals spend nearly 70% of their working hours communicating (writing, reading, speaking, listening, etc...) it seems reasonable that one of the most inhibiting forces to successful performance is lack of effective communication. When a thought or an idea is transmitted, the mental picture perceived by the receiver should be exactly the same as was envisaged by the sender.

Communication barriers

- 1) **Personal barriers:** Personal barriers arise from values, emotions and poor listening habits. They may also occur because of difference in education or socio-economic status. Emotions can also act as perceptual filters in all our communication.
- 2) **Physical barriers:** These barriers occur in the environment where communication takes place. (eg., sudden noise, spatial separation).
- 3) **Semantic barriers:** These arise from limitations in the symbols with which we communicate. People from different cultures may face semantic barriers.

Communication Problems and Remedies

Incomplete comprehension: There is no way to ensure that the receiver of the message has understood it. Human perceptual process complicates interpersonal communication. One may ignore part of the message, if it is considered irrelevant or unfavourable.

Message comprehension can be increased by the following;

1. Objective should be clear
2. Structure and language must suit the objectives
3. The language should suit the recipient and situation (simple, direct language is preferable)
4. Repeating important points will increase comprehension
5. Feedback will help to assess whether the message was understood
6. Assume differences until similarity is proved
7. Emphasis description rather than interpretation or evaluation
8. Practise empathy
9. Treat your interpretation as a working hypothesis (don't think that your interpretation is the final one)

10. Overloading: Distribution of too much information may lead to communication inefficiency.
11. Insufficient upward communication
12. Insufficient downward communication
13. Filtering: Sender manipulates the information and makes it more favourable to the receiver (correct information is not transferred)
14. Selective perception: The receiver selectively sees and hears based on his needs, motivations, experience, background, etc...
15. Defensiveness: Receiver will be in a preconceived defensive mood. It will reduce his/her ability to achieve mutual understanding.
16. Words (language): Words mean different things to different people.

Critical Thinking

Critical thinking is making objective judgments about choices and risks. It is the ability to analyse facts, issues and experience based on the positive and negative aspects in an independent way. This skill helps adolescents to recognise and assess the factors that influence their attitudes and behaviour. Critical thinking is the key, which helps adolescents to form the right attitude towards life and there by develop responsible behaviour. Critical thinking ability will also help them to settle their health related issues and the issues of others by critically assessing the facts and situations. It helps to develop a value-based life by resisting the negative influence behind each and every interaction.

Critical thinking of an individual is based on the result of the concept formation about each and every issue in the society. Many mental activities take place in the formation of concepts. Some of the important stages are perception, analysis, comparison, synthesis and naming.

- a) Perception: Comprehensive perception of an issue based on observation, knowledge or study is the first stage.
- b) Analysis: Analysis is made to distinguish the appropriate qualities or qualifications of a particular issue in hand.
- c) Comparison: Comparison supports us to identify the similarity and dissimilarity of several issues.
- d) Synthesis: Synthesis is the abstraction of the concept by strengthening similar or favourable qualities and avoiding dissimilar or unfavourable qualities.

- e) Naming: Naming is the final product identification code, which is retained as concept for a particular situation.

Creative Thinking

This is a unique way of thinking, which is based on the insight we have about a particular area. Insight is the reflection of ones depth of knowledge in that area or is based on the promotion of inborn talent.

Graham Walls studied the stages involved in the thinking process and he has classified the common pattern of thinking into five stages. (1) Preparation, (2) Incubation, (3) Illumination, (4) Evaluation and (5) Revision.

- 1) Preparation: Formulates the problem and collects the facts and materials considered necessary for the new situations.
- 2) Incubation: During the period of incubation, some of the ideas that interfere with the solution tends to fade. In addition, a creative thinker may have experiences that provide clues to the solution. The unconscious thought process involved in creative thinking is also at work during this period of incubation.
- 3) Illumination: An idea for the solution suddenly comes up into consciousness.
- 4) Evaluation: The apparent solution is tested to see if it satisfactorily solves the problem.
- 5) Revision: Revision is the correction of the solved problem with final modification.

Nature of creative thinking

JP Guilford (in Nair, 2010) has developed a battery of tests to measure creativity in people. Out of this work emerged the concepts of 'convergent' and 'divergent' thinking. Convergent thinking is connecting many different points into a single end. Divergent thinking is bifurcating the thinking from a single point and developing different ideas.

Convergent: Convergent thinking is concerned with a particular end result. The thinker gathers information relevant to the problem and their proceeds by using problem solving rules to work out the right solution.

Divergent: The characteristics of divergent thinking having many varied thoughts about a problem.

The creative thinker may use convergent thinking to gather information and thoughts as building materials. Then they may use divergent thinking to make various combinations, which will result in the creative output.

Decision-making

Decision-making is our ability to choose the best alternative solution to a problem from the alternative options, with due consideration of the consequences of different decisions. Most of the decisions are risky in the sense that we cannot be sure of the outcome. In the case of decision-making, we can only make our own estimates of the probabilities. But if we can do it scientifically, the result will be more favourable, when compared with unscientific decision-making.

Stages

- 1) Define the problem
- 2) Gather and analyse the relevant data
- 3) Develop solutions to the problem
- 4) Analyse the implication of each alternatives
- 5) Select and act on the best alternative
- 6) Follow-up
- 7) Modify approach if necessary

Traits influencing decisions: Risk taking behaviour, rigidity, decisiveness, personal favours, dependency, levels of stress, self-esteem, values.

Decision-making is a kind of problem solving in which we are presented with several alternatives, among which we must choose. While decision making, we may be trying to maximize our expected gain by minimizing the maximum possible loss and the other party concerned is also expecting the same thing. Why does a merchant buy a particular stock and not another? They are trying to minimise their maximum possible loss or alternatively they might be trying to maximise their expected gains.

In real life situation, while decision-making, we can only make our own estimation of the probabilities. Such estimated probabilities are called subjective probabilities. We use rules of thumb or heuristics in deciding among alternatives. Another judgement heuristic is known as availability. Frequent events, which are easier to remember, are called availability. Estimating subjective probability in the way is useful, but neglecting events that are difficult to remember can lead to misjudgements about certain outcomes.

Problem solving

We face many problems in our daily life. This may range from minor issues to major risky problems. Problem solving is a process involving four distinct steps. They are: (1) Defining the problem; (2) devising a strategy; (3) carrying out the

strategy; and (4) evaluating progress. In this process all relevant information pertaining to the problem is collected, physical and emotional feelings associated with the problems on either side is considered, possible alternatives are offered and steps are initiated to make the parties accept a mutually agreeable decision. This skill is helpful to sort out an issue, solve a problem or resolve a conflict. It is a way to get one's needs accomplished without using anger, intimidation, insubordination, aggressive behaviour or force.

Rules in Problem solving

There are mainly two rules. They are algorithms and heuristics. An algorithm is a set of rules, which if followed correctly will generate a solution to a problem. For instance if you are given two numbers to multiply, you immediately start thinking of all the rules of multiplication you have learned and you apply these algorithms to the problems. If you follow the rules correctly, you will solve the problem correctly. But for many problems we don't have an algorithm. Then we must be heuristic. Heuristics are strategies, usually based on our past experiences with a problem, which we think will lead to a solution. Here the problem is divided into smaller sub-problems and a sub goal heuristic is applied (which is called means-end analysis). Each of these steps will lead one closer to the desired goal.

Steps in problem solving

1. *Define the problem:* to clarify its nature and solution
2. *Devise a strategy:* a plan that shows reasonable promise of reaching the goal.
3. *Carry out the strategy:* Collecting rules and knowledge that may be useful to reach the goal by avoiding distraction.
4. *Evaluate progress:* to check whether we are in the right path and getting close to the solution.

Constraints in problem solving

1. Failure to analyse the problem
2. Thinking according to likes
3. Functional fixedness (fix to the known facts only)
4. Relying on the readily available information (The blind faith on any information without ascertaining the birth of the information).

Coping with Emotions

Emotions are normal reflections of the mind. Abnormal emotions are the reflections of the mind, which happens as a result of the inability of the mind to cope

with a particular situation or incident in our life. This is also followed by bodily changes such as increase in blood pressure, decrease in blood sugar, slow functioning of the intestine, changes in the functioning of the brain etc. Emotions like anger, sorrow, tension etc. can have negative effects on our health. Coping with emotion means being aware of our emotions and understanding how it influences our behaviour and then by find out remedial measures to respond to the emotions appropriately.

The word emotion is derived from the Latin Word *Emovere* which means to stirrup, agitate or excite. Emotion is a stirred up state of an organism. Emotions are physiological and psychological responses that influence perception, learning and performance. Emotions activate and direct behaviour. Emotions can be divided into pleasant and unpleasant. The harmfulness of emotions is always assessed by its intensity. According to Crow and Crow, emotion is an effective experience that accompanies generalised inner adjustment and mentally and psychologically stirred up states in the individual and that shows itself in his overt behaviour.

Characteristics of emotion

- a) Emotions are universal, prevalent in every living organism at all stages of development from infancy to old age.
- b) Emotions are personal and they differ from individual to individual.
- c) Some emotions subside slowly.
- d) An emotion once aroused, tends to persist and leave behind emotional hang overs.
- e) An emotion can give birth to a number of other similar emotions.
- f) Emotions occur along with feelings.
- g) Every emotional experience involves many physical and psychological changes in the organism.
- h) Emotions expresses themselves through internal and overt behaviour.
- i) Emotions can be identified and measured through introspective reports of the individuals and through observation of facial expression.

When we speak of emotions, we usually refer to (a) subjective feelings, (b) the physiological bases of emotional feelings, (c) the effects of emotion perception, thinking and behaviour, (d) the motivational properties of certain emotions and (e) the ways emotions are shown in language, facial expression and gestures. Thus an emotion is a state of feeling that has physiological, situational and cognitive components and that it energizes and directs behaviour.

Illustration

Imagine that while walking home during late night along a deserted street, you see two stout people following you. When you start walking fast, you see they also walk fast. Then your heart beat increases, you start running, you think about the followers' intention and feel scared. Here emotion can be analysed as below;

- 1) Physiological arousal (increase in heart beat)
- 2) Expressive behaviour (you run)
- 3) Conscious experience (interpreting the persons intention and feeling fearful)

Physiological changes followed by emotion

- 1) The blood pressure and heart rate increases.
- 2) Respiration becomes more rapid.
- 3) The pupils of the eyes dilate.
- 4) Blood sugar level increases to provide more energy.
- 5) The blood clots more quickly in case of wound.
- 6) Mobility of the gastrointestinal tract decreases or stops and blood is diverted from the stomach and intestine to the brain and skeletal muscles.
- 7) The hairs on the skin stands erect.

Emotional expressions

We express our emotion through verbal (words) and non-verbal behaviour such as facial expressions, eye contact, body movements, tone of voice and even positioning of eyebrows.

Emotions as being adaptive and disruptive

The adaptive and disruptive level of emotion depends on its intensity.

Mild emotion: We need mild level of emotional arousal to be alert and interested in the task. For eg. to be interested in studies, students should have mild fear of facing examinations.

High level: At high-level arousal, performance level decreases. It is because the nervous system responds to too many things at once, thus preventing the appropriate set of responses.

Enduring emotional states

Sometimes emotions are not quickly discharged but continue to remain unexpressed or unresolved. If one has a prolonged conflict with his employer or if one is worried over his chronic illness the emotion continues for a long time. This

hampers the individual's ability to function effectively. Sometimes, continued emotional tension can impair physical health.

Coping with Stress

Stress is a dynamic condition in which an individual is confronted with an opportunity, constraint or demand related to what he or she desires and for which the outcome is perceived to be both uncertain and important.

Intense emotions lead to stress. Mental disturbance due to problems is the root cause of stress. Heightened stress leads to many health problems. Emotional instability, adjustment problems, non-co-operation, sleeplessness, increased blood pressure, digestive problems, headache etc... are some of the problems. Coping with stress means recognising the source of stress and finding the way by which it can be controlled.

The term stress is borrowed from physics. The word actually means pressure. It is the inner pressure caused by the following three factors;

1. Endogenous: Internal pressure (within the body)
2. Exogenous: External pressure (from outside)
3. Interaction of endogenous and exogenous factors: both internal and external factors.

Illustration

An adolescent student says "Whenever it rains with lightning and thunder, when nobody else is in the house, I experience stress. Within a few minutes, I get wheezing and I am not able to breathe with ease. I get tensed up so much that I need to take some medicine to keep myself away from these problems."

Analysis

1. *Exogenous factors:* rain, lightning and thunder.
2. *Endogenous factors:* (a) being highly sensitive to such instances, (b) anticipation of the same unpleasant events, (c) feelings of inferiority, inadequacy and uncertainty.
3. When any one of the endogenous factors interacts with any one of the exogenous factors the stress responses occur.

Stress reactions

Any condition that makes the body mobilize its resources and burn more energy, than it normally does, is stress. Three stages appear to occur in the body's

reaction to stress. Collectively they are called General Adaptation Syndrome (GAS). Hans Selye (in Nair, 2010) explained its salient features as given below.

1. *Alarm reaction:* These are the typical bodily changes, which take place in an individual who is emotionally aroused. Dilation of pupils, dryness of the throat or mouth, nervous perspiration, need to urinate very frequently, trembling, rapid pulse, muscles becoming very tense, profuse sweating, etc.
2. *Resistance:* If the stress continues for some time, the individual enters into the second stage, which is called resistance to stress. In this stage the individual recovers from the first burst of emotion and tries to endure the situation as best as one could. Such endurance however puts considerable strain on one's resources.
3. *Exhaustion:* When one arrives at this point, he or she has exhausted resources for dealing with continued stress.

Stress related disorders

1. *Psychological disorders related to stress proneness and the role played by stress as a causative factor.*

a) *Respiratory disorders:* Common cold, Rhinitis (congestion of the nasal mucous membrane and blood vessels of the eyes wherein generally there is a watery secretion from stress accompanied by itching and sneezing), Bronchial asthma.

b) *Cardiac Vascular disorders:*

Tachycardia (irregular heart rhythm and breathing problem)

Anginal Syndrome (Sudden & severe pain in the chest),

Hypertension (high blood pressure),

Coronary diseases (heart attack)

c) *Gastro intestinal disorders:*

Anorexia (loss of appetite),

Bulimia (excessive appetite),

Peptic ulcer (open sore on the lining of the stomach),

Colitis (diarrhoea, constipation, lower abdominal pain and bleeding)

2. *Migraine or headache* (intensely painful headache recurring periodically on only one side of the head).
3. *Genito Urinary disorders:* Inhibition of bladder function, Chronic frequency of urination, enuresis (bedwetting).

4. *Menstrual disorders:* Dysmenorrhoea (painful menstruation), psychogenic amenorrhoea (decrease or stoppage of menstruation among women).
5. *Disturbance of sexual function:* Psychic impotence (unable to perform the sexual act - male), Frigidity (unable to perform the sexual act ^female)

Mental Health

Anxiety disorders (unrealistic, irrational fear):

- (a) Post-traumatic stress disorder: experience psychological trauma like life threatening situation;
- (b) Panic disorder: disturbance caused by unexpected panic disorder;
- (c) Phobia: fear of something
- (d) Depression (marked sadness of mood, fatigue, insomnia or hypersomnia, dimensional cognitive activities, etc..)

PROBLEM SPECIFIC SKILLS FOR ADOLESCENTS

In addition to general (generic) skills, which pave the way for overall healthy development and physiological competence of the adolescent, there are some specific issues particularly pertaining to adolescents which need specific attention and care. There should be efforts to strengthen our adolescents and to keep them away from these problems. Major problems specific skills required by adolescents are as follows:

- 1) Skill to keep away from substance abuse
- 2) Skill to understand sex and sexuality scientifically
- 3) Skill to avoid suicide tendency
- 4) Skill to cope with gender issues
- 5) Skill to overcome negative peer pressure
- 6) Skill to maintain assertiveness
- 7) Skill to overcome eating disorders
- 8) Skill to improve learning technique
- 9) Skill for time management and punctuality

Skill to Keep Away from Substance Abuse

Substance abuse refers to the practice of consumption of drugs not prescribed by a doctor. These drugs or substances usually affect mental function and give the user a kick.^ Commonly used substances are tobacco, alcohol, marijuana, sedatives, stimulants, opium derivatives, etc.. Awareness and training is needed to make adolescents keep away from this practise.

Alcoholism

Alcoholism is the nation's 4th largest health problem after cancer, heart disease and mental illness. Alcoholism causes reduction in productivity, accident and higher health care costs. Alcoholism has got different growth stages. In the early development stage symptoms are almost non-existent. In the second or disruptive stage, the symptoms become visible. In the third stage, intensive treatment will be required to cure addiction.

Drug abuse

Drug abuse is more in people who are less than 30 years. Adolescents are more prone to drug abuse. This is done by theft. Detection is difficult because people try their level best to hide the habit.

Skill to Understand Sex and Sexuality Scientifically

Awareness about sex and sexuality is another requirement during adolescence. Adolescents undergo many changes. They change from girls and boys to women and men. It is natural for them to feel confused and anxious, when they are experiencing many new changes. In order to overcome this situation, awareness is necessary. According to their age and development, we should teach them body changes, functions, development and the natural and unnatural factors related with growth and development. Exploitation and misuse of relations should be stressed.

Skill to Avoid Suicide Tendency

Suicide tendency in adolescents is increasing day by day. The emotional/mental imbalance makes them take such decisions. Many who commit suicide have a history of depression, impulsiveness, drug abuse or aggression. Rigid perfectionists also commit suicide. Bad experiences like failure in examinations, guilt or disappointment, failure in love, etc., can also precipitate a suicide attempt. So, in order to avoid this tendency they should be equipped with resisting skills by understanding their specific mental situations and thought processes.

Skill to Cope with Gender Issues

Gender issues arise, when men and women are not aware about their role and the role of their spouse after marriage. This happens because men and women have different needs from marriage and relationships. Normally people care only about their own needs and aspirations and conveniently forget the needs and aspirations of others. We need gender understanding and relationship. Understanding the opposite gender means understanding the gender differences, gender concept and gender

correctness that are magnified by relationships. There is no doubt that gender misunderstanding will hurt relationships.

Gender identity

This refers to the acquisition of a set of benefits, attitudes and values about oneself as a man or woman in many areas of social life including intimate relations, family, work, community and religion.

The adolescents become aware of their bodies as they experience changes in body shape, height, weight and strength. Notions of physical attractiveness become more salient. They become aware that first impressions are based on physical appearance. Satisfaction with body image is important for approaching social relation with a positive optimist outlook. On the loss of love and passion, self-consciousness calls attention to new emotions such as jealousy or depression. Maturation of the hormonal system, which influences the emotional arousal as well as sexual urges, contributes to the development of the gender identity.

Skill to overcome Negative Peer Pressure

During the period of growth and development, drastic changes occur in adolescents' relationships with the family, peers, people of the opposite sex and society in general. Different types of pressures influence the adolescent. They include (1) pressure from the family, (2) pressure from peers, (3) pressure from media and (4) pressure from gender. Family pressure sometimes makes adolescents rebellious aggressive or passive, it also reduces the self-esteem and personal identity. Society and media also exert pressure. Adolescents seek popularity among their peers. They consider group standards more valuable than abiding by family rules and values.

During adolescence, peer-group membership assumes more importance than at any other period of life. A study conducted by Larson (1977), revealed that an adolescent spend more time talking with peers than doing academic work or being with their families or being alone. Hartup (1983) and Savin Williams (1980) describe another structural feature of the adolescent peer group in the dominance hierarchy. Peers play a crucial role in the psychological and social development of most adolescents. As their ties to parents loosen, adolescents become more dependent on peer relations. Many areas of their inner life and outward behaviour cannot be readily

shared with parents. Consequently, some adolescents feel that their friends understand them better than their parents.

Adolescents peer relation falls into three broad categories.

- 1) Broader (just friend)
- 2) Smaller (more intimate cliques)
- 3) Individual (intimate friend)

Positive Peer pressure

An adolescent peer may help a boy or girl gain a clear self-concept.

Negative Peer Pressure

- 1) Adolescents may be pressurised by peers to participate in activities like drinking alcohol or attacking social groups.
- 2) Adolescents who are neglected by peers are most likely to be digressive, inconsiderate and demanding of attention.

Skill to Maintain Assertiveness

Assertiveness is the capability to stand up for one's own values and needs and say No when one wants to say No with due respect to the other person's feelings.

Assertion training refers to the behaviour therapy procedure in which an individual is trained and supported in taking positive assertive action. Assertive behaviour is defined as proper expression of any emotion other than anxiety towards person. Assertive responses are considered as one of the major anxiety inhibiting stimuli. Four response categories are involved in assertive behaviour.

- 1) The ability to initiate, continue and successfully terminate conversation.
- 2) The ability to say No.
- 3) The ability to make requests and ask favours.
- 4) The ability to express positive and negative feelings.

Assertiveness is a stage between aggression and submission. The basic rationale for assertion training is taking appropriate positive action in problem situation and anxiety. Assertion as a therapy can be used with adolescents who are extremely timid, inhibited, passive, lacking self-confidence, depressed, hostile, aggressive and over bearing.

Dimension of assertion framing

Lange and Jackenbowski (in Nair, 2010) have advocated four basic dimensions. They are:

- 1) Differences between aggression, assertion and submission must be made clear by demonstration through behavioural rehearsal.
- 2) The client should be helped to identify and accept both their own personal rights and the rights of others.
- 3) Cognitive and effective obstacles preventing asserting action should be removed or reduced.
- 4) Assertion skills should be developed through active practise methods like role-play.

Skill to Overcome Eating Disorders

Eating disorder has recently emerged as a common adolescent problem. Terms like anorexia nervosa or bulimia, which are related to eating disorders are becoming move common in India also. Girls are much more disturbed about obesity than boys. Obese girls, have low self-esteem and feel frustrated when their dieting is unsuccessful. In anorexia, there is a pattern of self-starvation. The initial aim may be to achieve a perfect body, by reducing few kilograms of weight. But when they achieve that goal, then select a new target of much lower weight. Then they become so malnourished and are forced to get admitted in the hospital. Bulimia can be called the binge purge syndrome. Hence eating becomes out of control and vomiting tendency also develops. The therapeutic work with adolescents, whether individually or in groups demands skills and extensive experience with young people. Therapists must be worthy of trust and respect from adolescents.

Skill to Improve learning technique

Our students in the classroom are passive, dependent, uninformed and dissatisfied. Normal classroom activity involves students in mental inactivity. The teacher is doing much in a class instead of making the pupils to do their part. It is high time for us to change our system of education. Learning skills in children are an important ingredient for the development of the child. The role of the teachers is to set the climate, the environment and the conditions. The learner must use the situation fully and grow more independent of the teacher.

Learner Driven Learning (LDL)

- 1) The aim and objectives of LDL is to promote self-confidence, independence and a sense of autonomy in students.

- 2) Create an ability to control their own affairs and participate in the management of their society.
- 3) To foster effective, independent, learning through training.
- 4) To change teachers' attitude and behaviour.

Skill for Time Management and Punctuality

Now a days, all of us know that time management is a grave problem that all of us are facing due to many reasons. Though many of the reasons are within our control there are some reasons, which are beyond our control. In general, time abusers can be classified into four.

- 1) *Pre-emptive abuse* (finishing off work much ahead of the dead line. Not acceptable for team work)
- 2) *People pleasing abuse* (where too much is taken on because they hate refusing work) They waste time doing unproductive work.
- 3) *Procrastinating abuse* (where work is faked and put off.) Do projects very late.
- 4) *Perfectionists*: Works exceptionally well achieves targets but takes his own time to do the things.

So, time management skill is a very pertinent requirement in every walk of life. Adolescents should be trained to acquire this skill, which will help them to do their work in the most appropriate way.

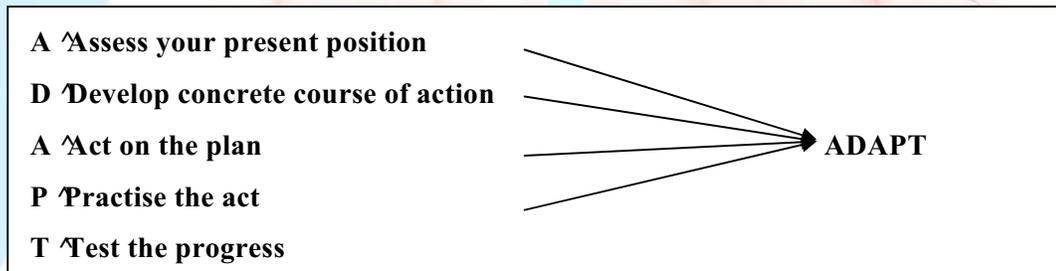
CONCLUSIONS

Adolescent development is a process of mental, physical, social and emotional growth during which young people prepare to live a productive and satisfying life within the customs and regulations of their society. During adolescent development experiences of high quality don't just happen. The best ones are carefully planned to encourage life skills development and to achieve specific results. By clearly stating desired changes as programme objectives, youth development experiences can be evaluated more effectively to determine if the programme succeeded in making the intended difference in the lives of youth.

A skill is a learned ability to do something well. Life skills are abilities that will help them to be successful in living a productive and satisfying life. Life skill is not something that can be acquired by reading books or simply understanding what it is. Understanding what life skill is only preliminary requirement for the process of acquiring life skills. The understanding of the skill should be felt to the individuals by participatory methods of training. Life skill training needs a long period of time. It has

been found that such continuity has been able to create a better impact. Periodical review and assessment is another unavoidable requirement of the process.

Practising life skill to improve the skill is a lifelong process. There is no end to the quality of the skill. Dedicated and sincere attempt paves the way for increasing the skills. We cannot say there is perfection or end to the acquisition of skills. The skill goes on increasing as we try to increase the skill by practising and correcting the defects by training and evaluations. The cardinal rule for acquiring life skill is embedded in the following illustration.



Life skills education empowers children. Life skills make adolescents to do things in a better and correct perspective. This automatically leads to positive action in them, nurturing positive development, pro-social activities and social development.

WHY SHOULD WE TEACH LIFE SKILLS TO STUDENTS?

The Training strategies for Life Skills Training Programmes has to be designed based on a specific approach followed by sufficient and appropriate materials, with the help of teaching aids and student friendly techniques. For details, see the respective chapters.

1. SELF-AWARENESS

- To enable the students to know themselves
- To make them understand their strengths, weakness, opportunities and treats
- To understand their positive and negative qualities
- To enable them to know the self-value which can bring them self-worth

2. EMPATHY

- To help the participants understand their own feelings and emotions.
- To make the participants realize the feelings of another person.
- To enable them to distinguish between sympathy and empathy
- To facilitate the participants to be sensitive to another person's emotional state.

3. EFFECTIVE COMMUNICATION

- To make them understand the importance of Effective communication
- To encourage them to communicate considering role and purpose
- To help them understand the concepts behind communication.
- To motivate them to listen actively to others and its importance in understanding what others are conversing.

4. INTERPERSONAL RELATIONSHIP SKILLS

- To help enhance one's relationship and intimacy with appropriate people.
- To understand different kinds of relationships and difference in each one's perspective.
- To know the importance of maintaining and sustaining positive relationships with other people.
- To create new relationships and to know how to break unfavourable relationships without creating issues.

5. CRITICAL THINKING

- To explore the various sources of information to a particular problem.
- To analyse critically and rationally.
- To approach any issue without pre-judgment on either sides.
- To use critical thinking as support to problem solving and decision making.

6. CREATIVE THINKING

- To be innovative and think out of the box (Think differently)
- To look beyond direct experiences and generate or explore new ideas.
- To adjust flexibility and adapt to changes quickly.
- To help them create original ideas and guide them to look for new perspectives.

7. PROBLEM SOLVING

- To realize the importance of solving problems effectively.
- To make them understand problems are inevitable
- To help them identify their own problem area.
- To explore more options using critical thinking and creativity.
- To guide them to plan and prioritize

8. DECISION MAKING

- To help the students decide things on the basis of facts rather than fictions.
- To make them understand the steps involved in decision making.
- To generate convincing options and make a decision.
- To guide them to implement and take the responsibility of the consequences.

9. COPING WITH EMOTIONS

- To understand one's own emotions and learn the need to control it.
- To be aware of the emotions of others and respond appropriately to those emotions.
- To make them realize the adverse effect of heightened emotions.
- To enable them to help others control their emotions in difficult situations.

10. COPING WITH STRESS

- To make them understand about the stressful situations in life.
- To understand the effect of stress and the importance of stress management.
- To explore the stressful situations from their experience and give tips to adopt a stress less life style.
- Relaxation techniques may be provided based on their need.
- Convey the importance of proper planning, schedule and time management to control stress and lead a comfortable life.

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Life Skills Education through Science

Dr. Geetha G. Nair
Professor in Botany, DESM, RIE, Mysore

Module

1

I keep six honest working men; they taught me all I know

They are what, why, when, who, where and how (Anonymous)

Introduction

Science, verily is knowledge. Knowledge is different from information based on facts. Knowledge is to be gained through the processes of the brain viz., thinking and solving processes whereas information is to be gathered. Science as knowledge includes facts organized into schemas with purpose (questions, hypothesis, theories etc.) The terms knowledge and information are used interchangeably in many contexts, but in discussions of life skills education, information refers to what is communicated about a particular fact or subject, while knowledge refers to a state or condition of understanding that permits factual information to be related to other information and knowledge, synthesized into broader concepts and usefully applied (<http://www.unicef.org>).

We live in an information age where facts of the world around are multiplying in leaps and bounds and we are now transiting slowly to a knowledge society. Science here becomes the very foundation of existence. Science is because knowledge is and knowledge has to be constructed. The NCF (2005) talks about constructivism and constructivist approach to learning in schools. Teaching and learning cannot be done in Science without constructivism. For that matter, NCF (2005) has made constructivism and the learner centered approach its rod and staff of learning.

Science is a systematic enterprise (latin *scientia*- knowledge) that builds and organizes knowledge in the form of testable explanations and predictions about the universe. Science is a body of knowledge itself that can be rationally explained and reliably applied. And life skills, which are the basic processes of the brain help in learning to learn.. Life skills are all about learning to learn. Life skills can be learnt through science and science education. How? Let us take the help of educationists to understand what transpires while learning science. Science education is an area of study where the learning of science is promoted through a definite system of practices or methodology. It concerns itself with the sharing of science content and processes

with individuals who are outside the purview of Science, and its application in day to day life with individuals who do not know reasoning, logic, processes of science viz., observing, inferring through analysis and synthesis of knowledge, concluding, questioning, hypothesizing, planning, predicting, investigating, communicating etc. This sharing aspect of Science Education is necessary for involving ourselves and investigating systematically an individual's personal and community life, to understand the environment and nature, to combat scientific ignorance and to enable individuals to apply knowledge of science to everyday life. Science and science education are necessary to remove preconceptions and misconceptions, to enable organization of knowledge, and to help an individual to think about thinking and learning and to help them evaluate their thinking and learning and also to evaluate scientific evidence. Though informal science education can be had through museums, media like TV and internet, and through community programmes, this may not be enough to understand the basic teaching learning processes of science.

Science *per se* is not sufficient for one to deal with day to day life. Science/knowledge has to be applied/brought into use in day to day life in an appropriate way. It has to be applied in real life contexts. Abilities to use knowledge in life are identified as life skills. Life skills are the psychosocial competencies required to deal with the challenges of day-to-day life and comprise ten generic skills as mentioned by WHO (1994, 1997). These are the Solving, Thinking, Relationship, Understanding and Coping skills (STRUC). Problem solving, decision-making, creative thinking, critical thinking, inter-personal relationships, effective communication, self-awareness, empathy, coping with emotions and coping with stress are the ten generic skills mentioned by WHO (1994, 1997). These are the basic cognitive processes of the brain that we use subconsciously, naturally and involuntarily (by virtue of the structure and function of the brain) in our day-to-day lives.

UNICEF (www.unicef.com) defines life skills as a behaviour change or behaviour development approach designed to address a balance of three areas—knowledge, attitude and skills and this is based on research evidences. While *^knowledge^* refers to a state or condition of understanding that permits factual information to be related to other information, the term *^attitudes^* is used in the context of life skills education to encompass the broad domain of social norms, ethics, morals, values, rights, culture, tradition, spirituality and religion, and feelings about self and others. Life skills are defined as psychosocial abilities for adaptive and

positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life (WHO, 1994, 1997). They are loosely grouped into three broad categories of skills: cognitive skills for analyzing and using information, personal skills for developing personality and managing oneself, and inter-personal skills for communicating and interacting effectively with others. Life skills education is a structured programme of needs- and outcomes-based participatory learning that aims to increase positive and adaptive behaviour by assisting individuals to develop and practise psycho-social skills that minimize risk factors and maximize protective factors. Life skills education programmes are theory- and evidenced-based, learner-focused, delivered by competent facilitators, and appropriately evaluated to ensure continuous improvement of documented results (www.unicef.org). Life skills education is an area of study emphasizing co-scholastic abilities spanning the entire life span of an individual, be it an adolescent, a youth, a middle aged person or an older individual. According to WHO (1998), Life skills Education is designed to facilitate the practise and reinforcement of psychosocial skills in a culturally and developmentally appropriate way; it contributes to the promotion of social and personal development, the prevention of social and health problems, and the protection of human rights (WHO, 1993, 1996). These psychosocial skills can be practised through science and practise of scientific knowledge.

This is where life skills will facilitate the learning of science. The reverse is also true in that science, the study and practise of science, will facilitate Life Skills Education and result in changes in behaviour of an individual through synergistic approach of the knowledge of science, scientific attitudes and skills. Life skills Education which promotes social and personal development and health etc. through the practise of ten generic skills can be learnt through science. For science is the outcome of knowledge itself and knowledge is the by-product of the generic skills and the two are inseparable. Life Skills education can be visualized as the process leading to Science (or knowledge) as a product.

Life Skills Education is an area of study emphasizing co-scholastic abilities in individuals spanning the entire life span of an individual, be it an adolescent, a youth, a middle aged person or an older individual. Life skills promote psycho-social competence and are needed by individuals at each stage of his/her life.

According to WHO (1998) Life Skills Education is designed to facilitate the practise and reinforcement of psychosocial skills in a culturally and developmentally

appropriate way; it contributes to the promotion of social and personal development, the prevention of health and social problems, and the protection of human rights (also refer, WHO, 1993; WHO, 1996).

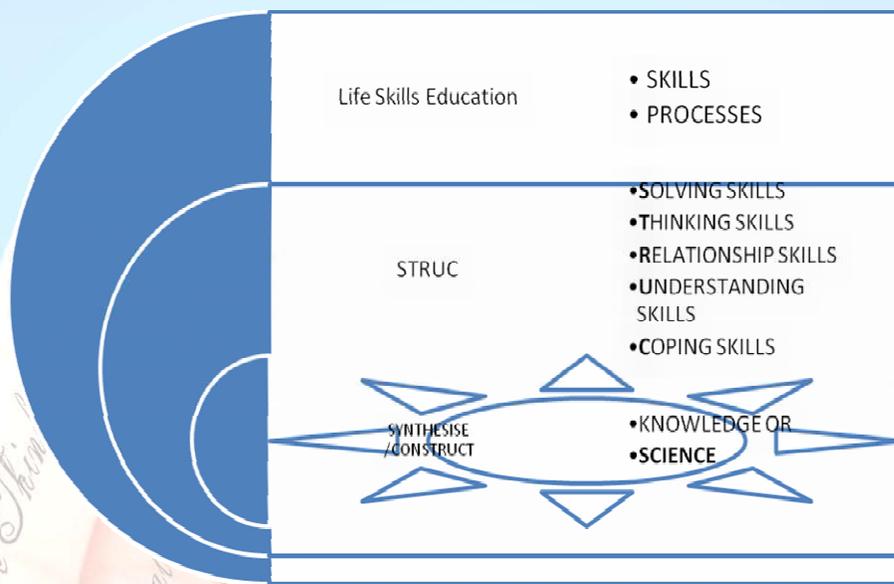


Figure 1.1.1: Learning of Science through Life Skills Education

Objectives

The major impetus for the development of a source book in Life Skills Education through science was the Adolescent Education Programme/Life Skills Education Programme recommended by the working group on Youth Affairs & Adolescent Development for XI Five Year Plan (2007-12) and the working group on Education (GOI, 2001). A few efforts exist at the Government level in Life Skills Education through programmes in rural areas. However, no concrete material or data exist for Life Skills Education through Science. VIMHANS (<http://www.vimhans.com/academics/>) is on track to bring out Life Skills Education and Science content related material. But no literature is available as yet on this and this is a major reason for developing a source book on Life Skills Education.

Reflections

What do we envisage in this source book in Life Skills Education to be brought out through the activities of the three workshops (planning, material preparation and review)? It is the imparting of life skills through the teaching learning of science processes. All the prescribed Science texts of the NCERT (2006, 2007) have life skills built into them (Author, 2011). An analysis of the textbooks would pave the way for learning process viz., of Life Skills.

The most important objective of the sourcebook is to justify the need for infusion of life skills in a particular content area and to high light how the content area could be used for life skills education. It is well understood that the co-scholastic area of life skills and its importance cannot be understated. Yet, it cannot be taught as a separate curriculum in the XII Standard as none exists so far and has not been recommended. Hence, integration or infusion of life skills into the existing content area of science remains the only recourse for ensuring life skills education before the students exit school. This is being done through exemplars in the respective science streams.

The second objective is the delineation of content areas of science for life skills integration. The source book should delineate and circumscribe content areas in the XII Standard Science Textbooks where life skills are to be integrated. These content areas are selected based on aligned life skills or life skills that could be employed to develop the content or based on the scientific activities/experiments/projects/problems/assignments/investigatory questions which are embedded in the content area. The XII Standard Texts in Biology, Physics, Chemistry and Mathematics provide content areas with infused life skills (cf. analytical tables in Appendix).

There should be deliberate planning and systematic integration of life skills in the content area of science through interventions. The source book should be a forum for expanding upon various life skills using the enlisted activities/experiments/projects/problems/assignments and investigatory questions from textbooks for the development of life skills education material in the content area. Be it Botany, Zoology, Physics, Chemistry or Mathematics, the pedagogical exercises in the content areas should be elaborated upon using process skills, appropriate scientific

methodology, educational teaching-learning methodology and methodology (interventions) for teaching life skills with respect to content transaction at the classroom level.

A source book should help bring about development of psychosocial competence in adolescents through life skills in content areas of science already outlined here. Life skills are a must for the adolescent generation. Why? Because adolescents who fall in the age group of 12-19 (or in teens) are in a stage of transition to adult stage and undergo a lot of physical and mental upheavals in the form of development of secondary sexual characters, onset of puberty. These developmental phenomena leads to explorations of new experiences and to incidences of sexual abuse, pregnancy, aggression, bullying, peer pressure, drug abuse, alcoholism, juvenile delinquency etc. Life Skills Education can help in preventing many such cases by providing psychosocial competence in this teen population.

Life skills education through Science should facilitate tapping of adolescent potential through its programmes. Adolescents form a major chunk of the world population in the Americas (Latin American countries) and in India and they hold tremendous potential for the development of the countries.

The sourcebook should enlist problems faced by adolescents and give remedial interventions for the same. Adolescence is a stage when they face stresses and strains of entry into field of work, adulthood and other concomitant responsibilities. Life Skills at secondary level of schools in India, therefore, holds a lot of promise for improving their quality of life and career achievements. A source book here should list out the problems faced by adolescents, the causes of these problems and the remedies to the problem areas in the form of local-specific and content specific life skills education training and programmes/modules/materials/interventions. A sourcebook should enable better career opportunities through entrepreneurship and guidance and counseling. Vocational education is facilitated through Life Skills (Kshatriya, 2008).

Life Skills Education programmes have been advocated by WHO (1993, 1997, 1998, 1999), UNICEF and UNESCO (1997, 2001) in response to these needs. Life Skills Education through a science source book should enlist materials available already on life skills in the form of packages. An enlisting of sources of materials on life skills developed by WHO, UNICEF, UNESCO would go a long way in simplifying the tasks of the facilitators of these programmes which could be carried

out by schools, hospitals, NGOs, educational organizations and industrial and business organizations. The facilitators here are generally a teacher, a doctor, an officer, a social worker, a psychologist, a psychiatrist or a peer group. For eg. CII and (www.cii.com) and FICCI-SEFD are two Industrial organizations in India carrying out Life Skills Programmes in collaboration with the Government of India. Mind lab (www.mindlab.com) and CISCO (www.cisco.com) are educational organizations in Europe and India catering to the call of development of life skills. Central Board of Secondary Education (www.cbse.com), Rajasthan Board of Secondary Education, RBSE (Hindu, 2006) has already come out with a curriculum for the XI Standard students.

Life skills should occur at a young age, before negative patterns of behaviour and interaction have become established and school is an appropriate place for the introduction of life skills education because of the 1) the role of school in socialization of young people; 2) access to children and adolescents on a large scale; 3) economic efficiencies (uses existing infrastructure); 4) experienced teachers already in place; 5) high credibility with parents and community members; and 6) possibilities for short term and long term evaluation.

Life Skills Education should promote Nation Building through Life Skills Education Programmes. Adolescence Education Programme is being implemented at the secondary level along with NACO by MHRD (Bordia, 2009). There are a number of programmes under MHRD but those of mental health and counseling programmes, career guidance (for adolescents to choose their courses as per their aptitudes and abilities), personality development programmes (for participation of adolescents in nation building) and vocational skills development programmes (for out of school students in work participation) are yet to take shape and underlines the need for work in this area.

Life Skills Education through Science should promote health education. A source book on Life Skills Education through Science will enable the facilitators (especially teachers and doctors) to achieve health standards among adolescents. This could be made possible with definite modules linking science content of (apart from programmes) health related topics like HIV/AIDS Transmission, rehabilitation of alcoholics and drug addicts) counseling for prevention of teenage pregnancy etc. in the source book as these programmes or themes have a pivotal role in the development and maintenance of good health.

The sourcebook should aid the process of learning and development through science (www.mindlab.com; www.ipoint.com). Learning is the process of increasing one's capacity to take action (Kim, 1993). Learning is both a process and outcome concerned with knowledge, skills and insight (Mumford and Gold, 2004) (Rajsenan Nair, 2010). Learning is of four types ^inst rumental, cognitive, affective and self-reflective. Life Skills should increase scholastic achievement. According to Gonzalez (1990), life skills increase IQ and brain capacity or brain power and thereby scholastic achievement. It should enable improvement in theoretical and practical knowledge in the content areas of subjects. It should improve general mental abilities of the human brain.

Life skills education through science should prevent brain drain. Though we have immense muscle in brain power and scientific personnel, perhaps the largest in the world, next only to Japan and China, scientific attitudes and scientific research which facilitates the process of a country's progress and is an index of its development leaves much to be desired. Though we have over 150 universities in the country that breed intellectuals in Science, they do not have the life skills to employ themselves fruitfully within the economic infrastructure of the country, resulting in brain-drain.

Reflections

More than half of our scientific manpower is drawn into the Americas and European continent. Why?

Life skills will increase our ability to retain our strengths and do away with our weaknesses and inefficiencies. A source book on life skills education should and will facilitate retention of brain power. It would also boost self-esteem and confidence in every person.

Life skills education should facilitate learning from the environment. A source book should help an individual to learn from the physical environment around (both in physical sciences, biological sciences and mathematics) and apply this knowledge through knowledge to life skill situations. For eg., in sustainable management of resources, one should become aware of depletion of various resources viz., forests, petroleum, coal, water etc. and through critical thinking and creative thinking and problem solving skills try to replenish and/or conserve the resources in the

environment for posterity. Mathematical skills could be employed here to calculate the rise of population and proportionate decrease in resources and proportionate requirement of natural resources. Life skills do form a part of engineering courses especially environmental engineering.

A sourcebook should prepare individuals for the scientific and technological world of the future. The skills foreseen in the scientific and technological world of the future- a digital online world with fiber optics, info whelm, internet, nanotechnology, Moore's law of exponential growth (Pring *et al.*, 2009) will be mostly that of process skills, critical thinking skills and inter-personal skills (of collaborative nature). This underlines the fact that Science and Technology will grow in leaps and bounds through life skills and so will the learning process which will be customized, holistic and virtual. Herein lies the importance of a source book in Life Skills Education through the teaching-learning of Science.

Life skills though separate from livelihood skills should enable management of personal matters like time and money. Time is a concept of Physics and money is a mathematical concept. Life skills are important for time management and finance management. Teaching concepts of time and money through life skills and through a source book should go a long way in management of this very important personal matter.

Life skill education programmes through science should make public aware of the harmful effects of nuclear devices and war and promote peace education. A nuclear device in a war torn area can cause tremendous harm. Life skills could promote disuse of nuclear devices, which have long lasting and lethal mutagenic changes in human beings and promote peaceful co-existence, absence of terrorism etc. Life Skills Education through Science can prevent annihilation and destruction of the world through nuclear explosions and terrorist activities. Educational programmes have been developed for peace education (Prutzman *et al.*, 1988).

Life skills education through critical thinking on the study of human races, the evolution of Homosapiens in Science (Biological Sciences), would remove gender, caste and economic bias and thereby promote inclusiveness and citizenship education. Life skills, especially a source book in life skills in the content area of science should be able to emphasise the importance of generic skills in day to day life and in the pursuit of scientific activities. It should enable an individual to visualize the working of the scientific phenomenon in every aspect of their lives in the universe. It should

bring in scientific attitude, aptitude and temperament and do away with all that is illogical, outdated and superstitious. Going by this reasoning, the objective of this source book, the most important one, is to develop consciously and through academic teaching learning exercises, the ten generic skills outlined by WHO (1994;1997).

Last, but not the least, a source book should provide a platform for creating Life Skills Education Programme in Science.

Content

Important life skills as mentioned by WHO (1994,1997) are:

- a) Decision-making- to help us make constructive decisions in our lives without ill-effects on health
- b) Creative thinking-to enable us to explore the available alternatives and various consequences of our action and non-action-to respond adaptively and with flexibility to the situations of our daily lives.
- c) Critical thinking-to enable us to analyze information and experiences in an objective manner.
- d) Effective communication-to enable us to express our opinions, desires, needs, fears and asks for advice and help in times of need.
- e) Inter-personal relationships- to relate positively with people, keep friendly relationships for social support and for mental and social well being and also to end relationships constructively.
- f) Self-awareness-to recognize ourselves, our weaknesses and strengths, desires and dislikes.
- g) Empathy-to imagine what life is like for another person even in a situation that we may not be familiar with.
- h) Coping with emotions- to recognize them in ourselves and others, how they affect our behaviour-to control intense ones like anger or sorrow.
- i) Coping with stress- to recognize sources of stress in our lives and how they affect us (also refer Nair, R.).

The list provided above is in the form of expressed personality in real life situations. Hence they become concomitant educational objectives of the lesson plans to teach curricular content. Hence they need planned interaction of individuals with others, with objects and with environment. The modules in this exercise of developing sourcebook would attempt to provide such exemplars like brain-storming, role play, debates, quizzes, group discussions, buzz groups, anecdotes, case studies and

situational analysis, for infusing life skill objective with cognitive objective of science related topics (CCE, 2010).

The teaching of the above core life skills and their basic components (Murthy and Rao, 2005; WHO, 1994) will form the first step towards creation of a source book in Life Skills Education through Science or even for creating a Life Skills Education programme in Science.

Reflections	
<input type="checkbox"/>	Are our efforts in this direction supported?
<input type="checkbox"/>	How can we make our efforts successful?
<input type="checkbox"/>	Will it bring the required attitudinal and behavioural change in each one of us?

According to UNICEF (www.unicef.com) for successful life skills education

- 1) It should not only address knowledge and attitude change but more importantly behaviour change.
- 2) The information based traditional approach (eg. lectures on safe behaviour or even drug abuse) is not sufficient to yield changes in attitude and behaviour and should be substantiated with exercises and situations where participants can practise safe behaviour (or process of deaddiction from drugs) and experience its effects.
- 3) Exercises and situations in life skills education for changes in attitudes and behaviour should be augmented and reinforced i.e. repeated, recapitulated, reinforced and reviewed.
- 4) All the above three processes should be combined with policy development.

The life skills approach can be successful if the following three components are undertaken together (www.unicef.com)

- a) The skills which involves a group of psychosocial and interpersonal skills which are interlinked with each other, eg., decision making is linked with creative thinking and critical thinking.
- b) Content area-skills must be utilized in a particular content area to bring in behaviour change eg. decision making would be relevant if the content is relevant and constant-the content here could be drug-abuse, HIV prevention or any other aspect of health, Biology, Applied Biology or Science.

In this exercise on source book preparation in Life Skills Education, we are infusing Life Skills in Science content area to bring in attitudinal and behavioural change.

- c) Methods- Skills based education relies on groups of people who interact with each other to be effective. Therefore, life skills can be taught effectively through the use of certain methods and tools.

Summary

A source book in Life Skills Education through Science is an attempt to awaken all of us to the process of learning. The cognitive processes of the human brain are brought here to the science students in a simplified manner through various methodologies and interventions. The co-scholastic area of life skills are not to be undermined for these life skills form the very basis of our survival in day to day life. The objectives of the source book in terms of expected advantages are many ranging from scholastic achievement to quality life, quality environment, health benefits, personality development, peace and inclusive education. The criteria put forth by UNICEF support our efforts to bring in an attitudinal and behavioural change through the transactional processes of life skills in a class-room.

Worksheet

Worksheet 1

A. Enumerate and describe scientific events in your life.

- 1 -----
- 2 -----
- 3 -----
- 4 -----

What are the life skills emerging through these events?

B. What are floods caused due to? What is the scientific concept to be understood here?

How can you prevent floods and consequent damages in future? What life skill will you employ here?

C. How was the Uttarakhand tragedy caused? Is there a scientific reason for this event?

How would you employ life skills and Science to mitigate the after effects of the tragedy?

Worksheet 2

A. A bus goes up in flames as metallic tank hits against a stone. Give a scientific explanation as to what happened.

How would you prevent such a tragedy in future using life skills?

B. How much does our educational system spend for an engineer or doctor?

What are the employment opportunities for a highly educated individual?

What will you do by way of life skills to absorb the product/technical expertise of our educational system in our country and thereby prevent brain drain?

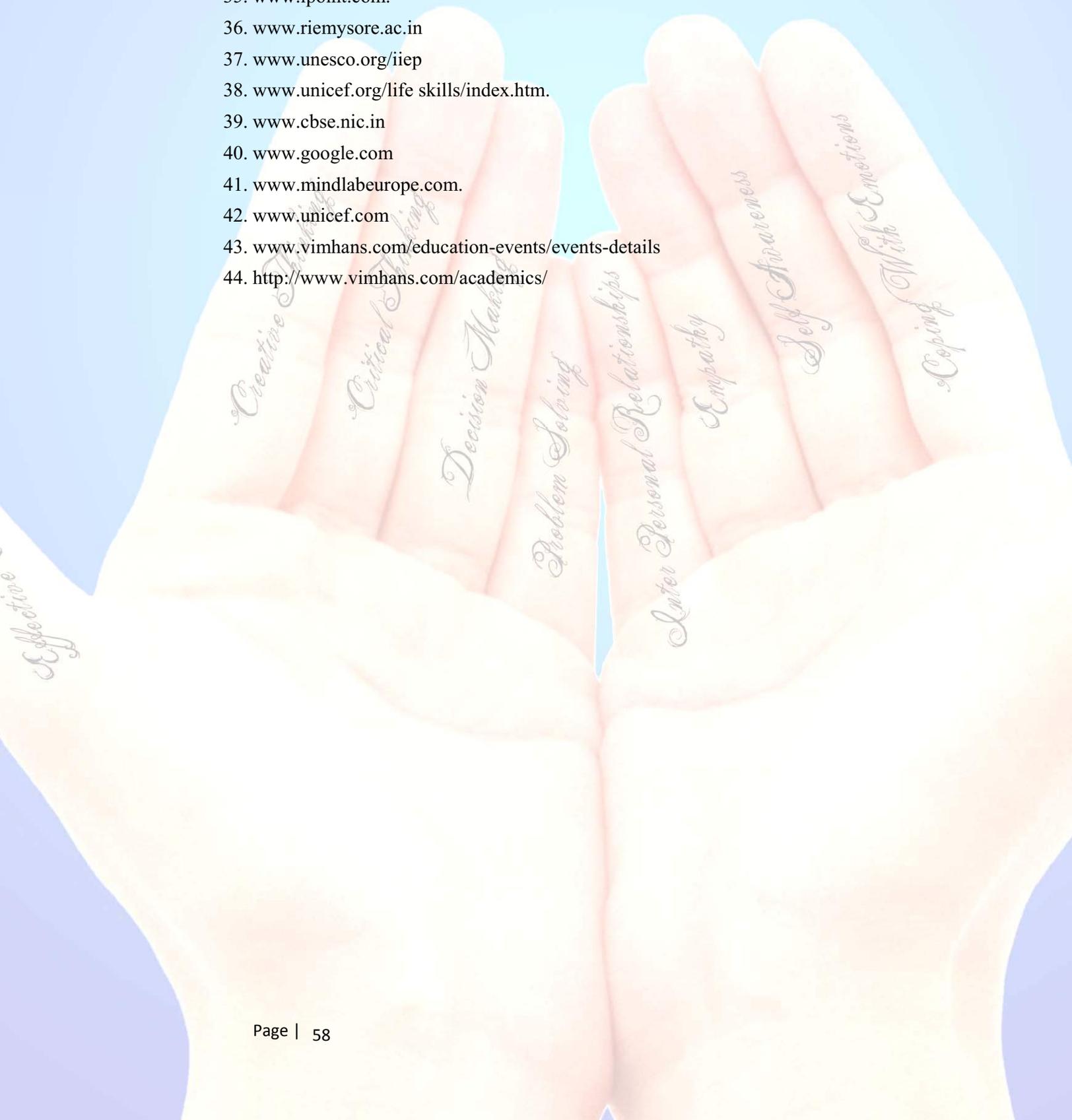
C. We are in the 21st century fast tracking with net, infowhelm, photonics, robotics etc. What are the life skills required for the 21st century?

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Dr Kumara Swamy H.
Lecturer, CTE, Mangalore

Dr. Premlata Sharma
Retired Principal, RIE, Mysore

Introduction

National Curriculum Framework 2005 has brought a paradigm shift in the very vision of school education. One of the major recommendations of NCF 2005 is to make education relevant to life (NCF, p. 13). The purpose of education is to build personalities and not just help learners memorise certain content and reproduce it in examinations. All these shifts in our view of classroom learning have opened new possibilities of integrating skills required for life into classroom processes. This is where integrating life skills education to learning of various subjects becomes important. The subject matter needs to become mediating factor in learning life skills and it has to be learnt in terms of its applicability to life. When subject learning becomes a governing force of an individual's thinking and practises, what comes to the forefront is the life skill. This interplay exists whether we consciously think of it or not. But being aware of such an interrelationship will lead to better understanding of the subject promoting related life skills.

Objectives

After reading this module you will

1. Learn what NCF says about Science Education.
2. Understand how the essence of NCF 2005, objectives of teaching of Science and life skills education are closely related.
3. Come to know the efforts made in NCF 2005 to relate classroom learning to real life.
4. Appreciate the relevance of the life skills training component in Science Education curriculum at the +2 level.

Content

Science Education and NCF 2005

NCF summarises the essence of Science Education in these words, Good science education is true to the child, true to life and true to science.(Art. 3.3, p.46).

This statement identifies three areas where Science learning has to be made relevant.

1. The learner
2. Life of the learner and life in society in general
3. The discipline of Science

That a learner is able to relate himself/herself to the subject is an important criterion for success of science education. Unless a learner makes sense of what is being taught, science education cannot become meaningful. Each learner comes with his/her own abilities and background. Learning is constructed against this background. The learner interests and preferences have to be catered to in the process of classroom interactions. Science education should be planned on the basis of understanding the worth of students i.e. in terms of their knowledge, adaptability and acceptance of Science. The aptitude of students for the science content also has to be determined by the teacher.

Similarly the learning of science has to become relevant to the life of the learner and life in society at large. The type of skills and thinking developed in science classes must help the learners lead a better life in society. The society should also be benefitted by the science education given to its future generation. The benefits could be in terms of making the quality of life better, improved facilities or application of technology to life situations. For example, the use of pressure cookers has become common place. But how many of the users are knowledgeable with regard to the proper use of a pressure cooker? Do they follow the recommendations strictly? Is there any relationship between the time taken to cook and the food that is being cooked? How can we save fuel and time by making use of the cooker? Perhaps, apart from what the company recommends, we learn a lot on how to use the cooker. The user understands that the pressure cooker works on the pressure principle as the name goes. Water boils in the cooker and water vapour pressure builds up and while lifting the valve and passing out makes a whistling sound and the latent heat of vaporisation of water of 540 calories instantly cooks the food inside. A user must be in a position to make observations, relate facts, hypothesise and finally test a few methods and arrive at his/her own terms of using the cooker. This seemingly simple

example shows how scientific concepts and an understanding of the same can help people in their day to day life.

In our society social beliefs and traditions play an important role in our life. For example, during eclipses, people are not supposed to move out of their houses, eat food and after the eclipse they are expected to bathe and then take food. This is because of the harmful radiations which reach the surface of the earth during an eclipse. It is the infra-red radiations which emerge from the photosphere of the sun that can cause blindness if the sun is viewed directly and accidentally for a long period of time. Radiations are known to cause harm to the skin also. The complex nature of the composition of short waves, quantum waves emitted and absorbed in the environment, and the duration of exposure, decides the phenotypic and genotypic changes in microbes and man. Phenotypic changes and multiplication have been recorded in microbes (Shriyan *et al*, 2011) The reason why our culture advises bath and avoidance of meals during that time. Changes in wavelengths of light, radiations etc. are easily recognised by animals in the surroundings and this affects their biological clocks and they get confused and stop moving. Flower buds may close during an eclipse. Solar eclipses bring in gravity related disturbances and changes in tidal levels. In short, nature gets disturbed. (<http://www.kaheel7.com/eng>). There has to be a mediation between scientific truths and popular beliefs. This should happen in science classes through life skills.

Science education should finally lead on to research and development in the field of science. The learners have the potential to become future scientists. Unless they are taught the ways of science appropriately, their education will be of no value to them. The rigour with which science education is conceived finally affects the future of scientific developments in a society. A class which expects the child to blindly accept what the already existing knowledge says cannot be a class true to the spirit of science. Learners must be encouraged to ask questions and verify the facts stated either by way of experiments or logical deductions. This is where science education becomes true to science. It has been recommended that experiments and problem solving have to be stressed at the higher secondary level.

A Science curriculum needs to follow some basic criteria (NCF, 2005; Art 3.3, p.46). Science education through the curriculum should enable the learner to

- know the facts and principles of science and its applications, consistent with the stage of cognitive development,
- acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge,
- develop a historical and developmental perspective of science and to enable her to view science as a social enterprise,
- relate to the environment (natural environment, artifacts and people), local as well as global, and
- appreciate the issues at the interface of science, technology and society,
- acquire the requisite theoretical knowledge and practical technological skills to enter the world of work,
- nurture the natural curiosity, aesthetic sense and creativity in science and technology,
- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment, and
- cultivate scientific temper, objectivity, critical thinking and freedom from fear and prejudice.

Let us now look at the broad aims of NCF 2005 in this background. (Art.1.7, p.10 and 11)

- Commitment to democracy and democratic values (equality, justice, freedom, concern for others, secularism, respect for human dignity and rights)
- value based decision making, both collectively and independently
- sensitivity to others' well-being and feelings, with knowledge and understanding of the world
- learning to learn, unlearn and relearn as a means to respond to new situations in a flexible and creative manner (processes of construction of knowledge)
- predisposition towards participation in democratic processes, and the ability to work and contribute to economic processes and social change
- Providing the means and opportunities to enhance the child's creative expression and the capacity for aesthetic appreciation.

Decision-making, sensitivity, knowledge, flexibility, and creativity are life skills that need to be developed in children in order to meet the aims of education and also reflect the current needs of society.

The guiding principles of NCF 2005(Art.1.4, p.5) are

- connecting knowledge to life outside the school,
- ensuring that learning is shifted away from rote methods,
- enriching the curriculum to provide for overall development of children rather than remain textbook centric,
- making examinations more flexible and integrated into classroom life and,
- nurturing an over-riding identity informed by caring concerns within the democratic polity of the country

A closer look at the aims of Science education, education in general and the guiding principles of NCF 2005 will show that they are all closely related and emerge basically from the guiding principles mentioned above. Social factors influencing the development of Science(p.48, NCF, 2005), acquisition of methods and processes for generating and validating scientific knowledge(process skills), skills to enter the world of work, creativity, critical thinking etc. link up life skills with the aims of education. It may be noted that the aims of education and aims of science education overlap in many areas. Process skills are stressed in science classrooms. The same processes can also be identified under the guiding principles. The broad aims also make it clear how education should help children form their personalities.

Reflections

Please reflect over the following questions. You can even discuss these questions with your colleagues.

Can Science Education be made relevant to the lives of children? What are your views on this? Do you think at the +2 level it would be difficult to infuse life skills into Science learning as the content load is more at this level? How can we make Science learning experiential for learners at the +2 level?

Major Orientations

One of the major thrusts of the NCF 2005 is the need to shift from traditional rote methods to personalised learning experiences leading on to the construction of knowledge by children. The other side of construction of knowledge is critical pedagogy. In critical pedagogy direct teaching is de-emphasised and control of students in the learning process gets priority. Question, explore and draw conclusion paradigm emerges here and leads to many life skills.

Personal and social development of children has to be stressed. The teaching of science should be recast so that it enables children to examine and analyse everyday experiences. Concerns and issues pertaining to the environment should be emphasised

in every subject and through a wide range of activities involving outdoor project work. Similarly, the teaching of Mathematics should enhance the child's resources to think and reason, to visualise and handle abstractions, to formulate and solve problems.

School experiences may help learners develop mutual trust and negotiation skills which are very necessary for successful living.

The question of inclusion has to be discussed at length in the classrooms. It is important to understand children with learning problems and help them build relationships with their peers.

It may be noted all these aspirations look at science learning beyond its content framework. Scientific thinking is expected to become a way of life. It is here that the life skills become relevant in the methodology of teaching science. The contents of Science as a subject remain objective and a separate body of knowledge. But when students begin to make sense of this separate body of knowledge, there begins an interaction between the student and the subject, i.e., Science. The process of making sense is nothing but the methodology of teaching-learning science. Learning of Science has bearing on student personality as well as societal development. Without relating to life, science has little to offer to learners. Once related to life it has the potential to influence the lives of students. In what way is the learner going to benefit from the learning of Science?

Reflections

1. In what way is the learner going to contribute to the development of science?
2. Will the learner emerge a better individual in the society after the learning of science?
3. How has the learning of science helped the learner develop various abilities and to apply them in life situations?
4. How is the attitude of the learner shaped in the classroom? Is he/she prepared towards becoming a fruitful contributor to the society?

These questions are not strictly related to the contents of a Science syllabus. What Science does to a learner is decided by how it is transacted in the classroom.

Will the knowledge be used for the good of the society or will it be used for destructive activities? How can such negative tendencies be controlled? All these are essentially issues related to life skills.

Methodological concerns are expressed as process concerns in the NCF. Many of the discussions in the document centre around how a transaction has to take place and what it should aim at. Some of the principles regarding the approach to knowledge in the curriculum are as follows (NCF 2005, p.33).

- Acquiring a critical perspective on social reality and the natural environment through the lenses provided by the subject matter. For eg., effects of solar eclipse(refer p.22)
- Connecting with the local and the contextualised in order to situate^ knowledge and realising its relevance^and meaningfulness^to reaffirm one's experiences outside school; to draw one's learning from observing, interacting with, classifying, categorising, questioning, reasoning and arguing in relation to these experiences.
- Making connections across disciplines and bringing out the interrelatedness of knowledge.
- Realising the fruitfulness^and openness^of enquiry, and the provisional nature of truth.
- Engaging with local knowledge/indigenous practises in the local area, and relating these to school knowledge wherever possible.
- Encouraging questions and leaving space open for pursuit of new questions.
- Being sensitive to the issues of equality^in classroom transaction as well as established stereotypes and discrimination regarding learnability of the knowledge area by different groups (e.g. girls not being given field-based projects, the blind being excluded from the option of learning mathematics, etc.).
- Developing the imagination, and keeping imagination and fantasy alive.

These objectives are not inherent to the discipline of Science. They come to the foreground when the knowledge of Science is applied to different situations. How a piece of knowledge is used is a serious question. Modern age is the age of Science and Technology. The knowledge of Science in the hands of an undeserving person can lead to destruction. So apart from helping the individual develop his/her ability to be creative and critical in thinking, it is also necessary to help the individual become a better communicator with empathy. Good interpersonal management skills will go a long way in ensuring success in life. Communication skills are a prerequisite for good

interpersonal skills. Life skills, in other words, are very important for realising the social goals of Science Education. This has been very clearly stated in the document.

Development of life skills such as critical thinking skills, interpersonal communication skills, negotiation/ refusal skills, decision making/ problem-solving skills, and coping and self-management skills is also very critical for dealing with the demands and challenges of everyday life (NCF 2005, P.40).

Age-appropriate context-specific interventions focused on adolescent reproductive and sexual health concerns, including HIV/AIDS and drug/substance abuse, therefore, are needed to provide children opportunities to construct knowledge and acquire life skills, so that they cope with concerns related to the process of growing up (NCF 2005, P.57).

The curriculum must expose children to practical life skills and work experiences of varied kinds. Physical development through sports activities is also a must (NCF 2005, P.68).

The need for life skills has been argued out throughout the document. The evaluation reforms suggested are also in tune with what is discussed earlier. One of the basic proposals is to make evaluation reflective. This opens up possibilities for evaluating both content knowledge and its application as well as the attitudes and thinking of the person using the knowledge. Reflections have an inbuilt structure for further learning. It also subsumes critical and analytical thinking.

Table 2.1.1: The shifts suggested in NCF 2005

Usual classroom practises	Suggested shifts in NCF 2005
Teacher centric, stable designs	Learner centric, flexible process
Teacher direction and decisions	Learner autonomy
Teacher guidance and monitoring	Facilitates, supports and encourages learning
Passive reception in learning	Active participation in learning
Learning within the four walls of the classroom	Learning in the wider social context
Knowledge as given and fixed	Knowledge as it evolves and is created
Disciplinary focus	Multidisciplinary, educational focus
Linear exposure	Multiple and divergent exposure
Appraisal, short, few	Multifarious, continuous

The shift does not speak of content knowledge as such. It focuses on the person learning Science and how the learning takes place. This is where life skills

interventions become crucial for eg., for active participatory processes of learning, the life skills of critical thinking, creative thinking, problem solving, effective communication are required; for learning in the wider social context, self-awareness, effective communication, empathy and good interpersonal relations are required; for the evolution and creation of knowledge through constructivism creative thinking and critical thinking are required and so on.

Examination reforms discuss the issue of reducing stress. Life skills teach learners to cope with stress. While the efforts at reducing the stress ease the pressure on children, life skills approach will help them manage some amount of pressure without getting disturbed. The tyranny of single answer and ranks have to make way to reflective practises. Learners must be enabled to make their choices.

Reflections

Please reflect over the following questions.

Do you think methodology is as important as the content at the +2 level? In what way would a methodology make a difference to content learning? Do you think content should form the objective or is it the methodology? What are your views on this?

Making a case for integrating life skills education to the learning of science

How do we ensure that science plays an emancipative role in the world? The key to this lies in a consensual approach to issues threatening human survival today. This is possible only through information, transparency and a tolerance for multiple viewpoints. In a progressive forward-looking society, science can play a truly liberating role, helping people out of the vicious circle of poverty, ignorance and superstition. In a democratic political framework, the possible aberrations and misuse of science can be checked by the people themselves. Science, tempered with wisdom, is the surest and the only way to human welfare. This conviction provides the basic rationale for science education.

There is a symbiotic relationship between Science Education and Life Skills Education. Knowledge of Science does not exist in isolation. There are persons using it. Knowledge of Science in the hands of people becomes the actual tool of

emancipation. Life skills become important both for furthering scientific knowledge as well as the abilities of a person using that knowledge. One contributes to the other. While growth in scientific knowledge calls for a meaningful utilisation of it, those who use the knowledge also contribute to developing the same. Ultimately, the preferences, prejudices and likings of persons affect the development and dissemination of scientific knowledge. Making learning functional in life has to be the focus. The traditional knowledge has to be tempered with modern thinking. For example, traditionally, there could be some ways of treating a person suffering from typhoid. We must be in a position to question those ways and see if they are appropriate. This is how knowledge helps. Unless education helps individuals take decisions appropriately, it is of little value. Life skills education helps learners in this regard.

One of the recommendations as put forth in the guiding principles is to go beyond the textbooks. This does not necessarily mean reading multiple texts. Reading multiple texts may be needed. But going beyond the text is actually taking learning to real life, to the society and learner contexts. Going beyond the text is to be able to see, recognise and apply scientific principles in our day to day life situations. It is to go beyond learning from the textbooks and create new knowledge. It is the usage of life skills of solving, thinking, relationships, understanding and coping with respect to a content area in our daily lives.

NCF 2005 does not just speak of learning science; learning through science is also a great concern. It is here that life skills education become important. Life Skills Education can be had only through Science. Life skills enable the child to enter the world of work. Science can be viewed as a social enterprise and the learner has to know how the social factors influence the development of science. The science curriculum must be used as an instrument for achieving social change in order to reduce the divide based on economic class, gender, caste, religion and region. Only then the goal of equity enshrined in our constitution can be achieved.

The need to bring a paradigm shift in science education is more felt these days than ever. The digital age, the virtual class-room learning, the information highway on Net underline the fact that inquiry skills, inventiveness, collaboration, team spirit and creativity need to be promoted among learners to make them independent learners.

NCF recommends infusing productive work as a pedagogic medium for knowledge acquisition, developing values and multiple skill formation at all stages of education, including the +2 stage.

Adolescence is a critical period for the development of self-identity. The process of acquiring a sense of self is linked to physiological changes, and also learning to negotiate the social and psychological demands of being young adults. Responsible handling of issues like independence, intimacy, and peer group dependence are concerns that need to be recognised, and appropriate support be given to cope with them.

The +2 level of education coincides with adolescence, a period in an individual's life that is marked by personal, social and emotional crises created due to the demands of adjustment required in family, peer group and school situations. Unless it is handled with love and delicate care it might lead to disasters later on. That is why guidance and counselling by trained professionals must be made available to children. Interventions to enhance self/career awareness, career exploration and planning are also essential. All these aspirations need a methodological intervention for their realisation. Integration of life skills training into subject learning will not only make learning experiential but also readily be useful to the learners and the society.

Reflections

How would life skills interventions make a science class more experiential and life related? Explain. In what way would that affect that quality of science learning?

Summary

NCF 2005 focuses on experiential learning and making learning relevant to the lives of learners. That the learners are able to relate classroom learning to their lives is of great importance in terms of making educational endeavour meaningful. NCF 2005 provides ample scope for the integration of life skills education into the regular school practises. Every school subject provides scope for the learners to develop life skills in the process of learning. Collaborative learning opportunities create lots of scope for interactions. It is expected that a teacher understands these

processes and successfully integrates life skills education into his/her regular subject teaching.

Worksheet

Worksheet 1

A. Enlist life skills in NCF(2005)

How will you use guiding principles of NCF for framing a curriculum in Life Skills Education?

B. What are the problems faced by the school system in India?

How would critically employ NCF(2005) and life skills for solving these problems?

C. Cite instances where arithmetic is useful in your day to day life.

How would you make arithmetic fun using life skills?

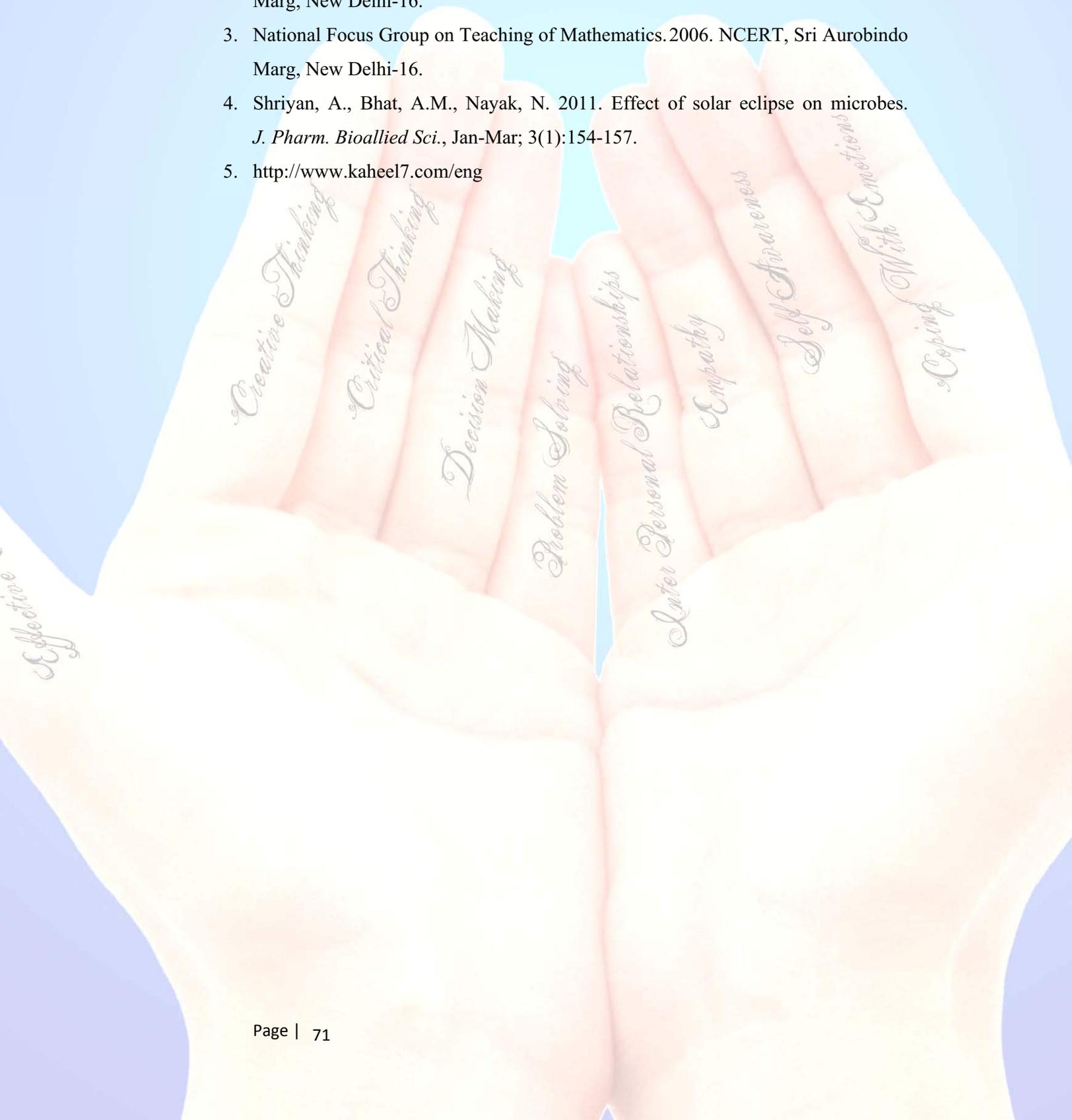
D. Today's employment scenario is based on computers and advanced scientific technology-so called white collared jobs.

What are the life skills required for entering the world of work today?

E. Our environment is ruined due to deforestation, mining, concrete and metallic structures and release of noxious fumes from industries. How will you stop this degenerative process using life skills?(n.b. environmental studies form a part of curriculum for Civil engineering)

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Significance of Life Skills for Adolescents

Module

3

Dr R.Subashree
RGNIYD, Sriperumbudur

Prof.Rajesan Nair
Deputy Director, NYKS, Government of India

Dr.D.G.Rao
Principal, RIE, Mysore

Introduction

Adolescence is a transitional stage and crucial formative period. Due to the lack of proper awareness or information about the rapid physiological and psychological changes and the follow up actions to be undertaken, adolescents often get confused about their role and identity. This leads to lack of self-control, emotional instability, personal flexibility and social adaptability. Now, it is high time to lay foundation during this stage, for developing capacity to improve the Life skills of the adolescents adequately. In fact, this period is marked as a period of stress and storm, as the impact of several physical and mental changes and developments taking place simultaneously may create different types of disturbances. This is the stage in the life span, noticed by fast changing developments characterized by rapid physiological, psychological, and psycho-social changes. Life skills intervention is the appropriate solution to extend support for the positive development of our adolescents.

Objectives

1. To understand the physical and physiological changes that the adolescents are undergoing.
2. To realize the intensity of the multi-dimensional nature of the needs and concerns of adolescents.
3. To recognize the need for holistic solution through life skills intervention.

Content

a) Physical growth and Life skills

During adolescence, bones, organs and body systems undergo rapid change. Many of the organs will change functionally and also in size. Lung performance improves, limbs grow, and bones increase in thickness and strength. The chest and shoulders get broader in boys and in girls, the hips and pelvis get wider. Muscle strength and size increases during this period. Teenager's stomach and intestine

enhance in size, and they need an increase in energy, proteins and minerals. Foods with plenty of calcium and iron are particularly important at this age to support bone growth and blood circulation. Teenage changes promote the brain development which reflects in the behaviour and social relations, improved self-control, and skills in planning, problem-solving and decision-making of an individual. Life skills help to adjust with the growth symptoms and create a favourable and promoting attitude to the growth and development.

Secondary sex characters appear along with rapid physical growth. Puberty is a period of rapid physical growth, culminating into sexual maturity. For boys, ejaculation occurs at this time, first during self-stimulation and later in sleep. Boys and girls, who develop very early or very late growth symptoms, might feel more self-concerned, get teased and have body image concerns. Girls at this stage, often reduce physical activity, despite improved strength, because of body image and perceived gender-based role. Girls who have early physical development will have an earlier growth spurt. They might be bigger and stronger than the boys of the same age for a while. The adolescent growth spurt is a rapid increase in the individual's height and weight during puberty resulting from the simultaneous release of growth hormones, thyroid hormones, and androgens. Sweat glands in the armpits and groin area are activated and this can lead to increased body odour and glands in the skin on the face become more active during puberty, producing more oil. This can lead to skin conditions such as pimples and acne. This is a period of very much concern about the changes and its intensity. Life skills help to set right the concerns and to find solutions or adjust with the changes incurred.

b) Psychological development and Life skills

It is well recognized that childhood and adolescence are periods of intense psychological growth and development and often involve inner turbulence and behavioural deviance. These can adversely affect the proper development of an individual into a healthy adult. So, appropriate Life skills interventions are necessary at this stage. Improvements in cognitive ability are the major psychological development in adolescents. The 15 year boy and girl have their basic thinking abilities that are comparable to those of adults. These improvements are attention (Improvements are seen in selective attention, the process by which one focuses on one stimulus while tuning out another), memory (Improvements are seen in both working memory and long-term memory), processing speed (Adolescents think more

quickly than children. Processing speed improves sharply between age five and middle adolescence) organization (Adolescents are more aware of their own thought processes and can use mnemonic devices and other strategies to think more efficiently) and Metacognition (Thinking about the thinking process and its consequences).

Self concern and consciousness increase and morally they may think, right and wrong, as absolute and unquestionable. Self-awareness centres on external characteristics, and may feel that others are staring at them. Self esteem increases in boys but may decrease in girls due to assigned gender roles in society involving inequalities in power and prestige. Separation from family and increasing involvement with peers occur during this period. Changes occur in the cognitive development, from the concrete operational thinking (believing only what he/she can see, hear or touch) to formal logical operations (can understand concepts better) Unfortunately, most of the changes during this period are pertaining to physical and mental changes which they are not aware due to the dissident factors they possess during the period which necessitate the need and importance of different life skills and coping mechanisms to adjust with the process of positive development.

c) Social development and Life skills

In the society, adolescents have to establish and maintain their relations, values and social commitment. Because adolescents constantly and realistically appraise themselves, they are often characterized as being extremely self-concerned. However, the self-evaluation process based on Life skills education leads to the beginning of long-range goal setting, emotional and social independence, and the making of a mature adult. Life skills accelerate the process of social development in the right direction.

Adolescents need to make use of their newly acquired physical and mental growth logically and make judgments rationally. When they reach the ages of fourteen and fifteen (the period known as mid-adolescence), adolescents strive to loosen their ties of their parents and tend to socialize more with the peers friends and role models usually from outside home. The adolescent becomes risk-taking, and experiments with different ideas. This plays an important role in finding ones relations to oneself, groups, and opposite sex. During this period, the adolescents battle over own set of values versus the set of values established by parents and other adults. The adolescent also begins to take self-decisions on educational and vocational

pursuits and related activities. It is during this period, that adolescents' self-dependence and a sense of responsibility become more apparent, along with their quest to contribute to society and find their role in it. Life skills help to control adventuresome, experimentation, relationships, vocational pursuits, social relations etc and make it rational and appropriate.

During late adolescence (from eighteen to nineteen), adolescents have a more stable sense of identity and role in the society. At this stage in they feel psychologically integrated with fairly consistent view of the outside world. Adolescent should, by this time, have established a balance between their aspirations, fantasies, and reality. In order for them to achieve this balance, they should practise Life skills by displaying concern for others through giving and caring, instead of the earlier childhood pattern of self-gratification. At the conclusion of late adolescence they have had designed their role in society, have set a realistic goal in life, and have begun earnest efforts to achieve it. All these positive development will happen only if the imbibing of life skills had occurred in the previous stages of development. It is in this context that Life skills education for the practise and reinforcement of psychosocial skills that are culturally and developmentally appropriate plays a significant role in guiding the adolescent.

Key areas of concern where Life skills are more significant

As the child enters the adolescent stage, he/she experiences a lot of stress and strain as a result of the adjustment process to the rapid changes in the physical and psychological systems. The crucial task of adolescence is the establishment of a sense of ego identity. If adolescents succeeded in integrating roles in different situations self-identity develops. Role confusion develops if they fail to establish stability in activities. Identity has many components including physical, sexual, social, vocational, moral, ideological and psychological characteristics that make up the total self. The adolescent who fails in fixing an identity will experience lack of clarity, role diffusion, and role confusion. Such individuals may indulge in self-destructive or one-sided activity. They may some times get preoccupied with the opinions of others or may some times turn to the other extreme of no longer caring what others think. He or she may withdraw or turn to drugs or alcohol in order to relieve the anxiety that role diffusion creates. The extent to which people are able to cope with these changes in identity is determined partly by the success with which they have first mastered through the practise of Life skills directly or indirectly.

a) Body image

The process of developing sexual maturation is a phenomenon particular to adolescence that never occurs again in the life of an individual. Biologically, this is a totally new experience. Its significance is due to its pervasiveness and also to the societal expectations. It creates in adolescents some delight about their self and the feeling of having something in common with all human beings. It influences their whole relationship to each other, whether, male or female. Entering this part of maturity also stimulates them to assess themselves in terms of new body image. The required awareness and behavioural adjustment can be brought in by Life skills education.

b) Development of independent self

The development of self and the searching for self starts in childhood, but the intellectual as well as the emotional consciousness of self is particularly the characteristic of adolescence. It is a time when personal meaning is given to new social experiences. The young person defines himself what he is experiencing in his relationships with others. His meaning may be different from that of those with whom he is interacting. But so long as it makes sense to him he can grow and move forward. But, practising Life skills gives more clarity to the concerns and feelings of others.

c) Identity crisis

Identity crisis is a time of intensive analysis and exploration of different ways of looking at oneself. It is a subjective sense as well as an observable quality. Identity achievement occurs when an individual has gone through an exploration of different identities and made a commitment to one. Adolescence is a time when teenagers begin to explore and assert their personal identity. During this developmental period, teenagers engage in a process of searching for where they fit in with peers and society at large. It is common for adolescents to have an unstable sense of self and try out new personal labels and associate with various peer groups. Additionally, adolescents might struggle to define their sexual and gender identity during the teenage years. Self-awareness development practise will be helpful to guide the adolescents in this regard.

d) Development of new values

Though the development of value is a lifelong process, it has some sense during adolescence. It is related to both thinking and feeling, and is being exhibited

through behavioural expressions. Life skills serve as a background for the maintenance and promotion of values. The adolescent engages in the re-evaluation of values that have been either accepted at an earlier age or simply rejected because of self-resistance. S/he moves beyond simple perception and sees things in a moral framework as good^and bad.^ S/he may be consciously searching for value clarification. In a society where institutions frequently do not follow the general ideological system, value confrontations are inevitable. The young, because of their intense belief, tend to be uncompromising. At this stage proper care and follow-up through Life skills training is necessary for the development proper and stable value system.

e) Experimentation as a way of life

The adolescents are physically, mentally, and emotionally more energetic and are always eager to try out many new things. Experimentations are considered by them as important as eating or sleeping. Human beings learn through experimentation from childhood onwards. The child explores, for instance, by touching, putting things into his mouth, etc. Adolescents experiment in the wider circles. They experiment with their own strength and value systems, try out intimate relationships, engage in some form of adventure etc. The experimentation practised by adolescents usually includes a touch of risk. It is their way of learning about self and the surrounding to get a direct feedback. This some times faces danger because adolescents are not as cautious as adults. Life skills interventions are necessary at this stage to channelize the experimentation into a major form of positive healthy development of the young.

f) Withdrawal from adult protection

Adolescents also show signs of varying degrees of withdrawal from the protection generally given by parents and relatives to dependent children. Whatever may be the degree of previous protection, the adolescent may move out from the protection of the family towards independence mainly with three categories of people: (1) with the peers of own generation; (2) with elders on an interacting or a rebellious level instead of a dependent level (adults often increase their attempt to control and direct adolescents, which tends to promote active rebellion); and (3) with younger children, not on a play level but on a caring and nurturing level. This process or moving away from dependency also creates tension and emotional conflicts which can be managed with Life skills.

g) Enormous mood swing

Massive mood swings are cited as characteristic of adolescents who can shift moods rapidly, vacillating between happiness and distress and self-confidence and worry. Many factors contribute to the swings. Physiological changes are related to emotional changes. Increased hormones and changes in the brain structure arise from normal physical growth creates emotional change. Complex social interactions such as conflicts with friends, school pressures and experimentation with romantic relationships etc can exacerbate the emotional state of adolescents. Moving from dependence to inter-dependence creates a whole series of tensions and conflicts. The involvement of peers many times magnifies the situation. The feeling of supremacy over events, clashes with the feeling of helplessness and inadequacy. The feeling that 'it won't happen to me' may some times succumb to the fear that 'it will some times happen to me'. Expecting to act like an adult one time and being treated like a child at the next occasion becomes a different experience and confusing. How can one be too young to do almost everything one wants to do, and adult enough to behave as the elders think one should? All these issues can be set-right only with the help of Life skills.

h) Peer pressure

During adolescence, relationships with peers begin to take precedence over relationships with the family. Although family interactions are still important and essential for a teen's development, adolescents often place a stronger emphasis on their friends' perceptions and values. Likewise, during the adolescent years, teens might be strongly influenced by their peers' beliefs and behaviours. Paired with adolescents' limited life experience and under-developed decision-making skills, teenagers are often vulnerable to negative peer pressure.. To gain group acceptance the individual seems to relegate his personal competitive drives to second place, at least temporarily. The emphasis is on cooperation, whether the goal is positive or negative-manning a hotline emergency service, for example, or flipping off a certain store. Imparting decision making skills can help the adolescent to take right decision.

i) Developing a healthy life style

The problems of adolescents are multi- dimensional in nature and require holistic approach. A large number of adolescents in India are school drop outs, malnourished, get married early, work in vulnerable situations, and are sexually active, exposed to drug abuse and vulnerable to diseases. All these issues are due to

unawareness, negligence and inadequate guidance. They require healthy lifestyles and awareness about their health and its maintenance. Misconception and misdirection by peers also influence them a lot. At this juncture they require being educated about personal hygiene and wellness. They require an attitudinal shift to health care and also having balanced nutrition as well as giving up risky behaviour like tobacco cessation. The general health care to promote positive living style with the support of Life skills will help them to focus more on meaningful activities.

j) Concern about career and future

Adolescent occupational choice is influenced by many factors, including life context, personal aptitudes, and educational attainment. Meeting the challenge of this developmental milestone is critical in adolescents' lives. Adolescents require career adaptability to choose occupations and to cope with vocational concerns. To achieve this, they need the competencies for decision making and problem solving; and coping behaviours.

How to use life skills?

Appropriate use of Life skills is necessary for each and every issue. The skill to identify the appropriate skill or the combination of skills depends on the skill of the Life skills consultant. Generally, Core Life skills are used for the general development with out specifically focusing any issue. Problem Specific Skills (Combination of two or more skills) are used to rectify a specific problem.(Ex: Skills to keep away from substance abuse, skill to avoid suicide tendency, skills to cope with gender issues, skills to overcome negative pressure, skills to maintain assertiveness, skills to overcome eating disorders, etc.). This is therapeutic in nature. Area Specific Skills are also combination of skills being used for the development in a particular area such as skills for time management and punctuality, skill for career development, skill to maintain values, etc.

Significance of Specific Life skills

Today's world demands higher skills for every level of job. The Skill development programme in early years of schooling can be the most appropriate tool for youth to get shaped to enter into the desired promising career and not just career alone, in all aspects like education, healthy life and social as well as economic status too. In recent years there has been increased usage of life skills as an arena for developing skills in youth, where life skills being viewed as those personal characteristics and skills that help for goal set, emotional control and self-

development and social acquaintance. As life skills play a vital role in competence building, it has to be initiated among school children at the earliest possible occasion. Overall, teachers regard Life Skills Education as a useful subject that needs to be taught in the school system. The significance of each Life skill can be summarized as follows.

1) Self-awareness helps to enable the adolescents to know themselves, understand their positive and negative qualities by analysing their strengths, weakness, opportunities and treats and enable them to know the self-value, which can bring them self-worth.

2) Empathy facilitates the adolescents to understand their own feelings and emotions and realize the feelings of others as if they were in such a situation. It facilitates adolescents to be sensitive to another person's emotional state.

3) Effective communication skill encourages adolescents to communicate considering their specific role in a particular situation and purpose for which they are communicating. It increases their listening habits by motivating them to listen actively to others and its importance in understanding what others are conversing.

4) Inter-personal relationships aid to enhance one's relationship and intimacy with appropriate people and understand different kinds of relationships and differences in each one's perspective. It brings to mind the importance of maintaining and sustaining positive relationships with other people and the need to break unfavourable relationships without creating issues.

5) Critical thinking helps to explore the various source of information to a particular problem, analyse it critically and rationally and approach any issue without pre-judgment on either sides.

6) Creative thinking makes the adolescents innovative and thinks differently and looks beyond direct experiences/generates or explores new ideas and look in new perspectives.

7) Problem solving skill facilitates them realize the need and importance of solving problems effectively. It helps to identify their own problem area and explore more options and solutions using critical thinking and creativity.

8) Decision making helps the adolescents to decide things on the basis of factual rather than fictions. It enables to generate convincing options and make a decision and own the responsibility of the consequences.

9) Coping with emotions is to understand the adverse effect of heightened emotions and learn the need to control it. It helps to be aware of the emotions of others and respond appropriately to those emotions and help others to control their emotions in difficult situations.

10) Coping with stress strengthens the mind to understand the effect of stress and the importance of stress management. It supports to explore the stressful situations from their experience and give tips to adopt a stress less life style by adopting adjustments or relaxation techniques based on their need.

Summary

Adolescence is a period of tremendous and rapid physical and mental changes necessitating the development of Life skills in order to self-regulate and monitor these developmental changes. Life Skills Education with its stress on practise and reinforcement of culturally and developmentally appropriate behaviour will go a long way in providing direction to the adolescents. The immediate benefits to adolescents include prevention of behavioural problems such as substance abuse, immoral activities, negative peer pressure and improvement in self development, self-esteem, academic competency and social acceptability. In the long run, the overall development at the appropriate level based on values will improve the behaviour, personal quality, competency, protection of self, promotion of health, family and social relations, development of appropriate career path and apt employment and a good and covetable social life.

Worksheet

Worksheet 1

- A. A teenager throws tantrums at home for the money to go to the movies. What is the effect of the media here?

How will you solve this problem using life skills?

- B. Narrate an incident where a peer has changed the behaviour of an adolescent using life skills.

- C. List out life skills required by adolescents when

They look ugly, fat and unbecoming

They have feelings of inadequacy and inferiority in a peer group

They have constant altercations with parents for money and freedom

They are unable to attain scholastic targets.

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Implications of Life skills for Society

Module

4

Dr. Bindu R.L.

*Associate Professor, Department of Education,
University of Kerala Thycaud, Thiruvananthapuram, Kerala*

Dr. V. Rajasenan Nair

Social Psychologist & Former DD, NYKS, Govt. of India

Introduction

Life Skills are abilities for adaptive and positive behaviour that enable individuals to deal effectively and efficiently with the demands and challenges of everyday life (WHO, 1998). The term 'adaptive' means the skill of a person to have the flexibility to adjust according to the situation. Life skills help to identify the 'capacity' (basic inherent qualities) of the child, increase his 'capability' (by improving the inherent qualities by training) and achieve 'competency' (further improvement by imparting skill) in each endeavour in his life. For positive behaviour, a person needs to have positive thinking and positive outlook at opportunities even in difficult situation, in order to cope with the situation.

Life skills include Generic Life Skills, Problem Specific Life Skills, and Area Specific Life skills. Generic Life Skills are the ten core life skills identified by WHO. Generic life skills are required for the day to day activities and overall development of the personality. Problem Specific Skills are the combination of different Life skills to deal effectively with specific problems (eg., drug abuse). Problem Specific Skills are therapeutic in nature. Area Specific Skills are combination of skills that are used for the development in a particular area (eg., developing skill for a particular profession). The generic understanding of Life skills from the dual angle of personal fulfillment and realization of social responsibility includes both empowerment and the 'competency' to become part of a heterogeneous group and strive for common goals.

Objectives

1. To promote positive behaviour in society.
2. To develop psychosocial skills which are culturally and developmentally appropriate
3. To prevent health problems in society.
4. To promote human rights and human resource development in society.

Content

Life skills paradigm identifies significant life skills that can be used in a specific way to improve positive behaviour and overcome or adjust with the problems of life of an individual. This mainly includes becoming aware about oneself, being familiar with ones surroundings, getting acquainted with one's work, understanding other persons in their actual situation without bias, making and maintaining good friends, controlling anger, knowing one's violent behaviour and controlling it, modulate one's talk, considering your role and purpose, seeing and viewing things judiciously, adopting novel and innovative ideas, trying for conflict resolution, practising good decision making, coping with emotions and stress, etc. The methodology for developing skills is a critical aspect of effective programming. The methods of skills acquisition involve cooperative learning, peer support, continued opportunities for rehearsal, accurate feedback and constructive criticism, and modeling of skills by other peers and adults. Thus life skills are nothing but cross-cutting applications of knowledge, values, attitudes and skills which are important in the process of individual development and lifelong learning.

Implications of Life Skills Education

Life skills education is designed to facilitate the practise and reinforcement of psycho-social skills in a culturally and developmentally appropriate way. It contributes to the promotion of personal and social development, the prevention of health and social problems. Life skills enhance the abilities of the individual with the changing environment and empower them to make informed and rational choices about their day to day and future life needs and practises. It is not a substitute but complimentary to any type of education or training. Facilitating the learning of life skills is the central component of programmes designed to promote healthy behaviour and mental well-being. Based on the area of reflection, the implications of Life skills can be divided into four. They are the Personal development implications, Educational implications, Socio-cultural implications and Developmental implications.

1. Personal development implications

Skills are improved through practice and patience. A skilled person uses less time, energy and resources to do a job and produces quality results when compared to an unskilled person with the same rank. Life Skills are the group of psycho-social competencies that help people to lead a healthy and productive life. Enhancing Life

Skills enables us to adapt to situations and people and helps us to translate knowledge, attitude and values into actual abilities by helping us decide what to do, when to do and how to do it and lead a healthy and positive life.

a) Specific Self-development implications

1. Implications of Self-awareness: One of the major implications of Life skills is that it promotes self- development of the individual. Self-awareness necessitates developing a positive attitude towards life. Being aware of the good points about oneself helps young people build a sense of self-esteem and self-confidence. Self-awareness makes one aware of the changes around, to adjust with the changes or modify those changes to suit ourselves. Self-awareness gives us the strength to change ourselves or change the circumstances of life.

2. Implications of Empathy: Empathy equips us with the skill to see the other person as if we were in such a situation. This feeling helps us to modulate our activities without hurting others and stand with them at times of need. Empathy encourages a positive behaviour towards people in need of care and assistance and not to laugh at others who are in need or difficulty. It works wonders when applied to our relationships ^with our loved ones, cl assmates, parents, friends, cousins and colleagues. It promotes effective communication without which our relationships with others are likely to be dominated by suspicion, guesses, misunderstandings and false assumptions.

3. Implications of Inter-personal Relations: Ability to establish positive relationships helps us to relate in positive ways with the people we interact with, make and maintain friendly relationships, which can be of great importance to our mental and social well-being.

4. Implications of Effective Communication: Every communication has a purpose. If we are not well versed with communication skill, considering our role and situation, the communication will not become effective.

5. Implications of Critical thinking: Critical thinking provides the tools for self-evaluation and self-reflection. In order to live a meaningful life and to structure our lives accordingly, we need to justify and reflect on our values and decisions. It can help us recognize and assess the factors that influence our attitude and behaviour.

6. Implications of Creative thinking: Creative thinking helps us to look beyond our direct experience, and to respond adaptively and with flexibility to situations in our daily lives. Creativity enhances the ability to accept change and newness, a

willingness to play with ideas and possibilities, a flexibility of outlook, the habit of enjoying the good, while looking for ways to improve it.

7. Implications of Decision making: Decision making is the process of making right choices from the different options before us. To make the right choice of the option at the right time depends on our Decision making skill. It helps to solve many day to day problems and expected issues in many future pursuits.

8. Implications of Problem Solving: These skills enable us to deal with problems in our lives in a constructive manner. The skill is necessary to manage problems without anger or becoming violent. Persons having problem solving skills will be in a position to solve the problem without hurting the other person.

9. Emotions and its implications: Heightened emotions such as fear, disgust, anger, grief etc. hamper the normal mental and physical balance of the individual. To maintain a balanced physical and mental health on par with the social situations, coping with emotions is inevitable.

10. Stress and its implications: Research studies show that more than 50% of the physical and mental problems being faced by people are due to stress. So, practising coping mechanism will improve both physical and mental health of the people at large.

b) General Self-development Implications

1. Competency to deal with complicated social problems: People have to use various combinations of Life skills to address the real problems in life. This competency will help people to deal complicated personal and social issues with proper co-ordination based on their perspectives, past experiences, values, needs and understanding of the issues.

2. Competency to deal with area wise development: Development in a particular area (eg., career development) can be achieved only by the combination of different Life skills which are apt and appropriate. This combination helps for the specific development of a person in that particular area.

3. Makes the individual competent: Practising Life skills starts with identifying the capacity of the individual where capacity is the basic qualities embedded in the person. When the capacity is subjected to training it will develop into capability. On skill training, capability gets transformed into competency. Thus the Life skills training makes the person competent to do an activity when compared with others.

4. *Promotes personality development:* There are four basic skills such as Personal skills, Conceptual skills, Technical skills and Managerial skills. Improving of Personal skills and Conceptual skills will lead to Life Skills. When more traits are imbibed by a person practising Life skills, it will lead to Personality development.

5. *Promotes leadership:* The association of Technical skill and Managerial skill will transform into Institutional skill. When Personality development and Institutional skills are integrated that will emerge into proper Leadership.

2. Educational implications

The aim of introducing life skills in schools is to capture the true essence of adolescence and for this, age-appropriate and context specific interventions are essential. Adolescents usually consider the given social rules and taboos as unacceptable and thus it becomes imperative that their education be flexible, adaptable and experiential in nature. Life skills education provides this kind of education and the objective of this education is to build one's potential for dealing with challenges of life.

Life skills education programs can also be effective in preventing school dropouts and violence among young people. These programs can lay the foundation for skills demanded in today's job market. Life skills are hardly taught in school, and for the most part, people learn it through training and experience. Life skills education promotes involvement in authentic learning experiences integrated across the curriculum. The child-centred approach integral to Life skills, empowers children as they are rewarded for their commitment, work ethics and ingenuity. The school curriculum can practise life skills by active learning processes involving brainstorming, role-playing, games, debates and small-group work. It can provide valuable links between students in the general population and children who are separated from their peers due to disability, social isolation, etc.

Life skills programs are a vehicle for teachers to address a variety of outcomes and indicators from a variety of key learning areas in a context that has relevance to the real world. Life skills enliven the curriculum and instill a strong work ethic and the value of responsibility on the job for teachers. It has opened up a new world of collegiate relationships also.

In Science education, life skills integration promotes experiential learning. Creative experience of learning satisfies the basic urge for self-expression and self-fulfillment. Problem Based Learning, which is characterized by a student-centered

approach, hopes to develop students' intrinsic interest in the subject matter, promotes group work and helps students become self-directed learners. Learning becomes student-centered because the students are given the freedom to study those topics that they find more interesting to them and they determine how to study the topics. Students identify their learning needs, help plan classes, lead class discussions, and assess their own work and their classmates' work. Students develop a deeper awareness and ownership of important concepts in the course/subject by working on activities, a basic tenet of the constructivist approach to learning.

Life skills integrated science education also promotes Inquiry based learning and Contextual Teaching and Learning (CTL) concerned with providing educational experiences based on concerns, problems, issues related to situations in the society, particularly related to teacher education programs, business, industry, commerce and other areas of economic enterprises. It brings an educational connection between and among disciplines, skills and the real world. It is bringing the work world into the classroom and taking the classroom into the world of work, developing and using skills applicable in the real world and providing students with opportunities to apply their knowledge.

Life skills have opened new learning opportunities in other sectors, mainly in the environmental area. Environment-based education emphasizes specific critical thinking skills central to good science ^ questioning, investigating, forming hypotheses, interpreting data, analyzing, developing conclusions, and solving problems. Skills for Conservation of the Environment and environmental aesthetics also can be developed.

3. Socio-cultural implications

Life skills education improves the socialization process among learners such as relating to others in a friendly way, enable learners to choose good and reliable friends, helps learners to use their leisure time properly and assist learners to recognize and avoid risky situations. It brings about meaningful interaction among learners, teachers and the school community.

Parents/teachers/significant others act as role models for adolescents from whom they learn their Life Skills. Life Skills Education is an effective intervention measure in responding to socio-cultural problems like: HIV and AIDS, drugs and substance abuse, school unrest among others. Life Skills Education responds to critical needs of the youth. Life skills training needs to be developed when based on

the learners' real life experiences and starts in early childhood and continues throughout one's life.

Value-based education is in some way linked with the Life skills Paradigm as it also supports and encourages the personal growth of an individual. The significant place of co-curricular activities, utilization of voluntary efforts, use of folk media, folk culture and natural heritage could play a significant role to strengthen the value inculcation through life skill approaches and need to be exploited adequately for value enrichment. The picture of growing vulnerability of both children and youth to suicides, depression, drug abuse, violence, declined value system, stressful competitions, materialism and crimes is distressing. To be effective the teaching of life skills has to link with the teaching of health information and the promotion of positive health and pro-social attitudes and values.

To remove evils from the society, the women folk of today require a special training and skills with added values to solve the mysteries of life enthusiastically. Empowerment of women through life skills education will generate a greater degree of self-confidence, a sense of independence and capabilities to resist a discrimination imposed by the male dominated society. It implies greater control over finance, knowledge, information, technology skills training, political power, economic resources etc. It is a process of awareness capacity building, leading to greater participation, to greater decision making power and control and to transformative action.

Life Skills programs facilitate a significant assessment of social norms and peer influences, and helps young people explore their values and social acceptance through self-evaluation. Success in personal and professional life from a social point of view (such as cohesion, happiness, well-being, good functioning of a group, success in relating to others, living together etc.) gets improved through life skills education.

4. Developmental implications

Human development is the product of three interacting factors: biological maturation, the interface between persons and community, and the contributions that persons make to their own psychological development. Development on the other hand involves mastering those qualities which help to grow into an adult who has high-quality confidence, is socially incorporated, faces challenges and adapts to conflicts and strain. Development tasks are dictated by the interaction of the

biological, psychological, and societal systems during each stage. Life skills promote human development.

Life skill development is the primary area of development in the process of Human Resource development. It concentrates on the social behaviour of human beings in relation to different social situations. In the natural process of skill development, we need interventions to accelerate the speed of acquiring the skills and thereby the development of the individual.

Life skills programs contribute to the reproductive and sexual health education of young people. Many programs have been proved effective for improving youth's reproductive and sexual health. Life Skills enable adolescent boys and girls to utilize the other skills such as functional, vocational/livelihood and literacy skills better. Life Skills helps them to understand the importance of healthy and positive ways of living. It reduces vulnerability, decreases risk factors and improves protective factors. Life Skills education reduces high risk behaviour, helps in crisis and conflict resolution, stress management, relationships management, develops self-risk awareness, ethical and moral concerns, value systems, increases financial literacy (time management and money management), promotes an understanding of consumer choices, success in personal and academic life, and builds self-confidence and self-esteem.

Summary

Life skills as a teaching-learning approach is specifically designed to enhance efforts to positively develop or change behaviour, especially related to well being and healthy functioning in society. The beauty of Life skills education appears to be in its flexibility. It can be used for the personal development of an individual and also for the development of a community on a large scale. It values the contribution of all students, no matter their age, ability or background. It can concentrate on one type of activity or can accommodate a wide and ever evolving range of enterprises.

Life skills are not a substitute but complimentary to any type of education or training or developmental process. This adaptability means that Life skills can be adjusted to suit local conditions, teachers' strengths and students' interests. It has to inspire students and enable them to develop their capabilities to the highest potential levels throughout life (Life-long Learning), so that they grow intellectually, get well equipped for work, achieve personal fulfillment and contribute effectively for the well-being of the society.

Worksheet

Worksheet 1

A. A tsunami occurred in the South eastern coastal region and damaged life in terms of ^

1-----

2-----

3-----

How would you rehabilitate people in these areas? What are the life skills required?

B. HIV and AIDS are taking their toll on society and affecting even children. Can this disease be completely eradicated? Suggest measures using life skills

How will you arrive at an AIDS free 21st Century through life skills?

C. Equity is achieved through education. How will life skills help here to remove gender bias?

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Constructivist Approach using 5E Model

Module

5

Dr. Viswanathappa
Associate Professor in Education, RIE, Mysore

Introduction

Constructivist teaching is based on constructivist learning theory. Constructivist teaching is based on the belief that learning occurs as learners are actively involved in a process of knowledge construction. Learners are the makers of meaning and knowledge. Constructivist teaching will foster the critical thinking and this approach helps to motivate the independent learners. The framework of learning holds that the learning always builds upon knowledge that a student already knows; this prior knowledge is called a schema. Because all learning is filtered through pre-existing schemata, constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. A wide variety of methods claim to be based on constructivist learning theory. Most of these methods rely on some form of guided discovery where the teacher avoids most direct instruction and attempts to lead the student through questions and activities to discover, discuss, appreciate, and verbalise the new knowledge.

Constructivist teaching methods are based on constructivist learning theories of John Dewey, Jean Piaget, etc. based on their research on childhood development and education (Driver *et al.*, 1985). Both Dewey and Piaget were very influential in the development of informal education. Dewey's idea of influential education suggests that education must engage with and enlarge experience and the exploration of thinking and reflection associated with the role of educators. Piaget's role in the constructivist teaching suggests that we learn by expanding our knowledge by experiences which are generated through play from infancy to adulthood which are necessary for learning. Their theories are now encompassed in the broader movement of progressive education. Constructivist learning theory says that all knowledge is constructed from a base of prior knowledge. Children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or

her current conceptions. Therefore children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences.

Objectives

1. To actively involve learners in the process of learning.
2. To foster critical thinking.
3. To promote learners to depend on themselves.
4. To facilitate discovery and invention of new knowledge.
5. To facilitate play way method of learning.
6. To learn through experience.
7. To make learning interactive rather than a two way process.
8. To help students go beyond the text.

Content

Characteristics of Constructivist Teaching

One of the primary goals of using constructivist teaching is that students learn how to learn by giving them the training to take initiative for their own learning experiences. According to Audrey Gray (in Driver *et al.*, 1985), the characteristics of a constructivist classroom are as follows:

- the learners are actively involved
- the environment is democratic
- the activities are interactive and student-centered
- the teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous.

Examples of constructivist activities

The students work primarily in groups and learning and knowledge are interactive and dynamic in the constructivist classrooms. This approach helps to strengthen the social and communication skills, as well as collaboration and exchange of ideas. The traditional classrooms in which students work primarily alone, learning is achieved through repetition and the subjects are strictly adhered to and are guided by a textbook. Some activities encouraged in constructivist classrooms are:

- Experimentation: students individually perform an experiment and then come together as a class to discuss the results.
- Research projects: students research a topic and can present their findings to the class.

- Field trips: This allows students to put the concepts and ideas discussed in class in a real-world context. Field trips would often be followed by class discussions.
- Films: These provide visual context and thus bring another sense into the learning experience.
- Class discussions: This technique is used in all of the methods described above. It is one of the most important distinctions of constructivist teaching methods.

Constructivist approaches can also be used in online learning. For example, web2.0 and web3.0 tools such as online discussion forums, wikis and blogs can enable learners to actively construct knowledge. A comparison between the traditional classroom and the constructivist classroom is illustrated as follows.

Table 5.1.1: A comparison between the traditional classroom and constructivist classroom

<i>The Traditional Classroom</i>	<i>The constructivist Classroom</i>
<ul style="list-style-type: none"> • Begins with parts of the whole[^] • Emphasizes basic skills • Strict adherence to fixed curriculum • Textbooks and workbooks • Instructor gives/students receive • Instructor assumes directive, authoritative role • Assessment via testing / correct answers • Knowledge is inert • Students work individually 	<ul style="list-style-type: none"> • Begin with the whole ^expanding to parts • Pursuit of student questions / interests • Primary Sources / manipulative materials • Learning is interaction ^building on what students already know • Instructor interacts / negotiates with students • Assessment via student works, observations, points of view, tests. • Process is as important as product • Knowledge is dynamic / changes with experiences • Students work in groups <p>Source: Thirteen Ed Online (2004)</p>

Role of teachers

In the constructivist classroom, the teacher's role is to prompt and facilitate discussion. Thus, the teacher's main focus should be on guiding students by asking

questions that will lead them to develop their own conclusions on the subject. Parker J. Palmer (in Driver *et al.*, 1985) suggests that good teachers join self, subject, and students in the fabric of life because they teach from an integral and undivided self, they manifest in their own lives, and evoke in their students, a capacity for connectedness.[^]

David Jonassen (in Driver *et al.*, 1985) identified three major roles for facilitators to support students in Constructivist Learning Environments (CLE):

- Modeling
- Coaching
- Scaffolding

A brief description of the Jonassen major roles are:

Modeling [^]Jonassen describes Modeling as the most commonly used instructional strategy in CLEs. Two types of modeling exist: behavioural modeling of the overt performance and cognitive modeling of the covert cognitive processes. Behavioural modeling in Constructivist Learning Environments demonstrates how to perform the activities identified in the activity structure. Cognitive modeling articulates the reasoning (reflection-in-action) that learners should use while engaged in the activities.

Coaching [^]For Jonassen the role of coach is complex and inexact. She acknowledges that a good coach motivates learners, analyzes their performance, provides feedback and advice on the performance and how to learn about how to perform, and provokes reflection and articulation of what was learned. Moreover, she posits that coaching may be solicited by the learner. Students seeking help might press a How am I Doing?[^]button. Or coaching may be unsolicited, when the coach observes the performance and provides encouragement, diagnosis, directions, and feedback. Coaching naturally and necessarily involves responses that are situated in the learner's task performance.

Scaffolding - Scaffolding is a more systemic approach to supporting the learner, focusing on the task, the environment, the teacher, and the learner. Scaffolding provides temporary frameworks to support learning and student performance beyond their capacities. The concept of scaffolding represents any kind of support for cognitive activity that is provided by an adult when the child and adult are performing the task together.

Instructional scaffolding is a learning process designed to promote a deeper level of learning. Scaffolding is the support given during the learning process which is tailored to the needs of the student with the intention of helping the student achieve his/her learning goals.

Instructional scaffolding is the provision of sufficient support to promote learning when concepts and skills are being first introduced to students. These supports may include the following:

- resources
- a compelling task
- templates and guides
- guidance on the development of cognitive and social skills

Use of instructional scaffolding in various contexts:

- modeling a task
- giving advice
- providing coaching

Constructivist Learning Environments (CLEs)

Jonassen (in Driver *et al.*, 1985) has proposed a model for developing constructivist learning environments (CLEs) around a specific learning goal. This goal may take one of several forms, from least to most complex:

- Question or issue
- Case study
- Long-term Project
- Problem (multiple cases and projects integrated at the curriculum level)

Jonassen recommends making the learning goals engaging and relevant but not overly structured.

In CLEs, learning is driven by the problem to be solved; students learn content and theory in order to solve the problem. This is different from traditional objectivist teaching where the theory would be presented first and problems would be used afterwards to practise theory.

Depending on students' prior experience s, related cases and scaffolding may be necessary for support. Instructors also need to provide an authentic context for tasks, plus information resources, cognitive tools, and collaborative tools.

Constructivist assessment

Traditionally, assessment in the classrooms is based on testing. In this style, it is important for the student to produce the correct answers. However, in constructivist teaching, the process of gaining knowledge is viewed as being just as important as the product. Thus, assessment is based not only on tests, but also on observation of the student, the student's work, and the student's points of view. Some assessment strategies include:

- Oral discussions ^The teacher presents students with a focus^question and allows an open discussion on the topic.
- KWL(H) Chart (What we know, What we want to know, What we have learned, How we know it) ^This technique can be used throughout the course of study for a particular topic, but is also a good assessment technique as it shows the teacher the progress of the student throughout the course of study.
- Mind Mapping ^In this activity, students list and categorize the concepts and ideas relating to a topic.
- Hands-on activities ^These encourage students to manipulate their environments or a particular learning tool. Teachers can use a checklist and observation to assess student success with the particular material.
- Pre-testing ^This allows a teacher to determine what knowledge students bring to a new topic and thus will be helpful in directing the course of study.

An example of a lesson taught with a Constructivist background

The teacher mediating learning rather than directly teaching the class is shown by the example of Faraday's candle. There are various forms of this lesson, but all are developed from the Christmas lectures Faraday gave on the functioning of candles. In open constructivist lessons using these lectures as a basis, students are encouraged to discover for themselves how candles work. They do this first by making simple observations, from which they later build ideas and hypotheses which they then go on to test. The teacher acts to encourage this learning. If successful, students can use this lesson to understand the components of combustion, an important chemistry topic. Can we expand upon this exemplar?

5E Approach in Learning

- 1. Engagement:** The teacher on a curriculum task accesses the learners^prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose

prior conceptions, and organize students' thinking towards the learning outcomes of current activities.

The first phase engages students in the learning task. The students mentally focus on an object, problem, situation, or event. The activities of this phase make connections to past experiences and expose students' misconceptions; they should serve to mitigate cognitive disequilibrium. Asking a question, defining a problem, showing a discrepant event, and acting out a problematic situation are all ways to engage the students and focus them on the instructional task. The role of the teacher is to present the situation and identify the instructional task. The teacher also sets the rules and procedures for establishing the task. Successful engagement results in students being puzzled by, and actively motivated in, the learning activity. Here, the word *activity* refers to both mental and physical activity.

2. Exploration: Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete lab activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.

Once the activities have engaged the students, the students have a psychological need for time to explore the ideas. Exploration activities are designed so that the students in the class have common, concrete experiences upon which they continue formulating concepts, processes, and skills. Engagement brings about disequilibrium; exploration initiates the process of equilibration. This phase should be concrete and hands on. Educational software can be used in the phase, but it should be carefully designed to assist the initial process of formulating adequate and scientifically accurate concepts. The aim of exploration activities is to establish experiences that teachers and students can use later to formally introduce and discuss concepts, processes, or skills. During the activity, the students have time in which they can explore objects, events, or situations. As a result of their mental and physical involvement in the activity, the students establish relationships, observe patterns, identify variables, and question events. The teacher's role in the exploration phase is that of facilitator or coach. The teacher initiates the activity and allows the students time and opportunity to investigate objects, materials, and situations based on each student's own ideas of the phenomena. If called upon, the teacher may coach or guide

students as they begin reconstructing their explanations. Use of tangible materials and concrete experiences is essential.

3. Explanation: The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviours. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.

The word 'explanation' means the act or process in which concepts, processes, or skills become plain, comprehensible, and clear. The process of explanation provides the students and the teacher with a common use of terms relative to the learning task. In this phase, the teacher directs students' attention to specific aspects of the engagement and exploration experiences. First, the teacher asks the students to give their explanations. Second, the teacher introduces scientific or technological explanations in a direct, explicit, and formal manner. Explanations are ways of ordering the exploratory experiences. The teacher should base the initial part of this phase on the students' explanations and clearly connect the explanations to experiences in the engagement and exploration phases of the instructional model. The key to this phase is to present concepts, processes, or skills briefly, simply, clearly, and directly and to move on to the next phase. Teachers have a variety of techniques and strategies at their disposal to elicit and develop student explanations. Educators commonly use verbal explanations; but, there are numerous other strategies, such as videos, films, and educational courseware. This phase continues the process of mental ordering and provides terms for explanations. In the end, students should be able to explain exploratory experiences and experiences that have engaged them by using common terms. Students will not immediately express and apply the explanations' learning takes time.

4. Elaboration: Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

Once the students have an explanation and terms for their learning tasks, it is important to involve the students in further experiences that extend, or elaborate, the

concepts, processes, or skills. This phase facilitates the transfer of concepts to closely related but new situations. In some cases, students may still have misconceptions, or they may only understand a concept in terms of the exploratory experience. Elaboration activities provide further time and experiences that contribute to learning.

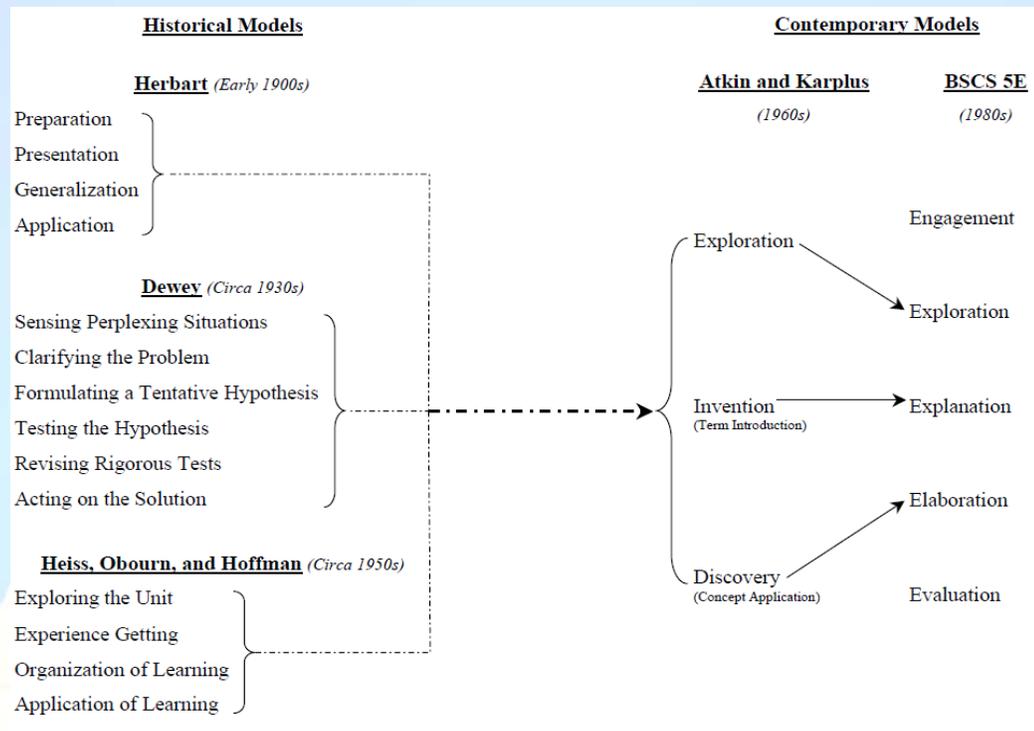
During the elaboration phase, students engage in discussions and information seeking activities. The group's goal is to identify and execute a small number of promising approaches to the task. During the group discussion, students present and defend their approaches to the instructional task. This discussion results in better definition of the task as well as the identification and gathering of information that is necessary for successful completion of the task. The teaching cycle is not closed to information from the outside. Students get information from each other, the teacher, printed materials, experts, electronic databases, and experiments that they conduct. This is called the information base. As a result of participation in the group's discussion, individual students are able to elaborate upon the conception of the tasks, information bases, and possible strategies for its learning task's completion. Note the use of interactions within student groups as a part of the elaboration process. Group discussions and cooperative learning situations provide opportunities for students to express their understanding of the subject and receive feedback from others who are very close to their own level of understanding. This phase is also an opportunity to involve students in new situations and problems that require the transfer of identical or similar explanations. Generalization of concepts, processes, and skills is the primary goal (Bybee *et al.*, 2006).

5. Evaluation: The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress towards achieving the educational objectives.

This is the important opportunity for students to use the skills they have acquired and evaluate their understanding. In addition, the students should receive feedback on the adequacy of their explanations. Informal evaluation can occur at the beginning and throughout the 5E sequence. The teacher can complete a formal evaluation after the elaboration phase. As a practical educational matter, teachers must assess educational outcomes. This is the phase in which teachers administer assessments to determine each student's level of understanding. The principle commonality underlying both models is the psychological theory that informed the

sequence and emphasis for the phases. Both models use the work of Jean Piaget (in Driver *et al.*, 1985) and subsequent research consistent with the Piagetian theory, specifically the focus of cognitive sciences and the work on misconceptions, the difference between novice and expert explanations of phenomena, and naive versus canonical theories. The view of learning is summarized here and discussed in greater detail in the next section. Individuals redefine, reorganize, elaborate, and change their initial concepts through interaction with their environment, other individuals, or both. The learner interprets objects and phenomena and internalizes the interpretation in terms of the current experience encountered. To change and improve conceptions often requires challenging the students' current conceptions and showing those conceptions to be incomplete or inadequate. If a current conception is challenged, there must be opportunity, in the form of time and experiences, to develop a more accurate conception. In sum, the students' construction of knowledge can be assisted by using sequences of lessons designed to challenge current conceptions and provide time and opportunities for reconstruction to occur. In this phase, students demonstrate their understandings and abilities through a new activity. This change was made to address the need for formal assessment opportunities that were integral to the instructional plan. This phase also provides opportunities for self-reflection, an essential component of learning revealed by studies on metacognition (Driver *et al.*, 1985). See the figure below to know the origins and evolution of the instructional models reviewed in this section.

Figure 5.1.1: History of Instructional Models



Summary

Constructivist teaching is the most accepted model of teaching facilitating exploration of ideas through teaching learning activities. It is based on the assumption that all knowledge is constructed by the learner through thinking. Constructivist classrooms activities are experimentation, field trips, research projects, group discussions and audio-video processes. Assessment of constructivistic teaching is done through oral discussions, KWL(H) chart, tree-testing, hands-on activities and mind mapping. The 5E constructivist approach is executed through engagement, exploration, engagement, elaboration and evaluation.

Worksheet

Worksheet 1

Develop a short lesson plan on critical thinking /problem solving/ creative thinking/decision making using 5E process

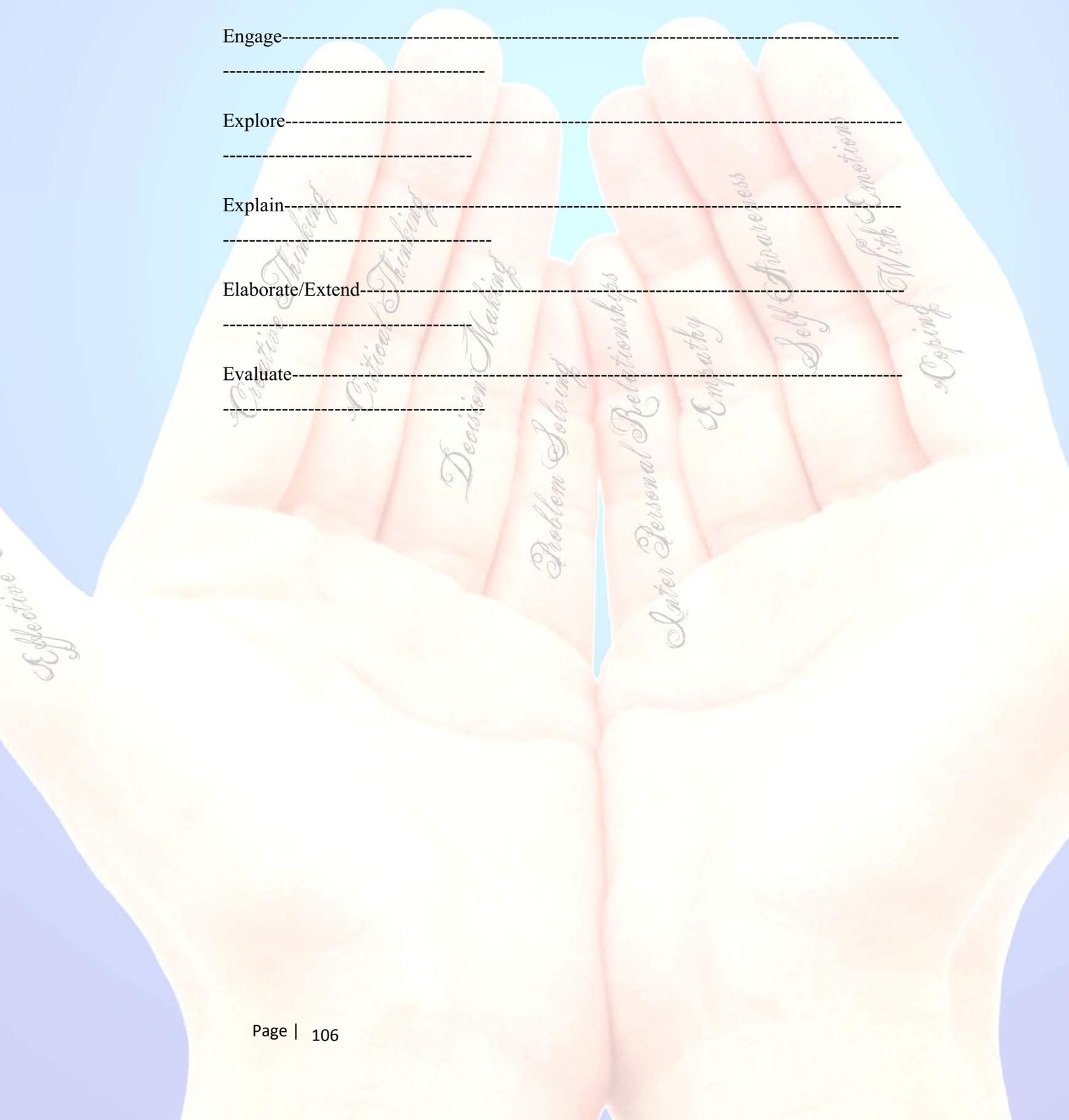
Engage-----

Explore-----

Explain-----

Elaborate/Extend-----

Evaluate-----



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Teaching Techniques of Life Skills Education

Dr. Geetha G. Nair
Associate Professor in Botany, DESM, RIE, Mysore

Prof. V. Rajenan Nair
Deputy Director, NYKS, Government of India

Module

6

Introduction

The process of teaching is based on specific teaching approach. Each approach has to be supplemented with sufficient and appropriate teaching materials, teaching aids and techniques. Teaching materials are basically the notes and explanations prepared with the support of text books and other relevant references, the usage of which leads to the desired behavioural change in the learner on par with the objectives of the lesson. Teaching materials include hand-outs, manuals, written or printed reference materials, materials related with training techniques such as activity materials and case study materials, materials connected with audio and visual aids, materials for films, etc. Teaching aids are some equipment or hard materials that are helpful to transfer the training material to the learner in an effective way. Training aids include LCD, Overhead projector, Film projector, Video-tape, Flip chart, Magnetic board, Closed circuit television etc.

Objectives

1. To understand the importance of teaching techniques
2. To learn different techniques and their importance

Content

Appropriate selection of the teaching technique, based on the objective of the training programme is the work that needs expertise and experience. The objective of the training programme cannot be achieved if the techniques are not appropriate. Different methods/techniques are being used for teaching life skills in a classroom and these include brainstorming, role play, group discussion, buzz groups, situational analysis, case studies, anecdotal records, games and simulations, art forms, concept mapping (decision mapping), storytelling, demonstration and guided practise, debates etc. (CCE, 2010). There are number of teaching techniques and some of the techniques are stated below.

1. Group Discussion

In group discussion, the group examines a problem or topic impartially with the objective of better understanding of an issue or skill, reaching the best solution, or developing new ideas and directions for the group. This provides opportunities for students to discuss and learn from one another and practise tuning to one another in finding solutions. It enables students to deepen their understanding of the topic and personalize their connection to it. It helps develop skills in listening, assertiveness, and empathy. In addition to that, the student gets some real experience when s/he passes through the organizational part of group discussion. The practise of designating the role of group leader and rapporteur, to control the group and record the report of the discussion, gives two students in the group some special assignment to improve their skills. The assignments such as how to make seating arrangement, how to start and proceed with the discussion, how to express effectively the ideas, how to pose meaningful open-ended questions, how to keep track of discussion and its progress etc. gives sufficient opportunity to the students to learn the content and also improve their skills.

2. Brain Storming

Students actively generate a broad variety of ideas when a particular topic or question is given for a brief period of time and are encouraged to come out with ideas. The ideas are recorded in board or chart paper where everyone can see it. After brainstorming, the ideas are reviewed, added, deleted and finally categorised. This process allows students to generate ideas quickly and spontaneously. Quantity and variety of ideas is the main objective of brainstorming. This is followed by debating on the ideas generated. It helps students use their imagination and break loose from fixed patterns of response. It becomes essential to evaluate the pros and cons of each idea or rank ideas according to certain criteria. Thus the follow up discussion helps for cognitive development and promotes critical thinking.

3. Role Play

Role play is an informal dramatization in which people act out a suggested situation. It provides an excellent strategy for practising skills; experiencing how one might handle a potential situation in real life. Role plays can be used for imparting experience from life situations on any skill. The process consists of description of the situation to be role played, selection of role players, giving instructions to role players, starting the role play and discussing what happened.

Role-plays are of two types, spontaneous and structured. Spontaneous role-play is the one that is applied by the facilitator at the spur-of-the moment, based on the situation of the class, for the spontaneous response of the participants. The structured one is employed after giving time to the participants to plan and present. One should make the participants well aware of the objectives of the role-play and the method in detail. Otherwise it will be only in the form of a drama. The selection of participants for each role needs to be done very carefully to suit the purpose of the role-play. Here emphasis is on learning the behavioural skills and not on acting. At the end of the role-play, take feedback from the participants of the role-play and the observers. At the end, the trainer should evaluate the performance of the trainees in relation to the objective of the role-play. This technique provides reinforcement of learning and is useful for improving interpersonal skills and attitudes.

4. Buzz Group

The name of this technique has emerged from the buzzing sound that comes from the group during discussion. Select small groups containing 3-4 persons per group for this technique. Divide a lesson or the subject of discussion into very small topics with specific objective. Give each issue to each group with direction to arrive at the decision based on the objective. It helps the students get to know one another better and increases the likelihood that they will consider how another person thinks. It also helps students hear and learn from their peers. The facilitator concludes the session by consolidating and highlighting the conclusion.

5. Games and Simulations

Play games or other activity exercises can be used as activities for teaching Life skills. Simulations are activities structured to feel like the real experience. Games and simulations promote fun, active learning, and rich discussion in the classroom as participants work hard to prove their points or earn points. They require the combined use of knowledge, attitudes, and skills and allow students to test out assumptions and abilities in relatively safe environment. Games remind students that the activity is meant to be enjoyable and that it does not matter who wins. Simulations work best when it is brief and discussed immediately. Students should be asked to imagine themselves in a situation or should play a structured game of activity to experience a feeling that might occur in another setting.

6. Situation analysis and Case study

Situation analysis activities allow students to think about, analyse, and discuss situations they might encounter. Case studies are real life stories that describe in detail what happened to a community, family school, or individual. Give the details of the actual situation or problem to the trainees. It can be a written description of an actual situation, with all relevant details. For training, some imaginary situation is also sufficient as case study. You can present the case study in various forms. It can be in printed form, on audio tapes, motion film or video tape as per the need of the training programme. The objective of the study should be clear to the participants before starting the case study. This technique enables the trainee to learn through independent thinking. Case study promotes attitude change, analytical skill, synthesis of issues and evaluation. It gives opportunity to the participants to develop solutions.

Situation analysis allows students to explore problems and dilemmas and safely test solutions; it provides opportunities to work together, share ideas, and learn that people sometimes see things differently. Case studies are powerful catalysts for thought and discussion. Students consider the forces that converge to make an individual or group act in one way or another, and then evaluate the consequences. Case studies can be tied to specific activities to help students practise healthy responses before they find themselves confronted with a health risk. The process consists of guiding questions which are useful to spur thinking and discussion. The facilitator must be adept at teasing out the key points and step back and pose some bigger and overarching questions. Situation analyses and case studies need adequate time for processing and creative thinking. Teacher must act as the facilitator and coach rather than the sole source of answer and knowledge.

7. Debates

In a debate, a particular problem or issue is presented to the class, and students take a position on resolving the problem or issue. The class can debate as a whole or in small groups. It provides opportunity to address a particular issue in depth by critical thinking. Debates allow students to defend a position that may mean a lot to them. It offers a chance to practise higher thinking skills. In debates, talkative students should not be allowed to dominate at the expense of others.

8. Story Telling

The instructor or students tell or read a story to a group. Pictures, comics and photo novels, filmstrips and slides can supplement the story. Students are encouraged

to think about and discuss important points raised in the story. This can help students to think about and also relate local problems and develop critical thinking skills. Students can be motivated to write stories, to promote creative thinking. Story telling is also encouraged as a part of this activity. Story telling lends itself to drawing analogies or making comparisons. The process starts with a simple and clear story line and stating of one or two main points. The story (and pictures, if included) can be related indirectly to the personal, health, or psychological issues of adolescents. The story has to be dramatic enough to be interesting. An attempt can also be made to include situations of happiness, sadness, excitement, courage, serious thought, decisions, and problem solving behaviours in the story.

9. Collage

Collage is the process of identifying the materials related with the study area from different types of books, printed magazines, booklets, and papers etc., provided for the purpose. Collage helps the students to prepare a convincing exhibition material so that the other participants can understand the subject. Give sufficient printed materials such as colourful magazine, newspaper, etc., and the chart paper to the participants. Then direct them to prepare an exhibition material based on a particular theme by collecting appropriate pictures that suit their imagination and paste it on the chart paper in a relevant and appealing form. On completion of the exercise, the group member will explain the theme, based on the chart. The facilitator can summarise consolidating main points.

10. Question box

The purpose of question box is to elicit questions from the participants on subjects or issues for which they are not comfortable to ask in public. Place a cardboard box in the training room and tell the participants to put their questions in the box. The facilitator or an expert in the field can answer the questions in general for the information of the questioner and others.

11. Quiz

Quiz is a very interesting way of providing information to the students. This method can be employed for giving information about questions, having short and specific answers. It is also useful for collecting information about the knowledge level of the students. Teachers can also put this method to assess the impact of a session from the participants.

12. Demonstration

Demonstration involves three stages. They are giving an idea about the area of study to the participants, showing it for further clarification and doing it by involving the participants. It is a highly effective training device and suitable for teaching various skills. This method will help the participants to get the practical knowledge about something and to observe and analyse the particular area of study for more clear understanding. In many cases, demonstrations are being restricted to situations requiring motor skill. It can also be used effectively in all other situations so as to demonstrate counselling, interview, etc.

13. Field visit

Field visit is nothing but study tour. This helps to have firsthand information about study areas or environment that is not possible to replicate in the classroom situation. This is learning by the practical application of the concept in the field and experiencing the inference from it. It serves as the learning by experience. The importance of field trip relies in the concept that the element of naturalism cannot duplicate in the classroom situation. The different stages of field visit include field observations, interviewing the target group, collection of information, etc.

14. Study assignment

Design the study assignments in such a way that the participants should be able to put their thoughts in a concise and cohesive manner related to a particular field of study. In this method, divide the trainees into groups of four or five and instruct to study all facet of issues connected with the study area. The learner must interact with the society and seek clarification. He must observe, analyse, verify and consolidate the findings to present it as a report. This will help to broaden the knowledge about the area of study.

How to select appropriate training technique?

1. Select a method that is applicable to the subject that is handled in the session.
2. The method and technique should be able to project the content of the subject
3. Don't tempted to use a technique only because it is interesting to the trainees
4. Don't use a technique because it is easily available in the training institute.
5. Don't have the impression that all sessions need training techniques.
6. Consider the technique only as a means to transfer the content effectively

7. Consider the level of trainees before fixing any technique
8. Available time may also be considered before finalizing a technique

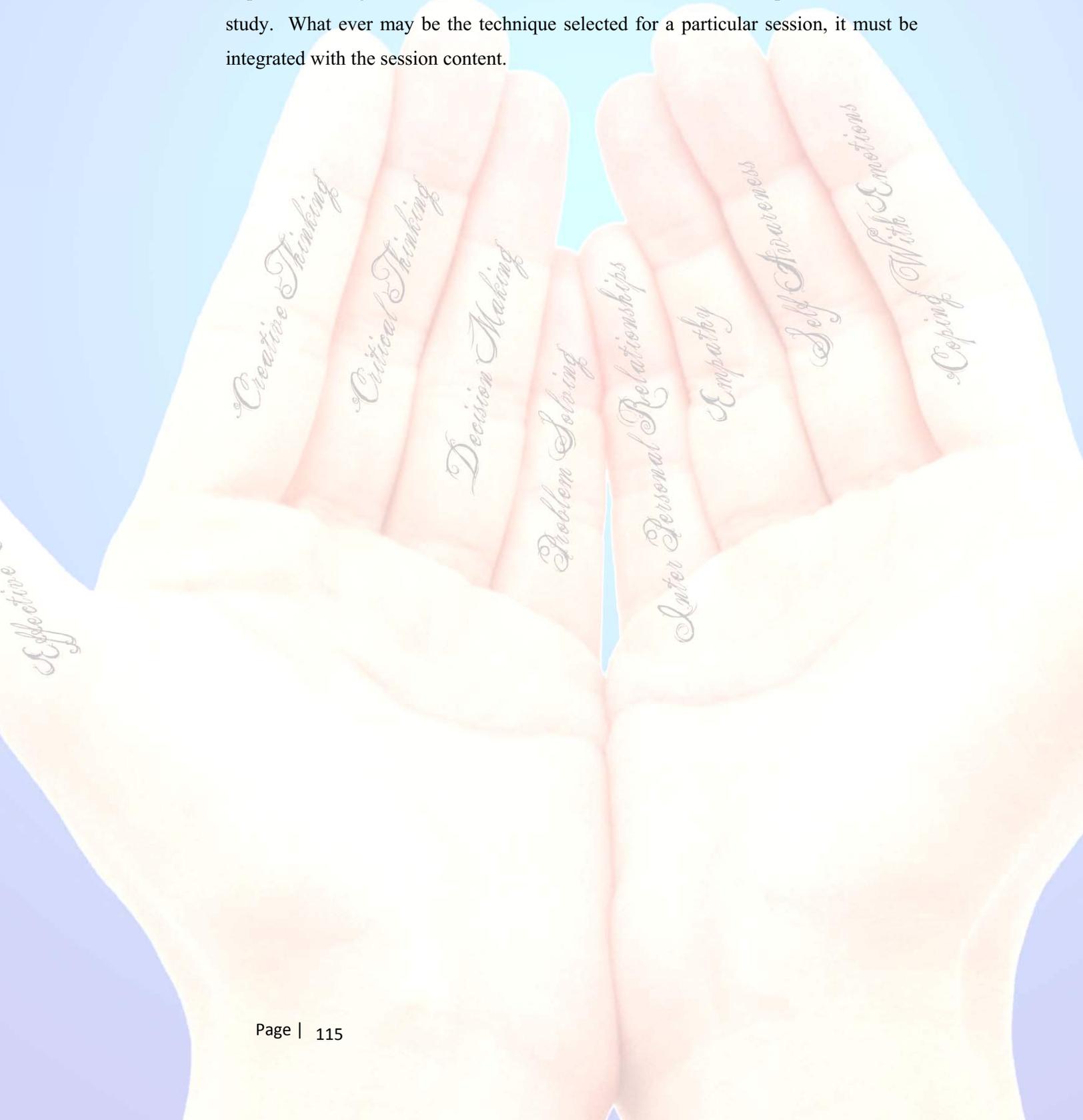
Integration of the technique with the session content

Whatever may be the technique selected for a particular session, it must be integrated with the session content. Techniques that never convey the content part of the subject under study, is mere waste of time and energy. The integration of different techniques in the training programme depends on the skill of the trainer. When applying different participatory techniques, it should be kept in mind that the same training technique will not work effectively in all the groups. The trainer has to modify the technique appropriately based on the educational and social level of the trainees. Integration of the technique is also the skill of the trainer. Two different techniques can be integrated into one based on the situation. It is also seen that many times, in the course of the application of the technique, an experienced trainer may bring in some felt changes in the process of the technique appropriately, based on the situation.

Summary

Teaching techniques enable students to strengthen their understanding and helps to develop skills. There are number of techniques. Brainstorming allows students to generate ideas quickly and spontaneously. Quantity and variety of ideas is the main objective of brainstorming. Role play is an informal dramatization, in which people act out a suggested situation. It serves as an excellent strategy for practising skills and experiencing a potential situation in real life. The name of Buzz group technique is emerged from the buzzing during discussion. Games and simulations promote fun, active learning, and more discussion in the classroom as participants work hard to prove their views. Situation analysis allows students to think about, analyse, and discuss situations they might encounter. Case studies are real life stories that describe in detail what happened to a community, family, school, or individual. In a debate, a particular problem or issue is presented to the class, and students take a position on resolving the problem or issue. In story telling students are encouraged to think about and discuss important points raised in the story. Collage is the process of identifying the materials related with the study area from the different types of books, printed magazines, booklets, and papers etc. The purpose of question box is to elicit questions on subjects or issues for which participants are not comfortable to ask in public. Quiz can be employed for giving information about questions, having short

and specific answers. Demonstration is giving an idea about the area of study to the participants, showing it for further clarification and doing it by involving the participants. Field visit helps to have firsthand information about study areas that cannot be replicated in the classroom situation. Study assignments help the participant to put their thoughts in a concise and cohesive manner related to a particular field of study. What ever may be the technique selected for a particular session, it must be integrated with the session content.



Worksheet

Worksheet

- A. Students of a Science class are not well-up in drawing inferences after carrying out an experiment on osmosis. Help them infer and communicate.

Situational analysis-----

- B. Fill up the following columns to develop self-awareness
Games and puzzles (Johari Window Model)

	Things I know	Things I do not know
Things they know	Open or public self	Blind self or area
Things they do not know	Hidden or private self	Unknown self or dark area

- C. The parliament needs to pass a bill on allocation of funds for electioneering.
Discuss.

Brainstorming-----
1.-----
2.-----
3.-----

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Approaches to Life Skills Education

Module

7

Dr. Bindu R.L.

Associate Professor, Department of Education, University of Kerala

Dr. Geetha G. Nair

Associate Professor in Botany, DESM, RIE, Mysore

Dr. R. Subasree

RGNIYD, Sriperumbudur

Introduction

Life skills are behaviours that enable individuals to adapt and deal effectively with the demands and challenges of life. They represent the abilities that are needed for the better functioning in the day to day activities. Practising life skills lead to qualities and competencies to initiate action and generate change. Life skills are thus distinctly different from perceptual motor skills or livelihood skills. But, no doubt, Life skills improve the quality of livelihood skills. There are many such skills, but core life skills are the ten skills pronounced by WHO. They are Self-awareness, Empathy, Inter-personal relations, Effective communication, Critical thinking, Creative thinking, Decision making, Problem solving, Coping with emotions and Coping with stress (WHO, 1997a; 1997b; 1999).

Researches shows that possessing life skills may be critical to young people's ability to positively adapt to and deal with the demands and challenges of life. The challenges facing young people today have changed significantly from those affecting previous generations; some simply did not exist before, and others have intensified or become more complex. The very common examples are HIV/AIDS and other sexually transmitted diseases, use of alcohol, tobacco and other drugs, unemployment, sexual and other forms of exploitation, and discrimination in different forms. The causes of these problems are complex and multifaceted, and so they are not easy to be solved simply or quickly. As part of a comprehensive, multi-strategy approach, the life skills approach may help to contribute to the reduction in the harm associated with these issues, and to maintenance and promotion of healthy lifestyles (GOI, 2006).

Life skills as a teaching-learning approach is specifically designed to enhance efforts to positively develop or change behaviour, especially related to well being and healthy functioning in society in addition to the theoretical subjects to be learned in the class. Life skills learning give emphasis to participatory approach and experiential

learning by integrating the curriculum and the Life skills. This is being done based on the concept that participatory approach and experiential learning will help the reinforcement of the skills of the student in a supportive learning environment and through the promotion of child-friendly practices in schools.

Expected learning outcomes include a combination of knowledge, values, attitudes and skills with a particular emphasis on those skills covered in this particular topic. Stakeholders of a life skills based education include youth, parents, teachers, administrators, health and social service practitioners. Life skills-based education is presently recognized as a methodology for the overall development of school students by integrating curriculum and Life skills to address a variety of issues of adolescent and youth development.

Objectives

1. To understand Life skills approach
2. To comprehend the importance of Participatory and Experimental method.
3. To grasp the idea of integration of Life Skills with the curriculum.

Content

The Life Skills Approach refers to the interactive process of teaching and learning which focuses on acquiring knowledge, attitudes and skills which support behaviours that enable us to take greater responsibility for our own lives; by making healthy life choices, gaining greater resistance to negative pressures, and minimising harmful behaviours.

The goal of the life skills approach is to promote healthy, sociable behaviour and to prevent or reduce risk behaviours, as well as make an impact on knowledge and attitudinal components. The life skills approach is based on the existence of a balance of three components: (i) Knowledge or information, (ii) Attitudes and values and (iii) Skills. The life skills approach encompasses and balances all three of these components. Teaching methods are adolescent and youth-centered, gender-sensitive, interactive, and participatory. The most common teaching methods include working in groups, brainstorming, role-playing, storytelling, debating, and participating in discussions and audio-visual activities, etc. (Nair, V., 2010).

The approach to life skills education for adolescents rests on an understanding of adolescence at a basic level. Adolescence is an age of a number of physical changes accompanied by mental anxieties, emotional drives and passions, extra

energy and increased capacity to be active. But at the personal level adolescents are confused about these changes. Society expects them to behave differently, where as they experience many things differently, which they themselves are unable to express. Within these confusions and turmoil they require guidance, empathy and reward, but are rarely able to get any. The causes of these problems are complex and multifaceted, and so they are unlikely to be solved quickly or simply. To empower adolescents it is necessary to align ones^attempts with their specific culture and community. As part of a comprehensive, multi-strategy approach, a life skills approach may help to contribute to a reduction in the harm associated with these issues, and to maintain and promote healthy lifestyles.

Different types of approaches

a) Informative approach (Expository approach): This method is similar to the teacher centred cognitive type of teaching method. Here importance is given to impart some relevant information that will create a general awareness about the content, environment and social situations. The teacher conveys the information and the student listens and understands the information. The student is being considered as a football without sufficient air which needs to be filled with air to make it functional. The teacher fills the student with some content which he feels that will make the student more functional and equipped for further initiatives. Here the teacher decides what is to be taught, how much to taught and what method to be adopted for the teaching. In this approach, learners do not have any other role except passively learning during the session period. Because of this basic belief, conventional training methodology does not allow learners to participate actively and are also being controlled by the trainer to a large extent. Hence, every part of the learning programme i.e. from defining the objective to evaluating the training programme is being done by the teacher. The teacher has the cardinal role in the whole process and thus it is completely teacher centred. It is basically a one way process, though there is some question answer session, and the impact will be very less when compared with other types.

Major assumptions underlying the informative method are the following:

- 1) Planning and implementing informative method is the sole responsibility of the teacher concerned
- 2) The ability of the teacher to teach is important
- 3) Making the participants aware about the subject leads to better performance
- 4) Impact of training is a simple function based on the capability of the student.

b) Team teaching approach

Team teaching is a type of instructional approach in which two or more teachers jointly co-operate to carry out the teaching process by combining classes together. It is a pooling of resources, interests and expertise, appropriate to the need of the specific Life skills of the students based on priority. The teachers take joint responsibility to share the planning, teaching and evaluation. The phases include lead lecture followed by group work which is helpful for comprehension of information presented in the lead lecture. In order to focus attention on students at different levels ability group is formed and group work is entrusted to them based on the need of a particular Life skill. As Life skills Education is always connected with activities, the presence of more than one teacher will help to pass on the activity in an appropriate way. The formation of ability group will also help to impart the specific skill to the specific person (Facilitator's Manual, 2006a,b).

Advantages

1. As two or more teachers are involved, the planning and organizing will be better.
2. Joint effort will bring out better teaching and output.
3. It will help students at different strata to practise the appropriate skill.

c) Participatory approach (Heuristic approach): Participatory type of Life skills approach is designed to avoid the one-way teaching-learning method as in the case of conventional method and make the training programme fully interactive with the involvement and participation of the students. So, this approach is also called student centred approach. The training techniques such as statement reaction, group discussion, buzz groups, case study, incident reaction etc. comes under participatory method. Participatory training methodology has its origin from the concept that people cannot be developed; they can only develop themselves. Participatory approach developed in response to the inadequacies in the conventional/traditional training system. The participatory training approach encourages the participants to become part of the training programme, to see themselves as a source of information

and knowledge and develop them by adding more knowledge to their existing level of knowledge.

Major assumptions on participatory approach

1) *Participatory approach is participant centred*: When compared to conventional/traditional training, the advantage of participatory training is that it always considers the participant as the most important part of the training and all activities are developed from this angle.

2) *Assessment of the existing level of knowledge of the participant is important for Training*: Participative training emphasises the need of assessing the level of the participant before training and formulating the lesson plan based on the assessment.

3) *New knowledge is built on the existing knowledge*: Participatory approach retreats the concept that nothing can be understood afresh without a base. Knowledge can be developed only from concrete things in mind to abstract forms. Thus the starting point for creating new knowledge is the existing knowledge that people have, particularly the authentic elements of its. As others begin to appreciate what one already knows, he is more open for accepting new information. This desire to seek new information and knowledge enhances the learning process. Here, the knowledge and experience is shared, practised and evaluated to get more clarity on the subject without getting bored.

4) *Participants have to take responsibility and control over their learning*: Here, the role of the teacher is that of a facilitator. The duty of the facilitator is to convince the participant to take the initiative and responsibility to learn things. This creates drive and full involvement of the participants in the training programme. Participatory training puts emphasis on the active participation of learners in generating their own knowledge. This encourages them to take responsibility of their own learning. It is this active posture which constitutes a powerful impetus for learning and for learners to exercise control over their learning.

5) *Learning becomes a collective process for the mutual benefit of the participants*: Learning is not an individual endeavour. Mutual interaction and sharing of experience between the participants enriches the learning process with mutual benefit to the participants. This promotion of collective responsibility for seeking new knowledge, participants learn to get together and start collectively seeking and analysing information.

6) *Thorough analysis takes place on discussions, and actions emerge only based on this:* In conventional training the instructor delivers some idea or explanation and the trainees are supposed to accept it. In participatory training ideas are discussed by the participants and got clarified so that each and every participant gets himself/herself convinced. Here many options are discussed based on concrete information. As a result participants are able to accept and reject options on an informed basis. This relates a sense of empowerment which is based on the confidence on which that information has been interpreted and understood.

7) *It thrusts on the combined focus of knowledge, attitude and skills:* Participatory training gives most importance to combined focus of knowledge, attitude and skills instead of considering it as isolated ingredients for development. Participatory training believes that only a combined effort to improve simultaneously knowledge, attitude and skills will fetch the desired result of behavioural change. This system of training also considers that knowledge, attitude and skills can be improved through group activities and combined effort of the participants.

8) *Learning through the experience sharing of the participant is most important:* Experience is the best teacher. Sharing of different experiences of different people from different situations enriches the quality of learning. Participatory training believes that participants already possess some knowledge. The synthesis of popular knowledge with existing scientific knowledge strengthens the educational experience of the participants.

9) *Creation of a suitable learning environment improves learning:* Conventional learning never considers the learning environment. Participatory approach believes that a satisfying learning environment and facilities will improve the positive attitude of the participants and that in turn improves learning.

10) *Training should be useful for day to day living of the participant:* Participatory training system views training not only for improving performance of the assigned job in the organisational set up but also emphasises that it is useful for improving the day to day activities and interactions. The very act of involvement in the process of analysing a given reality creates a sense of ownership of that knowledge and willingness to implement that information. Thus the participants will be able to initiate appropriate changes in their life style, interpersonal relations and social interactions.

Strengths of Participatory method

1. Existing popular knowledge is recognised and valued
2. New knowledge is built on the existing knowledge
3. Participants learn to exercise control
4. It becomes a collective process
5. It creates informed options
6. Actions emerge out of this analysis

d) Experimental method: In experimental method, there is the element of direct experience through which the participants learn. Simulation exercises such as role play comes under this method. Experiments are of two types. One is the experiments (activities) in the natural settings where the participants are put into real life situations to face the situation and get the feedback. The second one is the creation of experiment in laboratory or class room settings. Simulation exercises such as role play come under this group (Facilitator's Manual, 2006a,b; Life Skills Development, 2005).

Summary

Life skills are the abilities that are helpful for better functioning in day-to-day activities. Studies shows that possessing life skills may be critical to adolescents' ability to positively adapt and deal with the demands and challenges of life. Life skills learning give emphasis to participatory approach and experiential learning by integrating the curriculum and the Life skills. The Life Skills Approach refers to the interactive process of teaching and learning which focuses on acquiring knowledge, attitudes and skills, which support behaviours that enable to take greater responsibility by making healthy life choices, gaining better resistance to negative pressures, and minimising harmful behaviours. Basically there are three approaches to Life Skills. They are Informative approach, Participatory approach and Experimental approach. Informative method is teacher centred cognitive approach. Participatory approach is student centred with full initiative and involvement of the student. The third approach is Experimental approach where the student goes through direct experience through which s/he learns.

Worksheet

Worksheet 1

A. A young man gets addicted to drugs and alcohol. Excessive consumption of alcohol reduces his appetite, emaciates him and causes extensive liver damage.

How will you reform him? Advise-----
Expository approach-----

B. A panel of doctors examine a patient who is to undergo brain surgery for removal of a block in the blood vessel of the brain. It is a question of life, death and life after death if the patient survives along with the social stigma of a mental illness.

Advise-----

Team teaching approach

Doctor 1 Neurologist-----

Doctor 2 Anaesthetist-----

Doctor 3 Brain Surgeon-----

Doctor 4 General Physician-----

Doctor 5 Psychiatrist-----

B. How would you explain weightlessness?

Experiment method-----

Experience being at the top of a moving giant wheel. -----

Experience inside a spaceship.-----

C. Tantra is an ancient art of getting into someone else's body. Mythology states a young ascetic had to get into a young man's body to experience worldly life and then complete his renunciation process. Narrate the ascetic's experiences.

Experiment method-----

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Assessment of Life Skills

Module

8

Prof. K. Dorasami
Retired Principal, RIE, Mysore.

Dr. Jayashree
Director, i-point, Bangalore

Introduction

Education and evaluation of life skills for school children has gained significant importance in the recent years. Education of life skills happens both in scholastic and co-scholastic areas when students get involved in the learning process. The evaluation happens when students are subjected to various assessments that happen throughout the academic year. The assessment practices for evaluating learning associated with scholastic activities are fairly matured over the years. However, the assessment practices for evaluating learning associated with co-scholastic activities are still emerging.

Education and evaluation are an indispensable part of the educational process. It is necessary to ascertain what learning, change and progress takes place in the student over a period of time in different subjects of study as well as other aspects of the student's personality.

This aspect has been strongly taken care of in the National Policy on Education (1986) which states that Continuous and Comprehensive Evaluation (CCE, 2010) that incorporates both scholastic and non-scholastic aspects of evaluation, spread over the total span of instructional time^{8.24 (iii)} should be followed. Since learning is a continuous process, evaluation should also be continuous. With the shift of the system of assessment from the more traditional system of evaluation and examination, to a more interactive process between students and teachers that throws up data on how well their students are learning and to assist them in improving the teaching ^learning process, it's inevitable that the assessment of life skills should also be a continuous process.

In this chapter, it is proposed that the education of life skills be infused with scholastic subjects and assessed throughout the instructional period via the formative and summative assessments. The approach provided here serves as a broad guiding

principle to give teachers an idea of how to assess life skills when infused with Science. However, teachers are advised to use their own discretion and ensure they plan the instruction and assessment of life skills keeping in mind the constraints of time and the right balance of life skills is infused with the subject.

This chapter will focus on life skills as a primary co-scholastic activity. Here it is proposed that the education of life skills shall be infused in to scholastic subjects and hence the evaluation of life skills will happen along with the evaluation of scholastic activities. The assessment method proposed will outline the approach for identifying the scope for life skill learning in scholastic subjects and evaluating the same through the learning process.

Objectives

This chapter will help teachers to understand the following:

1. Assessment paradigms
2. How to assess Life Skills when infused with Science?
 - a) Assessing Thinking skills
 - b) Assessing Social and Emotional Skills
3. Model for Scientific method of assessing Life skills
4. Using the Model in Formative and Summative Assessments

The rest of this chapter will detail out the eight steps mentioned above.

Content

1. Assessment Paradigms

Assessment practice, more than any other practice in higher education, communicates to students the type of learning required of them. Numerous researchers have found that assessment practices impact strongly upon what students learn, and the approach adopted toward study. Hence the practice of assessment can drive not only the curriculum, but also teaching methods and students' approaches to learning.

There are four assessment paradigms:

Assessment of Learning

A process whereby someone attempts to describe and quantify the knowledge, attitudes or skills possessed by another

- ✓ *Summative*
- ✓ Teacher designs learning
- ✓ Teacher collects evidence
- ✓ Teacher judges what has been learnt (and what has not)

Assessment for Learning

Emphasis towards giving of useful advice to the student and less emphasis on the giving of marks and the grading function

- ✓ *Formative*
- ✓ Teacher designs learning
- ✓ Teacher designs assessment with feedback to student
- ✓ Teacher assesses what has been learnt (student develops insight into what has not)

Assessment as Learning

Generates opportunities for self assessment and for peer assessment. Students take on increased responsibility to generate quality information about their learning and that of others

- ✓ *Diagnostic*
- ✓ Teacher and student co-construct learning
- ✓ Teacher and student co-construct assessment
- ✓ Teacher and student co-construct learning progress map

Assessment in Learning

Deflects the teaching from its focus on a 'correct answer' to focus on 'a fertile question'. Through the inquiry, students engage in processes that generate feedback

- ✓ Student at the center of learning
- ✓ Student monitors, assesses and reflects on learning
- ✓ Student initiates demonstration of learning (to self and others)
- ✓ Teacher as coach and mentor

While there are four different paradigms of assessment, only Assessment *for* Learning and Assessment *of* Learning is in focus in this chapter.

- Assessment for learning is Formative Assessment and is part of the pedagogy and can be thought of as practice. The formative assessment will be part of the instructional process, where the teacher has the opportunity to use her creativity to make assessment joyful through student involvement and by using different techniques of assessment.
- Assessment of learning is Summative Assessment and is to evaluate performance after practice. The summative assessment is more periodic in nature, conducted usually at the end of a term and is more restricted towards the conventional mechanism of evaluation in the form of tests/examinations.

Reflections

- *Since Formative assessment is part of the instructional process, Thinking, Social and Emotional Skills can be assessed through different teaching methodologies/techniques*
- *As Science creates a natural path for the infusion of Thinking skills, it can be assessed in the Summative assessment as well*

2. How to assess life Skills when infused with Science?

In the conventional way of teaching science, emphasis is primarily on covering academic content, and any other aspect related to science is covered in a way the teacher considers appropriate. Despite the recognition of co-scholastic areas by various boards over the past few years regarding its importance and the need for its inclusion in the curriculum, there is still a pervading culture amongst academics, which maintains that learning of co-scholastic areas such as life skills, values and attitudes should be restricted to an implicit, rather than explicit curriculum. Also it has been observed that usually under the scholastic domain knowledge and understanding of the facts, concepts, principles etc. of a subject are assessed while the co-scholastic elements like life skills are either altogether excluded from the evaluation process or they are not given adequate attention.

However with the need for Continuous and Comprehensive Evaluation to incorporate scholastic and co-scholastic aspects of evaluation, most boards now insist on numerical scoring and grading of the co-scholastic areas to bring in objectivity and consistency to the grading process. This can be achieved by using a scientific method of assessment.

Reflections

Hence

- *There is a strong need for a scientific way of assessing Life skills ensure that the quantitative and qualitative assessment is fair and objective*
- *While there are several tools to assess life skills, such as rating, checklist, portfolio analysis etc., for fair and objective means of assessing Life skills, a scoring formula (ex: a rubrics)needs to be used*

2a. Assessing Thinking skills

The nature of Science creates a natural path for the infusion and assessment of Thinking Skills. Critical thinking for example, is an ability to analyze information and experiences in an objective manner (CCE, 2010) and is invaluable in science education. Unfortunately, they are frequently not taught explicitly, the assumption being that students will learn from the implicit values buried deep within teaching philosophies. Infusion of Life skills with the subject matter of Science will enable the

teacher to bring Thinking Skills to the forefront and making it an explicit component of the curriculum.

The question is, is it better to teach thinking skills to students by infusing it into the subject matter (*Approach A*) or separate curricula (*Approach B*)? Is it better to teach these skills directly or to create situations whereby students learn them inferentially through being placed in circumstances which call for them to apply these skills? Both approaches can be effective. While several documents in the thinking skills literature (Cotton, 1991) offer support for infusion of thinking skills activities into subjects in the regular curriculum, others (Cotton, 1991) provide support for separate thinking skills instruction.

Due to the nature of Science, it is possible to use both approaches as Science creates a natural path for the infusion and assessment of Thinking Skills and can hence be infused into the subject matter. Thinking skills are considered to be invaluable in science education, particularly at the Senior Secondary level. Science enables the teacher to bring Thinking Skills to the forefront and make it an explicit component.

Hence while teaching thinking skills, the focus might be on:

- i. Using different methodologies to expand learning and also build a habit/culture of thinking (*Approach A*)
- ii. Building familiarity with occasions in which thinking is appropriate as well as critical (*Approach A*)
- iii. Sharing inputs on structured ways of thinking (*Approach B*)

Broadly the Science curriculum of Class XII can be categorized into the following areas (*Refer table 8.1.0*):

1. Concepts & principles
2. Processes, tools and techniques
3. Application of knowledge to Science and Technology
4. Application of knowledge for welfare of society and environment
5. Interface of the area of science with other disciplines

While predominantly Thinking skills strongly align with Science (*Refer table 8.1.1*), a few Social and Emotional skills can be aligned depending on the topic (*Refer figure 8.1.2*).

The table given below indicates the life skills which strongly align with the broad categories of the Science curriculum for Class XII.

Science-Life skill Infusion -Table 8.1.0 (Thinking T, Social S, Emotional E)				
Concepts and Principles	Processes, tools and techniques	Application of Knowledge to science & technology	Application of Knowledge for welfare of society and environment	Interface of one area of science with other disciplines
Critical Thinking(T) Curiosity/Enquiry(T) Balancing Open-mindedness with Skepticism(T)	Organising thoughts & ideas(T) Evaluating options(T) Probing(T) Predicting(T) outcomes(T) Experimentation(T) Observation(T) Confidence to rely on data(T)	Research orientation(T) Problem solving(T) Critical thinking(T) Decision Making(T) Makes connections(T) Synthesis of information(T) Convincing skills(S) Predicting outcomes(T) Identifying challenges(T) Planning(T) Taking risks(E) Creative thinking(T) Willingness to modify explanations(T) Reasoning(T)	Research orientation(T) Problem solving(T) Critical thinking(T) Decision Making(T) Makes connections(T) Synthesis of information(T) Convincing skills(S) Predicting outcomes(T) Identifying challenges(T) Planning(T) Taking risks(E) Creative thinking(T) Willingness to Modify explanations(T) Reasoning(T)	Synthesis of information(T) Making connections(T) Predicting outcomes(T) Creating synergy(T) Problem solving(T) Research orientation(T)

While this is a broad categorization of Life skills that align with the Science curriculum of Class XII, for every topic, teachers need to identify the relevant Life Skills that need to be developed and assessed.

There are two examples given below:

- Example 1 - depicts strong infusion of thinking skills with Subject matter (*Refer table 1.1*)
- Example 2 ^depicts infusion of Social and Emotional skills with Subject matter (*Refer table 8.1.2*)

Table 8.1.1: Example 1: Infusion of Life skills in the subject- Biology-Unit 2- Genetics and Evolution

Topic	Sub topics	Infused Life Skill	Broad Skill
Genetics and Evolution	1. Mendelian inheritance <i>(Refer Annexure 1 for details of identified Thinking Skills relevant for Mendelian Inheritance)</i>	Curiosity/Self-Awareness/Critical Thinking	Thinking skills
	2. Deviations in inheritance	Balancing open mindedness with skepticism/Probing	Thinking skills
	2a. Incomplete dominance		
	2b. Codominance		
	2c. Multiple alleles and inheritance of blood groups	Problem solving/ Predicting outcomes	Thinking skills
	3. Pleiotropy	Probing/Predicting outcome	Thinking skills
	4. Elementary idea of polygenic inheritance	Probing	Thinking skills
	5. Chromosome theory of inheritance	Probing/making connections/research orientation/	Thinking skills
	6. Chromosomes and genes		
	7. Sex determination	Sensitiveness/ predicting outcome/ identifying challenges	Thinking skills
	8. Sex linked inheritance	Predicting outcomes/identifying challenges/	Thinking skills
	Hemophilia	Empathy/ sensitiveness	Social skills
	Colour Blindness		
	9. Mendelian disorders in humans	Predicting outcomes/identifying challenges	Thinking skills
	Thalassemia	Empathy/sensitiveness	Social skills
	10. Chromosomal Disorders in humans	Identifying challenges/ Empathy/sensitiveness	Thinking skills/Social skills
	Down's Syndrome		
Turner's Syndrome			
Klinefelter's Syndrome			

Table 8.1.2: Example 2: Biology-Unit 5- Ecology and Environment

Concepts/ Principles	Sub topics	Infused Life Skill	Broad Skill
Ecology and Environment	1.Habitat and niche	Self-Awareness	Emotional Skill
	2. Population and ecological adaptations	Adaptability	Social Skill
	3. Population interactions		
	3a.Mutualism	Co-operation/team work/seeks help/making connections	Social/Emotional Skill
	3b.Competition	Identifying challenges/managing stress	Social/Emotional Skill
	3c.Predation	Takes risks/plans well	Thinking Skill
	3d.Parasitism	Evaluating options	Thinking Skill
	4. Population attributes	Predicting outcomes/Empathy	Thinking/Emotional Skill

Hence, while the nature of Science creates a natural path for the infusion of Thinking Skills into the subject matter, some percentage of Social and Emotional skills can also be infused into the subject matter depending on the topic. Teachers need to assess the relevance of the Social and Emotional skills in relation to the respective topic and analyse the specific skills that need to be developed and assessed. Example: If Reproductive Health is being taught in the class, Assertive communication would become a key Social skill that the teacher might want to focus on.

The table below serves as a broad guideline to the percentage of each of the Life skills that can be infused into Biology for Class XII (*Refer table1.3*). It's imperative for teachers to be aware that the percentages would vary depending on the Social context such as Religion, caste, Economic class, Occupation groups, Domicile factors etc.

Table 8.1.3: Class XII Biology Theory
(Specific skills for each of the Units given in the Annexure 2)

Unit	Title	% of Thinking Skills	% of Social Skills	% of Emotional Skills
1	Reproduction	60	30	10
2	Genetics & Evolution	80	20	-
3	Biology and Human Welfare	60	30	10
4	Biotechnology & its applications	70	30	-
5	Ecology and Environment	65	30	5

Reflections

- *The nature of Science creates a natural path for the infusion and assessment of Thinking Skills and can hence it can be infused into the subject matter*
- *Science will enable the teacher to bring Thinking Skills to the forefront and make it an explicit component*
- *Since Thinking Skills are invaluable in science education, particularly at the Senior Secondary level, the teacher could explicitly help students inculcate these skills by:*
 - *Using different methodologies to expand learning and build a culture of thinking*
 - *Building familiarity with occasions in which thinking is critical*
 - *Sharing inputs on structured ways of thinking*
- *Teachers need to identify the relevant Social and Emotional Skills that need to be developed and assessed for different topics.*
- *The percentage of Thinking, Social and Emotional Skills that can be infused in to the subject matter will vary depending on the Social context such as Religion, caste, Economic class, Occupation groups, Domicile factors etc.*

2b. Assessing Social and Emotional Skills

Social and Emotional Skills on the other hand align more to positive and adaptive behavior and hence align more with group behavior and social contexts. Therefore, assessment of these skills needs to be done through different teaching methodologies/techniques. For example, a class discussion can be used to Social and Emotional Skills.

There are different methodologies/techniques that a teacher can use to develop and assess life skills, however it's crucial for the teacher to identify the relevant Social and Emotional skills for respective topics and identify the most appropriate methodologies/techniques that can be used to assess them (Refer table 1.4):

Table 8.1.4	
Methodologies/Techniques	
✓ Class discussions	✓ Educational games and simulations
✓ Brainstorming	✓ Case studies
✓ Demonstration and guided practice	✓ Story telling
✓ Role plays	✓ Debates
✓ Audio and visual activities, e.g. arts, music, theatre, dance	✓ Decision mapping or problem trees
	✓ Small group discussion

Example 3 below depicts how Social and Emotional skills can be developed and assessed using different Teaching methodologies /techniques (Refer table 1.5).

**Table 8.1.5: Example 3: Infusion of Life skills in the Teaching Methodology-
Biology-Unit 2-Genetics and Evolution**

Topic	Sub topics	Infused Life Skill	Broad Skill	Teaching Methodology/ Techniques	Life Skill infused in the teaching Methodology
Genetics and Evolution	1. Mendelian inheritance	Critical Thinking /Curiosity/ Self-Awareness	Thinking Skill Social skills	Class discussion*	Expressing self/ communication skills/ making connections/ creating synergy/ organizing thoughts and ideas
	2.Deviations in inheritance	Balancing open mindedness with skepticism/Adaptability	Thinking skills Social Skills Emotional skills	Class discussion	Listening/ articulation/ suspends judgment
	2a.Incomplete dominance				
	2b.Codominance				
	2c.Multiple alleles and inheritance of blood groups	Problem solving/ Predicting outcomes	Thinking skills/ Social skills	Role play	Expressing self/ communication skills/ making connections/ creating synergy/ organising thoughts and ideas
	3.Pleiotropy	Predicting outcome	Thinking skills	Project/presentation	Organizing thoughts/presentation skills/ communicative skills
	4.Elementary idea of polygenic inheritance	Probing	Thinking skills	Project/presentation	Organizing thoughts/presentation skills/ communicative skills
	5.Chromosome theory of inheritance	Probing/making connections/research orientation/	Thinking skills	Role Play*	Expressing self/ communication skills/ making connections/ creating synergy/ organising thoughts and ideas
	6.Chromosomes and genes				
	7. Sex determination	Sensitiveness/ predicting outcome/ identifying challenges	Thinking skills	Audio/Visual aids	Inquisitiveness/attention/ open mindedness/ listening and comprehending skills
	8. Sex linked inheritance	Predicting outcomes/identifying challenges/	Thinking skills	Audio/ Visual aids	Inquisitiveness/attention/ open mindedness/ listening and comprehending skills
	Hemophilia	Empathy/ sensitiveness	Thinking skills/ Social skills	Project/presentation	Organizing thoughts/presentation skills/ communicative skills
	Colour Blindness				
	9. Mendelian disorders in humans	Identifying challenges/ Empathy/sensitiveness	Thinking skills Social skills Emotional skills	Audio/Visual aids*	Manages emotions/ expresses emotions
	Thalassemia				
	10. Chromosomal Disorders in humans	Identifying challenges/ Empathy/sensitive ness	Thinking skills Social skills	Audio/ Visual aids	Inquisitiveness/attention/ open mindedness/ listening and comprehending skills
Down's Syndrome					
Turner's Syndrome					
Klinefelter's Syndrome					

Reflections

- While predominantly thinking skills can be infused with the subject matter, most of the Social and Emotional Skills can be developed and assessed using different teaching methodologies/techniques
- Teachers need to identify the relevant Social and Emotional Skills that need to be developed and assessed for different topics
- The teacher's creativity and planning is critical in designing and selecting the appropriate methodologies/techniques to assess Social and Emotional skills

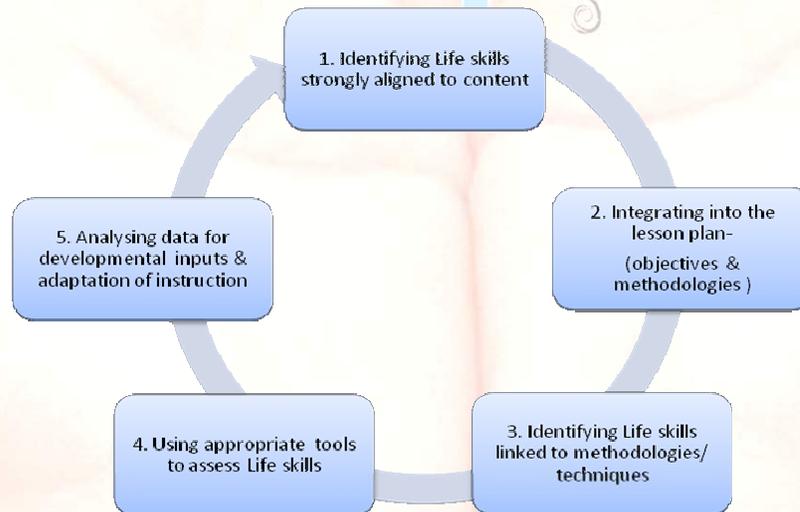
3. Model for Scientific method of assessing Life skills

While there are various tools to assess life skills (Refer table 8.1.6), with the need for numerical scoring and grading, it has become imperative for teachers to use a scientific approach to assess students. The model given below will help teachers ensure that the assessment is objective and consistent (Refer figure 8.1.0).

Table 8.1.6: Tools to assess Life skills	
✓ Questions	✓ Peer evaluation
✓ Observation schedule	✓ Rating
✓ Rubrics	✓ Checklist
✓ Self-evaluation	✓ Interview schedule
	✓ Portfolio analysis

The following model can be used to assess life skills when infused with academics:

Figure 8.1.0: Model for assessing life skills



Reflections

- Using the given model to assess Life Skills will ensure it is assessed in a scientific and objective manner.

4. Using the Model in Formative and Summative Assessments

4a. Formative Assessments (Assessments FOR learning)

Since Formative assessments are part of the instructional process, the Thinking, Social and Emotional Skills could be assessed through different teaching methodologies/techniques.

Table 8.1.7: Application of the model to Class XII Biology Chapter 9: Strategies for enhancement in Food Production, Topic: Genetically Modified Food (GM food)

<i>Step 1</i>	Identifying life skills strongly aligned to content	Thinking skills-Problem solving Social skills- Effective communication
<i>Step 2</i>	Integrating into the lesson plan- objectives & methodologies	Objectives: At the end of the class, students will be able to evaluate the pros and cons of GM food Methodologies: Role play, small group discussion
<i>Step 3:</i>	Identifying life skills linked to methodology/technique	Analyses information, Articulate
<i>Step 4:</i>	Using appropriate tools to assess life skills	Informal questions, Rubrics
<i>Step 5:</i>	Analyzing data for developmental inputs & adaptation of instruction	Positive and constructive feedback and inputs for the student

Table 8.1.8: Example of how the model can be used in Class XII (Example 1)

Example 1

Subject	Topic & Sub topics	Infused Life Skill	Broad Skill	Teaching Methodology/ Techniques	Life Skill infused in the teaching Methodology
Biology	Genetics and Evolution: Mendelian inheritance	Critical Thinking /Curiosity/ Self-Awareness	Thinking Skill Social skills	Class discussion	Expressing self/ communication skills/ making connections/ creating synergy/ organizing thoughts and ideas

Teaching Methodology

- Class Discussion: Throw the word Inheritance in the class and let students come up with whatever comes to their mind with that word. Pick up the relevant information from the points raised by the students, and elaborate on the topic weaving the concept of self-awareness, similarity/dissimilarity of different species narrowing it down to similarity/dissimilarity within the species, within extended family and within the family to highlight the existence of genetic factor and inheritance.

Tool to assess Life skills

Table 8.1.9: Rating scale to assess Effective Communication (Social skills)

Student Name:		
Class:		
Person responsible for observation(Teacher/Peer) and date:		
Sl. No.	Did the student ^	Grade on a scale of 1-5 1- Never 2- Rarely 3-Sometimes 4- Quite often 5- Very often
1	Share information/facts/ideas	
2	Give any examples/experiences	
3	Ask questions and seek clarification	
4	Build on ideas shared by others	
5	Speak clearly and confidently	
6	Summarise the discussion	

Table 8.1.10: Example of how model can be used in Class XII (Example 2)

Example 2

Subject	Topic & Sub topics	Infused Life skill	Broad skill	Teaching Methodology/ Techniques	Life Skill infused in the teaching Methodology
Biology	Genetics and Evolution: 2c.Multiple alleles and inheritance of blood groups	Problem solving /Predicting outcomes	Thinking skills/ Social skills	Role play	Expressing self/ communication skills/ making connections/ creating synergy/ organising thoughts and ideas

Teaching Methodology

- Role Play: Pick up the topic of Mendelian inheritance/multiple alleles/ dominance, let students play the role of chromosomes and genes and try to show the concept of inheritance through the role play. Discuss the dihybrid cross between round and yellow seed pea plants with wrinkled and green seed plants. Drive the topic based on the role play. 4 children of similar height could be chosen for playing chromosomes. Other children will play trait genes. Trait- shape, choose 4 children- Two plump(to represent round shape), two thin(to represent wrinkled shape); Trait- color, choose 4 children- Two (to represent yellow seeds), two (to represent green seeds). Show the two pair of chromosomes which are homozygous($rryy$ and $RRYY$) for the traits- shape and seed coat color(green and wrinkled; round and yellow- round and Yellow are dominant traits). Two children (ry and RY) form a pair by holding hands. Let each chromosome hold children representing trait gene by other hand. To show the inheritance, one chromosome from pair 1 will get aligned with one chromosome from pair 2, carrying the trait gene along with him. When the new chromosome pair is formed, the law of dominance or inheritance could be explained through the trait genes (this will show the F_1 generation, where heterozygous plants $RrYy$ are produced).

Tool to assess Life skills

- Informal Multiple choice questioning to assess Predicting outcome^(Thinking skills):
5 min assessment: Teacher to orally read out the following questions and students to write down answers only on a sheet of paper and hand it back to teacher after a quick
 1. If R is for round seed shape and Y is for yellow seed coat color, and both the features are dominant. Then what will be the genotype for a plant which produces wrinkled and green seeds, in the F_2 generation.
 - a) $RrYy$
 - b) $RRYy$
 - c) $rryy$
 - d) $rRYY$

2. What is the ratio of plants having the physical traits- round yellow to wrinkled green, in the f2 generation, when 2 plants from f1 generation are crossed.
 - a) 1:1
 - b) 1:3
 - c) 3:1
 - d) 9:1

3. When the genotype consists of a dominant and a recessive allele, the phenotype will be like ____ allele.
 - a) Recessive
 - b) Dominant
 - c) Co-dominant
 - d) None of the above

4. Which of the following represents a test cross?
 - a) Ww X WW
 - b) ww X Ww
 - c) Ww X Ww
 - d) WW x WW

5. Which of the following represents a dihybrid?
 - a) WwSs
 - b) WwSS
 - c) WWSs
 - d) wwss

Table 8.1.11: Example of how model can be used in Class XII (Example 3)

Example 3

Subject	Topic & Sub topics	Infused Life Skill	Broad Skill	Teaching Methodology/ Techniques	Life Skill infused in the teaching Methodology
Biology	Genetics and Evolution: 9. Mendelian disorders in humans	Identifying challenges/ Empathy/ sensitiveness	Thinking skills Social skills Emotional skills	Audio/ Visual aids*	Manages emotions/ expresses emotions

Teaching Methodology

- Audio/Visual activities: Pick up and play related audio/visual clipping to highlight the disease condition and related information. Students to share their thoughts/experiences after watching the video.

Ask children a couple of questions such as:

- What did they feel after watching the video
- If someone they knew were to be diagnosed with a genetically linked disease how would they feel and relate to them

Sensitize the children towards the plight of the sufferers and make them aware of the researches going on in the field of Biology to diagnose and find solutions to the genetically linked diseases. (Thalassemia, Down's Syndrome, Klinefelter's syndrome etc.)

Tool to assess Life skills

Table 8.1.12: Rubric to assess Manages emotions/expresses emotions[^] (Emotional skill)

Life skill	Indicator	A	B	C	D	E
		Level 5	Level 4	Level 3	Level 2	Level 1
Emotional Skills	Expresses and manages emotion	-Evaluates how expressing one's emotion in different situations affects others -Evaluates how positive attitudes help others	-Analyses how thoughts & emotions affect behaviour - Generates ways to develop positive attitude	-Describes a range of emotions and what led to it - Describes ways to express emotions in an acceptable manner	- Recognises and accurately labels the emotions they felt - Describes control of impulsive behaviour	-Is unable to accurately name the emotion felt - Describes impulsive behaviour

Table 8.1.13: Example of how the model can be used for Class XII (Example 4)
Example 4

Subject	Topic & Sub topics	Infused Life Skill	Broad Skill	Teaching Methodology/ Techniques	Life Skill infused in the teaching Methodology
Physics	Optics: Intensity of light	Makes connections to link theory to everyday situations	Thinking skills Social skills	Experiment	Helps others Supportive

Teaching Methodology

- Experiment: We all have seen Display boards, message displays, etc. at various places, like railway stations, shops, banks, etc. These display boards display various messages, depending on the purpose of use. Using the material provided create one such display which will indicate brightness or darkness in a room. You need to use Light sensor, along with 16x2 LCD to display the message. The light Sensor, will measure the light intensity level in the room, the LCD will display in words, whether it is DAY[^]time or NIGHT[^]time.

Tool to assess Life Skill

Observation Schedule to assess Makes Connections[^](Thinking Skill)

Observation Sheet	
Name of student:	
Date of observation:	
Subject & topic:	
Task given:	Experiment_ Day Night Indicator
Indicator:	Helps others [^] means facilitates others to complete their tasks
Positive behaviours to be observed	
	Discusses with other team members on the task that need to be completed
	Identifies who can do what and allocates work accordingly
	Motivates others to do their tasks
	Helps others when they are facing difficulty in completing their tasks
	Seek help from others when needed to complete the task

Observation Schedule to assess Helps others[^](Social Skill)

Observation Sheet	
Name of student:	
Date of observation:	
Subject & topic:	
Task given:	
Indicator:	Makes Connections [^] links theory to everyday situations
Positive behaviours to be observed	
	Tries out different ways of conducting experiments
	Changes the parameters in the experiment to produce different types of results
	Tries to correlate outcome of the experiment to day to day situation
	Looks at practical situations and analyzes how certain concepts are used in such situations
	Willing to experiment even if results are difficult to achieve

4b. Summative Assessments (Assessment of learning)

As Science creates a natural path for the infusion of thinking skills, it can be assessed in Summative assessments as well. Summative assessment being more periodic in nature, and is more restricted towards the conventional mechanism of evaluation in the form of tests/examination, the type of questions can explicitly assess different Thinking skills (* Refer Table 1.8 - Step 4).

Table 8.1.14: Methodologies to expand the learning and also build a habit/culture of thinking - Application questions- 2 or 3 mark questions (Approach A)

Example 1

Subject	Topic & Sub topics	Infused Life Skill
Biology	Genetics and Evolution: Deviations in inheritance.	Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem)

1. If one of your parents has blood group type A and the other has type B, which of the following blood groups are you likely to have
 - a) A,B
 - b) B,AB
 - c) AB
 - d) O, A, B, AB
2. List out some human traits which you think are polygenic.
3. Males tend to inherit sex-linked conditions more because
 - a) They have more chromosomes than females
 - b) There is no corresponding allele on their Y chromosome
 - c) There is no corresponding allele on their X chromosome
 - d) None of the above
4. What is the probability of having a recessive trait child if both the parents are heterozygous for the trait.
 - a) 50%
 - b) 100%
 - c) 25%
 - d) 75%

Example 2

Subject	Topic & Sub topics	Infused Life Skill
Biology	Genetics and Evolution: Deviations in inheritance.	Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem)

For each of the genotypes below, determine the phenotype.

a) Bobtails are recessive (long tails dominant)

TT _____

Tt _____

tt _____

b) Brown eyes are dominant to blue eyes

BB _____

Bb _____

bb _____

c) Round seeds are dominant to wrinkled

RR _____

Rr _____

rr _____

d) Purple flowers are dominant to white flowers

PP _____

Pp _____

pp _____

Table 8.1.15: Building familiarity with occasions on which thinking is appropriate as well as critical Higher Order thinking question 3 or 5 mark questions (Approach A) (Examples 1, 2, 3)

Example 1

Subject	Topic & Sub topics	Infused Life Skill
Biology	Strategies for enhancement in Food Production, Topic: Genetically Modified Food	Inductive thinking/Deductive thinking

1. How can genetically modified food be harmful for human health? (inductive thinking)

Students already know that specific changes are introduced in the DNA of the organisms using the methods of genetic engineering. Thus, humans have the ability to introduce new crop traits and hence have a greater control over a food's genetic structure than earlier. Students already know the techniques, the changes introduced, the GM food produced. Now using the inductive thinking they have to predict the challenges that the GM food can pose to the human health in future, as its use will increase in future.

2. What are the environmental benefits of growing the GM crop?

(deductive thinking)

Students have studied why the genetic modifications in the crops are introduced, what are the advantages and disadvantages- let them use the deductive thinking to explain their response.

Example 2

Subject	Topic & Sub topics	Infused Life Skill
Biology	Genetics and Evolution: Chromosomal Disorders in humans	Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources

Prepare a project/ presentation on Down's syndrome. Refer the internet, and listed biology books. Include the classification, characteristics, inheritance, genetics and complications in Down's Syndrome.

Example 3

Subject	Topic & Sub topics	Infused Life Skill
Biology	Strategies for enhancement in Food Production, Topic: Genetically Modified Food	Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources

Prepare a project/presentation on genetically modified food (GM food). Refer the internet, and listed biology books. Include the history, need, techniques, advantages, disadvantages, and future of GM food.

Structured ways of thinking- Knowledge or Understanding of Thinking Skills 1 or 2 mark questions (*Approach B*)

Example 1: Differentiate between inductive and deductive thinking

Example 2: What are the key components of evaluating information?

Table 8.1.16: Application of the model to Class XII Biology Chapter 9: Strategies for enhancement in Food Production, Topic: Genetically Modified Food (GM food)

<i>Step 1</i>	Identifying life skills strongly aligned to Content	Thinking skills-Problem solving Social skills- Effective communication
<i>Step 2</i>	Integrating into the lesson plan- objectives & methodologies	Objectives: At the end of the class, students will be able to evaluate the pros and cons of GM food Methodologies: Role play, small group discussion
<i>Step 3:</i>	Identifying life skills linked to methodology/technique	Analyses information, Articulate
<i>Step 4:</i>	Using appropriate tools to assess life skills	Evaluation through examination*
<i>Step 5:</i>	Analyzing data for developmental inputs & adaptation of instruction	Positive and constructive feedback and inputs for the student

Summary

Teachers are comfortable assessing Scholastic areas as the assessment practices are fairly matured. The assessment of Co-scholastic areas however is still an emerging area and is a challenge for teachers due to various contingencies like the socio-economic background, gender, birth order etc. of the student. Hence, there is a strong need for a scientific way of assessing Life skills to ensure that the quantitative and qualitative assessment is fair and objective. The assessment method proposed in this chapter is a guide line which will help teachers to assess life skills when infused with Science.

When Life skills are infused with Science there are several complexities due the differences in the nature of the two. The nature of Science creates a natural path for the infusion and assessment of Thinking Skills and can hence be seamlessly infused into the subject matter. This will also enable the teacher to bring Thinking Skills to the forefront and make it an explicit component as it is an invaluable skill in the education of Science.

Social and Emotional Skills align more with group behavior and social contexts, and while some skills can be infused with the subject matter, primarily it can be assessed through different teaching methodologies/techniques.

With CCE insisting on numerical scoring and grading of Co-Scholastic areas, there is a strong need to bring in objectivity and consistency in the grading process. The proposed model provides a scientific method of assessing Life skills to ensure it is authentic and is substantiated with a scoring formula, such as a rubrics.

It is imperative for teachers to plan well and identify the relevant Thinking, Social and Emotional Skills that need to be developed and assessed for every topic. Besides the teacher's creativity and planning is critical in designing and selecting the appropriate methodologies/techniques to assess the different Life skills.

Worksheet

See Annexure 3

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Annexure 1

Infusion of Life skills in the subject- Biology-Unit 2- Genetics and Evolution

Example for Mendelian inheritance

Topic	Thinking Skills
1. Mendelian inheritance 2. Deviations in inheritance 2b. Codominance	<p>Curiosity - Humans have 4 different kinds of blood groups. eg., A, B,O, AB. What could be the reason behind this? (T)</p> <p>Self-Awareness - Own blood group and reason behind it (T)</p> <p>Balancing open mindedness with skepticism - Student sharing his/her own ideas to an established theory (T)</p> <p>Probing - Asking questions to get a deeper understanding of Mendel's Law(T)</p>

Creative Thinking

Critical Thinking

Decision Making

Problem Solving

Inter Personal Relationships

Empathy

Self Awareness

Working With Emotions

Coping

Effective

Annexure 2

Details of specific skills that can be infused into the Subject matter for Biology Class XII curriculum

Unit 1: Reproduction

Sub topics	Infused Life Skill	Broad Skill
1.Reproduction in organisms	Self-Awareness/ predicting outcomes/taking responsibility Adaptability/evaluating options	Thinking/Social
1a.Reproduction		
1b.Modes of reproduction		
1c.Asexual reproduction in plants		
Binary fission		
Sporulation		
Budding		
Gemmule		
Fragmentation		
Vegetative propagation		
2.Sexual reproduction in flowering plants	Predicting outcomes/seeking help/evaluating options/making connections/predicting outcome/identifying challenges	Thinking/Social
2a.Flower structure		
2b.Development of gametophytes		
2c.Pollination		
2d. Outbreeding Devices		
2e.Pollen Pistil Interaction		
2f.Double fertilization		
2g. Post fertilization events		
2h.Development of seed and fruit		
2i.Special modes		
Apomixis		
Parthenocarpy		
Polyembryony		
2j.Significance of seed dispersal and fruit formation		
3. Human Reproduction	Self-Awareness/taking responsibility/identifying challenges/ managing emotions/expressing emotions/seek help/sensitive/ respecting others/ empathy	Thinking/Social/ Emotional
3a. Male and female reproductive systems		
3b. Anatomy		
3d. Gametogenesis		
3e.Menstrual cycle		
3f.Fertilisation		
3g.Embryo development		
3h.Implantation		
3i.Pregnancy		
3j.Parturition		
3k.Lactation		
4. Reproductive health	Self-Awareness/predicting outcomes/probing/empathy/ taking responsibility/managing emotions/assertive communication/sensitive/seeks help/evaluating options/	Thinking/Social/ Emotional
4a.Need for reproductive health and prevention of STD.		
4b.Birth Control		
4c.Contraception and MTP		
4d.Amniocentesis		
4e.Infertility and assisted reproductive technologies-IVF, ZIFT, GIFT		

Percentagewise distribution of skills in the above topic	
Thinking skill	60%
Social skill	30%
Emotional skill	10%

Life skills that can be infused in the subject- Biology-Unit 2- Genetics and Evolution

Sub topics	Infused Life Skill	Broad Skill
1.Heredity and variation	Curiosity/ Self-Awareness/Balancing open mindedness with skepticism/Probing/Problem solving/Predicting outcomes/making connections/research orientation//identifying challenges/ Empathy/sensitiveness	Thinking/Social
1a. Mendelian inheritance		
Deviations in inheritance		
Incomplete dominance		
Codominance		
Multiple alleles and inheritance of blood groups		
Pleiotropy		
1b.Elementary idea of polygenic inheritance		
1c.Chromosome theory of inheritance		
1d. Chromosomes and genes		
1e. Sex determination		
1f.Linkages and crossing over		
1g. Sex linked inheritance		
Hemophilia		
Colour Blindness		
1h. Mendelian disorders in humans		
Thalessemia		
1i.Chromosomal Disorders in humans		
Downs Syndrome		
Turners Syndrome		
Klinefelters Syndrome		
2. Molecular basis of inheritance	Probing/ identifying challenges/ predicting outcomes/ Balancing open mindedness with skepticism/ Probing/ Problem solving/ organising thoughts and ideas/ making connections/ synthesis of information/ research orientation	Thinking
2a.Search for genetic material and DNA		
2b. Structure of DNA and RNA		
2c. DNA packaging		
2d. DNA replication		
2e. Central dogma		
2f. Transcription, genetic code, translation		
2g. Gene expression and regulation		
2h. Genome and human genome project		
2i. DNA fingerprinting		
3. Evolution	Curiosity/ balancing open mindedness with skepticism/ probing/making connections/synthesis of information/predicting outcome/problem solving	Thinking/Social
3a. Origin of life		
3b. Biological evolution and evidences for biological evolution		
3c. Darwin's contribution, modern synthetic theory of evolution		
3d. Mechanism of evolution		
3e. Types of natural selection		
3f. Gene flow and genetic drift		
3g. Hardy Weinberg's principle		
3h. Adaptive radiation		
3i. Human evolution		

Percentagewise distribution of skills in the above topic	
Thinking skill	80%
Social skill	20%

Life skills that can be infused in the subject- Biology-Unit 3- Biology and Human Welfare

Sub topics	Infused Life Skill	Broad Skill
1. Health and disease	Self-awareness/taking responsibility/identifying challenges/Problem solving/research orientation/finding solutions/probing/evaluating options/predicting outcome/managing emotion/ managing stress	Thinking/Social/Emotional
1a.Pathogens		
1b. Parasites causing human diseases		
1c. Basic concepts of immunology-Vaccines		
1d. Cancer		
1e. HIV		
1f. AIDS		
1g. Adolescence, drug and alcohol abuse	Managing stress/ managing emotions/evaluating options/predicting outcome/seeking help/empathy/sensitiveness/	Thinking/Social/Emotional
2. Improvement in food production	Predicting outcomes/seek help/evaluating options/making connections/predicting outcome/identifying challenges	Thinking/Social
2a. Plant Breeding		
2b.Tissue culture		
2c.Single cell protein.		
2d.Biofortification		
2e.Apiculture		
2f.Animal Husbandry		
3. Microbes in human welfare	Research orientation/Evaluating options/critical thinking/predicting outcomes/taking responsibility/identifying challenges/ taking risks/research orientation	Thinking/Social
3a. Household food processing		
3b. Industrial production		
3c.Sewage Treatment		
3e. Energy generation		
3f. Biocontrol Agents		
3g. Biofertilizers		

Percentagewise distribution of skills in the above topic	
Thinking skill	60%
Social skill	30%
Emotional skill	10%

Life skills that can be infused in the subject- Biology-Unit 4- Biotechnology and Its Applications

Sub topics	Infused Life Skill	Broad Skill
1. Principles and processes of biotechnology	Self-awareness/taking responsibility/Identifying challenges/Problem solving/ Research orientation/finding solutions/probing/evaluating options/predicting outcome	Thinking/Social
1a. Genetic Engineering		
2. Application of biotechnology in health and agriculture	Taking responsibility/ Identifying challenges/ Problem solving/research orientation/finding solutions/probing/evaluating options/predicting outcome/ Sensitive/ respecting others/follow norms/taking risks/open to feedback/ Innovative	Thinking/Social
2a. Human insulin and vaccine production		
2b. Gene therapy		
2c. Genetically modified organisms		
Bt crops		
Transgenic Animals		
2d. Biosafety issues		
2e. Biopiracy and patents		

Percentagewise distribution of skills in the above topic	
Thinking skill	70%
Social skill	30%

Life skills that can be infused in the subject- Biology-Unit 5- Ecology and Environment

Sub topics	Infused Life Skill	Broad Skill
1. Organisms and environment	Self-Awareness/ Adaptability/ Cooperation/team work/seeks help/making connections/ Identifying challenges/ managing stress Takes risks/plans well/ Evaluating options Predicting outcomes/Empathy	Thinking/Social/ Emotional
1a. Habitat and niche		
1b. Population and ecological adaptations		
1c. Population interactions		
Mutualism		
Competition		
Predation		
Parasitism		
1d. Population attributes		
1e. Age Distribution		
2. Ecosystems	Curiosity/evaluating options/ predicting outcome/observations/probing	Thinking
2a. Patterns		
2b. Productivity and decomposition		
2c. Energy flow		
2d. Pyramids of number, biomass, energy		
2e. Nutrient cycle		
2f. Ecological Succession		
2g. Ecological services		
2h. Pollination		
2i. Seed dispersal		
2j. Oxygen release		
3. Biodiversity and its conservation	Self-Awareness/observation/ Finding solutions/identifying challenges/ predicting outcome/ sensitiveness/empathy	Thinking/ social
3a. Concept of biodiversity		
3b. Patterns of biodiversity		
3c. Importance of biodiversity		
3d. Loss of biodiversity		
3e. Biodiversity conservation		
3f. Endangered organisms		
3g. Red Data Book		
3h. Biosphere reserves		
3i. National parks and sanctuaries		
4. Environmental issues	Identifying challenges/ Predicting outcomes/ problem solving/ innovation/research orientation/organising thoughts and ideas/creating synergy/ plans well/sensitiveness/evaluating options	Thinking/Social
4a. Air pollution and its control		
4b. Water pollution and its control		
4c. Agrochemicals And their effects		
4d. Solid waste management		
4e. Radioactive waste management		
4f. Greenhouse effect and global warming		
4g. Ozone depletion		
4h. Deforestation		
4i. Case studies		
4j. Diseases		

Percentage-wise distribution of skills in the above topic	
Thinking skill	65%
Social skill	35%
Emotional	5%

Annexure 3

Worksheet

Decision making and critical thinking

- A. There are four types of mirrors in a room-concave, convex, plane and compound. Which mirror gives you your correct image? Reason out.

Answer

LL1 Light falls on you and diverges on to the mirror
yes/no

LL2 An inverted image is formed yes/no

LL3 The image returns to the retina as a normal image yes/no

LL4 A concave mirror gives a caved in image yes/no

LL5 A convex mirror gives a bulged image yes/no

LL6 A plane mirror gives a normal image yes/no

LL7 A compound mirror gives multiple images

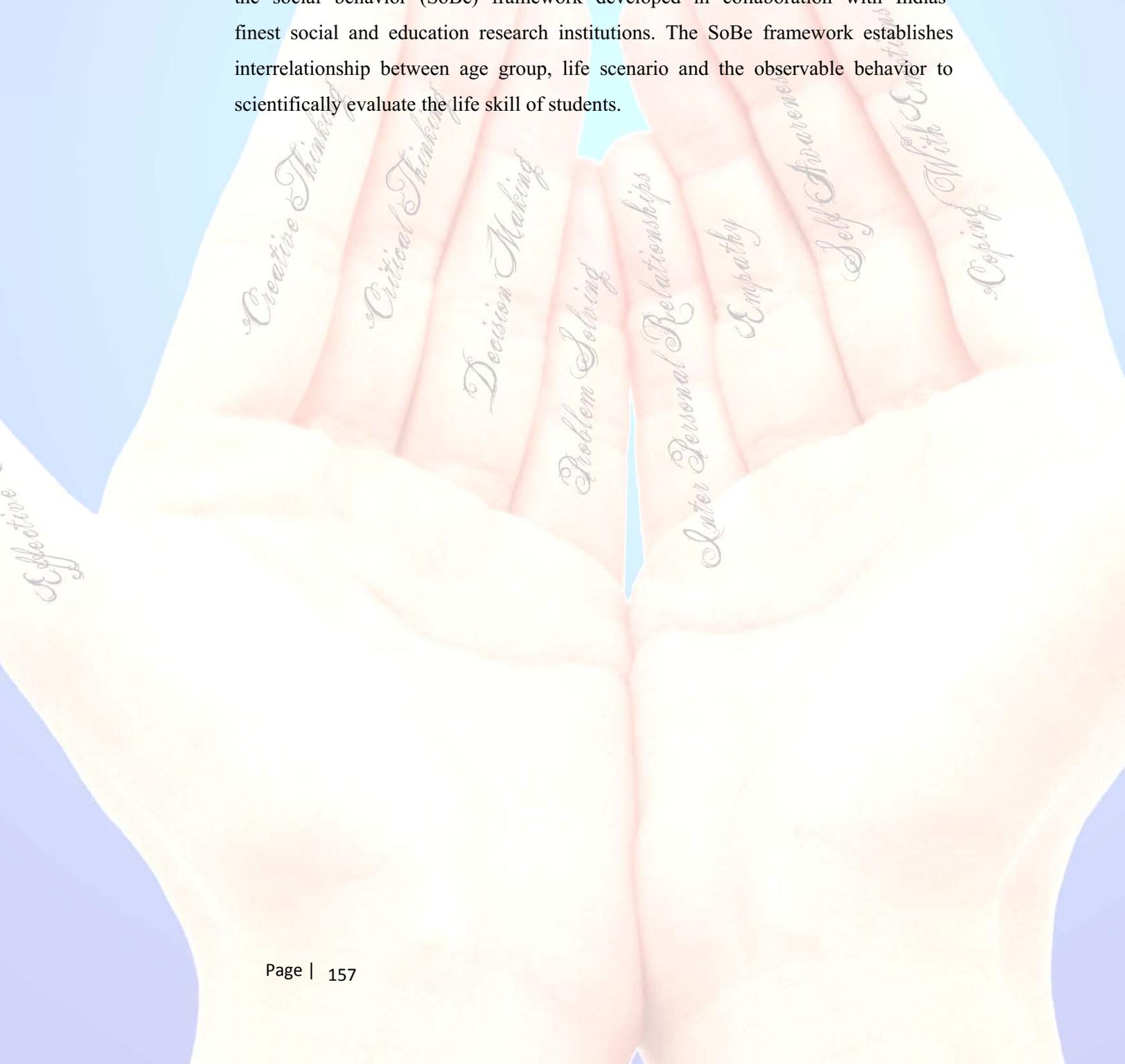
Yes/no

If two right attempts are made by the students and if each learning level has a score of 1 each, the student scores 2/7 i.e. $\frac{2}{7} \times 100 = 28.57 = 29\%$ attainment in life skills of decision making and critical thinking which are the two paired life skills involved here.

About i-Point

i-Point Consulting Services Private Limited is a leading company offering learning & development solutions with a stellar track record of delivering skill & behavioral programs to thousands of students and working professionals.

i-Point is currently associated with the research and development of LIGA product which has in-built, easy to use but powerful solution for life skills education and evaluation as per CBSE CCE framework. The LIGA product is based on the social behavior (SoBe) framework developed in collaboration with India's finest social and education research institutions. The SoBe framework establishes interrelationship between age group, life scenario and the observable behavior to scientifically evaluate the life skill of students.



Resources in Life Skills

Module

9

Dr. L. Srikantappa

Retired Professor of Zoology, DESM, RIE, Mysore.

Dr. G.V. Gopal

Professor of Botany, DESM, RIE, Mysore.

Dr. Kumara Swamy H.

Lecturer, CTE, Mangalore

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Useful Websites

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The image shows two hands held palm-up against a light blue background. The fingers of both hands are inscribed with calligraphic text in a cursive script. On the left hand, the fingers are labeled: 'Effective' (thumb), 'Creative Thinking' (index), 'Critical Thinking' (middle), and 'Decision Making' (ring). On the right hand, the fingers are labeled: 'Problem Solving' (index), 'Empathy' (middle), 'Self Awareness' (ring), and 'Coping With Emotions' (pinky).

***This skill element has to be integrated
with the higher education system to
ensure maximum mobility[^]***

— Krishna Kumar
The Hindu, Tuesday, April 2, 2013

PRACTICAL ASPECTS

Exemplars

Section

II

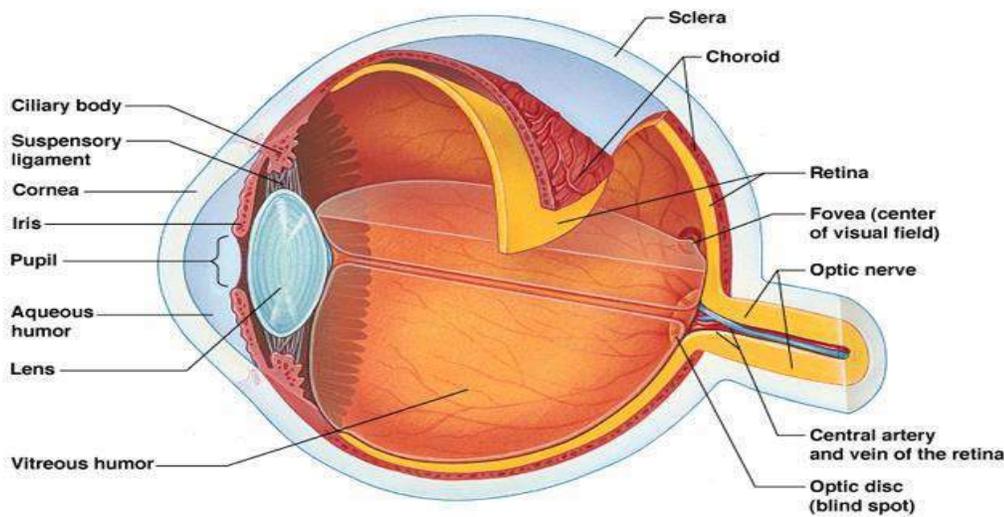
EXEMPLARS IN BIOLOGY

Exemplar 1

Topic: The Human Eye

Overview

Human Eye



The human eye belongs to a general group of camera-type eyes. The human eye focuses light onto a light sensitive membrane called the retina. Retina serves as the part in lieu of film in the camera. The cornea is a transparent structure found in the very front of the eye that helps to focus incoming light. Behind the cornea is a colored ring-shaped membrane called the iris. The iris has an adjustable circular opening called the pupil, which can expand or contract depending on the amount of light entering the eye. A clear fluid called the aqueous humor fills the space between the cornea and the iris. Situated behind the pupil is a colorless, transparent structure called the crystalline lens. Ciliary muscles surround the lens. The muscles hold the

lens in place but they also play an important role in vision. When the muscles relax, they pull on and flatten the lens, allowing the eye to see objects that are far away. To see closer objects clearly, the ciliary muscle contracts in order to thicken the lens.

The interior chamber of the eye is eyeball. Eye ball is filled with a jelly-like tissue called the vitreous humor. After passing through the lens, light travels through this humor before striking the sensitive layer of cells called the retina. The retina is the innermost of three tissue layers that make up the eye. The outermost layer, called the sclera, gives most of the eyeball its white color. The cornea is also a part of outer layer. The middle layer between the retina and sclera is called the choroid. The choroid contains blood vessels that supply the retina with nutrients and oxygen and removes its waste products. Embedded in the retina are millions of light sensitive cells, which come in two main varieties. They are rods and cones. Rods are good for monochrome vision in poor light, while cones are used for color and for the detection of fine detail. Cones are packed into a part of the retina directly behind the retina called the fovea. When light strikes either the rods or the cones of the retina, it is converted into an electric signal that is relayed to the brain via the optic nerve. The brain then translates the electrical signals into the images we see.

Objectives

At the end of the session the students will be able to:

1. Understand human eye and its defects;
2. Instill the idea that eye has to be protected and eye defects can be rectified;
3. Develop empathy with persons with sight problems and help them whenever possible; and
4. Understand the virtue of eye donation.

Columnar Framework

Sub-topic	Concept	Sub-concept	The process	Aligned life skills	Takeaway life skills
Defects of human eye	Myopia Hypermetropia Astigmatism	Rectification of eye defects	Understanding Observation Explanation Conclusion	Critical thinking Creative thinking Empathy	Self awareness Critical thinking Decision-making Empathy Inter Personal Relations and Communication

Materials required: power point presentations, puzzles, information sheets, charts, slides, small paper slip notings, flash cards, obstacles, scarves, timers, students etc.

The process

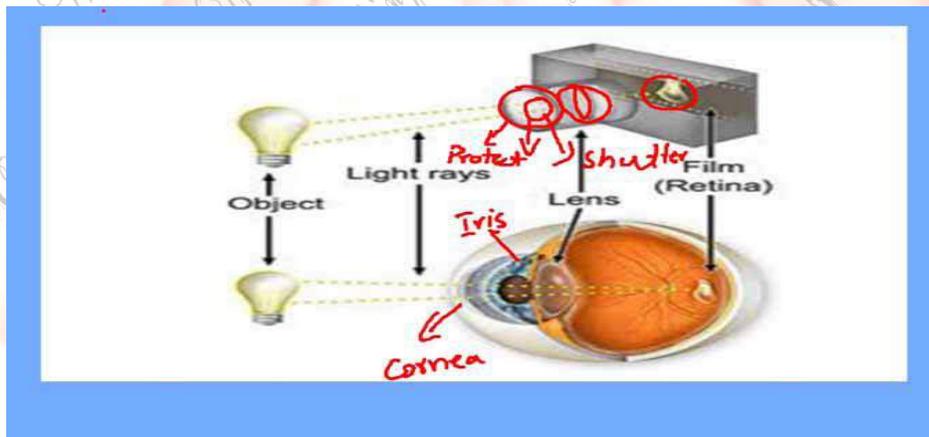
The 5E model of teaching has to be adopted. The 5E's are:

- Engage: Take care to engage the students in the discourse, with interactions, questions, activities.
- Explore: Explore the possibilities of eliciting information from the student and connecting it with the content.
- Explain: Explain the content step by step so that the main points are grasped by the students.
- Elaborate: Elaborate each point to get more clarity with examples, illustrations, activities, exercises etc
- Evaluate: Verify whether the students have acquired the expectations specified in the objectives.

Introductory lecture/discussion with slides followed by participatory approach with the help of activities (also refer physics exemplars)

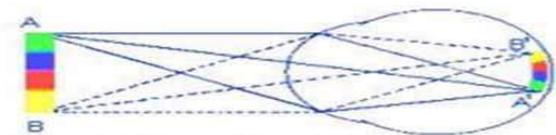
Power point presentation

Human eye and camera



Formation of image in human eye

Formation of Image in Human Eye



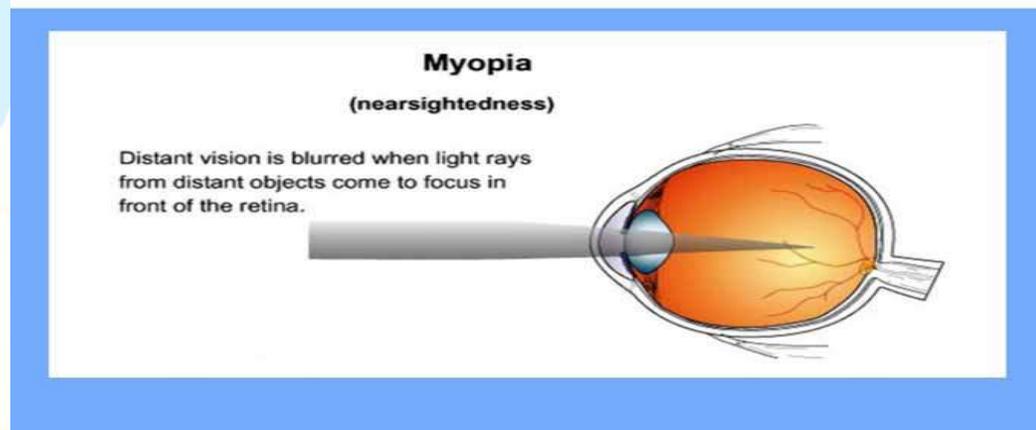
Incoming light rays from each point on the object are bent by the cornea and lens so that (in normal vision) they come together at a single point on the retina. Note, however, the image is inverted. The brain ultimately interprets the image as rightside-up.

b) Defects of human eye

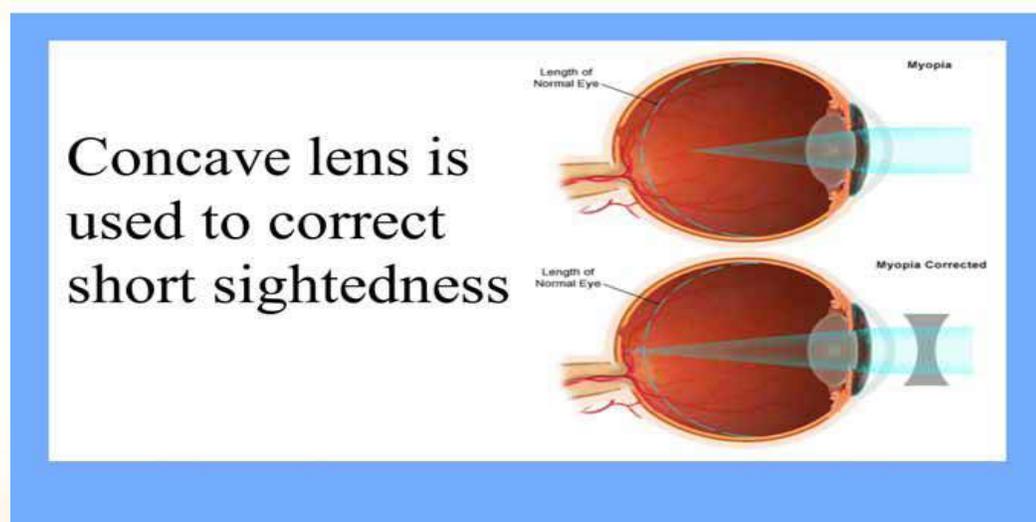
Human eye can suffer from a number of defects, the important ones being (1) myopia (short sight), (2) hyperopia (long sight) and (3) astigmatism. Astigmatism is an optical defect in which vision is blurred due to the inability of the optics of the eye to focus a point object into a sharp focused image on the retina. This may be due to an irregular or toric curvature of the cornea or lens.

a) Myopia: In case of a myopic eye, the image is focused in front of the retina and it can be corrected with a concave lens of suitable focal length.

Myopia (Short sightedness)



Correction of Myopia

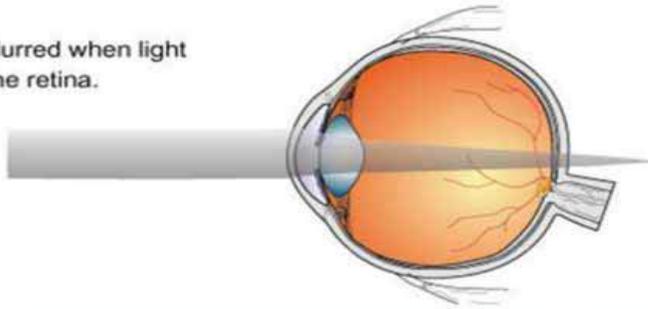


- 2) **Hyperopia:** A hypermetropic eye focuses the image behind the cornea, and is corrected by a convex lens of suitable focal length.

Hyperopia (Long sightedness)

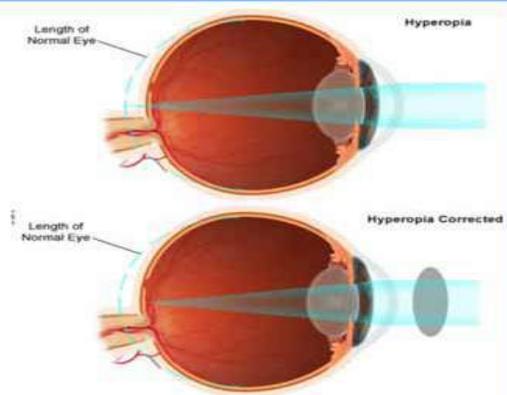
Hyperopia (farsightedness)

Distance vision is blurred when light rays focus behind the retina.



Correction of Hyperopia

Convex lens is used to correct long sightedness

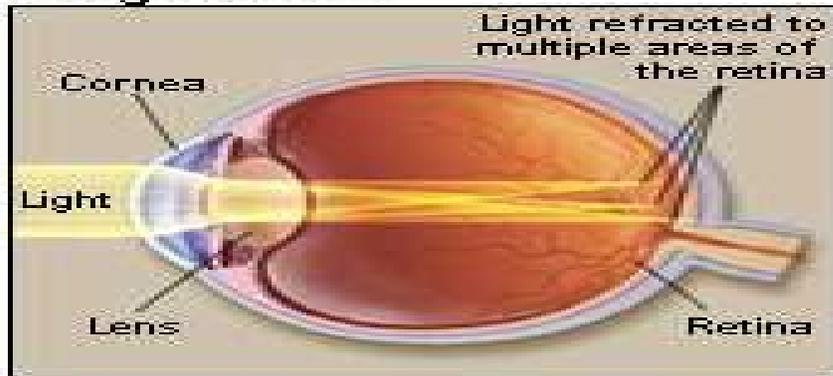


Correction of defects through lenses

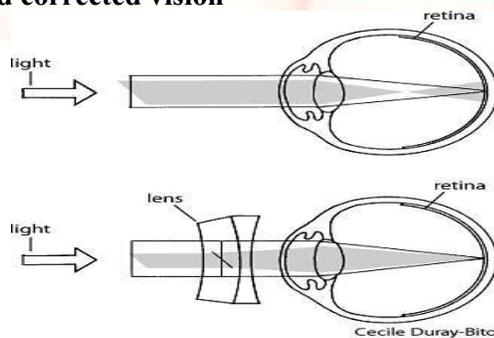


Astigmatism: Astigmatism occurs when the cornea is not spherical in shape. This results in lines in one direction being well focused while those in the perpendicular direction get distorted when looking at a wire mesh. This is corrected by a cylindrical lens.

Astigmatism



Astigmatic vision and corrected vision



Lens as seen by normal eye (A) and lens as seen by astigmatic eye



Associate Questions

What is blindness?

What is presbyopia?

What are contact lenses? How Are they used?

Do goggles correct or impede vision?

Year end Evaluation

How would you rectify eye defects-

In a myopic eye?

In a hypermetropic eye?

In case of astigmatism? (short answer type questions)

Activities

Activity-1 Cross word puzzle

Name of the activity

Cross word puzzle

Objectives:

- 1) To help the student to understand the parts of an eye
- 2) To improve critical thinking

Materials required:

Sufficient number of pre-prepared puzzle sheets

Time:

15 to 20 minutes

Steps

1. Briefly describe objectives of the activity and method of conducting the activity.
2. Demonstrate briefly how to go about solving a crossword puzzle.
3. Distribute one sheet of crossword puzzle to each student.
4. Direct the students to remember the parts of the human eye from the slides which they have studied and locate the words from the sheet and mark the word with ink as shown in the model crossword puzzle. The words will be placed in the puzzle either vertically or horizontally.
5. On completion of the activity explain and sum up with the implications of critical thinking.

Cross word puzzle

P	U	P	I	S	C	L	E	R	A	A	B	C	D	E	F	O
G	H	P	I	J	H	K	L	M	N	O	P	Q	R	S	T	P
U	V	U	W	F	O	V	E	A	X	Y	Z	A	B	C	D	T
E	F	P	U	P	R	G	H	I	J	K	L	M	N	O	P	I
S	C	I	E	R	O	P	T	I	C	D	I	S	C	Q	R	C
S	T	L	U	V	I	R	I	S	W	X	Y	Z	A	C	B	N
C	D	E	F	G	D	H	I	J	K	L	N	N	O	O	P	E
C	E	N	T	R	A	L	A	R	T	E	R	Y	Q	R	R	R
C	E	N	T	A	L	A	R	T	R	T	S	T	U	N	V	V
F	O	V	I	A	W	X	Y	Z	A	B	C	D	E	E	F	E
V	E	I	N	O	F	T	H	E	R	E	T	I	N	A	G	H
I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
Z	E	T	I	C	I	L	I	A	R	Y	B	O	D	Y	A	B
C	V	E	T	R	E	O	U	S	H	U	M	O	R	D	E	F
S	U	S	P	E	N	S	O	R	Y	L	I	G	M	E	N	T
G	H	A	Q	U	E	O	S	H	U	M	O	R	I	J	K	L
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Answer to the puzzle

				S	C	L	E	R	A							O
	P			H												P
	U			F	O	V	E	A								T
	P			R												I
	I			O	P	T	I	C	D	I	S	C				C
	L			I	R	I	S							C		N
				D										O		E
C	E	N	T	R	A	L	A	R	T	E	R	Y		R		R
														N		V
														E		E
V	E	I	N	O	F	T	H	E	R	E	T	I	N	A		
				C	I	L	I	A	R	Y	B	O	D	Y		
	V	E	T	R	E	O	U	S	H	U	M	O	R			
S	U	S	P	E	N	S	O	R	Y	L	I	G	M	E	N	T
		A	Q	U	E	O	S	H	U	M	O	R				

Activity-2 What is the good word?

Name of the activity:

Know your Eye

Objectives:

- 1) To help the student to understand the parts an eye
- 2) To improve critical thinking and decision making

Materials required:

Parts of eye written in small slips/flash cards, a small box, slide or chart showing the picture of eye without marking the parts

Time:

20 to 30 minutes

Steps

1. Put all the slips/flash cards in the box
2. Call the students one by one and direct them to take one slip/flash card, read it loudly and identify the part of the eye in the slide. If the student commits mistake call another student to mark the same.
3. Repeat the activity till all the parts are identified
4. Explain the parts once again and summarize how good decisions can be made.

Activity-3 Information sheets

Name of the activity:

Group discussion and Presentation

Objectives:

- 1) To help the student to understand the defects of an eye and the correction treatment
- 2) To improve Inter Personal Relations and Communication
- 3) To promote self-awareness

Materials required:

Sufficient number of information sheets to the groups. Five pre-prepared information sheets to each group on different areas may be given (see annexures)

Time:

40 to 50 minutes

Steps

1. Divide the students in to groups of ten
2. Briefly describe how to do a group discussion and procedures to be followed
3. Give five different annexure sheets to every group so that two of them can work on one information sheet(refer below).

4. Tell the small group of two persons in the 10 number group to study the information sheet. Give 10 minutes.
5. After 10 minutes tell the 2 member groups to convey the information that they have studied. 25 minutes can be given for that activity.
6. On completion of the discussion call one or two persons from each group for a presentation without paper.
7. Tell the group that they have to present the answers to the following questions.

- How do you know it is myopia?
- What are the symptoms of myopia?
- How is it cured?
- How does one identify a case of hypermetropia?
- How is it generally corrected?
- What are the causes of astigmatism?
- How is it treated by the ophthalmologist?
- What are the symptoms of the pink eye?
- How do people react to a person with the ailment? Is it infectious?
- What is the causative organism?
- What is the treatment?
- How can we prevent the spread of this infection?
- When does cataract affect an individual?
- What is the film over the cornea?
- Does it block vision?
- How is cataract treated?

Summarize and correct the mistakes. Explain how this activity helps to improve Inter-personal relations and communication skills.

Information sheet-1

Light rays of images focus in front of the retina, the light-sensitive part of the eye, rather than directly on the retina, causing blurred vision. Myopia runs in families and usually appears in childhood. Sometimes the condition plateaus, or sometimes it worsens with age. People who are nearsighted or myopic often complain of headaches, eyestrain, squinting or fatigue when driving, playing sports, or looking more than a few feet away.

Treatment-glasses, contact lenses, or refractive surgery can correct myopia. With myopia, your prescription for glasses or contact lens is a negative number, such as -3.00. The higher the number, the stronger your lenses will be. Refractive surgery can reduce or even eliminate your dependence on glasses or contact lenses. The most common procedures for myopia are performed with a laser, including **Photorefractive keratectomy**. It is also called PRK. Laser is used to remove a layer of corneal tissue, which flattens the cornea and allows light rays to focus closer to or even on the retina (**Laser-assisted in situ keratomileusis**. Commonly called LASIK). Laser is used to cut a flap through the top of the cornea and removes some corneal tissue. Then the flap is dropped back into its place. LASIK is the most common surgery used to correct near sightedness (**Corneal rings**). Plastic corneal rings, called Intacs, are implanted into the eye to adjust the shape of the cornea. One advantage of the rings is that they can be left in place permanently. It can also be removed in case of a problem or adjusted if a prescription change be necessary.

Information sheet-2

Hyperopia causes difficulty focusing on near objects, and in extreme cases the person will be unable to focus on objects at any distance. As an object moves toward the eye, the eye must increase its optical power to keep the image in focus on the retina. If the power of the cornea and lens is insufficient, as in hyperopia, the image will appear blurred. People with hyperopia can experience blurred vision, asthenopia, accommodative dysfunction, binocular dysfunction, amblyopia, and strabismus, another condition that frequently causes blurry near vision. Presbyopes who report good far vision typically experience blurry near vision, because of a reduced accommodative amplitude brought about by natural aging changes with the crystalline lens. It is also sometimes referred to as farsightedness, since in otherwise normally-sighted persons, it makes it more difficult to focus on near objects than on far objects. The causes of hyperopia are typically genetic and involve an eye that is too short or a cornea that is too flat, so that images focus at a point behind the retina. Various eye care professionals, including ophthalmologists, optometrists, orthoptists, and opticians, are involved in the treatment and management of hyperopia. At the conclusion of an eye examination, an eye doctor (ophthalmologist or optometrist) may provide the patient with an eyeglass prescription for corrective lenses. Minor amounts of hyperopia are sometimes left uncorrected. However, larger amounts may be corrected with convex lenses in eyeglasses or contact lenses. Convex lenses have a positive dioptric value, which causes the light to focus closer than its normal range. Hyperopia is correctable with various refractive surgery procedures, such as PRK, LASIK, Radial Keratocoagulation or Thermokeratoplasty

Information sheet-3

Astigmatism, whether it is regular or irregular, is caused by some combination of external (corneal surface) and internal (posterior corneal surface, human lens, fluids, retina, and eye-brain interface) optical properties. In some people, the external optics may have the greater influence, and in other people, the internal optics may predominate. Importantly, the axes and magnitudes of external and internal astigmatism do not necessarily coincide, but it is the combination of the two that by definition determines the overall optics of the eye. The overall optics of the eye are typically expressed by a person's refraction; the contribution of the external (anterior corneal) astigmatism is measured through the use of techniques such as keratometry and corneal topography. One method analyzes vectors for planning refractive surgery such that the surgery is apportioned optimally between both the refractive and topographic components.

Astigmatism may be corrected with eyeglasses, contact lenses, or refractive surgery. Various considerations involving eye health, refractive status, and lifestyle determine whether one option may be better than another. In those with keratoconus, certain contact lenses often enable patients to achieve better visual acuity than eyeglasses. Once only available in a rigid, gas-permeable form, toric lenses are now available also as soft lenses. If the astigmatism is caused by a problem such as deformation of the eyeball due to a chalazion, treating the underlying cause will resolve the astigmatism. Laser eye surgery (LASIK and PRK) is successful in treating astigmatism. Corneal incisions if properly placed can correct astigmatism. These techniques include Mini Asymmetric Radial Keratotomy (M.A.R.K.), Astigmatic Keratotomy (AK) and Limbal relaxing incision (LRI). However these techniques are used less often than laser-performed ones.

Information sheet-4

Symptoms of viral pinkeye include, redness in the white of the eye, swelling of the eyelids, itching or burning feeling of the eyelids, swollen and tender areas in front of the ears, a lot of tearing, clear or slightly thick and whitish drainage. Viral pinkeye symptoms usually last 5 to 7 days but may last up to 3 weeks and can become ongoing or chronic.

Bacterial pink eye infection may develop when bacteria enter the eye or the area around the eye. Symptoms of bacterial pinkeye include redness in the white of the eye, gray or yellow drainage from the eye (This drainage may cause the eyelashes to stick together), mild pain, swelling of the upper eyelid, which may make the lid appear to droop (pseudoptosis).

Most cases of pinkeye are caused by infections caused by viruses or bacteria, dry eyes from lack of tears or exposure to wind and sun; chemicals, fumes, or smoke and allergies.

Traditionally, at-home remedies have been sufficient for soothing conjunctivitis associated with uncomplicated colds, minor infections, or allergies. Treatment consists primarily of cleansing the eyes and preventing the condition from spreading. Viral conjunctivitis usually runs its course in one to two weeks. Because it is not caused by bacteria, viral conjunctivitis does not respond to antibiotics. Artificial tears will also help relieve symptoms. For bacterial conjunctivitis, the treatment will probably call for antibiotic eye drops or ointment. This generally clears the symptoms within a few days.

Since most pinkeye is caused by viruses for which there is usually no medical treatment, preventing its spread is important. Poor hand-washing is the main cause of the spread of pinkeye. Sharing an object, such as a washcloth or towel, with a person who has pinkeye can spread the infection

Information sheet-5

Cataract type and prevalence are highly variable based on population demographics .It is estimated that 50% of people 65-74 years of age and 70% of people >75 years of age have age-related cataract change.

A *cataract* is any opacity or discoloration of the lens, localized or generalized; the term is usually reserved for changes that affect visual acuity. An opaque-appearing eye may be due to opacities of the cornea (e.g., scarring, edema, calcification), lens opacities, tumor, or retinal detachment.

Treatment is by outpatient (usually) or inpatient surgery. There is currently no medication to prevent or slow the progression of cataracts. Cataract extraction via small incisions, followed by implantation of a prosthetic intraocular lens; lenses have power calculated based on size of the eye and curvature of cornea usually to correct for distance vision; surgery is performed on 1 (worse) eye, with contralateral surgery only after recovery and if deemed necessary; it generally takes less than an hour depending on surgical technique.

Activity-4 Blind walk

Name of the activity:

Games

Objectives:

- 1) To help the student to understand the worthiness of eye
- 2) To Improve Empathy and Inter-personal relations

Materials required:

Scarf, obstacles etc

Time:

30 to 40 minutes

Steps

1. The activity is walking without touching the obstacles by the blindfold person with the help of a friend.
2. Fix a path for the blind person to walk and create obstacle on the way with bench, table, chairs etc
3. Select a person from the group and tie the scarf and blind fold him/her
4. Direct the friend to help the blind person to walk to the other side without touching the obstacles and also without touching the friend or other persons.
5. For directing the path, the friend can use only three words, i.e., right, left, straight
6. Select two persons from the students to misguide the blind with the same words right, left and straight
7. The blind person will be out when he touches the obstacle.
8. Repeat with 2 or 3 persons subject to the availability of time
9. Share the experiences by projecting the need for empathy and Inter-personal relations
10. Summarize to project the following: a) Life of Hellen Keller and recent news paper stories b) worthiness of eye, c) consideration to blind persons and persons with impaired eye sight and the feeling of empathy and d) Need and importance of eye donation.

Exemplar 2

Topic: Reproduction/Unit VI/Ch.1

Overview

This is a prime process for the propagation of individual species in plants and animals. It could be sexual or asexual method of reproduction and the purpose is propagation of the species. Asexual reproduction is through dispersal of seeds and germination of seeds and reproductive units in plants, whereas sexual reproduction is through the union of gametes produced in gametangia or sex organs.

Objectives

- 1) The student will be able to observe and distinguish asexual from sexual reproduction and vegetative reproduction (critical thinking) and become aware (develop self-awareness) of the continuity of life through reproduction.

Columnar Framework

Subtopic	Concept	Sub-concept	Process skills	Aligned life skills	Takeaway life skills
Reproduction	Types	Vegetative, asexual, sexual	Observation Classification Exploration	Self-awareness knowledge	<ul style="list-style-type: none">• Critical thinking• Self awareness

Materials required

- a) Arrangements for field visit/plant or animal studies (with reproductive organs) in the lab.
- b) Biology lab with different specimen and a worksheet.

The process

Engage

Students visit the museum.

Students observe specimen and they are categorised into lower and higher groups of plants.

Students classify plants as follows and mention the type of reproduction in each taxon in a worksheet with the help of the teacher (developing thereby critical thinking).

Worksheet

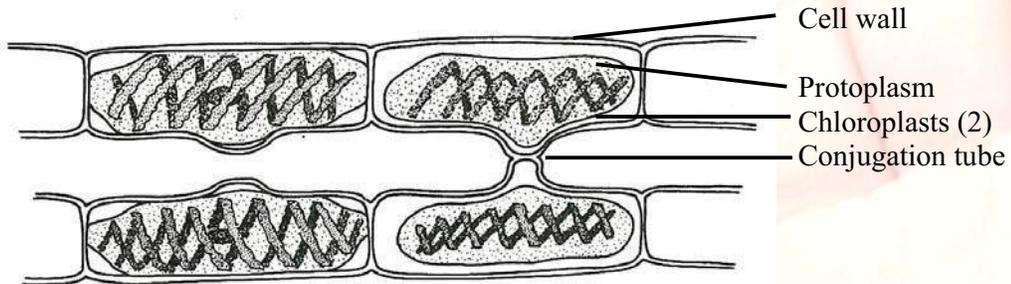
Plant Kingdom

Cryptogams		Phanerogams	
Category	Type of reproduction	Category	Type of reproduction
Algae		Gymnosperm	
Fungi		Angiosperm	
Bryophytes			
Pteridophytes			

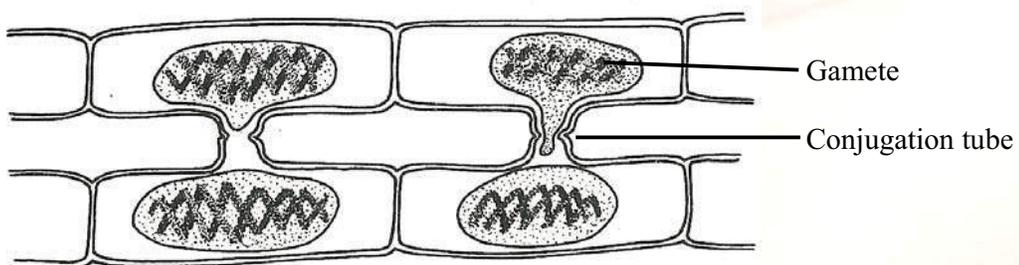
Through the above worksheet the students develop self-awareness and critical thinking.

The process of reproduction in one plant from lower group and one plant from higher group is narrated and illustrated through sketches.

a) Lower group of plants- In *Spirogyra*, reproduction is through conjugation
Cells of each filament put out a conjugation tube

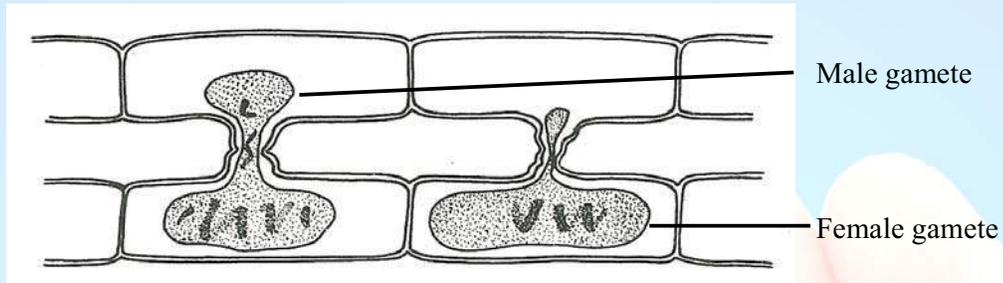


The conjugation tubes meet and join up. The chloroplast starts to break down cell contents become a gamete.

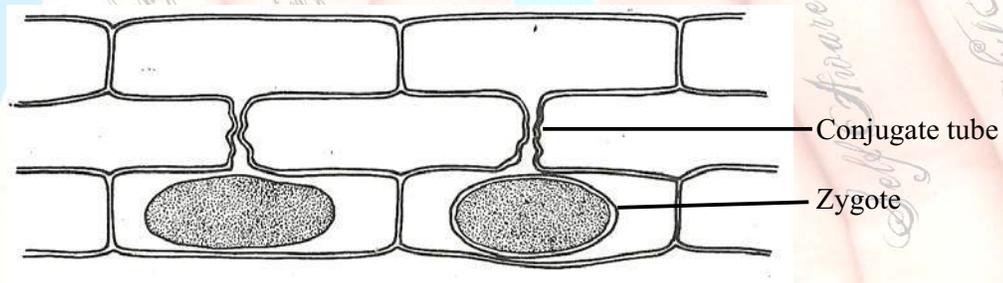


The cell contents of one filament pass through the conjugation tube and the nuclei fuse.

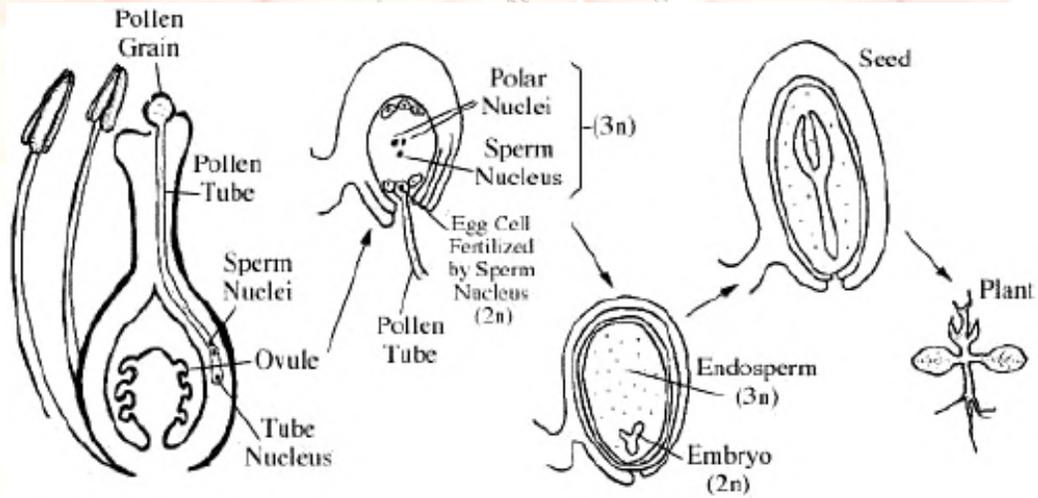
Although there is no visible difference between the filaments, one is clearly acting as the producer of male gametes.



The zygote forms a wall round itself and becomes a spore which can resist adverse conditions, e.g. cold and lack of light.



b) In higher plants like the angiosperms reproduction occurs through pollen-pistil interaction and double fertilisation.



Through the above process, students develop scientific process skills of observation, categorisation, classification, narration, illustration, discussion and exploration of knowledge and thereby the life skill of critical thinking.

Explore

Students look at the specimen of potted plants and charts showing reproduction of plants and are asked to list down plants showing asexual and vegetative reproduction. The students view the specimen carefully, analyse and list the features of the individual plants in a logical manner and conclude that they are *Chlamydomonas*, *Penicillium*, *Spirogyra*, eyes of *Solanum tuberosum*, rhizomes of ginger *Gingiber* sp., bulbils of *Agave*, leaf buds of *Bryophyllum* and offset of *Eichornia* sp. They differentiate between asexual, vegetative and sexual reproduction and develop logical and analytical thinking stimulated through questions. The students develop self-awareness and logical thinking through brainstorming, generation of ideas and their collation as follows.

A) How do *Chlamydomonas* and *Penicillium* reproduce? What happens during the process/? What are the units of reproduction here? How are these formed? (promotes self-awareness)

- Ideas ^1-reproduce by spores/conidia
- 2-reproduce by budding
- 3-reproduce through gametes

B) What is the structure of *Spirogyra*? Why do the filaments get laterally aligned? Does the protoplast of the cell divide or fuse with another protoplast? (promotes self-awareness and logical thinking)

- Ideas ^1- Structure of *Spirogyra* is filamentous with protoplast dividing
- 2-Structure of *Spirogyra* is unicellular and protoplasts fuse with one another to form zygote
- 3- Structure of *Spirogyra* is filamentous protoplasts form akinetes

C) What are the additional tissues or tissue clusters seen externally in potato, *Agave*, ginger, *Bryophyllum* and water hyacinth? How are these formed? What is their constitution? (promotes self-awareness)

- Ideas ^1-additional tissues are buds formed from meristems
- 2-additional tissues are eyes formed from meristems
- 3-additional tissues are tubers/bulbs formed from axillary buds

Explain

The students explain differences between asexual, vegetative and sexual reproduction through definite examples and illustrations.

D) How have several organisms existed on earth over millions of years? (promotes divergent thinking)

- Ideas generated
- By eating food
 - Through fission and fusion
 - Because of evolution
 - By multiplying their DNA
 - Through reproduction

E) What is reproduction? Does it stall/aid the process of birth, growth and death (promotes logical and divergent thinking)

- Ideas generated a process that
- aids birth
 - Stalls death
 - Helps in growth
 - Helps in evolution of species
 - Helps in survival
 - All of the above
 - All but one of the above

F) Can a single parent produce an offspring? What is the phenomenon termed? Is it possible in lower as well as higher organisms?(promotes divergent thinking)

- Ideas generated
- yes, through tissue regeneration as in lizards
 - yes, through spores
 - yes, through buds, bulbils and eyes
 - no, not possible
 - yes through gamete/sperm banks
 - all but one of the above

G) Why is sexual reproduction absent in lower organisms? Is this process a more specialised process developed during the course of evolution? (instills critical thinking)

Ideas-1-lower organisms like bacteria and yeast reproduce through fission because of their simple structure

2-algae and fungi show asexual reproduction which is an advanced process because of arising structural complexities

3-Most of the higher organisms depict sexual form of reproduction because of further structural complexities and specialisation.

Elaborate

A series of questions are asked to further the content knowledge.

H) What is a clone? (Anticipation of future consequences of cloning in human beings promotes critical thinking)

- Ideas-
- 1- an individual of similar genotype and phenotype
 - 2- an organism produced through tissue culture
 - 3- a new species produced through genetic engineering

I) What are annuals, biennials and seasonals? and relate it to reproduction (promotes critical thinking)

- Ideas-
- 1- are plants with different periods of life cycles
 - 2- are plants which show only vegetative growth
 - 3- are plants with varied reproductive cycles.

I) What are the different stages in the life of a human being ? (promotes critical thinking)

- Ideas-
- 1- infancy and youth
 - 2- infancy and old age
 - 3- infancy, adolescence, youth, middle age, old age

J) What is meant by growing old ? Is it loss of cell/ tissue /organ function or damage and destruction of tissue structures?(promotes critical thinking and self-awareness)

- Ideas-
- 1- growing old means loss of vital functions
 - 2- growing old means loss and damage of cells and tissues
 - 3- growing old is graying of hair, stooping body etc.

Evaluate

Each answer to a question is justified rationally(develops critical and rational thinking).

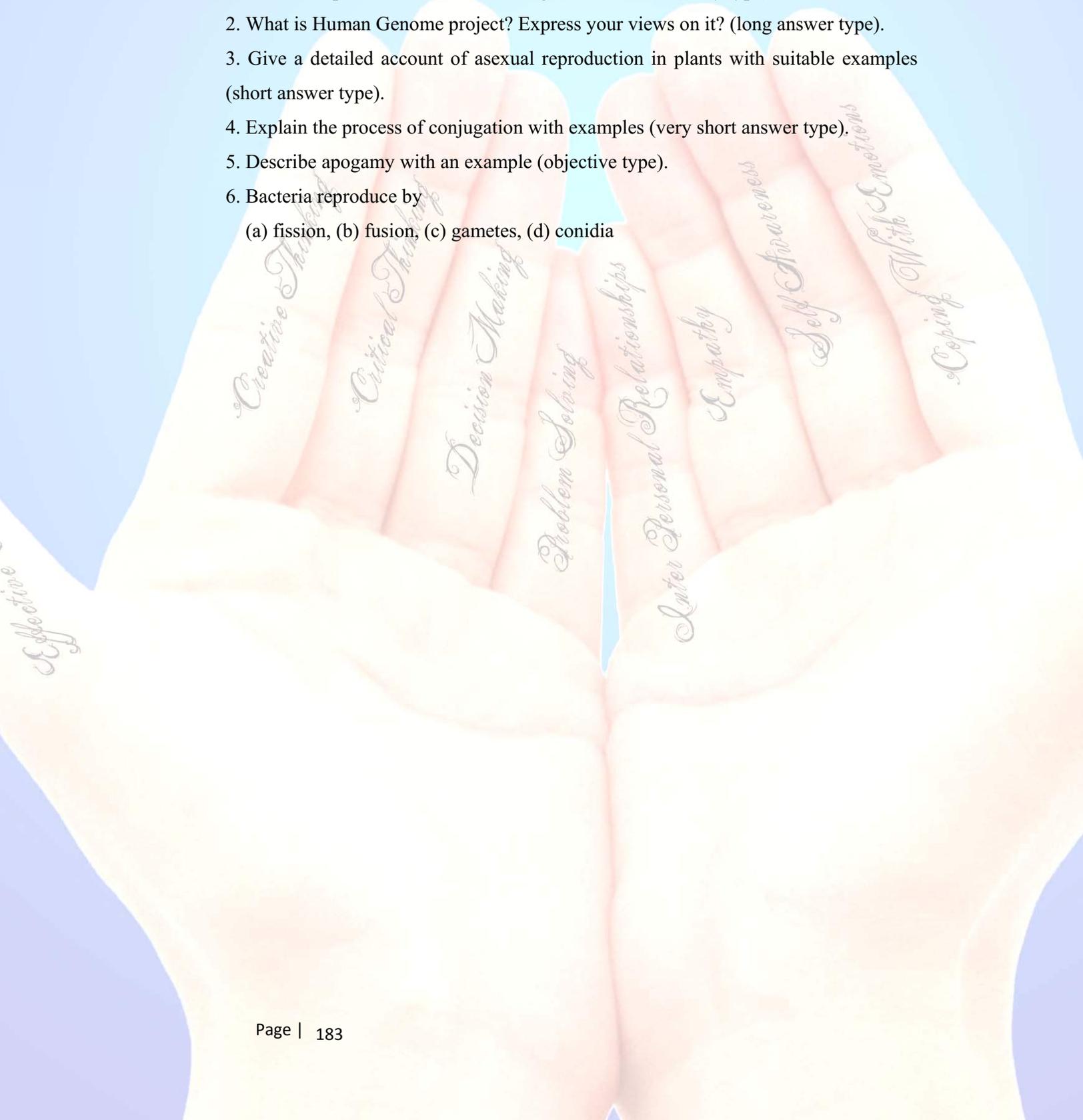
Associate Questions

- a) What are human clones?
- b) How does genetic engineering help the process of reproduction and the evolution of new species?
- c) What is a blood bank/sperm bank?
- d) What is *in vitro* fertilisation?
- e) What is artificial insemination?
- f) What is apogamy and apospory?

- g) How are seedless grapes produced?
- h) What is parthenocarpy?
- i) How is a test tube baby produced?

Year end Evaluation

1. What is implication of human cloning for the future? (essay type).
2. What is Human Genome project? Express your views on it? (long answer type).
3. Give a detailed account of asexual reproduction in plants with suitable examples (short answer type).
4. Explain the process of conjugation with examples (very short answer type).
5. Describe apogamy with an example (objective type).
6. Bacteria reproduce by
 - (a) fission, (b) fusion, (c) gametes, (d) conidia



Exemplar 3

Topic: Reproductive Health /Unit VI/Chapter 4)

Overview

Reproductive health refers to total well being in all aspects of reproduction i.e., physical, biological, emotional, behavioural and social.

It is about creating awareness about the importance of good care of reproductive organs and implications of unhealthy practises and their effects on man and woman, about reproductive organs and healthy sexual practises to adolescents.

It refers to legalized practises of termination of early pregnancy (MTP) in our country and associated issues with adolescents.

It also concerns itself with modern methods available for assisted reproductive technologies (ART)

Objectives: Students will be able to

- i) Understand about Medical Termination of Pregnancy (MTP), Sexually Transmitted Diseases (STD) and foeticide to develop skills of problem solving and decision making.

Columnar Framework

Sub-topics	Concepts	Sub-concepts	Process skills	Aligned life skills	Take away Life skills
Reproductive health	Reproductive health problems and strategies -MTP; foeticide -STD -Infertility	(a) Social evils like sex abuse and sex related crime (b) Various contraceptive methods and surgical methods of birth control c)MTP- -Misuse of MTP ^ leading to foemale foeticide d) Types of STDs or VDS or RTI -Mode of transfer of STDs -Effect of STDs in society -preventive measures e) Different techniques of assisted reproductive technologies(ART)	Observation Analytical explanation Planning Hypothesising Communication Questioning Investigation	Empathy Coping with emotions Problem solving Divergent thinking Decision making	Decision making Empathy

Materials: Newspaper clippings. Video of people suffering from diseases and being treated.

The process

Engage Students are engaged in reading a paper cutting on child abuse or statistical data of rate of population growth in India. What is the effect of knowing about child abuse? What is government's role in control of population growth?

Explore-Students are divided into groups and learn decision making through group discussions.

They make a visit to gynaecological clinic/hospital and read about the statutory warning about female foeticide; they discuss with a doctor or a midwife in a Pre-natal Home Clinic and collect information; they web search on child sexual abuse, STDs and the psychological implications of these. They search for data on child adoption in India and make a visit to counseling centres.

Group A

Observes a pregnant lady
Learns about C-section
Learns sex determination is not done
Learns about pre-natal clinic and birth control practises

Group B

Observes a woman in labour
Learns about Medical Termination of Pregnancy
Learns about female foeticide
Learns about STDs/infertility clinic

The groups discuss their observations and conclude that despite advances in medicine and technology and pre-natal care, a lot of women go in for abortions and C-section. That sex determination is done on the sly and despite leaps in education and women's rights and liberation slogans, a male issue is still preferred over the female. There are states where there is an imbalance of male and female gender ratio (eg., Kerala has a high number of females) and to keep up the balance of gender in population, female foeticide and idolization of the male issue should stop. The group highlights that birth control practises are adopted using various devices apart from pills, contraceptives and natural methods.

Through group discussions students will be able to make decisions regarding these in their lives (decision-making), and will be able to empathise with the women with gynaecology problems coming from various socio-economic backgrounds (empathy) and also are able to relate well and interact appropriately with these people with various problems and requirements.

Explain: The groups later on present their findings and observations made during the field visit.

Study of child abuse in India and control of population growth

Case study	Observation made during field visit	Inferences
1. Female foeticide		
2. Child sexual abuse		
3. STD		
4. Child adoption		

Elaborate ^Teacher further explains the social and mental health implications of unhealthy sexual practises, legislation for abortion of foetus, child adoption etc. and comment on how this has been misused and why it should not be misused.

Evaluate

Continuous oral assessment is carried out and students are asked to suggest solutions (problem solving). For eg., 1) How will you overcome the dangerous situation the country is facing of more and more youngsters contracting STDs? 2) Collect information about the Government of India and other agencies to bring awareness to people on birth control practises and protection from STDs. 3) How ultra sonography is misused for detecting the sex and female foeticide, and what are the consequences of imbalance in sex? This will also open up the fact that female genocide is crime and leads to population imbalance. Man to woman ratio is essential for the healthy growth of any population.

Associate Questions

1. Is child adoption beneficial to the child?
2. How will you prevent foeticide in India?
3. What measures will you take to prevent STDs?
4. Can birth control be effective in population control?
5. Mention contraceptive devices adopted by men and women.

Year end Evaluation

1. What is a C-section?
2. How is infertility cured? What is a test tube baby?
3. Define STD.
4. What is MTP?
5. What are the common birth control practises ?

Exemplar 4

Topic: Biodiversity and Conservation/Chapter 15/Unit-10

Overview

Biodiversity is studied at genetic, species and ecosystem levels.

Conservation efforts are aimed at protecting diversity at all these three levels.

India is one of the 12 mega biodiversity countries of the world.

The diversity of plants and animals is not uniform through out the world but shows a rather uneven distribution depending upon temperature, rainfall and other climatic conditions.

Biodiversity conservation may be in natural or artificial environment and the *in situ* (when the whole ecosystem is protected) and *ex situ* (when an animal or plant is threatened).

Objectives

To understand different patterns of biodiversity

To understand the methods of conservation of biodiversity

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned components of life skills	Take away Life skills
Bio-diversity	Biodiversity exists at different levels of biological organisation	1. Species diversity varies in different hilly regions	Mention process skills	Divergent thinking	Critical thinking Decision making
		The diversity of plants and animals is not uniform throughout the world		Imaginability	
	Different living organisms exhibit different kinds of biodiversity	Within a region species richness increases with increasing explored area		Anticipation of consequences	

Materials: Maps, film strips, video paper cutting, OHP/multimedia/PPT

The Process

Engage

The students are engaged in studying different examples using film strips/ video/paper cuttings and/or field visits. e.g., colours of *Bougainvillea* species for the study of diversity. Observations are discussed in groups and the two groups outline their points as below.

Group A

- The students examine different flowers of *Bougainvillea* kinds of diversity
Eg., genetic and species diversity
- The students relate topography and ecosystem diversity in India and Russia
- Students relate topography and diversity of any one species
- Students discuss ways of conserving diversity.

Group B

- The students study ecosystem diversity
- The students relate topography and ecosystem diversity in India, South America and Antarctica
- Students explore genetic diversity in a population of plants of the same species through expressed variations.
- Students discuss government efforts for conserving biodiversity in India and global efforts round the globe.

Explain

The students explain species diversity and ecological diversity in India and interpret that species diversity decreases as we move away from equator towards poles.

Elaborate

For e.g., forest ecosystems in different parts of India are highly diverse from cold deserts of tundra to the temperate deciduous forests of Himalayas viz., the tropical rain forests and tropical evergreen forests and the desert ecosystem.

Extend

The following conclusions are arrived at through discussions (the group discussion here promotes critical thinking and decision making).

- 1) There is a vast amount of genetic diversity in any population as is seen by the number of variations for one particular character eg., A *Bougainvillea* flower (*B. spectabilis* L.) is seen with yellow, white, pink and orange colours. And a single genus of a plant has several species.
- 2) The topography of the Indian sub continent is varied promoting different ecological niches where as Russia is a vast plain land and therefore has fewer types of ecosystems. South America is rich in flora because of the varied topography and the tropical climate where as Antarctica is a cold desert half the year round with only patches of plant life.
- 3) Government promotes conservation through wild life sanctuaries, national parks, museums, buffer zones, research projects and policy decisions from time to time.

Evaluate

Students draw different ecosystems on the map of India (and thereby develop critical thinking).

Associate Questions

What is the total number of life forms in the world?

Name a few extinct plant and animal species.

What is a red data book?

What is WWF?

What is Chipko movement? Who started it?

How many sanctuaries and national parks are there in India?

Year end Evaluation

Write an essay on conservation and its significance? (essay type)

Prepare posters on Environment (objective type)

Describe forest ecosystems of Karnataka (long answer type)

Mention the flora and fauna of Kukkarahalli tank in Mysore (short answer type)

Chamundi hills have - Scrub forest ecosystem

- Tropical forest ecosystem

- Temperate forest ecosystem (objective type)

Exemplar 5

Topic: Biotechnology and its Applications/ Chapter 12/Unit 9

Overview: GM or Genetically Modified plants are useful in producing plants more tolerant to abiotic stresses, making plants pest resistant. GM plants are plants with modified genes eg., maize, tomato and cabbage. GM plants yield quality food, are pest resistant, cope in different climatic conditions and are less costly. Herbicide resistant genes are inserted via *Agrobacterium* species into the food plant so that the crop is not affected by herbicide. It is not harmful. Food tests are done to see the effect of GM crops.

Objectives: To impart knowledge about the biotechnology of making GM plants, its popularity in present day situation pros and cons of GM food.

Sub topic	Concepts	Sub-concept	Process skills	Aligned component life skills	Life skills
GM plants	General use of GM plant	Bt cotton pest resistant plant using RNA interference	Description & presentation	-Knowledge of the situation -Anticipation of consequences -Rationality -General intelligence	Decision making Problem solving

Materials: Paper clippings, News articles, Video clippings, power point presentation, research papers on GM crops. Students are engaged in viewing a PPT on GM Food.

The Process

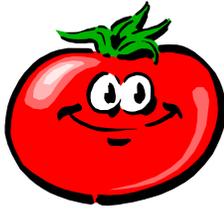
Engage

The students are engaged in viewing a PPT on GM food.

SLIDE 1 What is GM food?

- GM food stands for Genetically Modified Food
- Organisms are made up of cells containing genes, the hereditary material of which is DNA (deoxyribonucleic acid) in nature
- GM food is food with genes modified. Genes can be transplanted by taking out useful pieces of DNA from one organism and merging them with the DNA in another organism.

SLIDE 2 Common GM Foods



Tomato



Maize



Pasta



Cabbage

Explore

Explore new GM foods in Indian market. Students state the need for GM food (due to the high quality, herbicide and pest resistance, acclimatisation and improved food production long shelf period).

SLIDE 3 Why produce GM food ?

- To improve the quality of food
- To improve food production to feed the world
- To strengthen the resistance against diseases (herbicides) and pests
- To cope better with climatic changes
- To minimize the cost of production
- To minimize loss during transport and storage
- To increase the shelf-life period of food

SLIDE 4 Herbicide resistance

- Herbicides, like glyphosphate and glufosinate, are used to eliminate weeds to maintain nutrient content in the soil but they decrease the yield.
- Scientists insert the herbicide resistance genes via *Agrobacterium* spp. into food plants so that they will not be affected by the herbicide.
- This reduces the excessive use of herbicide.

SLIDE 5 Pest resistance

- Scientists insert the toxin producing gene from *Bacillus thuringienus*, a kind of soil bacterium, into maize.
- Destructive insects will be killed when eating the crop.
- The loss due to destructive insects is greatly reduced.

Explain

The students try to answer effects of GM food on health and effects of toxins produced, allergic reactions to the GM food, side effects to the GM food and the effects of GM food on ecosystems.

GM food is consumed as DNA molecules. So far no side effect has been noticed. GM plants may release toxins and vegetarians may not be able to take GM food because of animal genes. Also, genes may jump the species barriers.

SLIDE 6 Is GM food harmful ?

- Will it affect our health?
- Will it affect the eco-system?
- Will it have harmful side-effects on our health?
- Will it reduce consumer choices?

SLIDE 7 Will GM food incur health problems?

- GM food is consumed as modified DNA molecules.
- As human body has been coping perfectly well with foreign DNA for millions of years, no harm is proved at this moment.

SLIDE 8 Harmful to ecosystem?

- Will it affect the growth of other plants?
- Will living things lose their living environment?
- Will it create strange species?

Extend

They notify GM foods by putting labels to packages. The efficacy of GM food is determined by carrying out food tests.

SLIDE 9 Any side effects ?

- Will genes used to modify crops jump the species barrier?
- Can the possible DNA mutation be controlled?

SLIDE 10 Religion and choice

- What happens if vegetarians eat food which is genetically engineered with an animal gene?
- Will it repel choice of food?

SLIDE 11 Solutions

- Add labels to the packages
- Improve genetic modification technology
- Food tests

Evaluate

Evaluate through brainstorming and discussions in groups.

Teacher discusses the concept of GM food through a general group discussion on problem situations such as -

- How can you solve hunger and malnutrition that has been bothering the country for long? Can GM plants solve our food problem?
- What are the oppositions to GM foods?
- In what way can we solve this conflict? Discuss in groups pros and cons of GM food and come out with solutions.

During the discussions two groups are made ^one stating advantages (group 1) and the other stating disadvantages (group 2) of GM Crops as given below, and thereby developing decision-making abilities.

Group 1: Advantages

Increases productivity
Solves food problem
Quality of food increases

Cost of production is less

Herbicide and pesticide resistant plants are produced

GM foods can be labeled and used separately

Group 2: Disadvantages

Releases toxins

Vegetarians cannot eat GM food plants with implanted animal genes

Requires advanced genetic technology and therefore is expensive

Genus may jump the species barrier and produce strange plants

Genetic engineering technology to be perfected

Teacher mediates the discussions and concludes the discussion on GM food.

Associate Questions

What are GM foods?

Do you find GM food in India?

Have our farmers agreed to grow GM food?

If not, why?

What is your view about using GM food?

Do Bt cotton and Bt Brinjal have any advantage over normal cotton and brinjal ?

Year end Evaluation

Objective type

Genetically modified crop has foreign genes. Yes / No

The foreign gene in GM crop may have negative effect on soil. Yes / No

Are you playing a role in bringing a drastic change in species by manipulating the genes? Yes / No

Will the local varieties become rare if GM plants are grown in local field? Yes / No

Is there any ethical issue involved in making GM animals? Yes / No

Long answer type

Why did Bt. Brinjal become an issue? Elaborate.

Essay type

What is the role of biotechnology and genetic engineering in modern society?

Short answer type

How does genetic engineering facilitate improvement of crops?

Explain how GM Food is popular among farmers.

Very short answer type

The foreign gene in GM crop may bring harmful effects on your health. Explain

Exemplar 6

Topic: Prevention and Control/Unit VIII/Ch. 8

Overview: The adage prevention is better than cure applies to drug abuse, addiction, alcohol and tobacco. It is difficult to understand the emotion of adolescents due to various physiological changes within their body. Environment and opportunity will lead to the psychological disorders, such as anxiety, depression, drug/alcohol abuse and other bad habits/evils.

A positive environment has to be provided to adolescents in order to know the problem and cope up with emotions and stress, and control their behaviour especially for youngsters of today who need counseling and medical help for addiction

Objectives:

Students will be able to:

To understand the need for prevention and control.

To understand various preventive measures of drug/alcohol abuse

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Drug Alcohol and Substance Abuse	Prevention is better than cure. Health maintenance is for happy living.	Preventive measures Control of drug abuse	Observation Understanding Inference	Sympathy Empathy Objectivity Self awareness Analysis Resilience Stability	Coping skills Coping with emotions Coping with stress

Materials

Newspaper cutting, video clips/film strips, charts.

The Process

1. Prevention is better than cure

Engage

Students are engaged in studying video clips/taking up case studies of a cancer patient undergoing all physical pains and emotional suffering and being cured of cancer.

The students engage themselves in enquiring about sufferings of drug addicts amongst relatives and neighbours. Through case studies approach students learn to cope with the stress of peer pressure.

Case 1 (Avoid undue peer pressure)

Arjun has many friends. A few of his friends recently introduced him to smoking. He knows smoking is not good. But his friends compel him to smoke. He is not able to go away from his friends. They are also asking him to try drinks. They are even ready to spend on him. May be, he will have to spend money on them later on. He cannot afford to spend any money like that. He does not want to continue with these friends. But he cannot. He is not able to share his feelings with anyone. His friends are asking him to bunk classes and go with them. They do not care for the marks. But he has to get a good percentage to pursue his studies further. He is not able to concentrate on his studies.

What can Arjun do to get out of his emotional stress?

Explore

The students explore how people had coped differently in different situations in the above cases and thereby gain the ability to understand from another's perspective

Students are divided into five groups. Each group is given a case study; one case study each relating to one method/measure of prevention and control.

Worksheet

Case Study 1	Case Study 2
Cancer patient	Drug addict
Prevention strategies 1. Immunity boosters 2. Periodical tests biopsy 3. Clean, hygienic food and water	Prevention strategies 1. Good company 2. Self-restraint 3. Good family support system
Coping strategies 1. Radiation therapy 2. Medicines	Coping strategies 1. Deaddiction therapy

A cancer patient takes radiation therapy and medicines.

And a drug addict is put on deaddiction therapy ^reduces intake of drugs and replaces drugs with other substances.

Through case studies they acquire coping skills.

Case 2 (Education and Counselling)

Arpitha has failed in class X examinations. She is not able to break this news to her parents. She spends her day with a few friends who offer her some drinks. She is now further disturbed. In the evening however, she goes home. Once she sees her parents she breaks into tears. She is overcome by her grief and is not able to speak. The parents are worried. Then the father calls Arpitha's teacher to find out what happened. The family now realises the gravity of the situation. The father can also make out that his daughter had consumed alcohol. He calls a close friend of his who is a counsellor and asks him to talk to Arpitha. He counsels Arpitha. She is finally able to face the reality. She also decides to take up the supplementary examinations and complete the course.

1. What do you think would have happened if there was no counselling?
2. How do you think counselling has to be done in such situations? Asking them not to worry may not be very effective. How would you talk to such a person in stress?

Explain

The students will prepare and present in groups in the class and discuss/explain how/why people cope with stress/emotions and gain the ability to understand situations from another's perspective.

Extend

A project work is given to students to visit a deaddiction centre/rehabilitation centre to collect information regarding patients suffering from drug abuse/other addictions. They find out how patients suffering from cancer cope with stress and emotions/how the family of the patient copes/how they can cope better and develop planning ability and management in difficult situation.

Evaluate

1. How do you avoid friends with bad habits?
2. What are their healthy pursuits?
3. How do you help an addicted person?
4. What are the danger signs of drug abuse?
5. What are the advantages of maintaining good health?

2. Health maintenance is for happy living

Engage

Students are engaged in studying ill-effects of drug abuse through newspapers cuttings/video clips/charts and enquiring about the family health conditions of drug addicts.

Case 3 (Seeking help from parents and peers)

Esther got into a love affair. She knew she should not be wasting her time on such distractions. But she is not able to come out of her attractions for the boy. Even for the slightest misunderstanding at home, she looks up to him for solutions. She becomes more and more dependent on him. She also knows she cannot continue like that. She realises the need to talk to some elders about it. Before that she tries to speak to her friends.

Whom do you think she should approach for help? Elders, parents, peers or teachers? Why?

Explore

Exhibition/poster display enable exploration of various health disorders. A poster presentation illumines them on the advantages of yoga and exercises for healthy living. A drug addict would be dull and lethargic with drugs in blood that finally affect the brain. They may have droopy eyes, slurred speech and staggering gait. These can be corrected by yoga.

Explain

The students explain/present the poster display. Yoga tones up the systems of the body, improves breathing and even controls the functioning of different organs. Exercises help one loose unwanted fat/flab and keeps one physically fit.

Extend

The students extend the study to real life situations through visits to nearby slums/villages/hospitals.

Case 4 (Looking for danger signs)

John, of late, does not mix with his friends at all. Soon after the class he goes away somewhere. Sometimes he bunks classes. Even in class he has stopped mixing with others. Many a time he is shouted at for not completing the assignments given. Sometimes he is found sleeping in the class. Most of the times he appears sleepy. Every one is worried about John.

What do you think of John's situation? Can you list a few more such symptoms for children with problems?

Case 5 (Seeking professional and medical help)

Shree has a lot of itching and burning sensation in her eyes. She does not get sleep until late night. She has a problem with her stomach too. She does not feel like eating. She is not able to enjoy food. She goes off to sleep the moment she sits with a book. She is not able to watch films on TV or work on the internet. And she is not able to concentrate on her studies. What do you think is Shree's problem? How can she be helped? Whom should she contact? A counsellor or a doctor? Or both? Why?

How have people coped differently in different situations in the above cases? Ability to understand a situation from other's perspective is promoted by the above case studies.

The groups study the cases and discuss them in detail. Then the teacher reflects over their presentations and further continues the discussion.

Evaluate

Why are people addicted to drugs/alcohols?

What are the ill-effects of tobacco/gutka/alcohol?

What is the secret of maintaining good health?

List out common diseases caused due to drug abuse.

Through a case study, the student is able to gain insights into few components of life skills:

Sympathy

Empathy

Objectivity

Resilience

Self-awareness

Stability

Associate Questions

What do you know about deaddiction as a therapy?

What are the common drugs to which students get addicted?

Can drugs like opium, heroin, LSD, ganja be bought off the shelf?

Where are these drugs manufactured?

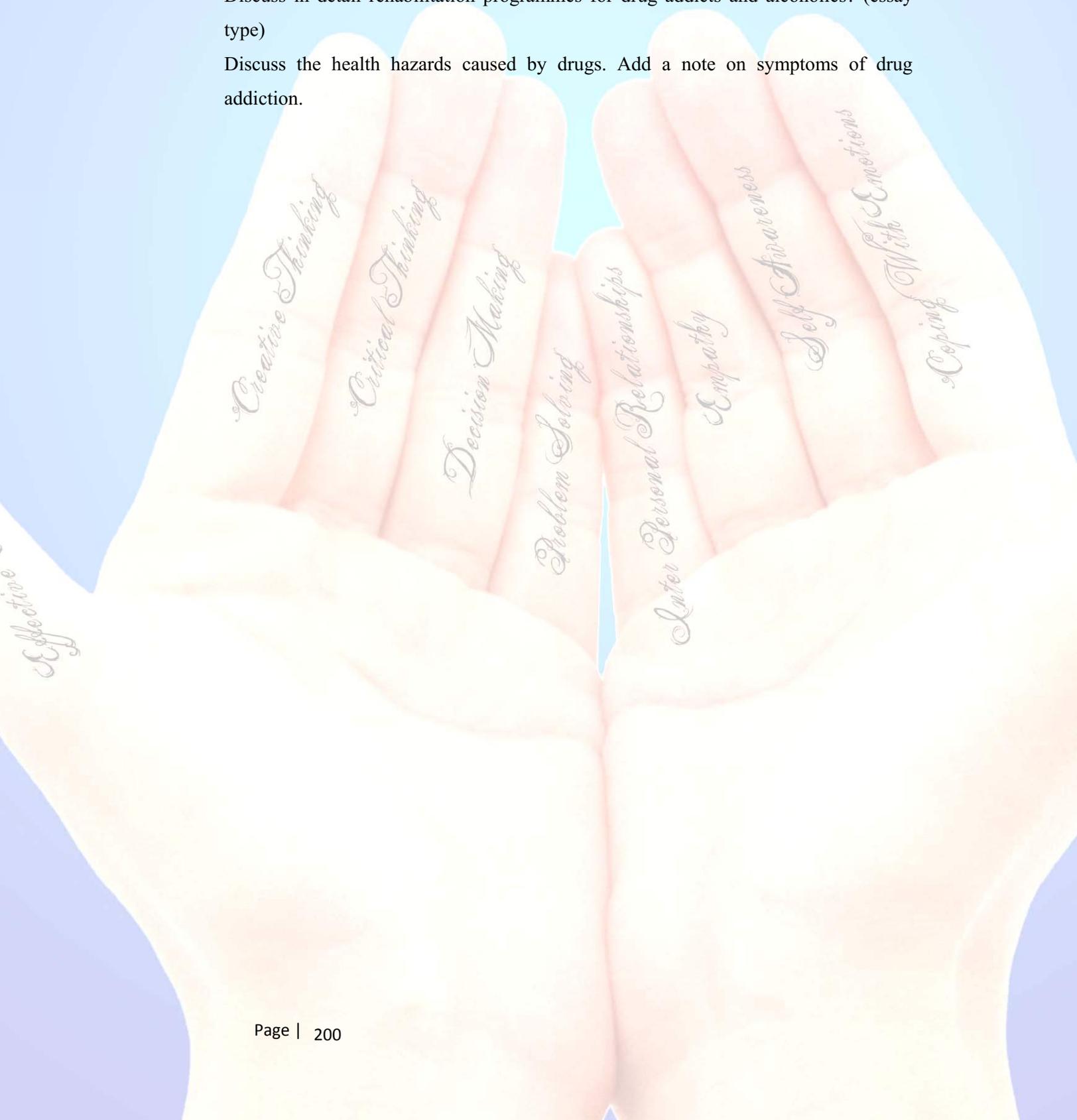
Year end Evaluation

What will happen if drugs are consumed regularly? (short answer type)

How would an individual overcome drug addiction? Suggest measures. (long answer type)

Discuss in detail rehabilitation programmes for drug addicts and alcoholics? (essay type)

Discuss the health hazards caused by drugs. Add a note on symptoms of drug addiction.



Exemplar 7

Topic: Reproductive health/Unit 6/Chapter 4

Overview: Reproductive health refers to total well being in all aspects of reproduction i.e. physical, emotional, behavioural and social.

Counselling creates an awareness of safe sex and sexually transmitted diseases.

Objectives

To know and understand about AIDS/HIV and what precautions need to be taken to prevent them.

Materials

Newspaper clippings

Videos/PPT

Posters related to HIV/AIDS/STD

Columnar Framework

Sub-topic	Concepts	Sub-concepts	Process skills	Aligned Life skills	Take away life skills
Reproductive health STD/ HIV/AIDS	STD/AIDS/ safe reproduction/ safe sex	Medical facilities and precautions	Presentations	Effective communication Expressive skills Assertiveness Analytic ability Patient listening Reacting on the spur of the moment Tolerance Accept others as they are Sensitivity Decision making Empathy Logical thinking Interpersonal relations	Interpersonal relationships and Effective communication

The Process

Engage

The students are engaged in answering the following questions-

What is the full form of STDs? Have you heard of STDs? What are the different types of STDs?

Diseases or infections which are transmitted through sexual intercourse are collectively called sexually transmitted diseases (STD) or venereal diseases (VD) or reproductive tract infections (RTI).

- Gonorrhoea

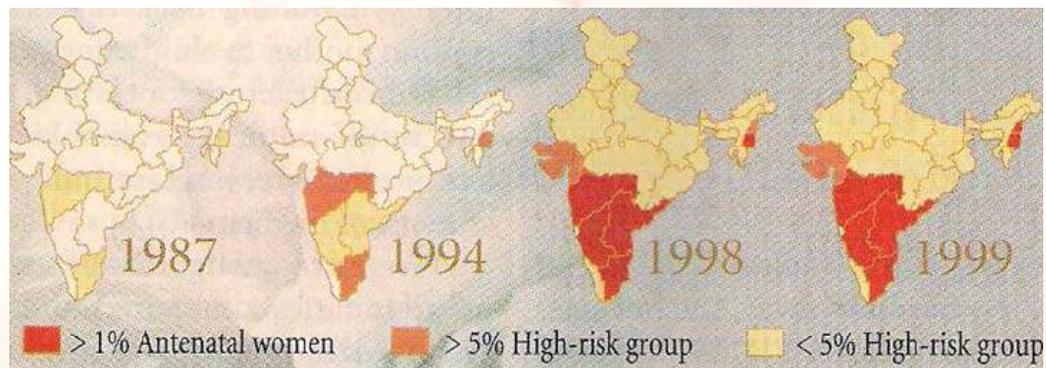
- Syphilis
- Genital herpes
- Chlamydia
- Genital warts
- Hepatitis-B
- HIV/AIDS

The students involve themselves in groups for a power point presentation or chart on STDs and their types. Students look at the prevalence of HIV in the Indian scenario and compare it with the important continents/countries the world over including cumulative numbers of deaths.

AIDS and the chilling numbers

Countries	People living with HIV	Children orphaned by AIDS
North America	900,000	70,000
Caribbean	360,000	85,000
Latin America	1,300,000	110,000
Western Europe	520,000	9,000
North Africa and Middle East	220,000	15,000
Sub-Saharan Africa	24,500,000	12,100,000
Eastern Europe and Central Asia	420,000	500
South and Southeast Asia	5,600,000	850,000
East Asia and Pacific	530,000	5,600
Australia and New Zealand	15,000	<500

Indian scenario (Adult HIV Prevalence)



In India at present AIDS cases are not properly diagnosed, reported or treated. As on June 1, 1987 the day third International Conference on AIDS began its sessions at Washington D C. The W H O has recorded 51 lakh cases from 113 countries (The number is doubling every 12 to 15 months. In India 55 lakh people suffer with HIV and 10% have full blown AIDS during (1999-2000) so from (2000 to 2008) the numbers have exactly doubled i.e., 60 lakh people in total. NACO, which is established i.e., National Aids Control Organization is at presently undertaking the survey work about the disease in India. In the absence of any preventive, vaccine and drugs to cure of AIDS, knowledge and awareness among general population about HIV and AIDS, is the most preventive measure available. Since the infection is spreading not only among the high-risk behavior, persons but also among the general populations as seen from the surveillance among anti-natal clinic attendants and persons who have received transfusion of blood and blood products in hospitals. so it is essential that everybody should know the modes of transmission of HIV infection and also how it can be eradicated

Explore

Brainstorming session between two groups is carried out. Teacher divides the class into two groups and assigns a task about a dreadful disease like AIDS where there is no drug so far for its cure.

A. Group discussions analysing the chart of statistics are carried out. A set of questions are given to the groups.

1. Which countries have large number of HIV infected persons?
2. What is the situation of India?
3. Is being HIV positive, the same as suffering from AIDS? In what way they are different? The student develops life skills of effective communication.

B Role play as AIDS Consultant/Counsellor

Role play is done to talk to a villager to enhance his/her awareness of AIDS. There are two role plays. Others observe and discuss the role play. They discuss it with a checklist.

Two individuals are identified to conduct the role play. One of them plays the expert and another the villager. Others observe the role play and assess the presentations using the following checklist. Copies of checklist could be distributed before the role plays begin.

Are personal equations established?

Does the villager come out of inhibitions to talk about HIV infection/AIDS?

Does the Counsellor make the villager speak out his/her understanding of HIV infection/AIDS?

Does the Counsellor present facts with examples?

Does the Counsellor clarify doubts?

Does the Counsellor patiently deal with differences?

Does he suggests ways of dealing with HIV infected person/suffering from AIDS?

Does he open up channels for further discussions?

Other students give feedback on the role plays. In the process they display their understanding of AIDS and related issues. The teacher assesses the communication skills of students in giving feedback, and conducting the role play.

The following could be kept as observation points for assessment of students.

- The observations are presented with evidence from the role play.
- The positive aspects are highlighted first.
- The negative aspects are presented facilitating reflection without offending anyone.
- Allows time for others to speak out their views.
- Agrees/Disagrees politely.
- Able to communicate their views without any confusion.

- Accepts others' point of view and reflects on them objectively.
- Allows corrections by others (The student here develops good interpersonal relationships.)

Explain

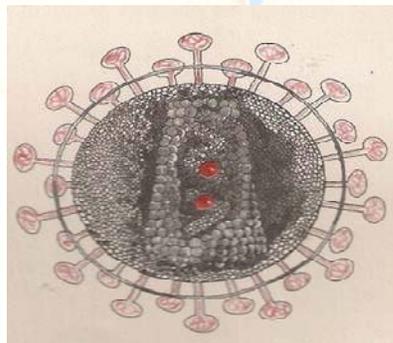
Students go through ppt/slides/handouts/brochures/materials /charts.

Task to be accomplished

- Teacher gives hand- outs about AIDS and asks children to communicate among their friends by using effectively social media network/social book marking to a larger population.
- The students are engaged in the process of adopting different strategies like organizing activities like:
 - Organizing rally
 - A debate competition
 - A seminar on AIDS
 - An invited talk by a famous doctor
 - A video/film show on sympathy towards AIDS patients

What is AIDS ?

It stands for	A	Acquired
	I	Immune
	D	Deficiency
	S	Syndrome



HIV looks like this under the microscope

The Logo of AIDS



Where does HIV live in the body?

HIV lives in the body fluids of the infected person such as semen, vaginal secretion, blood and blood products made from infected blood. The concentration of HIV in tears, sweat and mother's milk does not infect others.

After going through the handouts and materials students try to put in their own words the following-

What is AIDS?

The meaning of a red ribbon?

Where does HIV live in the body?

AIDS

Is a disease caused by HIV

The expansion of AIDS-
Acquired Immunodeficiency Syndrome

This disease surfaces after 8 years of infection by HIV

The virus is transmitted through unethical sex, multiple partners, blood transfusion, sharing of needles, tattooing, from mother to foetus, and from mother through milk to the symptoms of AIDS include weakening of immune system, breakdown of defence mechanism of the body.

HIV

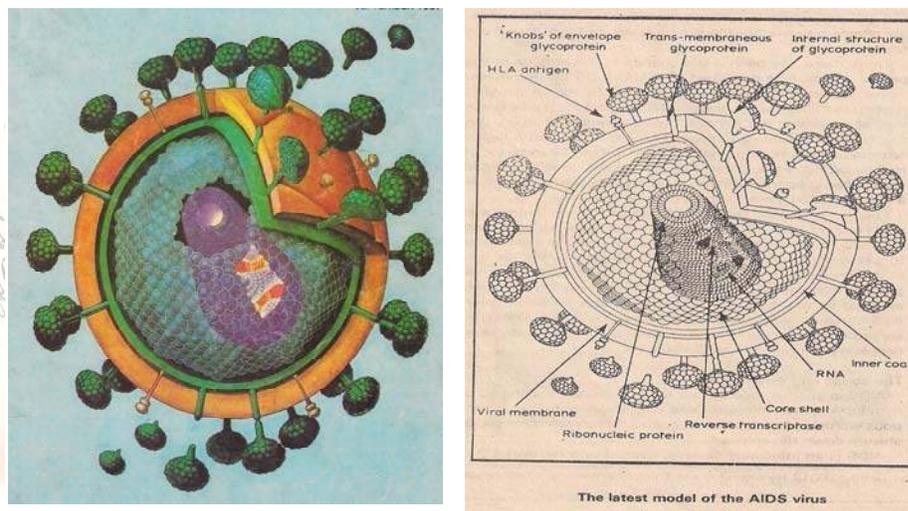
Is a retrovirus.

The expansion of HIV-
Human Immunodeficiency Virus

Elaborate

The students will discuss the transmission of the disease from one person to another. Handouts on HIV/AIDS distributed here. The students will explain the process of breakdown of immune mechanism of the body-the formation of viruses in the blood cells and their release into the blood causing fever and breakdown of immune defenses. They elaborate the mechanism of infection.

AIDS Virus a three-dimensional view.



AIDS transmitted

- Unethical sex
- Multiple partners
- Pre-marital and extra-marital sex
- Needles, tattooing, organ transplantation
- Unscreened blood
- How does HIV enter the Body ?

AIDS not transmitted

- Safe sex
- Monogamy
- Through contact
- Proper disposal of used needles
- Proper screening of blood

How does HIV enter the Body?

03 How does HIV enter the body?

(I) Through Unprotected Penetrative Sex:

- You could get infected with HIV if you have sex with an infected man or woman or
- If you have sex with a Commercial Sex Worker (Prostitute) or a man who already has had many sexual partners, or
- If you have sex with many different casual partners, you have a HIGH CHANCE of getting infected with HIV or
- You might get infected the very first time you have sex if your partner is already carrying the infection.

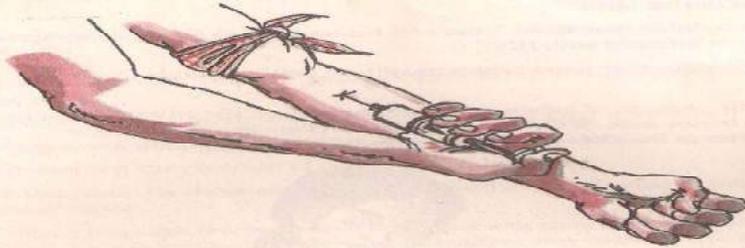
(II) Through contaminated Blood and Blood products

- HIV can enter the body when contaminated blood or blood products which contain HIV is given to a person through blood transfusion, or

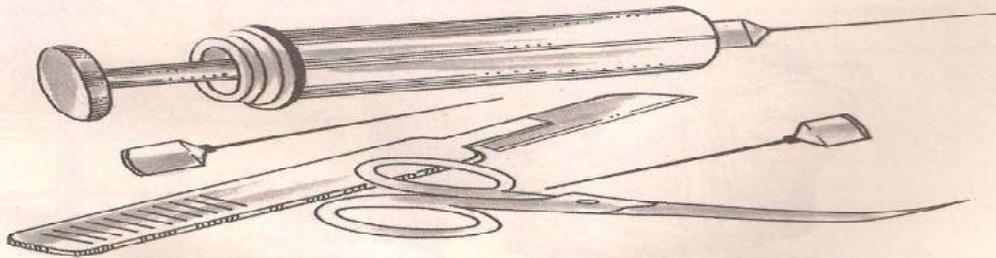


How does HIV enter the body?

- If contaminated injecting equipments are used e.g. by drug users to inject drugs (such as heroin) into their bodies



- HIV can enter the body when medical instruments are not cleaned and sterilised properly
- HIV can also enter the body when sharp tools used to cut the skin (such as ear-piercing and tattoo making) are not cleaned and sterilised properly

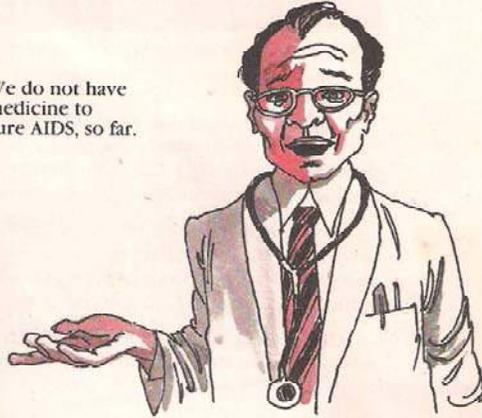


NO! Cure for AIDS

Isn't there a cure for AIDS – traditional or allopathic?

NO!

We do not have medicine to cure AIDS, so far.



Though some people have made claims that they have a cure for AIDS, these claims have not been proved.

There is a lot of research going on in many countries to try and find a medicine to cure AIDS. Till a cure is found **PREVENTION IS THE ONLY CURE.**

Isn't it then very important to know more about HIV and AIDS. Let us know more about HIV and AIDS.

Remember correct information is the only way for prevention. There is no vaccine for prevention. Protect yourself and your loved ones by practicing preventive methods.

**HIV/AIDS
IS NOT
WORTH
THE RISK**



What happens to a person infected with HIV?

07 What happens to a person infected with HIV?

The body of the healthy person is well protected by a strong defence system which fights off harmful infections.

... But in an HIV infected person:

HIV weakens and destroys the defence system of the body and because the body then has no protection, many other illnesses make the person very sick and eventually the person dies.

In the early stage...

Many people with HIV infection look healthy and feel well. They may not even know that they are carrying HIV in their bodies though they are capable of infecting others.

... But after some years:

Most HIV positive persons go on to develop AIDS as their immune system becomes severely weakened. Normally mild diseases turn into fatal diseases.

For clinical definition of AIDS in adults there must be at least two major signs with at least one minor sign and the absence of known causes of immunosuppression.

Clinical Case Definition of AIDS in Adults

Major signs:

- Weight loss, at least 10 per cent body weight
- Chronic diarrhoea, for more than one month
- Prolonged fever, for more than one month (intermittent or constant)

Minor signs:

- Persistent cough, more than one month
- Generalised pruritic dermatitis (general skin disease/infection)
- An episode of herpes zoster (viral infection)
- Oropharyngeal candidiasis (fungus infection in mouth and throat)
- Chronic progressive and disseminated herpes simplex infection
- Generalised lymphadenopathy (enlargement of lymph glands)

The presence of generalised Kaposi's Sarcoma or Cryptococcal meningitis are sufficient by themselves for the diagnosis of AIDS in adults.

Extend

The discussion is extended to drugs known to cure a person of AIDS and their chemical structures and this promotes self-awareness. The students also discuss the structure if HIV RETROVIRUS.

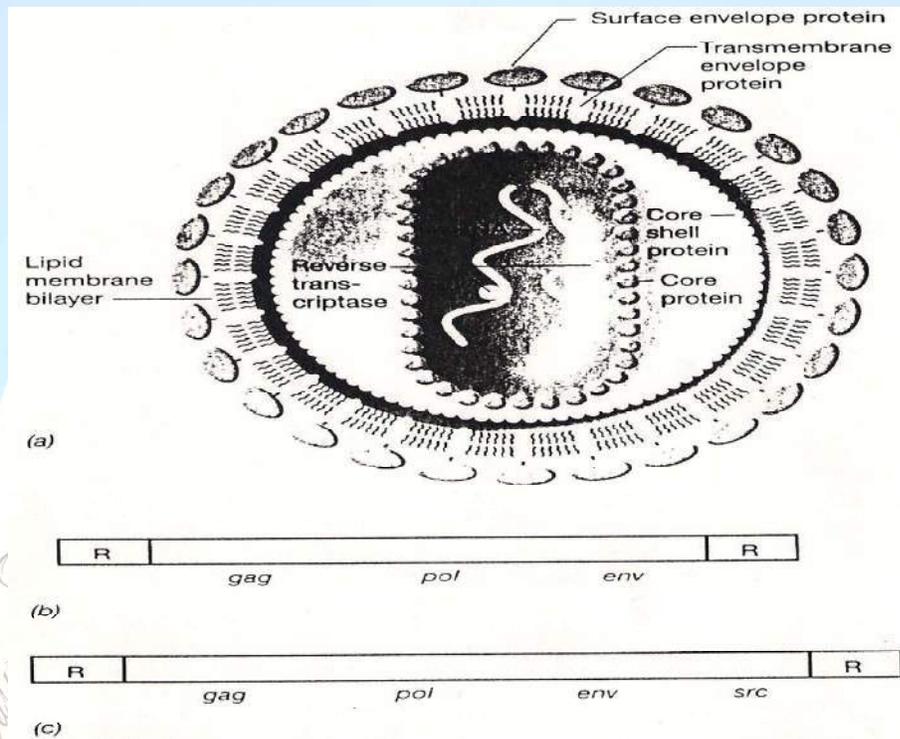
Chemicals Approved for HIV/AIDS treatment



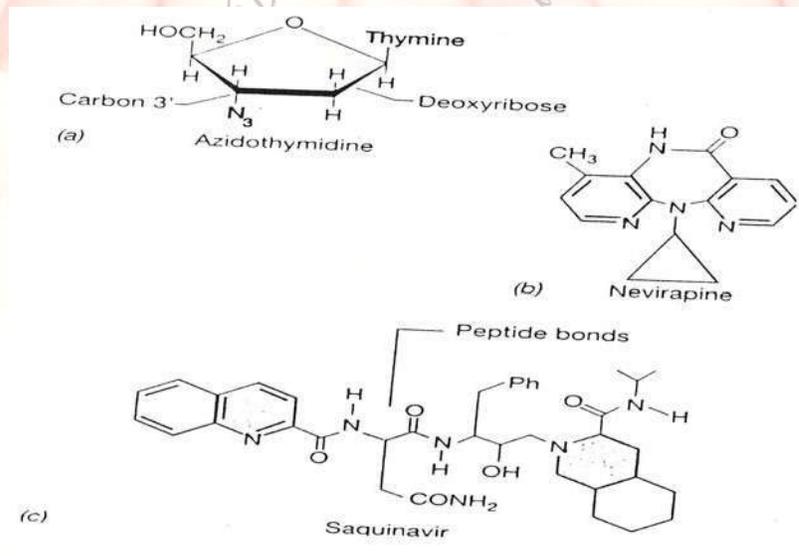
TABLE Chemotherapeutic agents approved for HIV/AIDS treatment

Drug	Mechanism of action
Azidothymidine (AZT, ZDV, or Zidovudine) (Figure 23.34a)	Nucleoside analog; reverse transcriptase inhibitor; nucleoside chain synthesis terminator; increases survival time and reduces incidence of opportunistic infection in AIDS patients; toxic to bone marrow cells; may be used in combination with other drugs in multiple drug treatment protocols.
Dideoxycytidine (ddC or zalcitabine) Dideoxyinosine (ddI or didanosine) Stavudine (d4T) Lamivudine (3TC)	Nucleoside analogs; reverse transcriptase inhibitors; mechanism of action and effects are the same as AZT; may have less toxicity than AZT in some patients; may be used in combination with other drugs in multiple drug treatment protocols.
Efavirenz Nevirapine (Figure 23.34b) Delavirdine	Nonnucleoside reverse transcriptase inhibitors (NNRTIs); bind directly to reverse transcriptase and disrupts the catalytic site; do not compete with nucleosides; may be used in combination with other drugs in multiple drug treatment protocols.
Infinavir Nelfinavir Ritonavir Saquinavir (Figure 23.34c)	Protease inhibitors; computer-designed peptide analogs designed to bind to the active site of HIV protease, inhibiting processing of viral polypeptides and virus maturation; may be used in combination with other drugs in multiple drug treatment protocols.

HIV/AIDS virus is a retrovirus and its structure



Chemical structure of drugs for AIDS



Evaluate

If you know there is a HIV patient in your class, how do you deal/help him and convince your other friends to accept him as a normal friend?

The students try to come to a conclusion regarding a possible final cure for AIDS. The following questions are asked- Is there no cure for AIDS?

Can AIDS be overcome /controlled through low risk behavior?

What are the chemicals approved for HIV/AIDS treatment?

What is the chemistry of these drugs?

Are any of these a N-base?

Associate Questions

Can the breakdown of the immune system of our body be prevented?

Is prevention better than cure?

Was prevention the traditional method for AIDS?

What are the immunity boosters one should consume daily to overcome AIDS?

Year end Evaluation

Mention at least two modes of transmission of HIV(Short Answer Type).

Give definite reasons for causes of HIV(Essay Type).

What are the preventive measures for overcoming AIDS?(Long Answer Type)

What is the medication for HIV?(Objective Type)

Identify from the following the more prevalent evil?(Objective Type)

Drug addiction

Organ transplantation

Blood transfusion

Can this disease be transmitted from mother to child?(objective type)

What is the incubation period (AIDS symptoms) HIV virus?(objective type)

What is ELISA test?(objective type)

If a child in your class is a known case of HIV positive, what would be your response?(Objective type)

Exemplar 8

Topic: Human Health and Diseases/Unit 8/Chapter 8

Effects of Drugs and alcohol abuse

Overview: Adolescence means both a period and a process (between 12 and 18 years) where a child undergoes a lot of physical, cognitive and behavioural changes. Some attitudinal changes make them vulnerable to drugs and alcohol addiction.

Curiosity, experiment, unsupportive family, peer pressure are some of the factors leading adolescents to addiction.

Addiction leads to euphoria and a temporary feeling of excitement, elation, happiness and well being. These psychotropic drugs have withdrawal syndrome.

Objectives

To become self-aware of physical, cognitive and behaviour changes due to hormones produced in the body. To be aware that drugs and alcohol can cause reckless behaviours, violence and health problems.

Columnar Framework

Topic	Sub-topic	Concepts	Process skill	Aligned life skills	Takeaway life skill
Human health and disease	Effects of drugs and alcohol abuse	Adolescence Behavioural changes due to hormones Reasons for addiction Curiosity Adventurous attitude Impulsive/enterprising nature Experimentation attitude Unsupportive/ Ignorant parents Peer pressure. Withdrawal syndrome	Observation Questioning Recognition Understanding	Self-esteem Self-confidence Self-discipline	Self-awareness

Materials

Problems of the student community, a deaddiction centre, incidents in life, and personal experiences of students.

The Process

Engage: Engage students in discussion (through situational analysis) quoting various incidents and personal experiences where effect of alcohol was observed.

Situational analysis

Raghav is a very studious boy. He joins hostel for XI and XII in a PU college which also trains the student for professional colleges. His classmates (hostel mates) are in the habit of burning the midnight oil. Due to his friends' circle he too joins the group in the habit of studying till late in the night. To keep themselves active, his friend tries some mild drugs and suggests that to Raghav also. He initially resists but falls into it due to peer pressure. Slowly he finds himself addicted to it. He and his family feel miserable about his life.

The students analyse this situation in the following way.

1. Was Raghav right in giving in to peer pressure?
2. Was it his weakness?
3. Does he have any strong attitude to overcome his weakness? (His strength) (self-confidence is required)

If he wants to come out of this situation, what effort should he make? (The students develop self awareness here and understand self-discipline)

Explore:

The students look around for others who have family problems, socio-economic problems, health and financial problems, marital discord, and such as those who can fall prey to habits of addiction.

The students visit a deaddiction centre and observe the patients and discuss. Explore in the form of discussion, video showing various life situations where people may fall prey to alcohol and drug abuse.

Explain

The students explain problems of peer pressure, interpersonal problems, bullying teenage aggressiveness and other family problems faced by them every day. They explain how they resort to drugs and alcohol under these varied situations. Drugs and alcohols are psychotropic. Drugs enter the blood stream and hamper physiological processes because of their chemistry. Alcohol enters blood and makes it thinner and one loses appetite. Drugs affect the neurons and tissues of the brain.

Extend/Elaborate

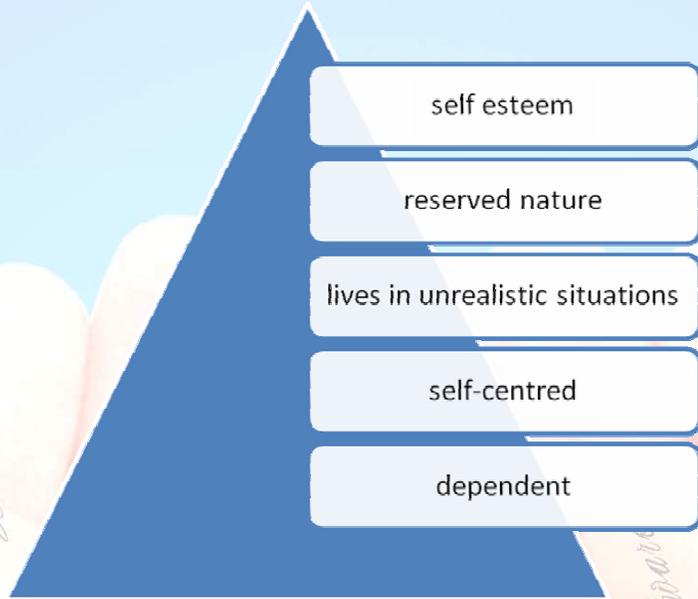
The students extend the problematic situation to a life long process. Problems during adolescence can reappear during the 40's and post-retirement and in old age if one does not have a planned life.

Evaluate

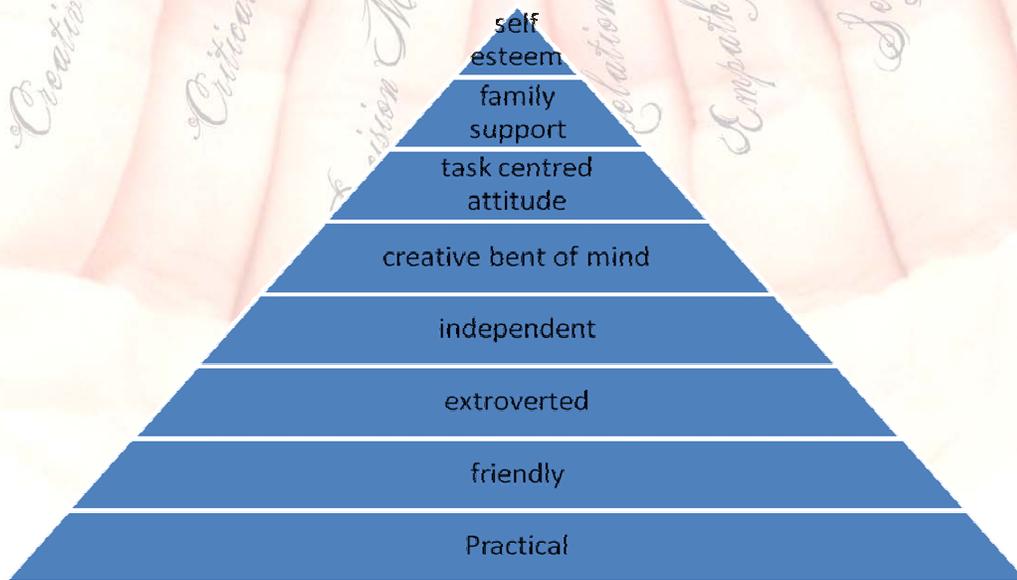
The students enhance self-awareness and evaluate their self-awareness through concept mapping.

Concept mapping

In continuation of this situation analysis, each student is asked to draw a pine tree and represent each branch with some character. The character may be a weakness or strength.



What kind of self-esteem is this? Low self-esteem



What kind of self-esteem is this? High self-esteem

The students learn about self-esteem in this way and this helps in the development of self-awareness.

Checklist

1. More weak branches ^ low esteem(negative traits)
2. More strong branches ^ high esteem(positive traits)

3. Strongly condemn the action of Raghav.
4. Give circumstantial situations to support Raghav's action.
5. Emphasis on self-discipline which Raghav should have followed.
6. Takes Raghav's action lightly.

Associate Questions

In what ways do NGOs play a vital role in discouraging use of drugs and alcohol?

Is alcohol present in medicinal preparations? What are the medicinal uses of alcohol?

Year end Evaluation

What are the reasons for the students' attraction for drugs?(long answer type)

List out different drugs obtained from plant extracts and their ill effects(essay type)

What measures are taken by peers and teachers to avoid the use of drugs by youth
(short answer type)

What is LSD? (Objective type)

How does alcohol affect our general health?

Exemplar 9

Topic: How do we conserve bio-diversity?/Unit X/Chapter 15

Overview: It has taken millions of years to accumulate the rich diversity in nature through the process of evolution. Increase in urbanisation and depletion of forest resources and pollution and its effects has led to loss of many species. The present rates of species loss may lead to wiping out of many species from the surface of earth. One of the concerns of international community is to conserve biodiversity. It is possible by *in situ* (on site) and *ex-situ* (off-site) conservation.

Objectives: To enable the students to think in various ways about tackling the problems of conservation of endangered, threatened and extinct animals and plants.

Columnar Framework

Sub topic	Concept	Sub concepts	Process Skills	Aligned life skills	Take away Life skills
Types of conservation	<i>In situ</i> (on site) conservation <i>Ex situ</i> (off site) conservation Endemic species Red data book	Urgency of conservation of biodiversity at specific sites Measures to conserve biodiversity	Inferring Predicting Interpreting	Understanding Observation	Decision making Rationality Critical thinking

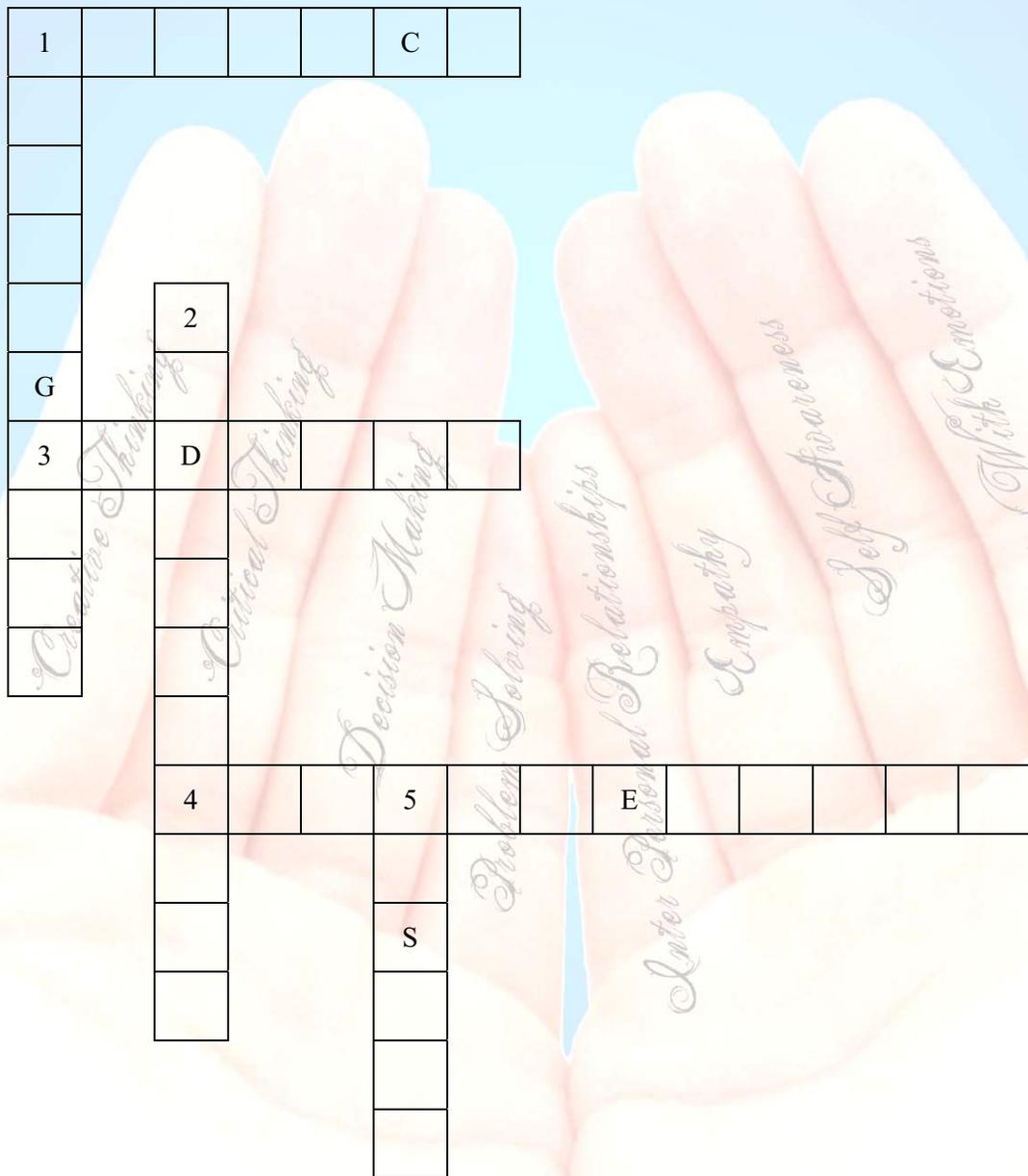
Materials: A puzzle/crossword/ photographs/chart papers

The Process

Engage

The teacher engages the students in activities to find out through browsing about existing number of species /endemic species/endangered species and details of the Red Data Book. They work out a puzzle to develop critical thinking.

Teacher asks the students to complete the following word puzzle.



Down: 1. Species on the verge of extinction.

2. A book carrying information about endangered species.

5. Consequence of deforestation.

Across: 1. Species which have vanished.

3. Species found only in a particular habitat.

4. Variety of plants, animals and micro-organisms found in an area.
(Self knowledge)

The answer: Down: 1. Endangered

2. Red data book

5. Desert

Across: 1. Extinct

3. Endemic

4. Biodiversity

While solving the puzzle, the students will be initiated to terms/concepts of endemic species, extinct animals, endangered species, biodiversity, etc. (and will develop critical thinking and rationality).

Explore

The students go deep into the details of extinct/ endangered plants mentioned in the red data book. For e.g., one of the endangered species is the gymnosperm *Ginkgo biloba*. Where is this plant found in India? What is its nativity? What are the characteristic morphological traits?

Explain

The students explain the above genus and its morphology in detail and advocate ways and means of preserving the germplasm through traditional and innovative practises for the future. The students explain the meaning of *in situ* (on site) and *ex situ* (off site), and their implication for conservation of biodiversity i.e. save endangered, threatened animals and plants.

The students explain that *in situ* conservation takes place in sacred groves and ask whether *ex situ* conservation of animals and plants is necessary to conserve biodiversity in sacred groves?

Elaborate

The explanation is extended to other extinct species like [^] *Rhododendron kanehirai* (Taiwan), *Terminalia acuminata* (Brazil), *Dipterocarpus cinereus* (Sumatra), *Lepidodendron*, *Calamites*, *Sphenophyllum*, etc. The teacher starts a group discussion and experiential learning.

The teacher starts a group discussion.

She gives two problem situations and asks what precautions are to be taken to solve them?

Problem Situation 1

In India, vulture/tiger population is alarmingly decreasing.

Problem Situation 2

The number of species of *Nepenthes khasiana*/Mangroves are decreasing.

(*Nepenthes khasiana* is an endemic species only available in Khasi Hills)

All these animals and plants may be extinct at one point of time. So what may be the reason for their reduction in number and what precautions are to be taken to save them?

The students while solving the above problem identify the problem, gather information, create alternatives, implement and arrive at a solution. The students come out with answers: *In situ* (on site) for first problem and *Ex situ* (off site) for second problem. The students rationalize that one reason for the reduction in number is due to disturbance in food chain/food web. Precautions to be taken include ensuring survival of existing species through food chain and ensuring similar climatic conditions through out the year for *Nepenthes* (Rationality). They give examples of where *in situ* and *ex situ* conservation has been done to take care of biodiversity conservation in your state and your immediately neighbouring states.

Narrating experiences

Teacher states that in response to the above questions a student from a village of Madhya Pradesh share his story/experience related to sacred groves.

There were sacred places in a village which were called Devasthalas/Saranas. It was a small patchy forest where village deities were located. The villagers were not allowed to enter into one of these forest areas which was called Kadamara Sarana. It was believed that ghosts/evil spirits/God inhabited these. It is believed that anybody who enters into that forest would suffer from sudden fever, vomiting or death. So people were afraid of that area. The village priest allowed the people to enter into that forest on specific festival days. Since there were no collections, cutting of fruits, flower, twigs, etc. made from that area, the variety of plants and animals present there were from ages and there was no threat to them.

There was another sarana which was called phool sarana, where we were allowed to play. Men and women were allowed to collect flowers, fruits, twigs, branches, etc. Villagers entered these forests at any time. But they were not allowed to cut any plant from forests in this sarana on festival days. The priests and people together worshipped village Gods present in that forest. Both saranas are considered as treasures of plants and animals. Many outsiders came to list out the available plants and animals and went out with great surprise to see new variety of plants and animals which were not available anywhere (analytic ability).

After the story the teacher asks the students to discuss:

1. How have sacred groves helped in conservation of local specific species of plants and animals since ages?
2. What will happen if people of the village change their religion and stop worshipping plants/God/Goddesses of forests? How will it affect biodiversity conservation?

Evaluate

The students question themselves as to ^

Why species die/disappear?

What are sacred groves?

Why is conservation important?

How rich is the flora of India?

What is a hot spot?

Associate Questions

How are *in situ* (on site) and *ex situ* (off site) conservation practically implemented?

How does conservation of biodiversity help in sustainable development?

Dodo (in Mauritius), Sew Cow (in Russia) and Bali Tiger (in Bali) are endangered animals. Make a list of vulnerable animal and plant species.

What precautions need be taken to save the endangered species?

Year end Evaluation

What is the need for biodiversity conservation ? Relate it to ecological balance with suitable examples(long answer type)

Differentiate between *in situ* and *ex situ* conservation?(short answer type)

Give five examples of major *in situ* and *ex situ* conservation and how they helped in biodiversity conservation in our country(objective type)

Collect case studies of conservation of animals and plants (*ex situ* and *in situ*) (long answer type)

Prepare a board game taking into consideration positive and negative aspects of biodiversity conservation (short answer type)

Collect information about sacred groves of different states and write the advantages of sacred groves.

Prepare a list of endangered, extinct animals and plants (as per IUCN categories list).

If possible, collect the photograph of some of these and make an album.

What are the different types of biodiversities? Discuss with suitable examples (short answer type).

Exemplar 10

Topic: Ecosystem Services/Unit-10/Chapter-14

Overview: Healthy ecosystems provide wide range of goods and services. They are related to economic, environmental and aesthetic aspects of our lives. Considering the goods and services provided by different ecosystems, they are to be price-tagged. The cost of ecosystem services vary according to nature's life support services.

Objectives: To enable the students to

1. To know about the characteristics of a healthy ecosystem.
2. To estimate the cost of various ecosystem services.

Columnar Framework

Sub-topic	Concept	Sub-concepts	Process skills	Aligned life skills	Take away life skills
Ecosystem	Healthy ecosystem	Healthy ecosystem and goods and services Meaning of ecosystem services Price tag for ecosystem services. Aim of price tag in climate regulation, biodiversity conservation and tackling environmental issues	Inferring Interpreting Predicting Explaining	Analytic and synthetic abilities Inductive-deductive reasoning	Anticipation of consequences Decision making

Materials: Chart paper and sketch pen

The Process

Engage

1. Students will be asked to list a number of ecosystems eg., terrestrial and aquatic ecosystem like deserts, marine, pond, lake, estuarine, forest ecosystems, etc.

- They are asked to choose one ecosystem listed above, and note down the characteristics to conclude that it is a healthy ecosystem (they develop analytic ability).
- Then they are asked to list different types of goods, activities given by an ecosystem (and to classify them into economic, environmental, cultural, aesthetic or any other group). The goods and activities could be listed on the board under various heads (This develops synthetic ability).

Healthy ecosystems are the basis of wide range of activities given by an ecosystem.

Explore

Students enlist goods and services from various ecosystems

Explain

Keeping in mind your experience related to goods/services provided by ecosystems, whether there should be price tag for forest goods and services. If yes, explain why? (Develops inductive-deductive reasoning). The students carry out group discussion.

A. Group discussions

The students are asked to fill up the following tables in a group of 5-6.

Group work 1: Some individuals give services to your family and how much do you approximately pay them.

	Services			Goods	
	Students	Gardener Servant	Driver	1 kg tomato	Bottle of oil
Payment Rs.					

Group work 2: Name the groups according to types of ecosystem i.e.

Marine Pond Forest Desert Garden

Ask them to list the goods and services provided to them/family/community/ society by their ecosystem on a chart paper and present it to the group.

B. Stock taking and marketing activity

Various developmental activities those which are going around us list the losses in the ecosystem due to one of these activities. Evaluate them, put price tag for losses and list implications of loss of ecosystem.

Students may be asked to take decisions (for Government) related to levying prices for various industries/setting parks/dams/thermal plants/mines. The students develop decision-making abilities and inductive-deductive reasoning.

Elaborate/Extend

Extend the idea of putting price tag to the situation in US (as per Robert Constanza), keeping in mind the priorities related to services and price tag.

Evaluate

The students are asked to put a price tag to goods and services of ecosystems and estimate value losses.

Associate Questions

What are the differences between unhealthy and healthy ecosystems?

Why should there be a price tag for goods and services provided by ecosystem? Explain.

What is the reason for putting different price tags for different services?

See the map of your own state and find out a place for starting a thermal plant considering losses and advantages.

Year end Evaluation

Carry out a case study of any two projects (Narmada Reservoir Project) and list losses and advantages caused by them (long answer type).

Give a detailed account of structure and functions of ecosystem (essay type).

What is energy flow? Illustrate with proper reasons (short answer type).

How ecological succession helps in the maintenance of species and community? (long answer type)

Exemplar 11

Topic: Microbes in Human Welfare/Unit-8/Chapter 10

Overview: Microbes are the major components of biological systems on this earth. Microbes are present in soil, water, inside our bodies and that of other animals and plants. Anaerobic respiration which a microbe undergoes is exploited by human beings for various household products.

Example: preparation of edible items like bread, idli, dosa, yoghurt, khaman, dhokla, naan, cheese.

Objectives

To apply creative thinking for production of various edible products using microbes.

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Microbes in household products	Fermentation in microbes	Different edible products formed	Observation Originality Flexibility Fluency	Creativity	Creative thinking Divergent thinking

Materials

Materials of their choice to prepare and carry out the activity. e.g. milk, flour, yeast, etc.

The Process

Engage

Students are asked to visit their kitchen and identify the products which are actually prepared using microbes.

Explore

How is it prepared? They make an edible product using a microbe. Chemicals are given to the students and using this technology they are asked to prepare any product.

A. Brainstorming

Theme: Benefits of pasteurization of milk

The students were asked to understand the process for which microbes have been used. In this activity the students undergo a brainstorming session to list out products produced using microbes.

1. What is pasteurised milk?

ideas- Milk that is heat treated

- Milk that is packeted
- Milk that is refrigerated

2. Benefits of pasteurisation are

ideas- elimination of risk of diseases

- increases nutritional values of milk
- removes colostrum from milk

3. Pathogens removed during pasteurisation are

ideas- *Mycoplasma* spp.

- *Salmonella* spp.
- Bacteria/Fungi like *Escherichia coli*
- All the above

4. During pasteurisation

ideas- milk is heat treated at 40°C for 20 minutes

- milk is cooled
- shelf life of milk increases

Guidelines for brainstorming

1. The students are allowed to think freely to arrive at a conclusion.
2. They were asked to list out as many products as possible using microbes.
3. They were asked to recognize the process for usage of microbes in edible products.

Based on the brainstorming the students were asked to demonstrate the activity of preparing new products using microbes.

Explain

The principle behind the use of microbes in the above mentioned edible products is explained. What happens when inoculum is added to milk? The bacteria multiply, lactic acid is produced and milk turns sour and into curds.

Elaborate

Extend the concept to something new using the same principle. Also list out products formed using meiosis (good and bad).

B. Demonstrations ^

Make an edible product using a microbe

Using technology, produce any product.

C. Designing a new product (creativity)

Questions	Idea 1	Idea 2	Idea 3
Make curds	Inoculate with <i>Escherichia coli</i>	Inoculate with yeast	Inoculate with lemon juice

Score maximum for Idea 1

Idea 2

Idea 3

Evaluate

1. Work sheet
2. Recipe of new product by fermenting.
3. To collect recipe from other state/country where these techniques are used.

Divergent thinking processes are triggered and students generate new ideas for innovative products using microbes. They are able to use flexibility to produce new products using microbes.

Associate Questions

How does fermentation give a characteristic flavour and taste to the food?

Do all microbes do the same thing?

Why are curds added to milk ?

What makes food spongy and soft?

Year end Evaluation

State implications of microbial activity in edible food (essay type question).

Exemplar 12

Topic: Principles of Inheritance and Variation/Unit-7/Chapter 5

Overview: The chromosomal number in normal human being is 46 ($2n = 2 \times 23$). Whereas due to abnormality during cell division (i.e. during gametogenesis) (aneuploidy) abnormalities will be manifested in some individuals for eg., Turner's syndrome, Klinefelter's syndrome.

Objectives

- To understand abnormality of cell division leading to chromosomal aneuploidy.
- To know group of morphological abnormalities in people with aneuploidy.
- To develop empathy towards such children with abnormality.

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Chromosomal disorders	Aneuploidy	Abnormalities	Understand, know, develop	Knowledge Understanding	Empathy

Materials

Students

The Process

Engage

Have you come across a child/adult with both physical and mental disabilities in your day-to-day life? If you have observed these people closely list out your observations regarding their physical and mental characteristics and complications.

How do you feel about these children/people? From the above observations conclude the name of the abnormality from which the person suffers. Try to find the name of the abnormality and causes for such abnormalities leading to syndromes.

Explore (in groups)

Find out the names of other such abnormalities and list out the syndromes/ characteristics and complications.

Explain

Each group leader explains the name of syndrome, reasons, abnormalities and complications to the whole class.

Role play

The teacher assigns different roles to students, such as that of

- abnormal child
- parent
- siblings (brother/sister)
- neighbours
- special educators
- rehabilitation counselors

All the above will play their assigned roles, and others are asked to observe keenly and reflect upon the situation and different roles. The students should be able to comprehend some of the following emotions.

- Understand the difficulties faced by parents, sibling and neighbours of abnormal children.
- Accept that fellow beings such as these children also contribute to the society.
- Reflect on the attitude change towards such children (do not make fun/ridicule them; be kind and helpful). (Students develop Empathy)

Associate Questions

Explain why you would accept such children as fellow human beings (and help them in their rehabilitation)?

Interview the parents and sibling and find out how they are helping the special child to be independent.

Year end Evaluation

1. What is a syndrome?(very short answer type)
2. What is the reason for chromosomal abnormalities?(short answer type)
3. Name the abnormalities caused by sex chromosomes (long answer type).
4. Write an autobiography of a special child, who is attending a rehabilitation centre and is trained to join a job with only assembly line(long answer type).
5. Visit a rehabilitation centre and find out how many special children are leading an independent life (long answer type)
6. Discuss Mendel's laws of inheritance (Essay type)
7. Explain Monohybrid Experiment with a suitable example (long answer type)
8. What is incomplete dominance? Describe with an example (short answer type)
9. Define law of independent assortment (very short answer type)

EXEMPLARS IN CHEMISTRY

Exemplar 1

Topic: Non-ideal solutions/Unit 2

Overview

When a solution does not obey Raoult's law over the entire range of concentration, then it is called a non-ideal solution. The inter-molecular attractive forces account for the positive or negative deviation. Elevation in boiling point is a property of liquids which is one of the colligative properties. The property which depends on the number of solute particles irrespective of their nature and relative to the total number of particles present in the solution.

Objectives

1. To reason/interpret the graphs on the basis of the data.
2. To be able to solve problem reasoning deviation from ideal behaviour.
3. To appreciate the advantages of team work from the study of colligative property.

Columnar Framework

Subtopics	Concepts	Sub-concepts	Process skills	Aligned life skills	Take away life skills
Vapour pressure of solutions	Refer below	The pressure exerted by the vapour above the liquid surface in equilibrium with the liquid at a given temperature is called vapour pressure of the liquid.	Observation Inference	Problem solving skills	Problem solving skills
Reason for deviation		The difference in new forces and old forces between solute and solvent molecules result in deviation.	Interpreting graphs		
Lowering of vapour pressure		Relative lowering of vapour pressure is a colligative property	Solving numericals		
Colligative property		Some properties depend only on the number of solute particles	Citing examples Reasoning		

Concepts

1. An ideal solution is one which obeys Raoult's law.
2. If the new forces (after solution) are weaker than the earlier forces (before solution), it shows positive deviation.
3. Relative lowering of vapour pressure is a colligative property.
4. Colligative property depends on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution.

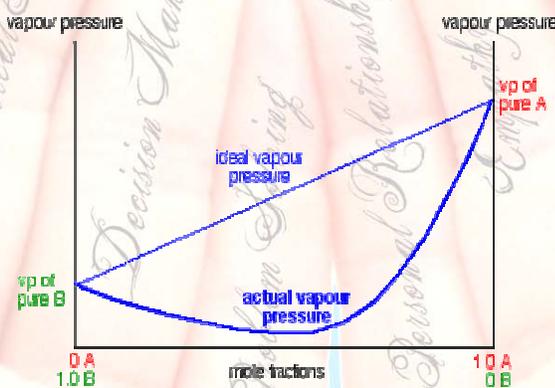
Materials

Charts, graph papers

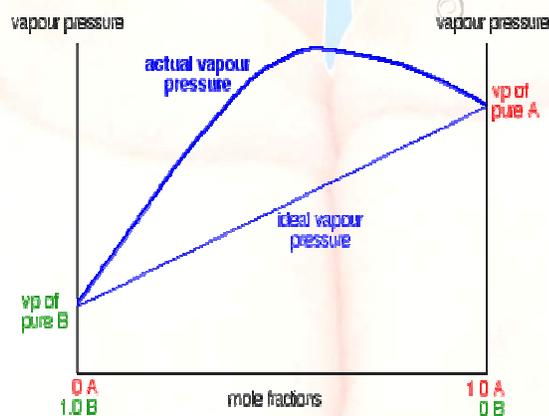
The Process

Engage

Teacher shows the charts of positive and negative deviations from Raoult's law ($p_1 = x_1 p_1^\circ$)



Negative Deviation



Positive Deviation

Figure 1: Chart showing positive and negative deviation

Explore

Students explore the two graphs with positive and negative deviations from Raoult's law enabling critical thinking. Teacher asks i) What do you observe in a positive deviation? ii) What do you observe in negative deviation? iii) How do you account for the deviations? Students explore the various reasons that could be responsible for positive and negative deviation facilitating creative thinking.

Explain

Teacher shows charts of the solutes responsible for positive and negative deviations and asks students to explain the relevance of examples to encourage effective communication.

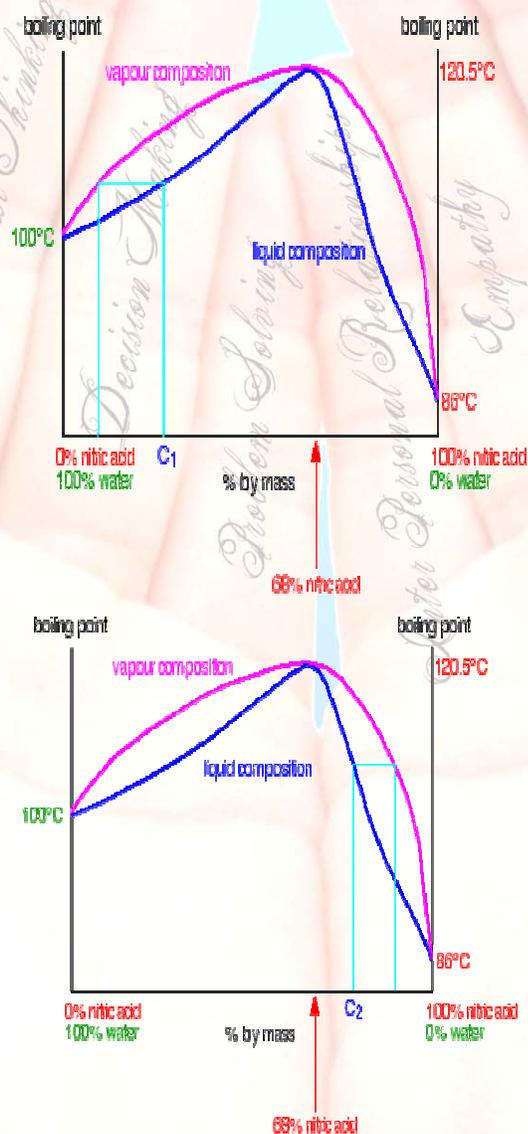


Figure 2: Changes in solvent properties 1

Study the graphs with respect to the solutes and correlate the graphs.

Teacher uses students' responses and facilitates generalization in proper terms.

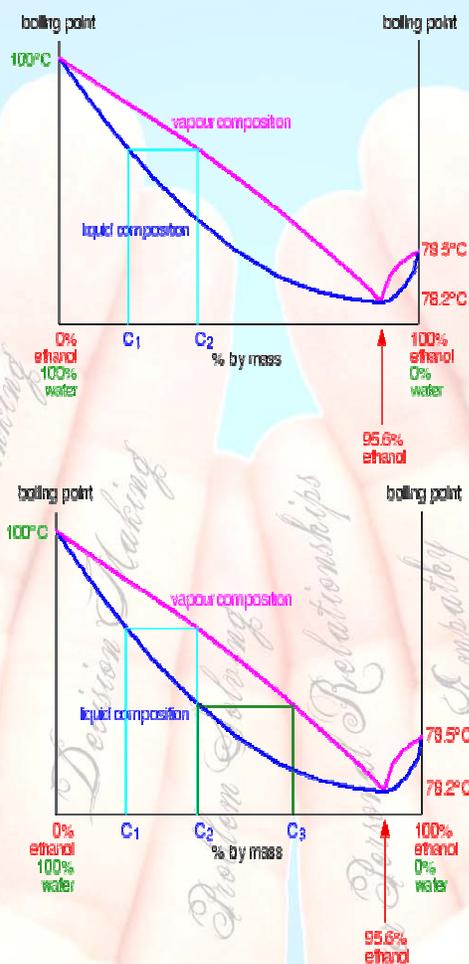


Figure 3: Changes in solvent properties 2

Situational analysis is done and an analogy drawn to life situations wherein an individual behaves differently in different situations in order to enable understanding of the behaviour of the solvent which changes its properties in the presence of different amounts of the solutes.

Elaborate

Students elaborate their idea by providing new examples and non-examples to increase self-awareness. Teacher asks the students to give similar examples of solutions for positive and negative deviations by applying the generalizations just arrived at.

Evaluate

Students evaluate properties whether a given property is colligative or not prompting decision making. Teacher asks students How do you make a solution boil at lower or higher boiling point than the solvent? The students are brainstormed with the following questions to promote problem solving skills.

1. Explore the properties and account for their characteristics.
2. There could be more than one reason for a particular behaviour/characteristic. Find out the reason.
3. Usually the properties of substances are explained on the structure and bonding. True or False?
4. Colligative properties are due to the number of particles and not on the nature of the substances. Justify.

Associate Questions

Define non-ideal solutions.

Why do solutions deviate from ideality?

What is a colligative property?

What do you learn from a bulk property?

Year end Evaluation

Assignment on the behaviour or properties of ideal and non-ideal solutions.

Exemplar 2

Topic: Molecularity of a reaction/Unit 3

Overview

Molecularity of a reaction is obtained by theories proposed to explain the steps of a reaction. The steps are arrived as the evidences available from experiments. A knowledge of molecularity helps to know the criticality of reactants in a reaction. Molecularity is the actual number of molecules involved in the rate determining step of a reaction.

Objectives

1. To compare a unimolecular and bimolecular reactions, and recognise the need of base as a reactant.
2. To be able to define molecularity.
3. To recognise the use of molecularity in making a chemical industry profitable/economically viable.
4. To recognise the importance of slow step as a rate determining step.

Columnar Framework

Subtopics	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Reaction, pathways	Refer below	Same type of reactions may differ in their pathways	Citing examples recognising	Problem solving Decision making	Problem solving Decision making
Mechanism of reaction		A reaction mechanism is a theory proposed	Hypothesising		
Application of molecularity		Helps industries to make production economical	Apply the knowledge		

Concepts

1. Molecularity is the actual number of the molecules involved in the (slow) rate determining step of a reaction.
2. Molecularity is obtained from theories proposed on experimental evidences.

Materials

Charts

The Process

Engage

The students are engaged in a studying a chart showing hydrolysis of alkyl halides (primary and tertiary). Students discuss the hydrolysis of primary and tertiary alkyl halides enabling critical thinking. Teacher gives the information that the hydrolysis of Primary halides is one step reaction and tertiary halide is a two step reaction.

Explore

Students explore the proposing mechanisms on experimental evidences facilitating creative thinking. Teacher facilitates student thinking by providing more information on carbonium ion.

Explain

Students explain the mechanism and its applications in industries prompting decision making. After explaining the concept of a slow step and a fast step teacher asks the necessity of using Sodium hydroxide. Also hints whether they can use a cheaper base. Students recognize that water is a cheaper and effective substitute.

Extend/Elaborate

Students are asked to analyse tasks^from the life situations and elaborate finding slow steps and steps to enhance the slow steps enabling problem-solving.

Evaluate

In evaluating the efficiency of tasks/reactions students are asked to suggest alternate designs. Situational analysis is done on a day-to-day task of Xeroxing a book and an analogy drawn.

1. Analyse the task and find out the slowest step.
2. Is the slow step crucial in reaching the goal?
3. How to enhance the slow steps and increase efficiency?
4. Exercise economy in fast steps and find interventions for the slow steps.

Associate Questions

Define molecularity.

Reactions more than molecularity three are uncommon. Give reasons.

How can you increase the efficiency of a work which is done in number of steps?

You are asked to explore the possibility of cutting down the cost of production of a chemical. How do you go about it?

Year end Evaluation

State examples from real life situations here for practise of life skills.

Exemplar 3

Topic: Electrochemistry of cells/Unit 3

Overview

Electro-chemical cells are often used to generate the electro-chemical series. By using different half cells the reduction potentials of the half cells can be graded. The series is of great help in understanding the metallurgical processes like reduction of the ores, electrolysis and substitution reactions. There is a lot of scope for the teacher to make students think critically and apply in designing new procedures.

Objectives

1. To recognise that different half cells have different potentials.
2. To reason out the EMF measured in an electrolytic cell.
3. To apply the knowledge in the choice of reducing agents in metallurgical processes.
4. To be able to design cells of required EMF.

Columnar Framework

Subtopics	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Electrode potential	Refer below	A metal in contact with its ion forms a double layer	Cite examples	Problem solving Critical and Creative thinking	Problem solving skills Critical thinking skills Creative thinking skills
EMF of a cell		The potential difference between two half cells is measured as EMF.	Reasoning		
Electrochemical series		A metal having higher reduction potential has higher reducing ability.	Apply in new situation		

Concepts

1. A metal in association with its salt solution forms a half cell.
2. The potential difference between two half cells connected by a salt bridge may be measured using a potentiometer.
3. Elements with high reduction potentials are better reducing agents.
4. A metal with lower reduction potential can displace another metal with a higher reduction potential.

Materials

Cells and half cells.

The Process

Engage

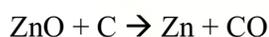
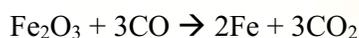
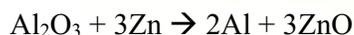
Students are divided into groups and engaged in the task of forming cells and measuring EMF, arranging the half cells in the increasing order of potentials, accounting for negative EMF, designing cells of required EMF and thinking critically about metallurgical processes and the suitability of choice of reducing agents. Students are engaged in construction of electro-chemical cells and measuring their EMF.

Explore

Students explore the construction of cells to get derived EMF enabling critical thinking. Teacher shows the chart of Electro-Chemical Series and asks students to form cells for given EMFs. The student develops thinking skills by construction of half cells and their EMF measurements (experiential learning).

Explain

Different metallurgical processes are given by the teacher and students are asked to explain the suitability of the choice of reducing agent prompting decision making.



Teacher asks the alternate choice of reducing agents in the above reactions. The students are able to make decisions concerning the choice of reducing agents or half cells.

Evaluate

Teacher asks the question: Copper will not give hydrogen with dilute acids while zinc does. Give reasons. Students are asked to extrapolate to substitution reactions prompting logical thinking.

Associate Questions

How does a half cell develop a potential?

What is the role of a salt bridge?

The EMF of a cell is found to be negative. What does it convey?

What are the different ways an electromagnet series can help you?

In the preparation of hydrogen, why is copper not used with dilute acids?

Year end Evaluation

Explanation of electrolysis and substitution reactions through examples in day-to-day life.

Justify the choice of materials used for electroplating.

What are the metals that we use in our daily life situations? Justify.

Exemplar 4

Topic: Catalysis/Unit 5

Overview

Catalysts are substances which alter the rate of a reaction without undergoing any permanent change. Most of the times, catalysts are used to enhance the rates and very rarely to decrease. Even small amounts of catalysts act very efficiently. Catalysts are very specific in their action. Catalysts are known to provide an alternate path for a reaction with lower activation energy. In a reversible reaction, catalysts influence both forward and backward reactions to the same extent. One of the theories on catalysis suggests that the catalyst may enter into the reaction forming an intermediate which is finally recovered along with the product.

Objectives

1. To recognise the role of catalyst by comparing catalysed and uncatalysed reactions.
2. To recognise the specific nature of a catalyst.
3. To reason out the action of catalysts on the basis of theories.
4. To appreciate the role of catalysts in life situations..

Columnar Framework

Subtopics	Concept	Sub-concept	Process skills	Aligned Life skills	Take away life skills
Catalyst as a factor influencing rate	Refer below	Some reaction rates are greatly influence by the addition of a small amount of foreign substance	Cite examples	Problem solving Decision making Self awareness Creative thinking critical thinking	Solving, thinking and understanding skills
Nature of the catalyst		A catalyst is specific to the reaction and has a characteristic set of properties	Cite examples and non-examples		
How does a catalyst work?		The catalyst lowers the activation energy of the reaction	Interpret the graph		

Concepts

1. A catalyst is a substance that alters the rate of a reaction without undergoing any permanent change by itself.
2. The action of catalyst is specific to the reaction.
3. Catalyst reduces activation energy of the reaction by providing an alternate path.

Materials

Charts showing catalysts in reactions and Catalytic activity

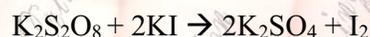
The Process

Engage

Students are engaged in demonstration of catalysed and uncatalysed reactions.

Teacher demonstrates the following experiments:

- i) Decomposition of hydrogen peroxide in the presence / absence of a pinch of Potassium permanganate. $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$.
- ii) Formation of Iodine from potassium persulphate and Potassium iodide with and without a pinch of Ferrous sulphate.



Explore

Teacher also presents a chart showing the rates of catalysed and uncatalysed reactions. The students study the chart showing rate of catalysed and uncatalysed reactions to know the nature and characteristics of catalysts. The students explore the chart to see the relationship between catalysts and their structure/bonding prompting logical thinking. Teacher gives a hint that most of the transition elements are used as catalysts. Students explore the specific nature of catalyst by using the catalyst in other reactions.

Explain

Teacher asks the students: We have experimental evidences to show that a catalyst does not undergo any permanent change in the reaction. Then how do you think the catalyst will help to hasten the reaction? Can you suggest any model? The students hypothesise in groups about the possible role of a catalyst in reactions facilitating creative thinking. Students explain the working of the catalyst with their own hypothesis facilitating creative thinking.

Elaborate/Extend

The students identify the use of positive and negative catalysts in life situations prompting decision making. Students extrapolate the use of catalysts in life situations prompting decision making:

- a. catalytic agents in success stories, processes and organisation.
- b. weeding out demotivating factors

Evaluate

Students evaluate the role played by each of the above factors.

Associate Questions

Define a catalyst.

How does a catalyst alter the rate of a reaction?

The equilibrium constant is not affected by the use of a catalyst. Give reasons.

In day-to-day life situations identify persons who:

1. catalyse our good work and those
2. check/retard our misdeeds.

Year end Evaluation

State examples of catalysed and uncatalysed reactions.

How can you help your child as a parent to have all-round development in a school?

Exemplar 5

Topic: Imperfections in solids (Solid State Physics)/Unit 1

Overview

Usually a solid consists of small crystals. These crystals have defects in them. These defects are responsible for the useful properties of many materials such as conductors, semi conductors and gems. Defects are imperfections and are of different types.

Objectives

1. To bring out drawing and problem-solving skills.
2. To develop critical and creative thinking and to facilitate divergent thinking.
3. To empathise with others

Columnar Framework

Subtopics	Concepts	Sub-concept	Process skills	Aligned life skills	Take away life skills
Defects	Refer below	Types of defects	Drawing	Self awareness Empathy	Empathy skills

Concepts

1. Defects are of two types, namely point defects and line defects.
2. Point defects are irregularities or deviations from ideal arrangement around a point.
3. Impurities are responsible for some useful properties.
4. Semi conductors, gems and super conductors and computer chips are perfect materials with imperfections.

Defects

i. Point defects	ii. Line defects	
iii. Irregularities from ideal arrangement around iv. A point or an atom in a crystalline substance	v. Irregularities or deviations from vi. ideal arrangements in entire rows of lattice points vii. (crystal defects)	
viii. Stiochiometric defects	ix. Impurity defects	x. Non-stiochiometric defects

<p>xi. These do not disturb the stiochemistry of the solid</p> <p>xii. Vacancy defects-some lattice sites are vacant</p> <p>xiii. Interstitial defects-some constituent particles occupy an interstitial site</p> <p>xiv. Frankel defect-shown by ionic substance where there is a large difference in size of ions.</p> <p>xv. Schottky defect-is a vacancy defect in ionic solids</p>	<p>xvi. One cation replacing another cation</p>	<p>xvii. The constituent elements in non-stoichiometric ratio due to defects in their crystal structure</p> <ol style="list-style-type: none"> 1. metal excess defect anionic caused by metal excess defect 2. metal deficiency defect
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Materials

Exemplar modules can be prepared by using small plastic balls, spring/metal wires of various sizes, semi-conductor materials, gems.

Models can be used to illustrate different types of defects eg., vacancy defects, interstitial defects, Frankel defects, Schottky defects.

The Process

Engage

The process of teaching and learning is established through activities and demonstrations. The students are engaged in experiments showing conduction of electricity through metals and develop self-awareness.

Explore/Explain

The students explore and explain the process of conduction in metals through literature survey or browsing the net. Conduction of electricity in metals is due to presence of partially filled valence crystals. The atomic orbitals of metal atoms in a solid form closely placed molecular orbitals known as bands. If the gap between filled band and unoccupied band is large, then the solid does not conduct electricity. Many semi-conductors are the solids in which impurity (imperfection) is deliberately added to reduce the gap between filled band and unoccupied band. Imperfections thus are essential properties.

Extend

The structure of gems is elaborated upon. The enchanting beauty of gems and diamonds are nothing but imperfections. Human beings learnt to deliberately introduce impurities into solids to produce solids that are most beautiful gems and/ or valuable computer chips. The students present anecdotal record of a ruby as follows and learn to empathise.

I am a Ruby. I have been prepared by crystal pulling method used for Ruby and Sapphire rod-shaped crystals. I was first of all just molten material of appropriate composition. A seed crystal was lowered into the melt and rotated. The seed was slowly pulled out of the melt and rotated and now resemble shape of a ruby.

Evaluate

Write the autobiography of a diamond. In writing this account, the students develop knowledge, self-awareness and empathy.

Associate Questions

How does a solid conduct electricity?

How is a semi-conductor prepared?

Imperfections are sometimes perfections. Explain with examples.

What moral (life skill) did you learn from this lesson?

Year end Evaluation

I am a man-made material and have the same composition and crystal structure as the natural material. Justify.

Exemplar 6

Topic: Nucleophilic substitution reactions/Unit 4

Overview: Nucleophilic substitution reaction occurs via two pathways Sn1 and Sn2. The reaction condition and the nature of the reactants decide which way the reactions take place.

Objectives

1. To enable students to know the two major types of substitution reactions
2. To enable them to recognize the two different types of reactions.
3. To enable students to differentiate between S1 and S2 reactions.
4. To analyse the nature of the substrates in the Sn1 and Sn2 reactions
5. To predict which substrate may undergo Sn1 or Sn2 reactions

Columnar Framework

Subtopics	Concept	Sub-concept	Process skills	Aligned Life skills	Take away life skills
Substitution reaction	Nucleophiles Electrophiles	Sn1 and Sn2 pathways	Identification, Explanation, Elaboration	Problem solving	Problem solving

Materials

Text, Black board, chalk pieces, tables and chairs.

The Process

Engage

Students are aware of the substitution reactions. They can identify the substitution reactions from a group of reactions given to them. Students can define and give examples of nucleophiles and electrophiles during the brainstorming sessions.

Explore

The students identify the nucleophilic reactions and substitution reactions. In electrophilic substitution reactions positively charged species/electron deficient species attack electron rich carbon of organic substrates. In nucleophilic substitution reactions negatively charged electron species attack electron deficient carbon of organic substrates. Nucleophilic substitution reactions are of two types:

They are provided with a problematic situation by giving reactions

Reaction between (-)- 2 methyl buten-1-ol and HCl producing (+)l- Chloro-2-methyl butane. They try to explore why the product has opposite configuration of the reactants.

Explain

Explains that nucleophilic substitutions are of two types-Sn1 and Sn2. In Sn1 mechanism the leaving group leaves and a carbocation is obtained and the incoming nucleophile can attack the carbocation from both the sides above and below the plane the carbocation. In Sn2 mechanism, the incoming nucleophile approaches the substrate exactly at 180 degrees to the leaving group. Students may have misconceptions/queries when all the four valencies of carbon have been already satisfied, for then how can the incoming group attack? They discuss in groups and develop problem solving abilities.

Teacher clarifies the idea that all the Sp³ hybrid orbitals which are involved in the bond formation have a small lobe in the opposite direction. When the leaving group starts leaving, the incoming group attacks the carbon through the small lobe. As the leaving group leaves the incoming group establishes the bond with carbon. The overall valency is retained as four.

Students engage in group discussions and defend their ideas regarding the different types of reactions.

Elaborate

Students discuss in groups and elaborate the concept of nucleophilic reactions selecting more examples of substitution reactions. Through discussions students develop a broader understanding of the reactions and may be able to differentiate between the two types of reactions. Students develop skill in making and balancing equation.

The students brainstorm on substitution reaction in primary halogenoalkanes and develop problem solving abilities.

Associate Questions

1. What is a nucleophile?
 - an electron
 - a proton
 - an atom
2. What is an electrophile?
 - positive atom
 - neutron
 - electron

3. How does the reaction occurs?

nucleophilic+R. LG \rightarrow R. nucleophilic+LGi

R. nucleophilic+R. LG \rightarrow nucleophilic + LGi

4. What are the reactions in organic chemistry with this mechanism?

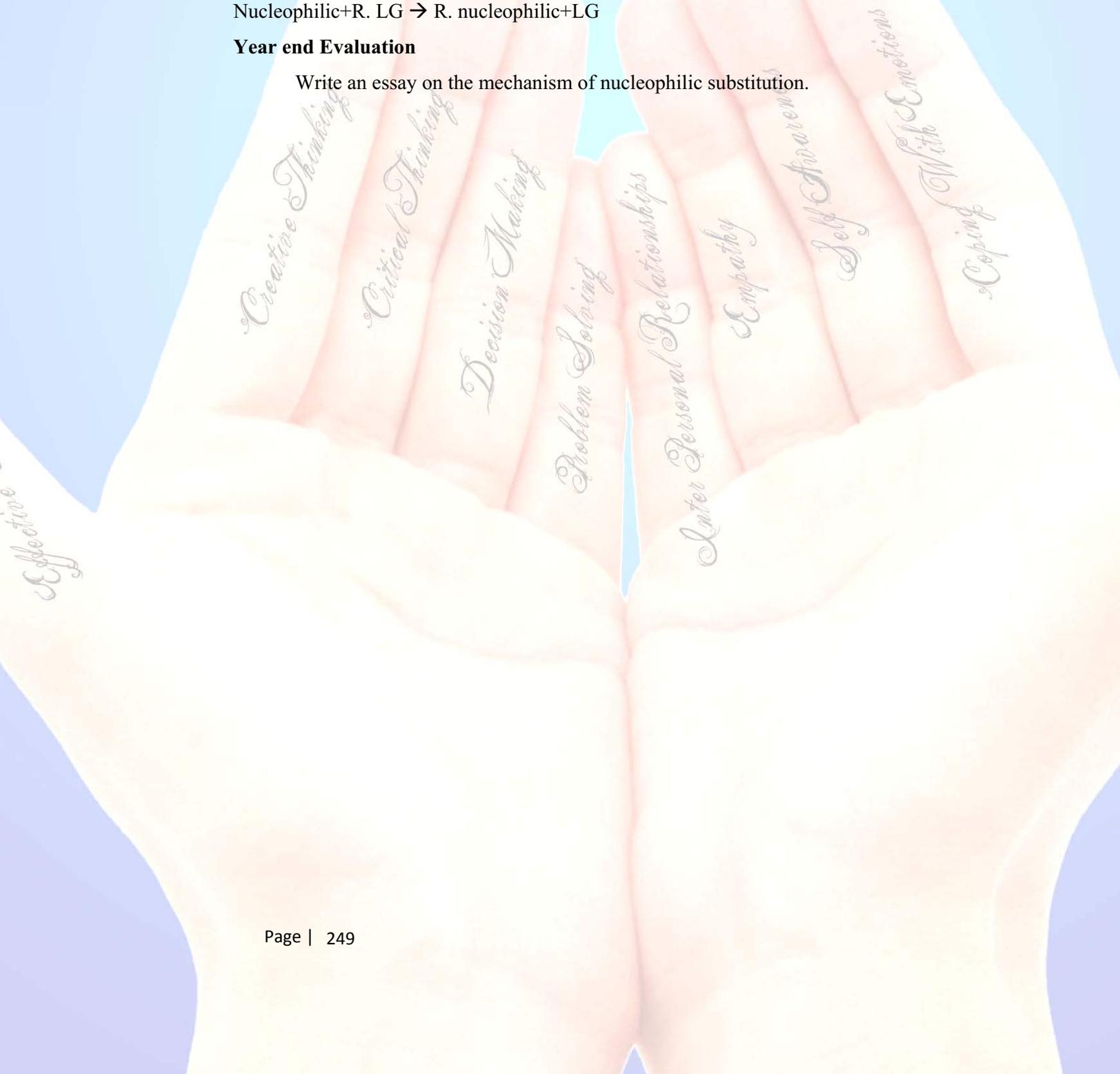
Organic reduction, hydrolysis, ether synthesis, Finkel stem reaction, etc.

Summary: Nucleophilic is an electron that bonds with positive atom electrophile to get a learning group.

Nucleophilic+R. LG \rightarrow R. nucleophilic+LG

Year end Evaluation

Write an essay on the mechanism of nucleophilic substitution.



Exemplar 7

Topic: Chemistry for everyday life-antacid/Unit 9

Overview

Few important classes of drugs have therapeutic action. Antacids are a class of drugs which are used for treating persons with acidity. In some of them, antihistamines are used to interfere with the natural action of histamines.

Objectives

To enable the students to

- understand the action of antacids on stomach.
- analyse the content of various antacids available in a drug store
- apply the knowledge of action of antacid on suggesting antacid for different persons
- anticipate consequences of use of metal hydroxides
- decide which antacids are to be suggested for persons suffering from acidity

Columnar Framework

Sub topics	Concept	Sub-concept	Process skills.	Aligned Life skills	Take away life skills
Chemistry in everyday life	Therapeutic action of different classes of drugs	Antacids	Observe Predict classify	Analyse Empathy Decision making Choosing from alternatives Anticipate consequences	Critical thinking

Materials

Antacid strips, chart papers and sketch pens

The Process

Engage

The students and teacher engage in discussing about the acid and its reaction on human body. Suddenly the teacher feels an irritation and pain in the stomach and expresses his uncomfortable feeling in front of students. He complains that he is having burning sensation in chest and stomach.

The students feel sorry and rush to help him by offering different solutions. One of the students offered water which helped the teacher feel better but the irritation

persisted. The students empathized with the teacher and they all came forward to help him feel comfortable by offering water, juice, butter milk and soda as well as antacids. The teacher chooses antacid tablets and takes them immediately. It soothes him and this experience stimulated the students to work on how antacids help in neutralising the acid level in stomach. The teacher thanks the students for their offerings and help to reduce pain and discomfort.

Explain

Students are asked to use net and discuss with family doctor and explain what will happen if excess metal hydroxide is taken and develop critical thinking through browsing and experiment method.

Explore

The students study the chemical content of antacids and answer the following. What will happen if hydrogen carbonate is used? Can we think of using any other alternative? For eg., metal hydroxides. Find out how these metal hydroxides work. In finding solutions to these problems, they develop critical thinking.

Extend

It is seen that some of the drugs have content of antihistamines. Why are antihistamines used in the above medicines?

Evaluate

The students are made to choose a remedy for illness from a list of options.

Situational analysis 1

In the above situation the teacher could feel the concern shown by the students towards him which is called empathy-an important life skill component. The students were able to understand the exact situation of the teacher which really moved them to help with concern.

When the question as to what will happen if excess metal hydroxide is asked/what are the side effects of consuming more metal hydroxides-it is the development of life skill of anticipation of consequences.

Buzz groups activity 1

Student groups list the names of antacids and analyse the content of those antacids (given strips of antacids). The students classify the antacids into hydrogen carbonate, metal hydroxides and anti-histamines.

Analyse the chemical contents of following

<i>gelusil</i>	<i>zintac</i>
<i>rانيتidine</i>	<i>Pan 40</i>

Students discuss in groups the functions of histamines and how they work in the stomach; and how and why antihistamines help to counter the effect of histamines and develop life skill of critical thinking.

Situational analysis 2

In Anand's family, his granny complains of acute burning sensation in chest. With his knowledge of use of histamines for acidity, Anand offers a cough syrup which has an antihistamine written on the content list. The granny takes it but her burning sensation does not subside. What may be the reason? Choose one from the following as the best answer.

He/she may be having heart problem.

The medicine given by Anand is an anti-allergic drug which is receptor specific.

There is acute ulcer in the stomach.

Anand should be able to think critically and decide whether antacid or anti-allergic drug could help his granny. Should Anand decide for himself or rush his granny to a specialist doctor. The decision making must be based on critical thinking with full fledged knowledge of antacids.

Associate Questions

1. What happens to the stomach when there is severe acidity?
2. Explain how different antacids work.

Year end Evaluation

Visit the net/discuss with a doctor and discuss the side effects of taking excess metal hydroxides. Discuss with elders at home (neighbourhood) and find out what are the home remedies to tackle acidity. Justify how/why they neutralize or nullify acidity.

Meet your family doctor, discuss why people suffer from acidity and what happens inside their stomachs? Discuss how prescribed drugs tackle the problem i.e. prepare a chart with chemical formulae of antacids.

EXEMPLARS IN PHYSICS

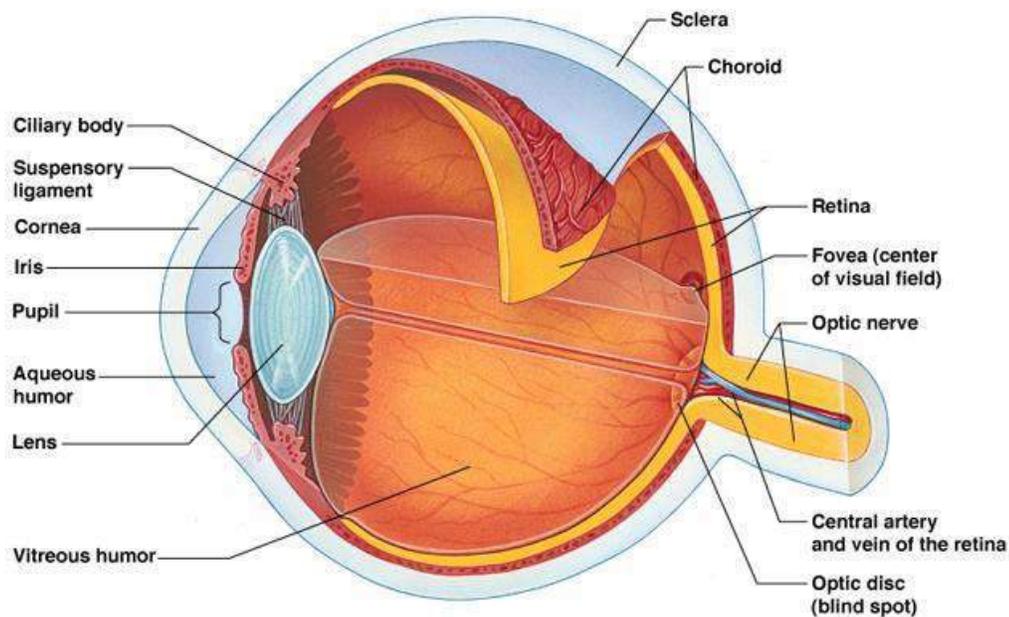
Exemplar 1

Topic: The human eye/Unit/Chapter 9

Overview: The human eye belongs to a general group of eyes found in nature called camera-type eyes. Instead of film, the human eye focuses light onto a light sensitive membrane called the retina. Here's how the human eye is put together and works: The cornea is a transparent structure found in the very front of the eye that helps to focus incoming light. Behind the cornea is a colored ring-shaped membrane called the iris. The iris has an adjustable circular opening called the pupil, which can expand or contract depending on the amount of light entering the eye. A clear fluid called the aqueous humor fills the space between the cornea and the iris. Situated behind the pupil is a colorless, transparent structure called the crystalline lens. Ciliary muscles surround the lens. The muscles hold the lens in place but they also play an important role in vision. When the muscles relax, they pull on and flatten the lens, allowing the eye to see objects that are far away. To see closer objects clearly, the ciliary muscle must contract in order to thicken the lens. The interior chamber of the eyeball is filled with a jelly-like tissue called the vitreous humor. After passing through the lens, light must travel through this humor before striking the sensitive layer of cells called the retina. The retina is the innermost of three tissue layers that make up the eye. The outermost layer, called the sclera, is what gives most of the eyeball its white color. The cornea is also a part of outer layer. The middle layer between the retina and sclera is called the choroid. The choroid contains blood vessels that supply the retina with nutrients and oxygen and removes its waste products. Embedded in the retina are millions of light sensitive cells, which come in two main varieties: rods and cones.

Rods are good for monochrome vision in poor light, while cones are used for color and for the detection of fine detail. Cones are packed into a part of the retina directly behind the retina called the fovea. When light strikes either the rods or the cones of the retina, it's converted into an electric signal that is relayed to the brain via the optic nerve. The brain then translates the electrical signals into the images we see. Human eye can suffer from a number of defects, the important ones being (1) myopia (short sight), (2) hypermetropia (long sight) and (3) astigmatism.

Astigmatism is an optical defect in which vision is blurred due to the inability of the optics of the eye to focus a point object into a sharp focused image on the retina. This may be due to an irregular or toric curvature of the cornea or lens.



Objectives

1. To understand the common eye defects.
2. To instill the idea that eye defects can be rectified.
3. To stress the idea that eye has to be carefully protected.
4. To cultivate the idea that one has to be sympathetic to persons with sight problems and help them whenever possible. Also understand the virtue of eye donation.

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Takeaway life skills
Defects of human eye	Myopia Hypermetropia Astigmatism	Rectification of eye defects	Understanding Observation Explanation Conclusion	Critical thinking Creative thinking Empathy	Self awareness and Empathy

Materials: Slides, charts, drawings, photographs, paper cuttings, etc.

The process: Power point presentation on the human eye and its defects

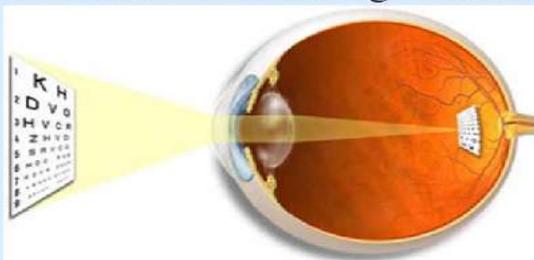
Slide 1: Learning Outcomes

By the end of the lesson, you should be able to;

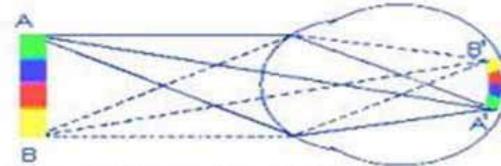
- describe ray diagram of an eye;
- describe defects of an eye;
- describe correction of defects.

Slide 2

Ray Diagram of an Eye, its Defects and Corrections through Lenses

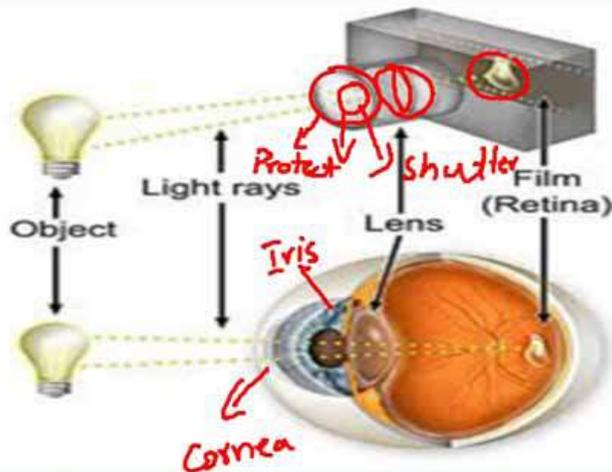


Formation of Image in Human Eye



Incoming light rays from each point on the object are bent by the cornea and lens so that (in normal vision) they come together at a single point on the retina. Note, however, the image is inverted. The brain ultimately interprets the image as rightside-up.

The Human Eye & Camera

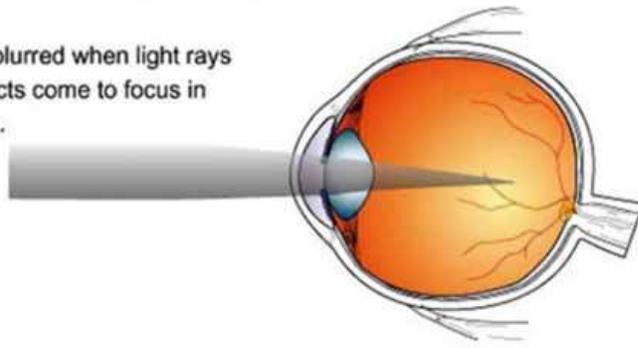


Myopia (Short sightedness)

Myopia

(nearsightedness)

Distant vision is blurred when light rays from distant objects come to focus in front of the retina.

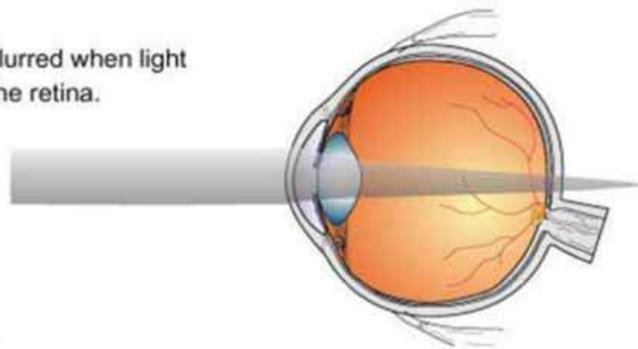


Hyperopia (Long sightedness)

Hyperopia

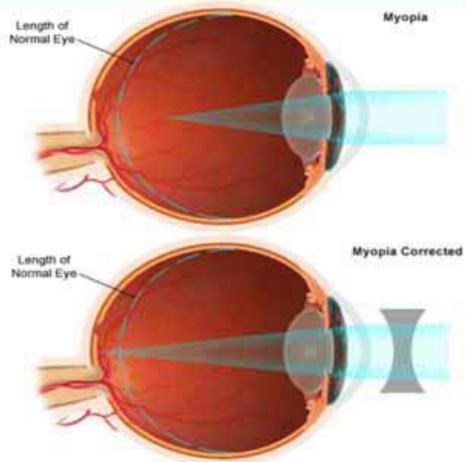
(farsightedness)

Distance vision is blurred when light rays focus behind the retina.



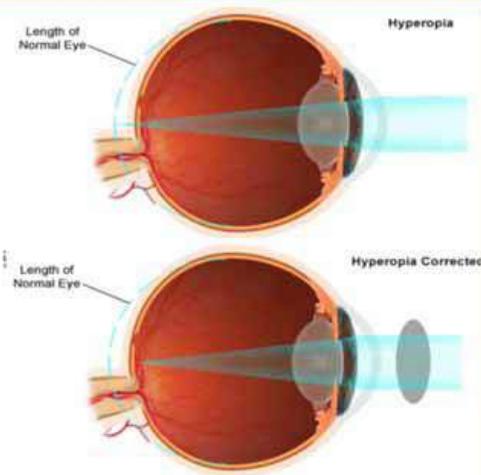
Correction of Myopia

Concave lens is used to correct short sightedness



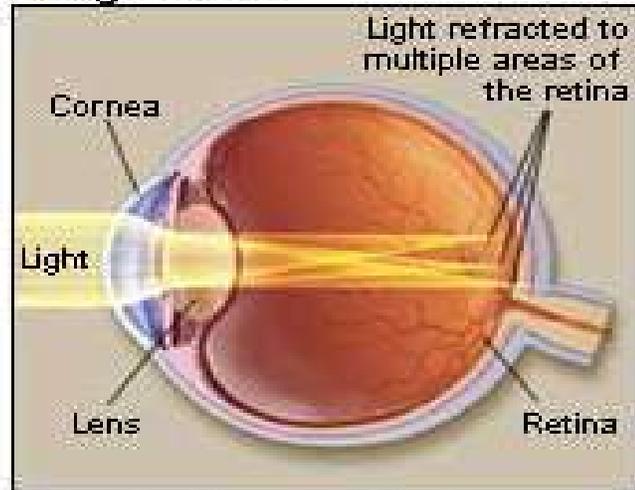
Correction of Hyperopia

Convex lens is used to correct long sightedness

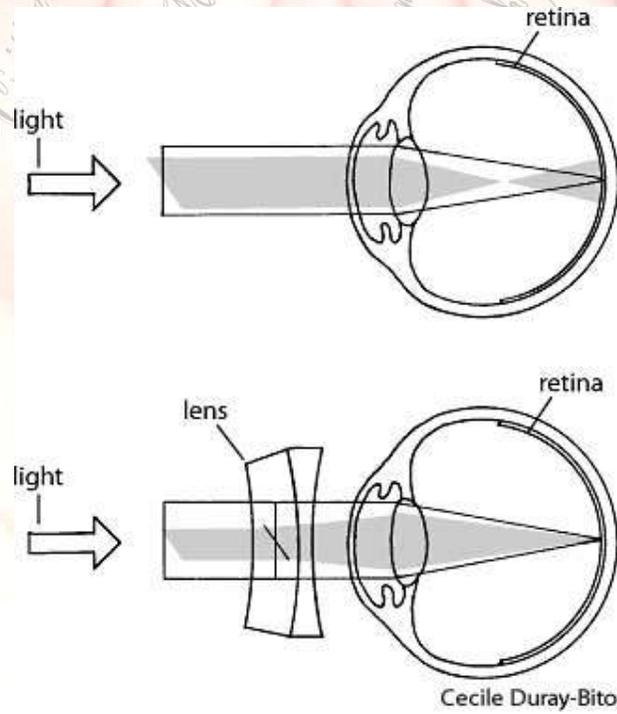


Slide 9

Astigmatism



Slide 10



Astigmatic vision and corrected vision

Slide 11



Lines as seen by normal eye and astigmatic eye

Engage

The teacher introduces the subject to the class, i.e. the topic for today's class is defects of human eye. And engages them in slides, charts, drawings, photographs and paper cuttings. She then poses a few questions.

Explore

The students go through charts provided, elaborate on the common eye-defects and how they can be corrected. They conclude that many a time a simple lens like a concave lens, a convex lens or cylindrical lens will rectify the defects.

Explain

In case of a myopic eye, the image is focused in front of the cornea and it can be corrected with a concave lens of suitable focal length. A hypermetropic eye focuses the image behind the cornea, and is corrected by a convex lens of suitable focal length. Astigmatism occurs when the cornea is not spherical in shape. This results in lines in one direction being well focused while those in the perpendicular direction get distorted when looking at a wire mesh. This is corrected by a cylindrical lens.

Elaborate

The class is brought to a discussion on the reasons of eye-defects. The class will come out with a number of reasons like vitamin A deficiency, too much of TV

viewing or reading without enough light, high sugar level in the blood, accidents, or congenital reasons.

The teacher can note down the points and explain about each of them, in brief. She can blindfold the students and make them understand the difficulty to walk through the class. The students develop empathy and self-awareness.

Evaluate

Students understand the point that those with impaired eye sight should not be made fun of and that we must help them in the little ways that we can. A blind person can lead a great life with a little help from the society. The story of Helen Keller is an excellent example. The teacher highlights the need of organ donation, especially eye-donation. This virtue is above all other human virtues since the acceptor is opened up to the whole universe due to the help from the donor. The teacher can even cite a few examples from recent newspapers. Some students decide that they would/should go willingly for eye donation.

A brain storming session is conducted on the theme of eye problems and their solutions are listed out. The students discuss about people they have come across with eye problems and how they deal with them. They quickly present their views to the class and discuss how persons with eye-defects need to be treated. They develop self-awareness.

The teacher mediates and stresses the need to visit an ophthalmologist and takes his advice for the eye defects. She also asks them to divide into pairs and one blindfolded student can be helped by another one who can see. The students can understand for themselves, the need for helping blind people. They develop empathy.

Eye problems

Remedies suggested

Conjunctivitis

Visit to Ophthalmologist

Astigmatism

Correction lenses

Myopia

Correction lenses

Hypermetropia

Correction lenses

Eye exercises

Collyrium

Adequate sleep

Vitamin A through coloured vegetables

Antibiotics/medicines

Eye donation and transplantation

Atropine an alkaloid

Replacement of eye lenses through operations

Correction with laser beams

All the above remedies are suggested and discussed.

Associate Questions

What is your opinion about eye-donation?

If a member of your family lost his eye-sight in an accident, do you expect him to get back his eye-sight through eye-donation?

Would you agree for eye-donation and convince a friend of yours to do the same?

Year end Evaluation

Are you sensitive to the needs of persons with eye-defects?

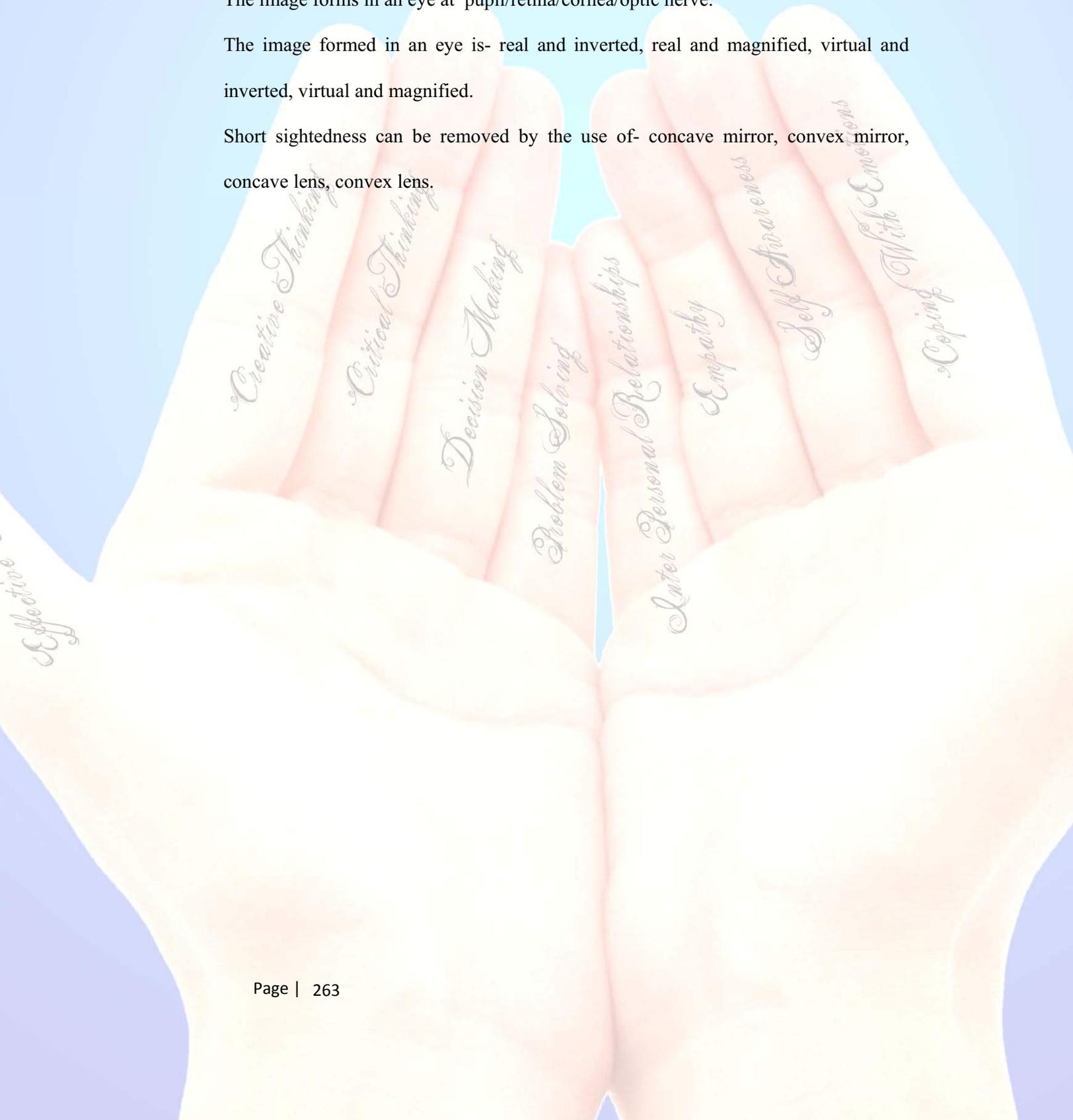
Do you think that taking care of blind people is a social necessity?

Are you inclined towards eye-donation on the spot or do you require to consult your parents? If they need to consult with their parents that has also to be encouraged since it is a good habit to take important decisions at young age with the parents' consent.

The image forms in an eye at ^pupil/retina/cornea/optic nerve.

The image formed in an eye is- real and inverted, real and magnified, virtual and inverted, virtual and magnified.

Short sightedness can be removed by the use of- concave mirror, convex mirror, concave lens, convex lens.



Exemplar 2

Topic: Permanent magnets and electromagnets/Unit-/Chapter 5

Overview: Materials are classified into paramagnetic, diamagnetic and electromagnetic material depending on their magnetic properties. Ferromagnetic materials like iron and steel are used to make magnets. Substances which retain their ferromagnetic property for a long period of time at room temperature are called permanent magnets. An electromagnet has a soft iron rod in a solenoid through which a current is passed. This increases the magnetism of the solenoid a thousand fold and gives an electromagnet. The word hysteresis means lagging behind. The hysteresis curve allows us to select suitable materials for permanent magnets. The material should have high retentivity (makes a strong magnet), high coercivity (stray magnetic fields should not erase magnetisation of the material) and high permeability as in steel. Alnico, cobalt steel and ticonal are other suitable materials for permanent magnets.

Objectives

1. To state the meaning of hysteresis curve.
2. To illustrate the idea that hysteresis curves of different materials will differ from each other.
3. To distinguish between coercivity and retentivity.
4. To select steel or iron for permanent or electromagnet, as the case may be.

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Takeaway life skills
Classification of magnets	Hysteresis curves	Coercivity Retentivity	Distinguish Select Illustrate	Creative thinking Problem solving Objectivity Knowledge of the situation Divergent thinking Analytical thinking Anticipation of consequences Logical thinking Intelligence	Decision making

Materials: Charts, figures, slides, drawings, paper cuttings, etc.

The Process

Engage

The teacher announces that the topic for discussion today is properties of soft iron and steel.

Explain

The students explain that permanent magnets are those substances which at room temperature retain their ferromagnetic property for a long period of time. Electromagnets remain magnetized only as long as a current passes through a coil wound around it. Hence of paramagnetic, diamagnetic and ferromagnetic material, magnets can be made only from ferromagnetic materials.

The teacher then takes up the idea of hysteresis curve.

Teacher's statement : Hysteresis curve is the graph between magnetizing field H and the resultant magnetic induction B. It is seen that B always lags behind H.

When we reduce H, B lags behind H and the phenomenon is called hysteresis.

The sequential lagging for a complete cycle is shown in figure.

Retentivity = Residual magnetic induction left in the specimen when the magnetizing field is reduced to zero = $o_b = o_e$.

Coercivity = Reverse magnetizing field required to reduce the magnetization to zero = $o_c = o_f$.

The teacher then shows slides or draws figure on the blackboard of the hysteresis curves of iron and steel.

Elaborate

The material should have high retentivity so that the magnet is strong and high coercivity so that the magnetization is not erased by stray magnetic fields, temperature fluctuations or minor mechanical damage. Also, it should have high permeability. Hence steel is selected to make permanent magnets. It has a slightly smaller retentivity than soft iron but this is outweighed by the much smaller coercivity of soft iron. Alnico, cobalt salt, etc. are other suitable materials for permanent magnets.

Cores of electromagnets are made of ferromagnetic materials which have high permeability and low coercivity. Soft iron is a suitable material for electromagnets. Since soft iron has a low coercivity, when we switch off the coil current, the magnetization effectively goes to null. The life skill evolved is decision-making. The subcomponents are analysis, synthesis, logical reasoning, seeing implications, giving reasons, etc.

Evaluate

Evaluation can be based on the following points (by observing students engaged in group work).

1. Do they listen to what their friends say?
2. Are they able to consider ideas expressed by their friends?
3. Are they able to engage in reflective thinking on issues that they have disagreements with?
4. Are they polite in their interactions?
5. Are the decisions based on a thorough analysis of facts available?
6. Are the decisions logically aimed at?
7. Are they able to see the implications of their discussions?
8. Are they able to justify their discussions?

The teacher brainstorms the students with the following questions on magnets after dividing them into small groups.

1. Are the magnets in use today natural or artificial?
 - Idea 1- they are artificial
 - Idea 2-earth has a natural magnet
 - Idea 3-substances with iron have magnetic properties
2. We know that substances can be divided into three groups depending on their magnetic properties. What are they?
 - Para, ferro- and diamagnetic
 - Ferro-, permanent and electromagnets
 - Ferromagnets, solenoids, and toroids

3. Of these three groups of substances which groups can be made into magnets?

Solenoids, ferromagnets

The groups present their views. The students of the groups are asked to be polite and respectful when they listen to the views of other groups. The subcomponents of the life skills are

1. ability to listen to other persons
2. reflective thinking
3. accepting others as they are.

The teacher then asks the students to work in groups on the following problem. They discuss in groups and answer the questions.

1. Between iron and steel, which one will you select to make a permanent magnet?
2. Which one is suitable for an electromagnet?
3. Explain your answer in both the above cases. Expand this.

The students present their decisions. The decisions are discussed. The answers are arrived at.

Associate Questions

Is there a magnet inside the earth? Is it a permanent magnet?

How does it help travelers at sea and on land and air?

Does the presence of magnet cause gravitational pull?

How does the 3G mobile help you find your way to an unknown destination?

Do magnets affect the climate?

What causes waves at sea?

Year end Evaluation

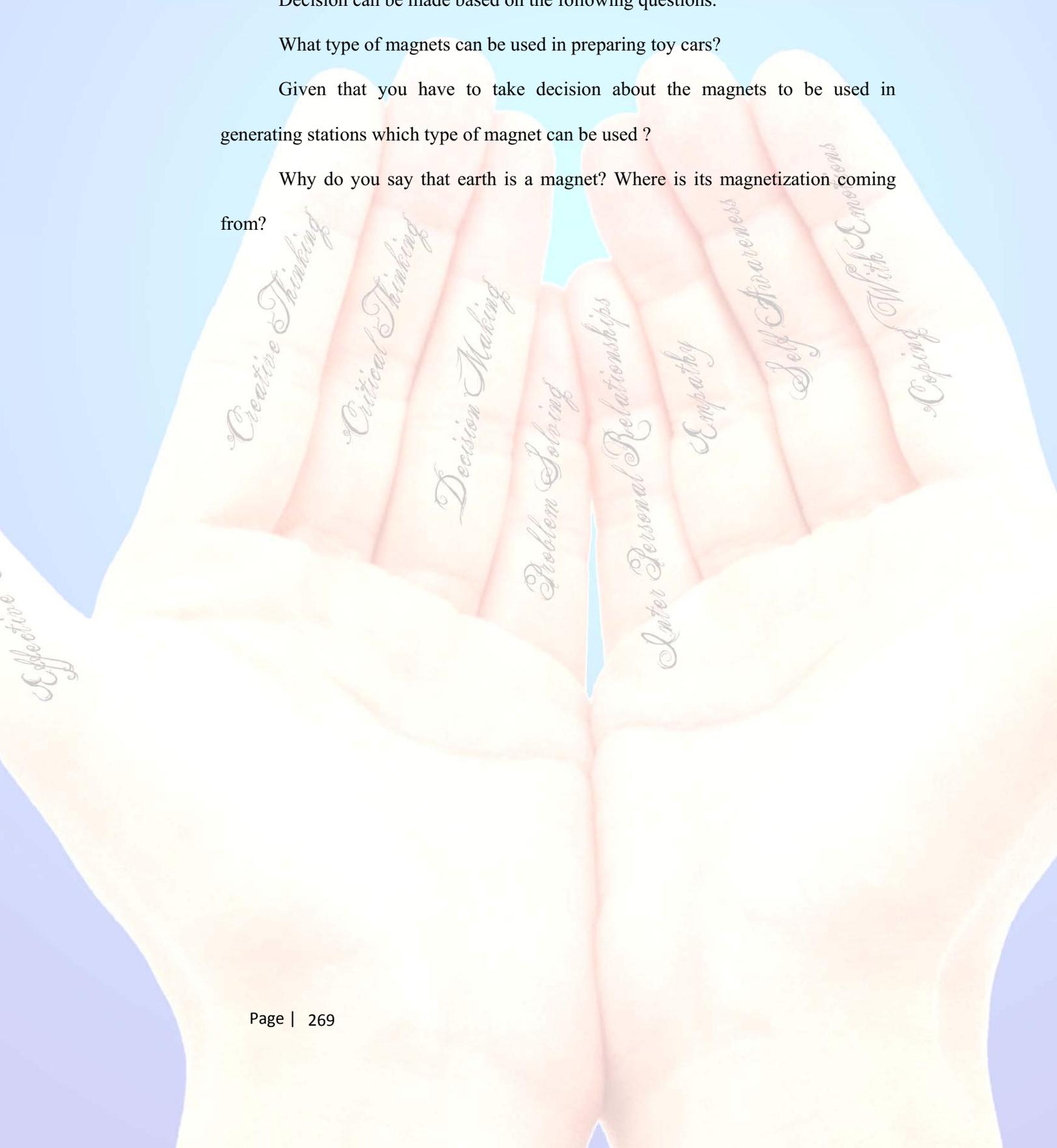
Year-end evaluation can be done based on the performance of students.

Decision can be made based on the following questions.

What type of magnets can be used in preparing toy cars?

Given that you have to take decision about the magnets to be used in generating stations which type of magnet can be used ?

Why do you say that earth is a magnet? Where is its magnetization coming from?



Exemplar 3

Topic: Frictional Electricity/Unit 1

Overview: There were definite and scrupulous observations by our ancestors that rubbing one object over another produce wonderful change in both the objects which could be sensed through touch. 1) Objects became warm. 2) Objects had a peculiar property that they started attracting small pieces of light material namely paper, dust, hair etc. 3) Objects started giving a strange sensation to soft skin of the body (we call it electric shock). If the nature of the two substances were different, the intensity of one or more of the above effects was quite conspicuous.

Objectives: To understand the phenomenon of frictional electricity. Students will be able to

1. Use different substances for rubbing and notice the change in strength of frictional electricity produced.
2. Classify the pair of substances which produced maximum effect and those which produce almost no effect.
3. Reason out the cause of this physical change observed in substances.
4. The nature of electricity produced on both substances is different.

Columnar Framework

Sub-topic	Concepts	Sub-concepts	Process skills	Aligned component life skills	Take away life skills
Frictional Electricity	Rubbing two different substances causes production of static electricity on both the substances.	<p>(a) The two substances become electrified with different kinds of electricity.</p> <p>(b) One of the substances takes away electrons from the other substance.</p> <p>(c) One which takes up electrons becomes negatively charged and the other is positively charged.</p> <p>(d) Electron affinity of different substances is different.</p> <p>(e) Substance having more electron affinity takes away electron from the other.</p> <p>(f) It is redistribution of charge. Free electrons in metals move randomly in a solid due to thermal energy. But when a field (electric or magnetic) is applied, random motion is modified and electrons have a tendency to follow external field.</p>	<p>Interpreting the observations</p> <p>Generating Curiosity</p> <p>Reflection</p> <p>Critical analysis</p> <p>Inference</p> <p>Predicting and communicating- Classification</p> <p>Shared Construction of knowledge</p> <p>Explaining</p>	<p>Critical thinking</p> <p>Creative thinking</p> <p>Effective communication</p>	Critical thinking
Drift velocity	Motion of electron in guided direction				

Materials: Suitable solids from immediate environment.

The Process

Engage

The pupils are engaged in collecting material of divergent properties, teacher would suggest what kind of material would be appropriate. Pupils collect at least 15 to 20 different solid substances. They make pairs and rub one over the other. The students are instructed to write down their observations.

Explore

Pupils explore the properties of the different solids and collect the materials for testing.

Explain

Teacher will suggest how electron transfer happens when two substances are in close proximity. For example, when dry hair is combed continuously, transfer of electron takes place. Some substances may be having more electron affinity than the other. The chances are that these may gather electrons from the substances of lesser electron affinity. Substances which can be conveniently used for producing frictional electricity.

Elaborate

Teacher would elaborate the list of pairs of materials producing frictional electricity. This promotes critical thinking.

Evaluate

Evaluation of the activity may be done by asking students to sequence the material in a particular order of friction to produce electrification. Thermal velocity associated with electron is very high in comparison to drift velocity, but switching the circuit on, the device responds immediately. Why?

Group work is carried out in sessions and the following questions discussed to promote critical thinking.

1. What is frictional electricity?
2. Is there any other form of electricity?
3. What are the different substances which will generate electricity by friction?
4. What are the general properties of the substances that are good in producing frictional electricity?
5. In your experience, which pair of substances produced maximum electricity? What is your explanation? What is the inference?
6. What are positive and negative electricity?
7. When glass rod is rubbed with silk and when plastic rod rubbed with fur, glass rod, fur → Positive; plastic rod, silk → Negative. Why?
8. Why do two glass rods rubbed with silk or two plastic rods rubbed with fur repel each other? Why do such a glass rod attract such a plastic rod? Explain.
9. Vehicles carrying inflammable materials have metallic ropes touching ground during motion. Why?

Charges developed in the vehicle due to friction with air, friction between moving parts and friction between tyres and the road, when accumulated can lead to sparks. This is bypassed to earth by the metallic ropes. This will cultivate critical thinking ability in the students.

Associate Questions

Plastic chairs get charged. How does it happen?

During winter we use sweaters which produce sparks on removing from our body. Terricot or other articles of synthetic material produce sparks and sometimes give shocks. What could be the reason?

Small and very thin poly sheets attach itself with other bodies. Why?

While cleaning briskly a surface, say of specks of dust on a window, sometimes dust deposits on the rubbed surface. Why does the surface get dirtier than earlier?

Year end Evaluation

Name the material which gets positively charged on rubbing with the other material.

Make a list of the substances in the decreasing order of electron affinity.

Some substances are not pro-static electricity. Why?

Glass can be made positively charged as well as negatively charged. Substantiate or negate the statement.

Which pair produces stronger attracting effect?

Is there any difference if the substances are rubbed briskly?

Does the time of rubbing make a change?

When electrons go from one substance to the other, is there any change in weight of the substances?

Exemplar 4

Topic: Kirchhoff's Laws/Unit 3

Overview: There are 7 laws of conservation. There is no instance identified where these fail. Kirchhoff's laws are based on two of the seven conservation laws. First law says *at any junction the sum of the currents entering the junction is equal to the sum of the currents leaving the junction at any point of time*. In brief there can be no accumulation of current in a live electrical circuit (though there can be charge accumulation). The law falls under conservation of charge. Neither charge can be created nor destroyed.

Second law says the algebraic sequential sum of potential difference across each device (load) in a closed loop including energy sources, if any, is zero. Potential difference across a device (load) is caused by flow of current through it (Ohm's law). It falls under conservation of energy. The energy supplied by source is equal to the energy consumed by device plus heat generated.

Objectives: To show that

Flow of charge causes current.

Current passes through a conductor.

The resistance of the conductor determines the quantity of current flow in a closed circuit. In other words the quantum of flow of current in circuit depends on the resistance to its flow.

Current at any junction of closed circuit equals current out from that junction.

Sum of current multiplied by resistance for each component equals source in the circuit.

Current source supplies current to a circuit included in it. Ideally strength of current is potential difference across the source divided by the total resistance of the circuit.

Columnar Framework

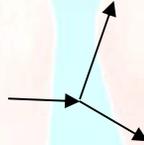
Sub-topics	Concepts	Sub-concepts	Process skills	Aligned components of life skills	Life skills
Kirchhoff's first law	There can be no accumulation of current at any junction in a circuit.	If electrical circuit is closed current flows. If current accumulated at any junction it is no longer a current.	Hypothesising investigating Identify junction	Thinking and motor skills Planning	Critical and Creative thinking

Materials: Battery connecting wires and small bulbs.

The Process

Engage

Supply a few conducting wires in a battery and a dry cell. Tell students to make connections so that a junction is formed. Current needs conductor for its flow. Simplest one is as under:



The junction can be with several wires as given in evaluation.

Engage the students in making any complicated circuit. If the battery is not included in the circuit there will be no current. Include a battery and make many connections like one makes for lighting bulbs. If many batteries are connected in series, the potential difference available becomes large. But if they are connected in parallel manner, current drawn can be more. But if the cells/batteries are connected randomly, we need to follow following rule. In any closed circuit we start measuring current and resistance product in anti-clockwise direction. If current has to pass from negative to positive terminal we take potential difference of the battery as positive. But if current passes from positive terminal to negative terminal in a circuit the potential difference needs to be taken as negative.

Explore

Complete a circuit with load or resistances with or without a battery and reflect. It is the conductor that provides resistance to the flow of current. Take any complicated circuit and verify/apply the law. The students develop critical thinking and creative thinking in this way through experiments.

Explain

Observe the following circuit



2. Is there a relationship between the charge flowing and the current generated? If yes, what is the relation?
3. What is the principle of conservation of energy? What form of energy is considered in Kirchoff's second law?
4. Why does electric current produce a shock?
5. How can you avoid an electric shock?

Associate Questions

When we light a bulb by cells, cells also get hot. Why? Why does a wire man wears rubber gloves?

Year end Evaluation

Justify that Kirchoff's first law is based on conservation of charge and second law on conservation of energy. Are the two conservation laws different? First law of thermodynamics is also based on conservation of energy. Is there any relation between them?

Current is said to flow from positive terminal to negative terminal of the battery then why flow of current from negative to positive of the battery in a circuit is taken as positive potential difference?

Open wires do not complete the circuit, then why do we suggest naked or open wire be not touched?

Why conductor is said to have a resistance?

Exemplar 5

Topic: Rectilinear Propagation of light: laws of refraction and refraction/Unit 9

Overview: This is an age old conceptual and prime process for the propagation of light. This usually comes under the broad content of geometrical optics. The most important yet difficult to understand in both reflection and refraction is the second law. It is surprising that it does not generate much interest among the teachers and students. But it is the central feature for the formation of images.

Objectives

1. The student will be able to observe and distinguish between reflection and refraction.
2. The student will be able to list down attributes and explain the reflection and refraction phenomena.
3. The students would learn how to locate direction of propagation of the ray.
4. The students among themselves would be able to deliberate and explore making a purposeful device to demonstrate second law for both reflection and refraction health.

Columnar Framework

Subtopic	Concept	Sub-concept	Process skills	Aligned life skills	Take away life skills
Reflection and refraction	Planar property of propagation of waves	Incident ray, reflected ray, refracted ray, ray normal to the reflecting surface	Observation Classification Exploration Observation, Categorisation, Classification, Narration, Illustration, Discussion and Exploration Making a static Model: Hands on experience	Objectivity Critical thinking Divergent thinking Lateral thinking Problem solving Capacity building Decision making	Critical thinking

Activity: Activity in the laboratory with cooperation among pupils.

Materials required

Plane mirror and a glass slab with stands

Coloured threads, cardboard, trace paper, pen

Worksheet

The Process

Engage

Students collect the relevant material. They are engaged in observing the direction of rays and locate it by aligning a coloured thread/pencil/coloured electric wire.

Explore

Students identify and name the rays. Students would classify the two processes involved namely reflection and refraction.

Worksheet

Electromagnetic waves

Reflection

Incident ray

Separating surface between two media

Normal at the surface at the point of incidence.

Normal at the surface at the point of reflection.

Rectilinear propagation

Reflected ray

Plane which includes both rays and the normal

Geometrical optics

Refraction

Incident ray

Separating surface between two media

Normal at the surface at the point of incidence.

Normal at the surface at the point of refraction.

Rectilinear propagation

Refracted ray

Plane which includes both rays and the normal

Explain

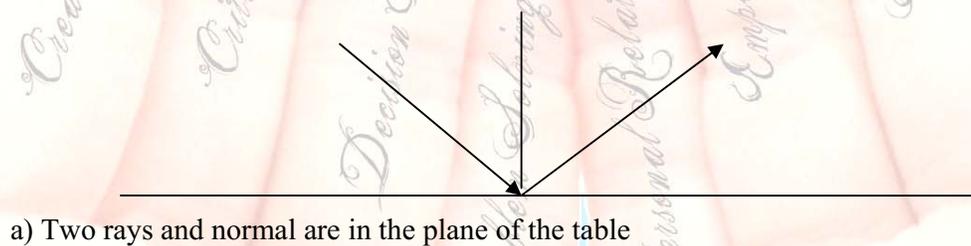
Geometrical optics is very useful in understanding concepts related to all the optical phenomena except for interference/diffraction and polarisation (which requires the knowledge of wave optics).

First let the student focus torch on a plane mirror, placed vertically on a table, and allow it to fall at

- Different angles on the plane of the table
- Different angles in the vertical plane

In both cases allow them to see the reflected ray by the naked eye.

Next place a block of glass on the table and allow light to pass through the glass slab for the cases defined in a) and b). See figures.



In which direction do the reflected rays go? How does the normal appear?

Then allow them to align a cardboard for two rays and normal at the point of incident ray, reflection / refraction and the normal at the point where the rays meet the surface separating the two surfaces.

N.B. In the above process, students develop scientific process skills of observation, categorisation, classification, narration, illustration, discussion and exploration of knowledge.

Elaborate

Students are asked to look along the thread kept in a straight line on the table, which can be termed as an incident ray. The outgoing ray can be seen in the plane of the table. The mirror used in vehicles is different: what are its properties? In many shops big mirrors are fitted to notice customer's activity (now CCTV is replacing it). Use a plane mirror to imitate simple figures and compare these.

Enquiry skill: Can we align the outgoing ray with the other thread? If yes then the plane is perfect?. If the ray is not visible on the plane of the table, it indicates that the mirror is not perfect ?^

Psychomotor skill: Extend the two threads from farther distance to as close as mirror. Do both meet at the same point at the mirror? Answer yes but if teacher disagrees, then reflect on the reason. Students develop critical thinking.

Evaluate

Fig a) If the ray coming out after reflection is along some other direction the possibility of non-verticality of the mirror may be the reason. Fig. b) is set to verify. Students are asked to take a hardboard, put her/his incident ray on the board and turn it so that the reflected ray also lies on the table.

The class can be split into a number of groups for doing the above exercises. Each group will discuss their observations and come out with their own conclusions. The class at large can validate and come to the correct inferences.

- A) Perform the above said activities with glass block. Wonderfully, we never see passage of ray inside the block though it is transparent. What is the cause? You want to see its passage through the glass block. Indirectly it can be done by extending the incoming and out going threads to the glass block. What do you notice? If glass block is removed are both the rays on the same straight line? If not, what has the block done to these rays? (The students develop logical thinking). Does it lead to Snell's law? Find the path inside the block. Hint: Let the two point where rays come out. Do you find that there was refraction?
- B) What are the additional experiments that you need to perform for finding that the rays and normal all lie in a plane?
- C) How to see rays passing through the rays from inside the block? Hint: use semi-transparent glass block. Light rays cannot be seen unless there are physical bodies in its passage. Use of laser torch makes thing easy to visualise.

Ideas generated

- Co-ordination of eyes and hands
- The three set of rays and normal are in the same plane.
- Normal has no physical significance.
- Deviation of ray occurs when there is change in median
- To start with we need to use bigger articles like coloured wires or even pencils or pens

- D) What is the difficulty faced?
- E) Interestingly the angle of incidence and angle of reflection are not exactly same. What can be the sources of error? (promotes analytical and divergent thinking)
- F) Why do the Snell's law $n_1 \sin i = n_2 \sin r_{ef}$ not fully satisfy measurement?
- H) What are the other suggestive experiments?

Associate Questions

What are mirrors? If I claim mirror need not be of glass, reflect for validity or non-validity of the statement.

If rays and normal are not in horizontal plane, what is the inference drawn?

What will happen if mirror is perfectly vertical and the rays and normal are not in a plane? What can be the other reason?

Does the deviation of the rays from glass block have anything to do with density of the material of the glass block?

Take the glass block having uneven surface. Does refraction occur as in previous case?

Is the job played by uneven glass surface also played by other surfaces?

Hint: go for diffraction.

Year end Evaluation

List down implications of reflection and refraction in human adventures.

Focus sunrays at a single point. What does it provide?

Focusing by concave mirror and convex lens can be dispensed with several mirrors. Where was it done strategically in world war?

Exemplar 6

Topic: Drift of electrons: Origin of resistivity/Unit 3

Overview: Just before the start of twentieth century, J.J. Thomson discovered carrier of current in solids the electron. Soon it was recognised that it was an entity which need to be given a prominent place in science as it had a few unique properties which made its inclusion for understanding of several theories in science especially of Physics and Chemistry. The properties were: Quickest response (10^{-8} s) to electric and magnetic fields, (though a microscopic entity its sincerity is unmatched), its participation in chemical reactions, very small de Broglie wavelength, ability to excite/make atoms and initiating some nuclear reactions.

Objectives

1. To recognise how significant an electron is in conduction. To know that every substance in its natural state is neutral.
2. To know that every material has a sea of electrons but these electrons do not show up as the same number of positive charges are present in the atoms constituting the substance.
3. To know that metals have large number of free electrons to the tune of 10^{21} per cc, whereas this number is very small for insulators (10^{16} per cc).
4. To understand that passage of electrons with time causes current.
5. To understand that more the electrons participating in passage, larger is the current.
6. To know that electron lattice interaction causes resistance to the passage of current.
7. To know that electron's mean free path can be several meters in metals and very small (a few nano-meters) in the insulators.

8. To know that resistors are made from conductors like manganin, nichrome and similar alloys which are less conducting.
9. To know that on heating phonon fluctuations increase in metals and so does the resistivity. But in insulators electron bonding with atoms decrease hence more electrons become available for conduction hence their conductivity increases (same happens with semiconductors).

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills and 5Es	Aligned components of life skills	Takeaway life skills
Electron flow causes current	Flow of positive charge causes current in the direction of its flow	Electron is negatively charged particle. Hence current flows in direction opposite to it.	Interpreting, reasoning, predicting, inferring, Hypothesizing, Gathering information	Thinking and relationship skills Inferring	Effective communication
Every atom has electrons	Conductors have large number free electrons.	There is resistance in conductors to the passage of electrons		Predicting	
Phonons	Random thermal fluctuation of atoms	Atomic vibration depending on temperature is termed phonon		Observation	
Resistance	Restricting flow/ moment is resistance	Electron phonon interaction restricts flow			
Mean free path	The distance scanned by a particle without interaction is free path.	The average path scanned between two interactions is called mean free path		Measurement	

Materials

A few metallic wires of different metals and alloys (called resistance wires) of say 1m length, nylon, cotton thread, rubber and plastic ropes (for brevity we will call each species as wire), multi-meter, some heating device, a battery and a bulb.

The Process

Engage

The pupils are engaged in collecting different kinds of wires and they write properties of the wires collected. They may collect these of different lengths and thicknesses to get as many observations as possible. The teacher introduces multi-meter to the class and how to use it for measurement of resistance. Students find resistance of the material they collected and record their values in tabular form. Teacher also defines the term photon as the quantum of thermal energy. He would ask the students to heat the wire and record their observations. Find out how many of them infer that the photon number in the material has increased (CCE). The students are engaged in reasoning and predicting outcomes.

Explore

Students know how to make a bulb glow with battery and wires. They inform that conductivity of different wires collected is different. Teacher finds out how many of them knew that conductivity is reciprocal of resistivity. They relate their observations with the intensity of the bulb's glow. Teacher suggests they could use heater for their extra findings and record observations. Activity ^The teacher with the help of probing questions and hints make pupils infer that i) conductivity of different materials is different, ii) the thickness of the wire and conductivity are related, iii) upon heating the resistance wire the effect is visible in the glow of the bulb, and

iv) if length of the resistance wire is large the effect it produces to the glow is different.

Let teacher suggest why those particular wires are only called resistance wires and why a multi-meter is not used to observe change in the resistance in place of a glowing bulb.

Explain

Students explain and relate it with thermal fluctuations (phonons). Most of the interatomic space in solids is scanned by phonons. With increase of temperature phonon vibration becomes larger and so electrons phonon interaction increases

Elaborate

At every temperature atoms fluctuate as fluctuations are related to kinetic energy.

The teacher elaborates the findings of the students to enable students to infer that more electrons' participation in flow, larger negative charge flows hence larger is the current flow.

At every temperature each atom for each degree of freedom possesses $\frac{1}{2} KT$ of energy.

Phonons interact with electrons.

When a metal has less number of free electrons the current flow is less Interaction leads to resistance When interaction is less, less is the resistance to the flow. Alloys are mixture of metals which decreases the conductivity.

Evaluate

The students prepare a few questions based on their inferences. Some hints and some questions are put up by the teacher on electron phonon interaction which

ultimately caused change in conductivity. A cautious observation leads to Ohm's law.

What will happen to mean free path if temperature of the conductor is increased?

Associate Questions

Questions related to other conductors like earth, wet material and human body may be asked to substantiate daily life experiences (please elaborate).

What are the characteristics of electrons?

Why are the electrons in the solids responsible for conduction?

What kind of wire should be used in electrical installations?

What electrical appliances use resistance wires for their functioning?

What goes wrong if the device which is not supposed to be heated becomes heated?

A buzz-group intervention is given after the initial presentation and activity is completed. After the students get their results, the teacher forms groups of 6. Now they are asked to discuss their findings and arrive at the correct answer. They need to argue out their answers or say why the answers of others are not acceptable. In the process, they have to present their views logically, without offending the other members of the group. In this way effective communication skill is cultivated in students.

After the groups complete their discussions and arrive at a consensus, they present their conclusions. Now the teacher discusses the conclusions and presents the correct answer arguing out why the other answers are not acceptable.

Year end Evaluation

The teacher makes observations while students are engaged in group discussion and also while they make their presentations based on the following points.

Are they able to communicate their views in a convincing manner?

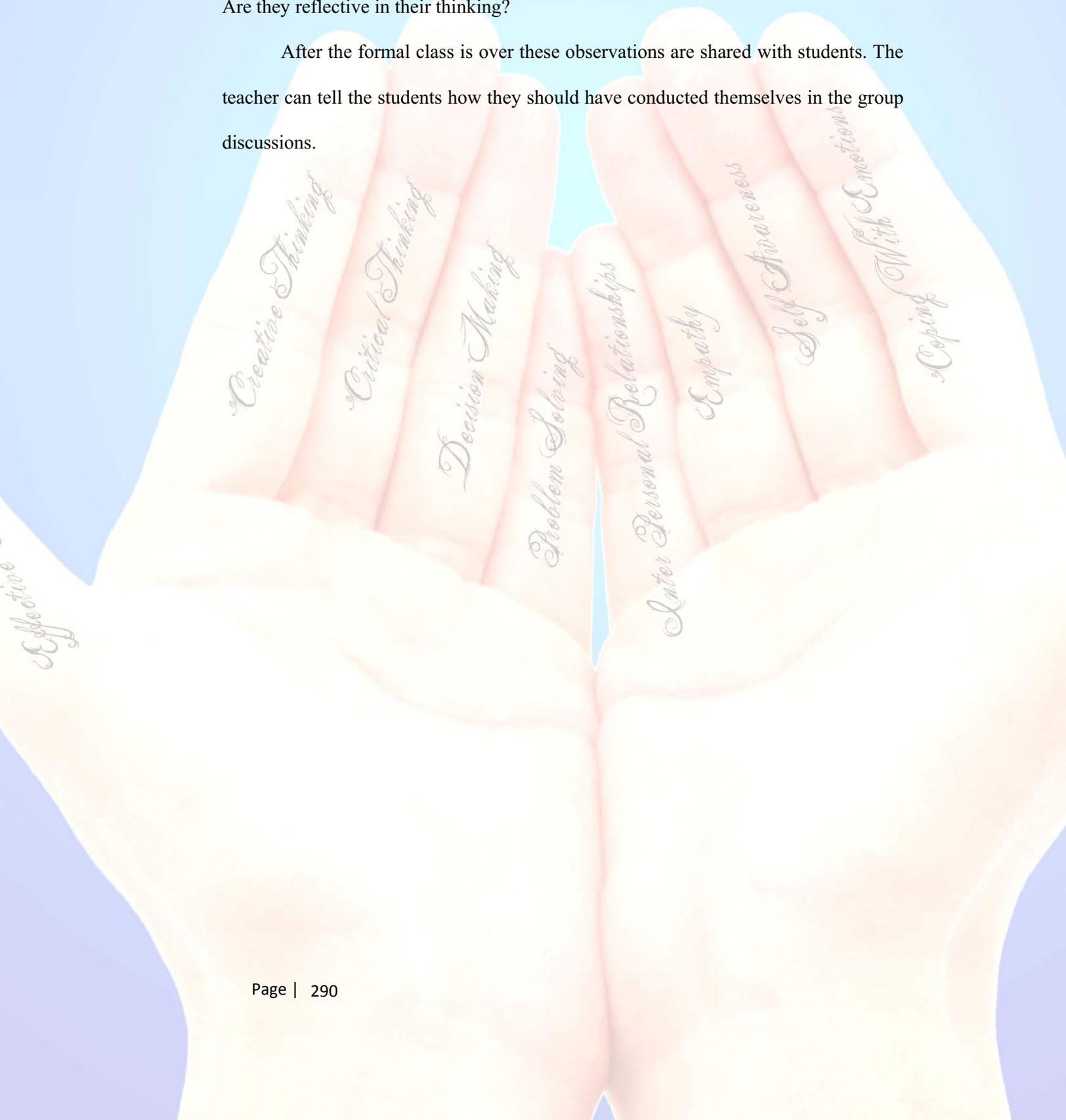
Are they logical in their thinking?

Do they get angry or lose their temper while arguing?

Does any one person dominate the discussion in the groups?

Are they reflective in their thinking?

After the formal class is over these observations are shared with students. The teacher can tell the students how they should have conducted themselves in the group discussions.



Exemplar 7

Topic: Working of the transformer and its application/Unit 6

Overview: There was a debate between Westinghouse scientist-cum-businessman and Edison the eminent scientist as to what mode should be used for energy transfer from one place to another. Westinghouse was in favour of AC and Edison was in favour of DC. Till nineteen sixties DC was supplied in India. It brought along with it several deaths. So battle was won by Westinghouse and AC has spread in the whole world. Due to following advantages it has become an indispensable mode for energy transfer.

1. Its transfer from one place to another is energy friendly (minimal loss of energy).
2. Its production is easier.
3. The not so high voltages does not kill human (human body is conducting and it can allow ~ 10 mA current (excess than it might kill) to pass without damage.
4. Many devices are use in this kind of current.

Objectives

It facilitates learning of different devices. In addition, student will be able to

1. Differentiate between AC and DC
2. Production of AC (DC can be obtained through chemical reactions that become extinct, DC is obtained from AC with the use of rectifier).
3. Conversion of DC into AC is not economic.
4. There is less transmission losses in AC over very large distances.
5. It is the transformer which enables one to handle AC.

Columnar Framework

Sub-topic	Concept	Sub-concept	Process skills	Aligned life skills	Takeaway life skills
Construction of the transformer	Changing magnetic field causes production of current in nearby closed loop conductor	Two disjoint circuits kept nearby, induces flow current in other closed circuit if the first circuit has flow of AC. The phenomenon is called mutual induction.	Differentiation Information gathering	Questioning Hypothesise Reflecting Explanation	Creative thinking

Materials: A few wires of different materials shielded by insulator and not insulated (naked), a battery, some pencil like rods of different metals and non-metals.

The Process

Engage- Students will make a host of transformer cores, different threads of wire (to serve as primary coil) of different lengths and different nature, different thicknesses, are wound on the core. Different threads of wire (to serve as secondary coil) of different lengths and different nature, different thicknesses, are wound on the core. Students identify terminals of primary and secondary wires and collect wires of different metals. One of them must be enamelled or have insulation. Make 4 groups of pupils. Let them take a pencil and tell them to coil it on the pencil such that the two ends of the wire are available for making connection. The other groups will use iron nail in place of the pencil, or some other metals like carbon rod, aluminium rod, copper rod these are called **core**, etc. Next tell them to take an other wire and wind it over the first coil. Again the two ends of this wire also must have two ends for making connections. This structure is called **transformer**. Next see that they connect one set of wire to a battery (called **primary** coil) and other set of coil (called **secondary** coil) to a galvanometer, AC/DC volt meter and ammeter.

Explore- Let the student connects a battery to primary coil and a meter in the secondary coil. Students collect data for these activities. Let each group record their observations as an answer to following questions: which of the meters did you connect to secondary coil? Which meter responds? Find all those conditions in which a certain meter responds? Under what condition does the meter (name it) respond most? Which rod was used when the deflection was optimum? Reason out.

Explain- Let teacher give hint that non- conducting core or iron core are conducive for a transformer. Naked conducting wires do not make a primary or a secondary coil. Deflection in meter, if any is instantaneous. Students explain on the basis of above hints.

Elaborate- If current passes through a coil magnetic field gets associated in its vicinity. Teacher gives a hint as to what happens to deflection in the meter if the primary circuit is alternately opened and closed (it is ac). On students response teacher would suggest to take AC in the primary coil. Let them record their observation as answer to following questions.

Students sit in small groups and discuss the following questions. They consider different view points and take decisions on the likely answers. They present their answers to the class.

Teacher facilitates better understanding of the concepts through mediation.

Questions for buzz group discussion

i) What happens if battery and meter are interchanged? ii) Core of which material responds well? iii) What is the effect of thickness when these are used as primary/secondary coil? iv) What is the effect when the number of turns are very less and very large? What happens when DC battery is replaced by the AC source?

The life skills components are assessed using the following checklist.

1. Have they considered all related aspects?
2. Have they discussed in their groups and analysed the questions in detail?
3. Are the answers logically argued out?
4. Did they listen to the view points of others?

Associate Questions

What happens when a road side transformer bursts?

Year end Evaluation

Why is an enamelled wire taken for making transformer?

How do you make step down transformer?

What is a step up transformer?

Why is secondary coil wound over primary?

If battery is used for secondary coil where would you go wrong?

Exemplar 8

Topic: India and nuclear energy/Unit /Chapter 13

Overview

1. Nuclear energy is available from thermo-nuclear reactors.
2. India's nuclear energy programme was launched around the time of Independence under the able leadership of Homi J. Bhabha.
3. India's nuclear energy program aims at the production of safe and reliable electrical power for our social and economic progress and it being self-reliant in all respects of nuclear technology.

Objectives

1. To understand the different ways of obtaining nuclear energy along with their pros and cons.
2. To instill the idea that nuclear energy is to be handled carefully.
3. To discuss about atom and hydrogen bonds. Briefly discuss India's nuclear programmes.

Columnar Framework

Subtopics	Concepts	Sub-concepts	Process skills	Aligned components of life skills	Take away life skills
Methods of production of nuclear energy especially in India	1. Nuclear energy can be obtained from different sources 2. Nuclear energy is used in many ways 3. Nuclear energy can be harmful also. 4. Do you think that India should remain a nuclear power?	Fission Controlled fission Uncontrolled Fission Fusion Thermonuclear reactions Sources of solar energy Uses of nuclear energy Radio isotopes Production of electrical energy Nuclear programmes of India	Understand Discuss Assimilate Explain	The students obtain communication skill, diverse thinking skills, critical thinking skills, empathy etc.	Empathy and Problem solving

Materials: Slides, charts, drawings, photographs, paper cuttings etc.

The Process

Engage

The teacher engages the students in a video clipping on uses of nuclear energy. The teacher starts an initialization on the different concepts and sub-concepts of fission, controlled and uncontrolled fission, sources of solar energy, sources of nuclear energy, radio-isotopes, thermonuclear energy, production of electrical energy.

Advantages of nuclear energy

- Nuclear plants help regions meet air pollution standards.
- Nuclear facilities, are non-emitting.
- Nuclear plants also reduce the cost of air pollution control for emitting facilities.

Environmental benefits

- Nuclear energy is the most ecologically efficient of all energy sources because it produces the most electricity in relation to its minimal environmental impact. There are no significant adverse effects to water, land, habitat, species, and air resources.
- Nuclear energy does not burn anything to produce electricity. Nuclear power plants produce no gases such as nitrogen oxide or sulfur dioxide that could threaten our atmosphere by causing ground-level ozone formation, smog, and acid rain. Nor does nuclear energy produce carbon dioxide or other greenhouse gases suspected to cause global warming.
- Water discharged from a nuclear power plant contains no harmful pollutants and meets regulatory standards for temperature designed to protect aquatic life. This water, used for cooling, never comes in contact with radioactive materials. If the water from the plant is so warm that it may harm marine life, it is cooled before it is discharged to its source river, lake, or bay as it is either mixed with water in a cooling pond or pumped through a cooling tower.
- The areas around nuclear power plants and their cooling ponds are so clean, they are often developed as wetlands that provide nesting areas for waterfowl and other birds, new habitats for fish, and the preservation of other wildlife as well as trees, flowers, and grasses. Many energy companies have created special nature parks or wildlife sanctuaries on plant sites.
- Because nuclear power plants produce a large amount of electricity in a relatively small space, they require significantly less land for operation THAN other energy

sources LIKE solar and wind farms.

- Nuclear plants are so environmentally benign that they enable endangered species to live and thrive nearby. Such endangered species as osprey, peregrine falcons, bald eagles, redcockaded woodpecker, and even the beach tiger beetle have found a home at nuclear power plants.
- Because nuclear power plants produce a large amount of electricity in a relatively small space, they require significantly less land for operation than other energy sources like solar and wind farms.

Economic benefits

- Nuclear power plants provide low-cost/predictable power at stable prices.
- Nuclear plants also contribute to national energy security and ensure stable nationwide electricity supply.



- Nuclear power plants provide low-cost, predictable power at stable prices.
- Nuclear plants also contribute to national energy security and ensure stable nationwide electricity supply.
- *Low Fuel Cost:* The main reason behind the low fuel cost is that it requires little amount of uranium to produce energy. When a nuclear reaction happens, it releases million times more energy as compared to traditional sources of energy.
- *Cheap Electricity:* The cost of uranium which is used as a fuel in generating electricity is quite low. Also, set up costs of nuclear power plants is relatively high while running cost is low. The average life of nuclear reactor ranges from 40-60 years depending upon its usage. These factors when combined make the cost of producing electricity very low. Even if the cost of uranium rises, the increase in cost of electricity will be much lower.
- Energy cannot be created nor be destroyed but it can be converted from one form to another. Nearly all the mass of the atom is concentrated in a tiny nucleus in the center. The nucleus is composed principally of two sorts of particles: the proton which carries the positive charge and the neutron which is electrically neutral and has a mass slightly bigger than that of proton. Nuclear energy is the energy released from the nucleus of an atom. When nuclear reaction occurs by fission or fusion, it produces large amount of energy. See more at: http://www.conserve-energy-future.com/Advantages_NuclearEnergy

How nuclear energy is produced

- When the heaviest element, uranium was bombarded with neutrons, it was discovered that instead of inducing radioactivity as did other elements, something different happened. This process was named fission. When fission occurred, not only were two lighter elements and a lot of radiation produced, but also more neutrons. It was clear that these neutrons could in turn also cause fission, producing more neutrons and developing a chain reaction which might spread throughout all the uranium present. See more at: http://www.conserveenergy-future.com/Advantages_NuclearEnergy

Uranium and plutonium

- In the fission of uranium 235 nucleus, the amount of energy released is about 60,000,000 times as much as when a carbon atom burns. Most of the energy from fission appears as kinetic energy as the fission products shoot apart and quickly

share their energy with their surroundings, thus producing heat. The first reactor to produce a usable amount of power was built at Calder Hall in England.

- With pure fissionable material, atomic bombs can be made. Of the two bombs dropped on Japan to end the World War 2, one contained plutonium and the other very highly enriched uranium 235.

Disadvantages of nuclear energy

Radioactive waste

- The nuclear wastes contain radio isotopes with long half-lives. This means that the radio isotopes stay in the atmosphere in some form or the other. These reactive radicals make the sand or the water contaminated. It is known as mixed waste. The mixed wastes cause hazardous chemical reactions and leads to dangerous complications. The radioactive wastes are usually buried under sand and are known as vetrification. But these wastes can be used to make nuclear weapons, e.g. Chernobyl and Fukushima ^Small radiation leaks can cause devastating effects with symptoms like nausea/vomiting/diarrhea and fatigue. People who work at nuclear power plants and live near those areas are at high risk of facing nuclear radiations/if it happens.
- *Impact on Aquatic Life:* Eutrophication is another result of radioactive wastes. There are many seminars and conferences being held every year to look for a specific solution. But there is no outcome as of now. Reports say that radioactive wastes take almost 10,000 years to get back to the original form.
- *Major Impact on Human Life:* We all remember the disaster caused during the Second World War after the nuclear bombs were dropped over Hiroshima and Nagasaki. Even after five decades of the mishap children are born with defects. This is primarily because of the nuclear effect. Do we have any remedy for this? The answer is still no.
- *Fuel Availability:* Unlike fossil fuels which are available to most of the countries uranium is very scarce resource and exists in only few of the countries. Permissions of several international authorities are required before someone can even think of building a nuclear power plant.
- Another practical disadvantage of using nuclear energy is that it needs a lot of investment to set up nuclear power station. It is not always possible for developing countries to afford such a costly source of alternative energy. Nuclear power

plants normally take 5-10 years to construct as there are several legal formalities to be completed and mostly it is opposed by the people who live nearby.

- *Non-Renewable*: Nuclear energy uses uranium which is a scarce resource and is not found in many countries. Most of the countries rely on other countries for the constant supply of this fuel. It is mined and transported like any other metal. Supply will be available as long as it is there. Once all extracted, nuclear plants will not be of any use. Due to its hazardous effects and limited supply, it cannot be termed as renewable.
- On August 9, 1945, Nagasaki fell to the same treatment with a Plutonium bomb. It is targeted only a mile and a half, but it still leveled nearly half of the city. In few seconds, Nagasaki's population dropped from 422,000 to 383,000. Over 25,000 people were injured.



Radioactive Isotopes

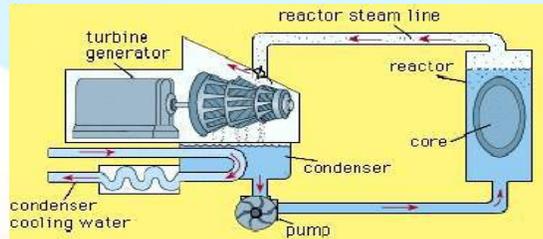
- Elements can be made radioactive by bombarding them with neutrons. The atoms of the elements so bombarded capture these neutrons, thus form a different nuclei called radioisotope. These radioisotopes have unstable nuclei, and dissipate excess energy in the form of gamma and other rays.

Medical Uses

- In isotope scanning, a radioisotope is introduced into the body, usually by means of intravenous injection. The isotope is then taken up in different amounts by different organs. Its distribution can be determined by recording the radiation it emits, and through charting its concentration it is often possible to recognise the presence, size, and shape of various abnormalities in body organs.
- The human body organs affected by cancer are treated with nuclear radiations called radiotherapy. Affected cells are killed by this process.

Production of Electric Power

- Production of nuclear power is similar to other plants with the difference that nuclear energy is used for the production of steam that rotates the turbine blades with its exhaust.



Use in Agriculture

- Technical advancement in nuclear technology has helped in the production of crop seeds having more crop production and safe from insects and other illness.
- Nuclear radiations help to preserve fruits and vegetables for a longer time.
- This also helps in analysing soil type and gives information to enhance its quality.

Explore: The students explore the advantages and disadvantages of nuclear energy through browsing the net.

Explain: The teacher explains the uses of nuclear energy.

Elaborate: The teacher elaborates on the uses of nuclear energy. The nuclear programmes of India are to be described. APSAR and CIRUS can be mentioned. The atom bomb and the hydrogen bomb are to be discussed along with their working principle and their negative effects. A mention of nuclear holocaust can be made.

Evaluate: The advantages and disadvantages of nuclear energy are evaluated through discussions.

Discussion- The teacher initiates a discussion on different concepts and sub-concepts of nuclear energy production with the help of charts, figures, drawings, video clips, paper cuttings, slides etc. She elaborates on the uses of nuclear energy. India's nuclear programmes have to be elaborated (mentions the Apsara, Cirus, etc.). The atom bomb and the hydrogen bomb can be discussed; their working principles and negative

effects can be discussed. A mention of nuclear holocaust can be made to promote empathy.

The class is divided into two groups next. 1) for India to remain as a nuclear power. 2) against it. The two groups elaborate on the position (no national security, energy, self-sufficiency) and negative aspects (bombs are harmful to life, they destroy life forever). Finally voting is done to decide outcome of the debate. These discussions and debates facilitate problem-solving.

Associate Questions

What are the benefits of nuclear energy in Space Age?

Is nuclear energy a necessary evil? Discuss.

Year end Evaluation

Enlist disadvantages of nuclear energy?

What is a time bomb made of?

When and where was the first nuclear explosion in India carried out?

EXEMPLARS IN MATHEMATICS

Exemplar 1

Topic: Matrices

Overview: An array of numbers or alphabets or both arranged systematically in the form of rows and columns is called a matrix. The array of numbers is enclosed by brackets ().

If a matrix has m rows and n columns then it is called a matrix of order $m \times n$ or of order m by n .

Types of matrices: a) zero matrix b) row matrix c) column matrix d) rectangular matrix e) square matrix f) diagonal matrix g) scalar matrix h) unit matrix i) upper triangular matrix j) lower triangular matrix k) symmetric matrix l) skew symmetric matrix.

Algebra of matrices- 1) equality of matrices 2) addition of two matrices 3) scalar multiples of matrix 4) multiplication of matrices 5) properties of addition, scalar multiplication and product of matrices 6) transpose of a matrix.

Objectives: Fundamentals of matrix and matrix algebra

Columnar Framework

Sub topic	Concept	Sub concept	Process skills	Aligned life skills	Takeaway life skills
Types of matrices	Algebra of matrices	Zero matrix Row matrix Rectangular matrix Square matrix Column matrix Diagonal matrix Scalar matrix Unit matrix Upper triangular Lower triangular Symmetric Skew symmetric	Understanding Express Analysis Representation Estimation	Self-awareness Empathy Inter-personal relationships	Self-awareness Problem-solving

Materials used: Diagrams, charts, models

The Process

Engage

Types of matrices

a) zero matrix- the matrix in which every entry is a zero, is called a zero matrix. The zero matrix of order $m \times n$ is denoted by $O_{m \times n}$.

b) row matrix- a matrix having only one row is called as row matrix

c) column matrix- a matrix having only one column is called as column matrix

d) rectangular matrix- a matrix in which the number of rows is not equal to number of columns is called as rectangular matrix.

e) square matrix- A matrix in which the number of rows is equal to number of columns, is called a square matrix. The elements along the diagonal which runs from left top to right bottom are called the diagonal element of the square matrix.

f) Diagonal matrix- A square matrix in which all the elements except the diagonal elements are zero, is called a diagonal matrix.

g) scalar matrix- A diagonal matrix in which the diagonal elements are equal is called a scalar matrix.

h) Unit matrix- A diagonal matrix in which each diagonal element is unity is called the unit matrix. The unit matrix of order $n \times n$ is denoted by I_n .

i) Upper triangular matrix- It is a square matrix in which lower triangular elements are zero.

j) Lower triangular matrix- It is a square matrix in which upper triangular elements are zero

k) Symmetric matrix- It is a square matrix the element of which satisfy the condition $a_{ij} = a_{ji}$ where a_{ij} represents elements in the i^{th} row and j^{th} column.

Explore

1. Row matrix : eg., $A = [1 \ 5 \ 7]_{1 \times 3}$

2. Column matrix eg., $x = \begin{bmatrix} x \\ y \\ z \end{bmatrix}_{3 \times 1}$

3. Square matrix eg., $A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 1 & 3 \\ 1 & -1 & 4 \end{bmatrix}_{3 \times 3}$

$$B = \begin{bmatrix} 1 & 2 \\ 5 & -4 \end{bmatrix}_{2 \times 2}$$

4. Diagonal matrix: eg., $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 4 & 0 \\ 0 & 5 \end{bmatrix}$

5. Scalar matrix eg., $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ $B = \begin{bmatrix} a & 0 \\ 0 & a \end{bmatrix}$

6. Unit matrix or identity matrix eg.,

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}_{3 \times 3} \quad I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

7. Upper triangular matrix eg.,

$$A = \begin{bmatrix} 5 & 4 & 2 \\ 0 & 1 & 2 \\ 0 & 0 & 3 \end{bmatrix}_{3 \times 3}$$

8. Lower triangular matrix eg.,

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 8 & 3 & 0 \\ 2 & 4 & 6 \end{bmatrix}_{3 \times 3}$$

9. Geometric matrix eg., $A = \begin{bmatrix} 2 & -5 & 1 \\ -5 & 4 & 7 \\ 1 & 7 & 3 \end{bmatrix}$

$$a_{12} = a_{21} = -5; a_{13} = a_{31} = 1; a_{23} = a_{32} = 7$$

10. Show symmetric matrix Eg: $A = \begin{bmatrix} 0 & 2 & 4 \\ -2 & 0 & -3 \\ -4 & 3 & 0 \end{bmatrix}$

Here $a_{12} = -a_{21}$, $a_{13} = -a_{31}$, $a_{23} = -a_{32}$

Explain

Equality of matrices: Two matrices are said to be equal, if they are of the same order and if the corresponding elements are equal

Ex: 1) If $A = \begin{bmatrix} 2 & 3 \\ 5 & 1 \\ 4 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 5 & 1 \\ 4 & -1 \end{bmatrix}_{3 \times 2}$ then $A=B$

Scalar multiplication of a matrix: If A is a matrix of order m x n and if k is any scalar then kA represents scalar multiplication of A by the scalar k

Ex: If $A = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{bmatrix}$ then $3A = \begin{bmatrix} 3a_1 & 3b_1 & 3c_1 \\ 3a_2 & 3b_2 & 3c_2 \end{bmatrix}$ and $B = \begin{bmatrix} 3a_1 & 3b_1 & 3c_1 \\ 3a_2 & 3b_2 & 3c_2 \end{bmatrix}$ Then AB represents multiplication b/w the modified A and B scale that

$$AB = A \begin{bmatrix} 3a_1 & 3b_1 & 3c_1 \\ 3a_2 & 3b_2 & 3c_2 \end{bmatrix} = A \begin{bmatrix} 3a_1 & 3b_1 & 3c_1 \\ 3a_2 & 3b_2 & 3c_2 \end{bmatrix}$$

Matrix multiplication is not commutative. But it is associative. Thus $AB \neq BA$ and $A(BC) = (AB)C$.

Transpose of a matrix: If A is a matrix of order mxn then transpose of A is also a matrix of order nxm which is obtained by interchanging the rows and columns of A.

- (i) If A is a symmetric matrix, then $A=A^T$
- (ii) If A is a scalar symmetric, then $A=-A^T$

Elaborate

The evolution of concept of matrices is the result of an attempt to obtain compact and simple methods of solving system of linear equations.

Problem

1. A manufacturer produces three products x, y, z which he sells in two markets. Annual sales are indicated below.

Market	Products		
I	10,000	2,000	18,000
II	6,000	20,000	8,000

If unit sale prices of x, y and z are Rs. 2.50, Rs. 1.50 and Rs. 1.00 respectively, find the total revenue in each market with the help of matrix algebra.

Solution

Let $P = \begin{bmatrix} 10,000 & 2,000 & 18,000 \\ 6,000 & 20,000 & 8,000 \end{bmatrix}$ be the annual sales of the products x, y & z in the I and II markets.

$S = \begin{bmatrix} 2.5 \\ 1.5 \\ 1.0 \end{bmatrix}$ be the selling price of the products x, y & z respectively.

$C = \begin{bmatrix} 2.0 \\ 1.0 \\ 0.5 \end{bmatrix}$ be the cost price of the products x, y & z respectively.

$$\begin{aligned} \text{We have total revenue} = PS &= \begin{bmatrix} 10,000 & 2,000 & 18,000 \\ 6,000 & 20,000 & 8,000 \end{bmatrix} \begin{bmatrix} 2.5 \\ 1.5 \\ 1.0 \end{bmatrix} \\ &= \begin{bmatrix} 25,000 + 3,000 + 18,000 \\ 15,000 + 30,000 + 8,000 \end{bmatrix} = \begin{bmatrix} 46,000 \\ 53,000 \end{bmatrix} \end{aligned}$$

\therefore Total revenue in I and II markets are 46,000 and 53,000 respectively.

* Student identifies to understand and express as a row matrix/column matrix as needed in problem solving.

The above word problem on matrices for x, y and z highlights development of life skills of problem-solving and self-awareness.

Matrices are not only used as a representation of the coefficients in system of linear equations. But utility of matrices far exceeds their use. Matrix notation is used in electronic, spreadsheet programs for personal computer, which in turn is used in different areas of business and science like budgeting, sales projection, cost estimation, analyzing the results of an experiment etc. Also many physical operations such as magnification, rotation reflection through a plane can be represented mathematically by matrices. Matrices are also used in cryptography, is a mathematical tool in genetics, economics, sociology, modern psychology and industrial management.

Evaluate

Q.1) What do you mean by matrix?

Ans: (1) Matrix is an array of only numbers

(2) Matrix is an array of only alphabets

2) Give an example for upper triangular matrix?

$$(1) A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 0 & 4 \\ 0 & 0 & 5 \end{bmatrix}$$

$$(2) B = \begin{bmatrix} 1 & -1 & 2 \\ 0 & -2 & 3 \\ 0 & 0 & -3 \end{bmatrix}$$

$$(3) B = A = \begin{bmatrix} 2 & 0 & 0 \\ 8 & 3 & 0 \\ -2 & 4 & 6 \end{bmatrix}$$

3) Give an example for symmetric matrix

$$(i) \begin{bmatrix} 2 & -5 & 1 \\ -5 & 4 & 3 \\ 1 & 7 & 3 \end{bmatrix}$$

$$(2) \begin{bmatrix} 2 & -5 & 1 \\ -5 & 2 & 7 \\ -1 & 7 & 2 \end{bmatrix}$$

$$(3) \begin{bmatrix} 0 & 2 & 4 \\ 2 & 0 & -3 \\ 4 & -3 & 0 \end{bmatrix}$$

(4) Give an example for scalar matrix

If $A = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{bmatrix}$ then $3A = ?$

Ans: $3A = \begin{bmatrix} 3a_1 & a_2 & a_3 \\ 3b_1 & b_2 & b_3 \end{bmatrix}$

$$3A = \begin{bmatrix} 3a_1 & 3a_2 & 3a_3 \\ 3b_1 & 3b_2 & 3b_3 \end{bmatrix}$$

Associate Questions

Where is matrix notation used?

State the importance of matrices in cryptography.

Year end Evaluation

If a matrix has 24 elements, what are the possible orders it can have? What if it has 13 elements?

The number of all possible matrices of order 3×3 with each entry 0 or 1 is 2^9 .

Exemplar 2

Topic: Relations

Overview: A relation R in a set A is called empty relations if $n \in A$ element of A is related to any element A . i.e., $R = \emptyset \times A$. A relation R in a set A is called universal relation, if each element of A is related to every element of A . i.e., $R = A \times A$. Both the empty relation and the universal relation are sometimes called trivial relations. A relation R in a set A is called (i) reflexive, if $(a, a) \in R$ for every $a \in A$,

(ii) Symmetric, if $(a_1, a_2) \in R$ implies that $(a_2, a_1) \in R$ for all $a_1, a_2 \in A$, for all $a_1, a_2, a_3 \in A$

Objectives: We can understand relations in a better way, providing better examples from real life.

Columnar Framework

Sl No.	Sub Topic	Concept	Sub concept	Process skills	A light life skills	Takeaway life skills
1	Types of relations	Subset, empty set & universal set and relation set	Observing skills		Interpersonal relationships Problem solving Decision making Creative thinking	Problem solving and decision making

Materials used: Black Board + chalk and charts

The Process

Engage: We can engage students by taking the example of XII standard students in two sets. Let us consider

$A = \{\text{students who are all having habit of studying scientific concepts}\}$

$B = \{\text{students who are all not having habit of studying scientific concepts}\}$

Then, some example of relation A to B

- (i) $\{(a, b) \in A \times B : a \text{ is more knowledgeable than } b\}$
- (ii) $\{(a, b) \in A \times B : a \text{ is more interested in research than } b\}$
- (iii) $\{(a, b) \in A \times B : a \text{ is utilizing time in proper way than } b\}$
- (iv) $\{(a, b) \in A \times B : a \text{ lives in some location as } b\}$

Explore: Let A be the set of all students of a boy's school Then $R=A \times A$

(i) Empty relation:- $R=\{(a,b) \mid a \text{ is sister of } b\}$

(ii) Universal relation:- $R=\{(a,b) \mid a \text{ belong to same school as } b\}$

By considering

$A=\{1,2,3\}$ and $B=\{1,2,3\}$

$R=A \times B=\{(1,1), (1,2), (1,3), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3)\}$

(i) Reflexive:- if $(a,a) \in R$, for every $a \in A$

(ii) Eg:-1) Consider $1 \in A$ then $(1,1) \in R$

(iii) So R is reflexive

(iv) Symmetry: if $(a_1, a_2) \in R$ implies that $(a_2, a_1) \in R$

It is purely visible that, it is symmetric.

Transitive:- if $(a_1, a_2) \in R$ and $(a_2, a_3) \in R$ implies that $(a_1, a_3) \in R$

$a_1, a_2, a_3 \in R$

Our relation $R=A \times B$ follows this rule. Hence it is transitive

Since it is equivalence because R is reflexive symmetric and transitive.

Explain:- Set is well defined collection of objects.

eg: $A=\{1,2,3,4,5,6,7,8,9\}$ $A=\{n \mid n \text{ is less than } 10\}$

$B=\{\text{collection of Indian rivers}\}$

$B=\{\text{Nile, Amazon, Ganga, Kaveri, Narmada, Godavari}\}$

B is not a set bcz, according to our definition B is set of Indian rivers.

(i) Empty relation:- Empty relation is a relation $R \subseteq A \times A$ given by $R=\emptyset$

Eg: Consider a relation R in the set $A=\{1,2,3,4\}$ given by $R=\{(a,b) \mid a-b=10\}$

This is the empty set, as no pair (a,b) satisfies the condition $a-b=10$

(ii) Universal relation:-
 $R^1 = \{a, b\} : |a-b| \geq 0\}$ is the universal set $A \times A_1$ as all pairs (a, b) in $A \times A$ satisfy $|a-b| \geq 0$

Empty Set:- The set containing no elements.

It is represented by \emptyset or $\{\}$

Elaboration: A problem on relations here highlighting life skills of problem solving and decision making is developed here.

Problem: To explore equivalence relation $\left\{ \begin{array}{l} \rightarrow \text{Reflexive} \\ \rightarrow \text{Symmetric} \\ \rightarrow \text{Transitive} \end{array} \right\}$

Let L be the set of all lines in xy plane and R be the relation in L defined as,

$$R = \{(L_1, L_2) : L_1 \text{ is parallel to } L_2\} \quad \begin{array}{l} - L_1 \\ - L_2 \end{array}$$

Show that R is equivalence relation.

Solution: Let A be the set of all lines in xy -plane.

$$R = \{(L_1, L_2) : L_1 \text{ is parallel to } L_2\}$$

$$R = \{(L_1, L_2) : L_1 \parallel L_2\}$$

Reflexive: Since every line L is parallel to itself,
 $(L, L) \in R$

Symmetric: Let $(L_1, L_2) \in R$

$$\Rightarrow L_1 \text{ is parallel to } L_2$$

$$\Rightarrow L_2 \text{ is parallel to } L_1$$

$$\Rightarrow (L_2, L_1) \in R$$

$\therefore R$ is symmetric

Transitive: Let $(L_1, L_2) \in R$ and $(L_2, L_3) \in R$
 $\Rightarrow L_1$ is parallel to L_2 and L_2 is parallel to L_3
 $\Rightarrow L_1$ is parallel to L_3
 $\Rightarrow (L_1, L_3) \in R$

$L_1 \text{ ---}$
 $L_2 \text{ ---}$
 $L_3 \text{ ---}$

i.e. whenever aRb and $bRc \Rightarrow aRc$

$\therefore R$ is transitive.

Knowledge of all types of relations is enhanced developing an inner sense of how to apply it for life skills of problem solving, decision-making and Geometry.

Evaluation: Q. (1) What is relation?

Ans: (1) Relation between two objects

(2) Relation between my friend and myself

Q.2) Are all relations are functions?

Ans: (1)Yes (2) No (3) May be or may not be

Q.3 Give some examples for empty relation?

Ans: (1) $A = \{\text{group of gentlemen}\}$

$R = A \times A = \{(a,b) : a \text{ is the sister of } b\}$

$r = a \times a = \{(A,B) : \text{is wife of } b\}$

Q.4) What are the types of relations?

Ans: (1) Empty relation

Universal relation

Reflexive relation

Symmetrical relation

Transitive relation

(2) Reflexive relation

Symmetrical relation

Transitive relation

Associate Questions

Try a problem taking three similar triangles in a plane. Does it form an equivalence relation?

Do relations and functions compare with relations in life?

Year end Evaluation

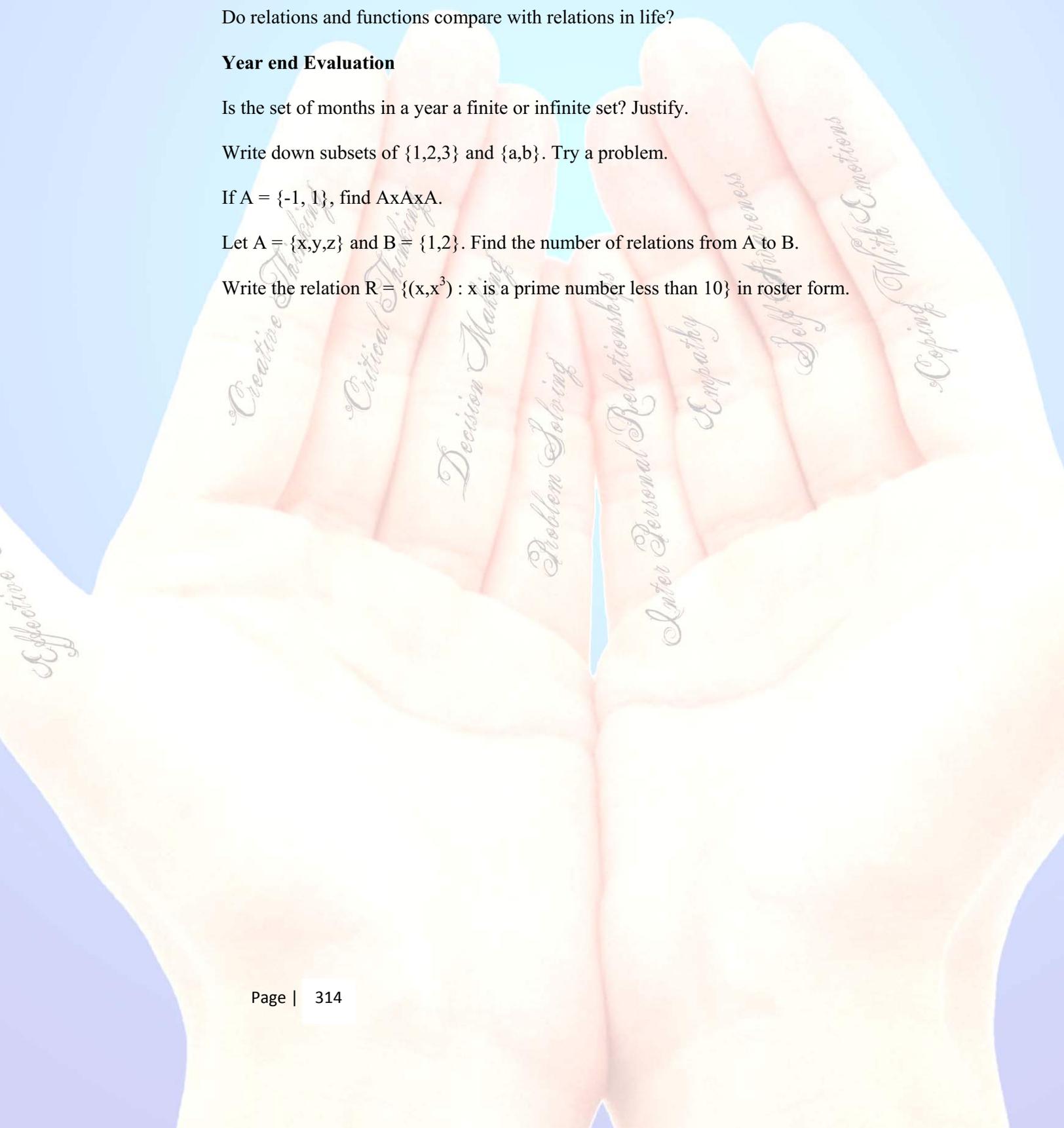
Is the set of months in a year a finite or infinite set? Justify.

Write down subsets of $\{1,2,3\}$ and $\{a,b\}$. Try a problem.

If $A = \{-1, 1\}$, find $A \times A \times A$.

Let $A = \{x,y,z\}$ and $B = \{1,2\}$. Find the number of relations from A to B.

Write the relation $R = \{(x,x^3) : x \text{ is a prime number less than } 10\}$ in roster form.



Exemplar 3

Topic: Linear Programming

Overview

- Linear programming is a mathematical technique used in the real-world to solve optimization problems.
- Typical real-world linear programming problems are complex and they are solved using sophisticated techniques. However, the classroom problems still give us an understanding of a method for solving problems. The **constraints**, expressed as linear inequalities and represented by their graphs and the **objective function** with its associated search line provide a model of a situation. In this sense, linear programming is also an example of a modelling technique.

Objectives

- 1) To understand the term Linear Programming and reason out why it is needed.
- 2) To understand the terms Objective function, Optimal Value of an objective function, linear constraints and decision variables in relation to a given problem.
- 3) To identify the feasible region, feasible solution, infeasible region, infeasible solution, optimal (feasible) solution from the graph.
- 4) To be able to solve an LPP problem using a graph.

Columnar Framework

Sub-topics	Concepts	Sub-concepts	process skills and 5Es	Aligned components of life skills	Life skills (take away)
Linear Programming and its use to solve problems in everyday life.	Objective function, Optimal value, Constraints decision variables and feasible region.	Plotting the feasible region in the graph by analysing a given problem on LPP.	Planning, Investigating, Explaining	Decision Making, Effective communication, Critical Thinking Problem Solving.	Decision Making

Materials

- squared paper or graph paper, pencils
- rulers, coloured pencils

The Process

Engage

- The students listen to a video lesson and analyse the various terms ^Objective function, Optimal value, Constraints, decision variables related to a problem.
- The students listen to another video lesson and identify the meaning of feasible region, feasible solution (Optimal) on a graph sheet.
- The Students listen to another video lesson and find an optimal solution to a given problem.

In the above process students develop the scientific processes of Analysing, Planning, Investigating, Explaining and Critical thinking.

Explore

- The students explore the topic through problems and exercises.
- Students listen to the first video and identify the terms Objective function Optimal value Constraints, decision variables related to a problem (promotes effective communication).

Explain

- Students listen to the second video lesson and relate the feasible region and solution to the graph sheet (Promotes, Decision Making and effective communication).

Elaborate/Evaluate

- Students listen to the third video lesson and solve the given problem using graphical method (promotes, critical thinking, decision making, Problem solving and effective communication).

Associate Questions

Can you identify some more problems from the exercise on LPP? (Also refer video clippings in CD)

What are the applications of LPP in industry, commerce and management science.

Year end Evaluation

Solve the following LP problems graphically.

Maximise $z = 3x + 4y$ subject to the constraints: $x+y \leq 4$, $x \geq 0$, $y \geq 0$.

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TEMPLATES FOR ASSESSMENT OF LIFE SKILLS IN MATHEMATICS

Table1: Infusion of Life skills in the subject- Mathematics Unit: Time & Distance

Topic/sub-topic	Possible skill	Technique

Table2:

Evaluation of a science project						
Rating						
Item Project	Out standing 4 points	Acceptable 3 points	Minimally acceptable 2 points	Poor 1 point	Weight	Weighted score
Planning of the project						
Designing of the experiment						
Lab skills						
Writing report						
General descriptive statement						
Teacher: -				Date		

Assessment of Creativity in Mathematics:

There is one example how University of Cambridge Local Examinations Syndicate, in 2006, amalgamates unseemly unrelated ideas and their association in a single question (Fig. 1). This question involves mathematical ideas of rotation, areas of similar figures, Pythagoras' Theorem and trigonometrical ratio. Such a creative question is not common in preceding years.

The points A, B, P and Q are (2, 4), (0, 4), (10, 0) and (8, 4) respectively.

- (a) (i) Calculate angle AOB.
(ii) Show that $OA = \sqrt{20}$.
- (b) The triangles OAB and OPA are similar.

Calculate the values of Area of ΔOPO .

Area of ΔOAB

- (c) Triangle OAB is mapped onto triangle XYZ by a rotation, 90° , anticlockwise, with centre (0, 2). Write down the coordinates of X , Y and Z .

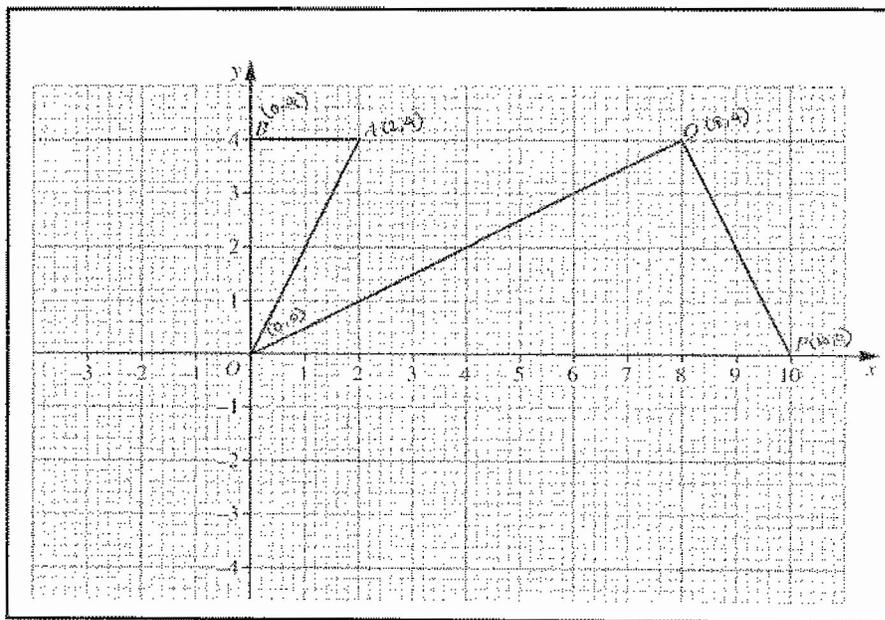
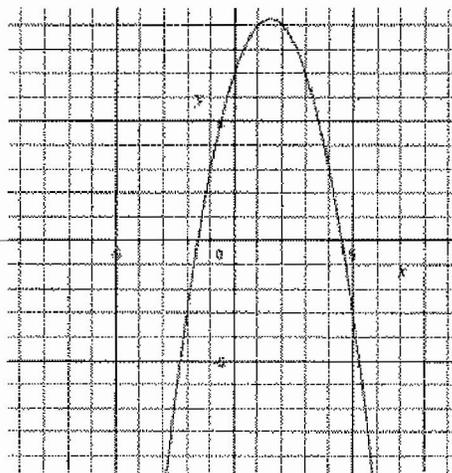


Figure 1

Exemplar1:

Task 1. Find the largest and smallest values of the function $y = 7 + 3x - x^2$ on the interval $[-1, 5]$.

Drawing



Responses:

"I recognise this function, I have seen that an x^2 -function (meaning second degree polynomial) can look like a valley if it is $+x^2$ and a hill if it is $-x^2$. I can see that the minimum is at the endpoint, at $x = 5$."

She sees that the maximum seems to be at $x = 1.5$, but recalls that one can not determine such a value from a graph. Anne calculates several function values for x close to 1.5, but seems unable to use them. She is silent for 2 minutes.

Interpretation:

"We have just learnt about derivatives... It says what the slope is. And, the maximum is the only place where the slope is zero. I can do that, I think... I think that the derivative of an x^2 -function is an x -function (meaning first degree polynomial)."

Dimensions of Creativity:

1. Novelty
2. Flexibility
3. Plausibility
4. Mathematical Foundation

Exemplar2:

"The formula $f(n) = n^2 + n + 41$ gives a prime number for all n I have tried, from $n = 0$ to $n = 30$. Therefore $f(n)$ is probably a prime for all whole numbers n ."

Exemplar2:

The triangle ABC is given. Calculate the area of the triangle.

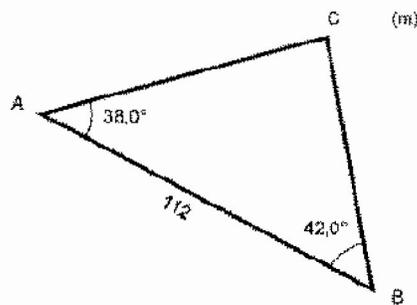


Figure 3.3: Triangle ABC.

APPENDIX 1

ANALYSIS OF XII STANDARD PHYSICS TEXTBOOK

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
1	1.2 p.no. 2	Frictional Electricity When substances are rubbed with each other accumulation of charges will occur Vehicle carrying inflammable materials usually have metallic ropes touching ground during motion.why?	Critical thinking Decision making problem solving	-
		Charges developed in the vehicle due to friction with air, friction between moving parts of the vehicle and friction between the tyre and the road This accumulation leads to sparks	Objectivity Self knowledge Knowledge of the situation Divergent thinking Analytical ability General intelligence Intelligence	-
3	3.4 p.no 96	Resistance of a conductor (equation) $R=l/A$ Q) From the given material of wire make a $0-01\Omega$ resistance Ans) He knows the material If the wire, can be find out Area can be calculated by using screw gauge. $\approx 10-5\Omega m$ $A = 10-4m^2$ $R=0.01\Omega$ $L=RA \approx 10 \text{ cm}$	Creative thinking Critical thinking Decision making Problem solving	Objectivity Self knowledge Knowledge of the situation Analytical ability Divergent thinking Systematic ability Logical thinking Intelligence
1 2	1.15.3 2.9 p.no.39,69	Electrostatic shielding Field due to a uniformly charged thin spherical shell Q) When there is lightning sitting inside the car is safer than sitting outside. Ans) Spherical shell. No change inside. Uniformly spread over the surface.	Creative thinking Decision making Problem solving	Objectivity Self knowledge Knowledge of the situation Logical thinking Intelligence

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
3	3.10 p.no.107	Combination of resistors Q) given resistors 100Ω,50Ω,75Ω,50Ω To set 18.76Ω 125Ω 118.76Ω →18.76= Parallel $1/R=1/R_1+1/R_2+1/R_3$ $=1/50+1/75+1/50$ $1/R=0.0533$ $R=18.76\Omega$ $R=R_1+R_2+R_3$ $100+50+75$ $=125\Omega$ 118.76 Combination of series and parallel 18.76 + 100 Diagram--	Creative thinking Decision making Problem solving	Objectivity Self knowledge Knowledge of the situation Analytical ability Divergent thinking Logical thinking Intelligence
9	9.4 p.no. 319	Total Internal Reflection Q) What is the curve of delayed sunset and early sun rise? Optical fibers- What are the applications?	Critical thinking Creative thinking Decision making Problem solving	Objectivity Self knowledge Knowledge of the situation Divergent thinking Analytical thinking General intelligence
5	5.7 p.no. 195	Classification of magnetic materials. Q) Steel is used to make permanent arrangement and iron for electro magnet. Why? Permanent magnet ferro magnetic - coercibility large Electro magnet iron - Coercibility is less Diagram Coercibility= UC Retentivity= UA	Creative thinking Decision making Problem solving	Objectivity Self knowledge Knowledge of the situation Divergent thinking Analytical thinking Anticipation of consequences Logical thinking Intelligence

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
2	2.12;2.13 p.no. 75 2.14	Prepare a capacitor How do you make a capacitor of capacitance $1\mu\text{F}$? Combination of capacitors given capacitance $12\mu\text{F}, 6\mu\text{F}, 2\mu\text{F}$, $V=24\text{V}$ get $C=4\mu\text{F}$, and $C=6\mu\text{F}$	Creative thinking Decision making Problem solving	Objectivity Self knowledge Divergent thinking Analytical thinking General intelligence
4	4.11 p.no. 165	A galvanometer has a resistance of 30Ω and current 2mA needed to give a full scale deflection. What is the resistance needed and how it is connected to convert a galvanometer into an ammeter of 0.3A and into voltmeter 0.02V range. $S=i_g/1-i_g=0.201\Omega$ $R=V/I_g-U=U/2\times 10^{-3}-30=70\Omega$	Creative thinking Decision making Problem solving Empathy	Objectivity Self knowledge Knowledge of the situation Divergent thinking Analytical thinking Logical thinking Intelligence
7	7; p.no. 259	What is the principle and working of a transformer? The core of the transformer is insulated. Why?	Creative thinking Decision making Problem solving Empathy	Objectivity Self knowledge Divergent thinking Analytical ability Logical thinking General intelligence
6	6.10 p.no.224	A C generator Q) Working principle of a. c. generator	Effective communication Creative thinking	Objectivity Logical thinking Intelligence
	9.7 p.no.332 9.9.1 p.336	Dispersion of light The eye	Critical thinking Creative thinking Decision making Critical thinking Decision making Problem solving	- -

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
9	9.9.2 9.9.3 (339-41)	Observation of a distant star and a small object	Critical thinking Creative thinking Problem solving Decision making	
10	10.1 p.no. 353	Does light travel in straight lines?	Critical thinking Creative thinking Decision making Problem solving Interpersonal relationships Critical thinking Creative thinking Problem solving	-
10	10.3.4 p. no.358	The Doppler Effect	Critical thinking Creative thinking Problem solving	
11	11.7 p.no. 395 11.8 p.no.398	Particle nature and wave nature	Critical thinking Creative thinking Problem solving Effective communication Coping with emotions Self-awareness	-
12	12.2 p.no.417	Explanation of parts of graph	Creative thinking	
12	12.3 p.no.421 12.6 p.no.431	Atomic spectra and emission lines of Hydrogen spectrum De Broglie explanation	Critical thinking Creative thinking Problem solving Decision Making Critical thinking Creative thinking Problem solving Decision Making	-

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
13	13.4 p.no.442, 444,445, 446,448, 452,455, 457	Heavy nuclei have lower BE. Why?	Critical thinking Creative thinking Problem solving Decision Making	-
	13.4 p.no.444	Explanation of BE curve	Critical thinking Creative thinking Problem solving Decision Making	
13	13.5 p.no.445	Nuclear force graph explanation	Critical thinking Creative thinking Effective communication	-
	13.6 p.no. 446	Why does radio-activity take place?	Critical thinking Creative thinking Problem solving Decision Making Effective communication	
	13.6.1 p.no.448	Half-life of U238 in 4.5×10^9 years	Critical thinking Creative thinking Problem solving	
	13.7 p.no.451, 452	Why is energy released in fusion greater than in fission? Compare atom bomb and hydrogen bomb- Hiroshima and Nagasaki.	Critical thinking Creative thinking Problem solving Decision Making	

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
	13.7.2 p.no.455	Draw a schematic diagram of a nuclear reactor	Critical thinking Problem solving	
	13.7.3 p.no.457	Nuclear holocaust	Critical thinking Problem solving	
	13.7.4 p.no.457	Controlled nuclear reaction-nuclear energy	Problem solving Effective communication Coping with emotions Coping with stress Self awareness Empathy	
14	14.4 p.no. 474,480, 485,487, 488, 489, 490,497, 500,501	Why do you add impurity to a conductor? How much impurity is to be added?	Creative thinking Decision making Problem solving	-
	14.6.2 p.480	Why is forward biasing required to cause current conduction in a p-n junction?	Critical thinking Decision making	
	14.8.1 p.no.485	Explain the working of Zener diode as a rectifier	Critical thinking Creative thinking Problem solving	
	14.8.2 p.no.487	Photo diodes are used in reverse biased condition. Why?	Critical thinking Creative thinking Problem solving Decision making	

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
	14.8.2 p.no.488	How does an LED WORK?	Critical thinking Effective communication	
	14.8.2 p.no.489	Solar cell Unconventional energy Lack of energy resources	Critical thinking Creative thinking Problem solving Decision making Effective communication Self-awareness Empathy	
	14.9.2 p.no.493-496	How do you get a collector current even though the C-B junction is reverse biased?	Critical thinking Decision making Problem solving	
	14.9.3 p.no.497	Transistor as an amplifier. Where does the extra energy come from?	Critical thinking Creative thinking Decision making Problem solving	
	14.9.5 p.no.500	What is the source of energy in an oscillator?	Critical thinking Decision making	
	14.10.1 p.no.502	Why is it called a gate?		

Chapter	Sub unit of Ch.	Content Area	Life skill	Sub skill
	15.4 p.no.519	Frequency bands in communication	Critical thinking Creative thinking Decision making Problem solving	-
	15.7 p.no.522	Necessity for modulation	Critical thinking Creative thinking Decision making Problem solving	
	15.10 528,	Internet, fax mobile	Effective communication Self-awareness	

ANALYSIS OF XII STANDARD CHEMISTRY TEXTBOOK

Chapterwise analysis of Std XII Textbooks(NCERT,2007) in Chemistry-Part I

Unit	Sub-unit	Content area	Life skills	Sub skills
1	1.2	The Solid State Amorphous & crystalline solids	Critical & Creative Thinking skills	-
1	1.3	Classification of solids	Critical thinking Decision making	-
1	1.8	Calculations involving unit cell dimensions	Problem solving	-
1	1.9	Imperfections in Solids	Self awareness Empathy	-
1	1.10.1 1.10.2	Conduction of electricity	Decision making Critical & creative thinking	-
2	2.1-2.6.5	Solutions	Problem solving	-
3	3.1-3.7	Electrochemistry of cells	Problem solving Critical & creative Thinking	-
3	3.8	Corrosion	Self awareness Critical thinking Problem solving	-
4	4.1	Chemical kinetics	Problem solving Decision making Self awareness	-
4	4.2	Factors influencing rate of a reaction	Self awareness	-
5	5.1.1	Surface chemistry Adsorption & absorption	Creative thinking Critical thinking	-
5	5.2	Catalysis	Problem solving Decision making Self awareness Creative thinking Critical thinking	-

Unit	Sub-unit	Content area	Life skills	Sub skills
5	5.4	Colloids	Critical & creative thinking Decision making Self awareness	-
7	7.1-7.2	P-Block elements periodic trends	Decision making Critical thinking Self-awareness	-
		VSEPR theory	Decision making	
9		Coordination compounds	Critical thinking	
9	9.1	Werner's theory	Critical and creative thinking Coping with stress and emotions Decision making	
9	9.4	Isomerism	Critical and creative thinking	
9	9.5.2	Magnetic properties	Critical and creative thinking Problem solving Decision making	
9	9.5.4	Crystal field theory	Critical and creative thinking Problem solving Decision making Self awareness	

ANALYSIS OF XII STANDARD BIOLOGY TEXTBOOK

Chapterwise analysis of Standard XII Textbooks (NCERT, 2006) in Biology

Unit	Chapter No.	Content area	Life skills	Sub skills
VI	1	Reproduction in organisms	Critical thinking Decision making Interpersonal relations Coping with emotions Empathy	
	2	Sexual reproduction in flowering plants	Critical thinking Decision making Problem solving Interpersonal relations Coping with emotions empathy	
	3	Human reproduction	Critical thinking Creative thinking Decision making Problem solving Interpersonal relations Effective communication Coping with emotions Self awareness Empathy	
	4	Reproductive Health	Critical thinking Creative thinking Decision making Effective communication Coping with emotions Self-awareness Empathy	

VII Genetics and Evolution	5	Principles of Inheritance and variation	Critical thinking Creative thinking Decision making Interpersonal relations Coping with emotions Self-awareness Empathy
	6	Molecular basis of inheritance	Critical thinking Creative thinking Decision making Interpersonal relations Coping with emotions Self-awareness Empathy
	7	Evolution	Critical thinking Creative thinking Decision making Interpersonal relations Coping with emotions Self-awareness Empathy
VIII	8 8.5	Human health and disease Drugs and alcohol abuse (Common diseases in Humans, Immunity, AIDS)	Critical thinking Creative thinking Decision making Problem solving Interpersonal relations Effective communication Coping with emotions Coping with stress Self-awareness Empathy

	8.5.4	Prevention and control i. Avoid undue peer pressure ii. Education and counseling iii. Seeking help from parents and peers iv. Looking for danger signs v. Seeking professional and medical help	Coping with stress and coping with emotions	
	9 9.1 9.2 9.3 9.4	Strategies for enhancement in food production Animal husbandry Plant breeding(green revolution;inbreeding;quality food;plant breeding, disease resistance;outbreeding, hybrids;improve food quality) Single cell proteins Tissue culture	Critical thinking Creative thinking Decision making Problem solving Interpersonal relations	
	10 10.1 10.2 10.3	Microbes in human welfare Microbes in household products(curds, lab fermenting, cheese) Microbes in industrial products Microbes in sewage treatment	Critical thinking Creative thinking Decision making Problem solving Critical thinking Creative thinking Decision making Interpersonal relations Effective communication Coping with emotions Coping with stress Empathy Creative thinking Critical thinking Decision making Problem solving Interpersonal relations Coping with	

			emotions Coping with stress Self awareness Empathy Creative thinking Critical thinking Decision making Problem solving Interpersonal relations Coping with emotions Coping with stress Self awareness Empathy Creative thinking Critical thinking Decision making Problem solving Interpersonal relations Coping with emotions Coping with stress Self awareness Empathy	
	10.4	Microbes in production of biogas		
	10.5	Microbes as bio-control agents		
	10.6	Microbes as bio-fertilisers		
IX	12	Biotechnology and its applications (Genetically modified organisms)	Decision making	Knowledge of the situation Anticipation of consequences Rationality General intelligence
IX	12	Biotechnological applications in Medicines Genetically Engineered Insulin Gene therapy	Problem solving Empathy Coping with emotions	Divergent thinking Rationality Sensitivity Objectivity Social inclination Social responsibility Social obligation Empathy
IX	12	Transgenic animals and ethical issues, biopiracy	Critical thinking	Anticipation of consequences Intelligence Logical thinking

X	13 13.1	Organisms and Populations- Organism and its environment (Abiotic factors like, temperature, water, soil)	Creative thinking	Novelty Innovativeness Divergent thinking
X	13 13.2	Organism and its environment Populations and various attributes like death rate, birth rate, sex ratio, age distribution, population density, population growth	Problem solving (problems arising due to better birth rate, inequal sex ratio, increasing growth)	Positive attitude Divergent thinking Anticipation of the consequences
X	14 14.8	Ecosystem Ecosystem services	Critical thinking	Intelligence
X	15 15.1	Biodiversity and conservation Biodiversity	Problem solving	Positive attitude Logical thinking Analytical ability Synthetic ability
	15.2	Biodiversity Conservation	Creative thinking	Innovativeness Novelty Fluency Flexibility Originality Unconventionality Independence and synthetic ability
X	16 16.1 16.2 16.3 16.4 16.5 16.6 16.7 16.9	Environmental issues Air pollution and its control Water pollution and its control Solid wastes Agro-chemicals and their effects Radioactive wastes Greenhouse effects Ozone depletion Deforestation	Problem solving	Positive attitude Divergent thinking Objectivity Rationality Logical thinking Analytical ability Synthetic ability Anticipation of consequences
			Critical thinking	Analysis and synthetic abilities, objectivity Anticipation of consequences, Intelligence and logical thinking
			Creative thinking skill	Innovativeness Novelty Fluency Flexibility Originality Unconventionally Independence

ANALYSIS OF XII STANDARD MATHS TEXTBOOK

Chapterwise analysis of XII Standard Textbooks (NCERT, 2007) in Mathematics-Part I and II

Chapter	Sub unit	Content Area		Life Skills	Sub skills
1	1.2 1.3	Relations & functions	-Types of function (onto, one-one) -Word problems related to R R	Interpersonal relationships Problem solving Decision making Creative thinking	-
3&4	3 & 4	Matrices & Determinants	Word problems on Matrices solving for xy & z	Self Awareness Empathy Interpersonal Relationships	
5	5.2 5.3	Continuity & Differentiability	Point of discontinuity	Decision making	
6	6.3 6.2	Application of Derivatives	-Strictly increasing or decreasing functions -Rate of change of quantities Word problems based on maxima and minima	Effective communication Decision making Logical thinking Interpersonal relationships	
9	9.5	Differential equations	Finding a general and particular solution of a Differential equation -Methods of solving 1 st order, first degree differential equation	Decision making Critical thinking	
10	10	Vector Algebra	-Finding the height of a monument	Interpersonal relationships Positive attitude	
11	11.5	3 -dimensional geometry	-Shortest distance formula	Decision making	
12	12.2.2	Linear programming	Formulating Linear Programming Problem and solving it graphically (word problems)	Critical thinking Effective communication Empathy Problem solving	
13	13.5	Probability	Bayer Theorem (word problems)	Critical thinking Effective communication Empathy Problem solving	

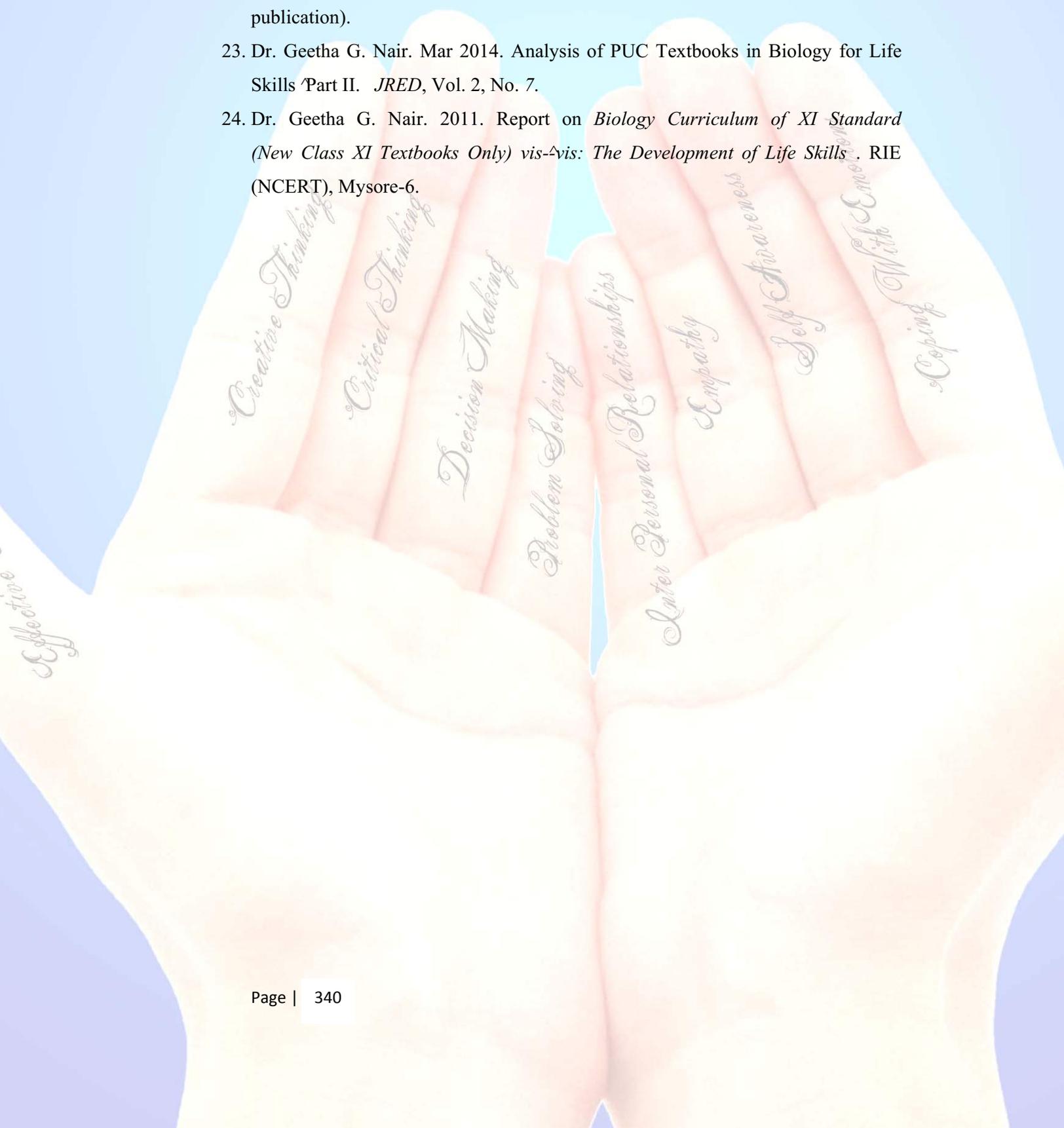
APPENDIX II

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APPENDIX III

WORKSHOP APPROACH PAPERS

Planning workshop (15-06-2013 to 19-06-2013)
Life Skills Education through the teaching learning of Science

Dr. Geetha G Nair
Professor in Botany
RIE, Mysore

Life Skills are the abilities for adaptive and positive behaviour in order to meet the challenges of day-to-day life. According to WHO (1994, 1997) there are ten generic skills (STRUC) categorized into five pairs as follows.

Solving skills

Problem solving
Decision making

Thinking skills

Critical thinking
Creative thinking

Relationship skills

Inter-personal relationships
Effective communication

Understanding skills

Self-awareness
Empathy

Coping skills

Coping with stress
Coping with emotions

These skills are mostly cognitive skills and have an enormous role in the process of learning and development. Life skills are the building blocks of mental development and are of lasting value right from childhood to adolescence and old age, these aid the process of life-long learning.

Most curricula include Life Skills as a co-scholastic area as these are not routinely monitored or assessed. These generic skills help in developmental processes of the brain and an individual develops these latently during the so-called educational process. These form the stepping stones for the furtherance of knowledge in an individual.

Many educational organizations are coming up at present with tools, kits and products for the development of life skills as these are basic to the learning process (mind lab, i-point etc.). And also they want this co-scholastic area to be included as a separate subject in the curriculum from the 6th to 10th standards in India. NCF (2005) is steeped in life skills but no effort has been made so far to introduce life skills into the curriculum or even to introduce life skills education for adolescents in schools. CBSE (2010) has published manuals for development of life skills. Also CBSE has quite a few books on life skills from 6th to 8th standard. Shiva Khera (2010) has come up with a series of books from 5th to 10th standards along with a training manual for evaluation on CCE pattern. CCE (2010) categorises life skills as thinking, social and negotiation skills and has come up with descriptive indicators for the assessment of these in IX and X standards. Life skills with chapters and activities in Major Life Skills form an important component of Integrated Interactive and Innovative Teaching Learning Materials (TLM) for the Next Generation School (with Technology enabled interactive classroom) and this has been prepared by NIIT (www.niitnguru.com). XI standard NCERT Biology textbooks have been analysed under an ERIC Project funded by DERPP, NCERT for life skills integrated into the subject and about 170 content areas with infused life skills have been brought forth (Author, 2011).

This proves that life skills as a co-scholastic area is inseparable from scholastic subjects. There is an imminent need for researching into this much neglected co-scholastic area and give it its rightful place with other subjects. This being so as life skills are important not only in learning and development, but also for improving the general quality of life through art education, work education, physical education, science education, adolescence education, vocational education, peace education, Personal-Social & Health education (PSHE), Citizenship /Inclusive education and community living. As life skills are not taught directly in the classroom as yet, a lacuna was felt in the teaching learning process envisaging the development of modules in Life Skills /Life Skills Education.

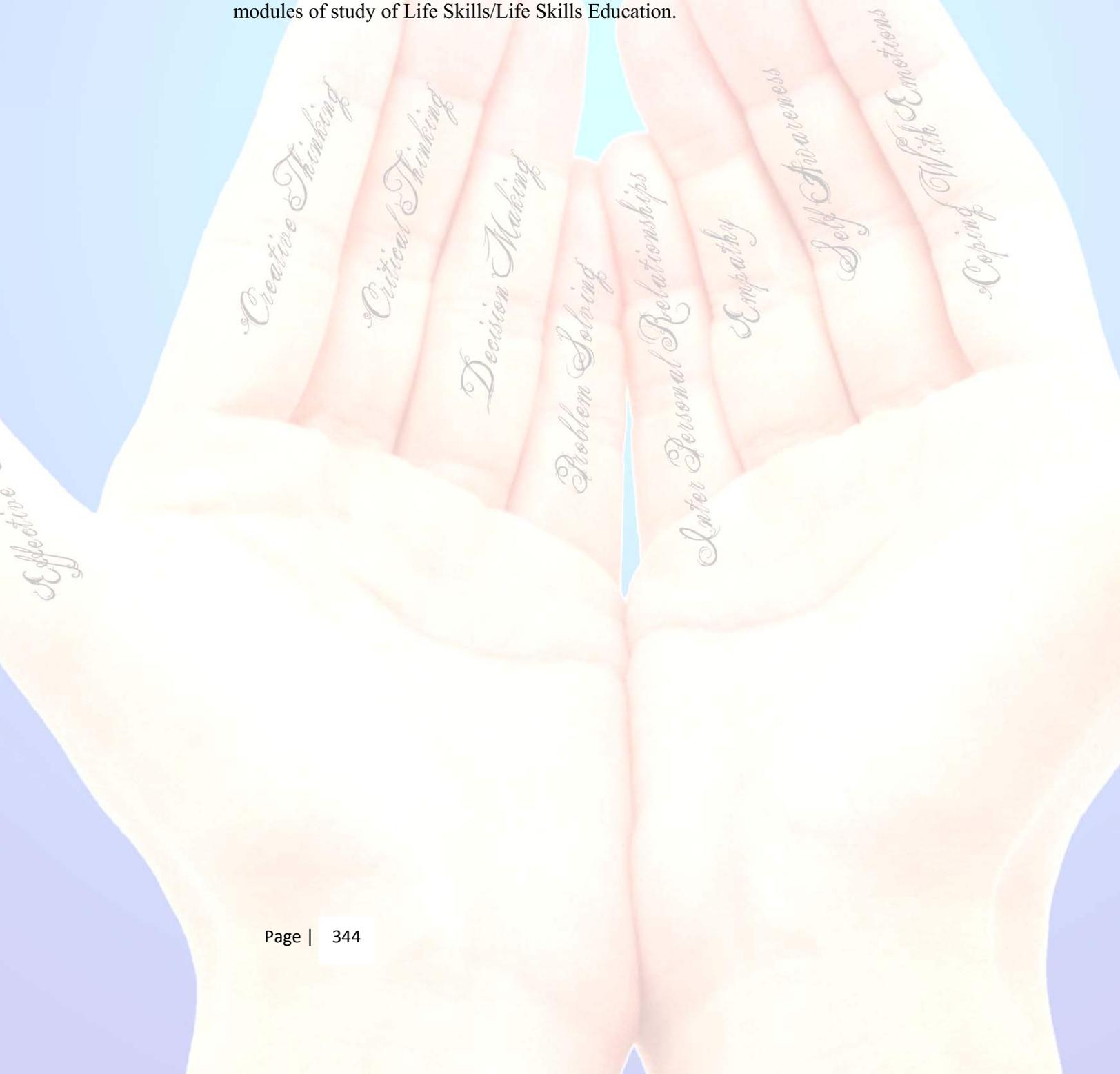
Science as a subject is based on pure logic and reason- be it the biological or physical sciences. And logic and reason and the inventive science and fact-finding of today requires solving and thinking skills at every step. How can these skills be developed in students at all levels of study? Literature reveals (Author, 2011) that life skills are woven into the teaching learning of different scientific concepts. But we need to cull out life skills from these content areas and evolve a methodology to develop only the life skills using the subject content of Science.

Biology is a discourse on life itself; Physics is all about force, energy and movement (be it light, electricity or heat or the forces that move the universe); Maths is dimensions, numbers and figures; and Chemistry is the phenomenon that made life possible on earth. Much more than these go into the process of living and life. There is a dearth of educational and modern facilities in many parts of the world despite all scientific and technological advances. These areas are teeming with uneducated unemployed masses (Latin Americas and the third world developing countries and many parts of India). The population here is dominated by teenagers at the threshold of adolescence- a stage when they are overwhelmed by physical and emotional changes, a stage when they take time to make mental adjustments in society and their own inner world is in a state of upheaval. Life skills form an important component of social psychology and help in improving social behaviour. The above mentioned ignorant young masses require Life Skills Education.

Programs in Life Skills Education (cii website) have been taken up as a Government initiative at several levels (The Srinagar initiative, CII, RBSE etc.). FICCI-SEDF has completed a project along with Rajiv Gandhi Foundation on Life Skills Education to adolescents in ten slums of Delhi (www.ficci.sedf.org). Child Development and Adolescent Health Centre, VIMHANS, under its project Expressions' has come out with a Life Skills Module for pre-primary, primary and middle school children (The Hindu, July 2004). RBSE has brought out a textbook on Life Skills Education along with State Government's Medical and Health Department as part of Rural Health Mission (The Hindu, May, 2008). However, there is a lack of material or resources and there is a felt need to develop some of the content areas in Biology/Science to enable Life Skills Education at secondary level. Life Skills Education is designed to facilitate the practise and reinforcement of psychological skills in a culturally and developmentally appropriate way. This involves promotion

of psychological competencies through utilization of available resources and leads to self, family, social and national development.

The present workshop envisages identification of areas in Biology, Physics, Maths and Chemistry; identification of important concepts in the content areas; identification of life skills (and sub-skills, WHO, 1994, 1997) integrated into the concepts; and, projection of the life skills along with the concepts involved into modules of study of Life Skills/Life Skills Education.



Workshop II (21-08-2013 to 30-08-2013)
Life Skills Education through the teaching learning of Science Streams for
XII STD students at Senior Secondary Level

By

Dr. Geetha G Nair

Associate Professor in Botany, RIEM

Life skills have been defined as *the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life* (WHO). *Adaptive* means that a person is flexible in approach and is able to adjust in different circumstances. *Positive behaviour* implies that a person is forward looking and even in difficult situations, can find a ray of hope and opportunities to find solutions. The terms *Livelihood skills* or occupational/vocational skills refer to capabilities, resources and opportunities to pursue individual and household economic goals and relate to income generation. Thus, Life skills are distinct from livelihood skills. We find that behaviour does not always follow the mind. This is when incidents of 'I know but I can't help it' occur. What we need is the ability to act responsibly. Life skills enable us to translate knowledge, attitudes and values into actual abilities. **Life skills Education** is a behaviour development approach designed to address a balance of three areas, viz., knowledge, attitude and skills.

Why is there a need for Life Skills Education?

The host of factors that promote high risk behaviour such as alcoholism, drug abuse and casual relationships are boredom, rebellion, disorientation, peer pressure and curiosity. The psychological push factors such as the inability to tackle emotional pain, conflicts, frustrations and anxieties about the future are often the driving force for high risk behaviour.

Life skills

Training is an efficacious tool for empowering the youth to act responsibly, take initiative and take control. It is based on the assumption that when young people are able to rise above emotional impasses arising from daily conflicts, entangled relationships and peer pressure, they are less likely to resort to anti social or high risk behaviours.

Who needs Life Skills?

The Life Skills programme is a school based programme where Life Skills are imparted in a supportive learning environment. They are applicable for all ages of children and adolescents in school. However, the age group targeted is mainly 10-18, adolescent years, since young people of this age group seem to be most vulnerable to behaviour related health problems. The programme is for the promotion of health and well being and targeted group is all children.

Different methods that are used for the promotion of life skills are

- Class discussions
- Brainstorming
- Demonstration and guided practise
- Role plays
- Audio and visual activities, e.g.,
- Small groups/buzz groups
- Educational games and simulations
- Case studies
- Story telling
- Debates
- Decision mapping or problem trees

NCF, Life skills and Secondary Education

According to NCF (2005), higher secondary stage should be devoted to disciplinary science, education with emphasis on experiments/technology and problem-solving (a life skill). At the secondary stage, the student should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules (creativity ^a life skill) and in activities and analysis of environmental issues. The National Curriculum Framework for School Education ^a Discussion Document (1999) under clause 1.2.17 mentions education as a life-long process with two major dimensions ^temporal and spatial. Article 3.5 of this document stresses quality improvement at higher secondary stage with the acquisition of learning skills, ability to explore, observe and discover the unknown; and facility in analysis, synthesis, critical thinking and decision-making that need to be the watchwords of curriculum transaction.

NCF, Life skills and Adolescence education/vocational education

Article 2.3.3 on p. 16 of NCF (2005) reads Adolescence is a critical period for the development of self-identity. The process of acquiring a sense of self is linked to physiological changes and also learning to negotiate the social and psychological demands of being adults. Responsible handling of issues like independence, intimacy and peer-group dependence are concerns that need to be recognised and appropriate support be given to cope with them. These physiological changes have ramifications in the psychological and social aspects of an adolescent's life. Most important of all is that this clause stresses the fact it is important to recognise that adolescents need social and emotional support that may require reinforcement of norms of positive behaviour, acquisition of skills essential to cope with the risky situations that they encounter in their lives, manage peer pressure and deal with gender stereotypes. NCF on p. 61 further states that universal secondary education will not succeed without inclusion of work related skills.

Life skills and Health and physical education

There is a growing realisation that the health needs of adolescents, particularly their reproductive and sexual health needs require to be addressed. Since these needs predominantly relate to sex and sexuality that is culturally a very sensitive area, they are deprived of opportunities to get the appropriate information. As such their understanding of reproductive and sexual health and their behaviour in this regard are guided predominantly by myths and misconceptions, making them vulnerable to risky situations, such as drug/substance abuse and HIV/AIDS transmission. Age-appropriate context specific interventions focused on adolescent reproductive and sexual health concerns including HIV/AIDS and drug/substance abuse, therefore, are needed to provide children opportunities to construct knowledge and acquire *life skills*, so that they can cope with these concerns that are related to their process of growing up (3.5 NFG position paper, 2006).

In recent times a great deal of importance has been given to adolescent health in school curricula and been dealt with as a co-curricular area. The thrust for this area has come from the Reproductive and Child Health and the HIV/ AIDS programmes and a number of modules have been tried and tested for creating awareness among adolescents by NGOs.

Life skills and Mental health programmes

Apart from adolescent health a comprehensive mental health programme has been advocated as part of the school health programme that includes health instruction at all grade levels, easily accessible health services, a healthful, nurturing and safe environment, and interaction with families and community organisations. The aim of school-based interventions is to provide an experience that will strengthen the children's coping abilities to counter environmental stress and disadvantages with which they have had to cope in growing up.

There are a few initiatives that have introduced programmes for stress management in children and early identification of emotional and mental difficulties in schools but these are not part of the curriculum of Health and Physical Education. An example of this is the VIMHANS project in urban and rural schools in Delhi.

There is a growing recognition of the examination related stress and its effect on children. These concerns are complex and need to be addressed in different forums and levels. While it is important to identify and provide skills and support for children to deal with stress, it is necessary to recognize that stress cannot be dealt by only dealing with children, parents and teachers. What is required is the reform of the examination system, which is an administrative and political decision.

NCF, Life skills AND COBSE

The NCF 2005 clearly outlines that rather than a stand-alone program, the AEP should become an integral part of school education. In this regard, the content analysis exercise undertaken by NCERT shows that textbooks in different parts of the country have integrated adolescent education issues in various scholastic subjects. Efforts are underway for more comprehensive inclusion of adolescent concerns in the curriculum. The Council of Boards for School Education (COBSE) is involved in advocacy efforts for curricular integration of life skills in selected state education boards in India with relevant stakeholders.

UNFPA AND NIOS and Life skills

Curricular interventions also include UNFPA's (United Nations Population Education Fund) ongoing support for integration of life skills in the secondary curriculum of National Institute of Open Schooling (NIOS) that enrolls approximately 400,000 learners each year. NIOS has a unique standing in the field of school education, as it provides educational opportunities to individuals who do not enroll in

traditional secondary and senior secondary schools either due to some constraints or as a matter of choice. Although NIOS has a system of contact program where the learners can seek clarifications on items that they do not understand; open learners are essentially self-learners with no teachers to guide them on a regular basis. Hence, the learning materials in NIOS assume further importance and are popularly known as teachers in print. Against this backdrop, senior NIOS officials were convinced that life skills enhancement was a worthy initiative that would go a long way in improving the overall quality of their learning materials. In 2009, NIOS took an informed decision to undertake an innovative pilot to integrate life skills in selected lessons and subjects in its secondary curriculum. NIOS is working towards integration of life skills across all the lessons (a total of approximately 150 lessons) in the five subjects (Social Sciences, Home Science, Science, Hindi and English) and the revised learning materials in the 5 subjects should be available to all the learners in the academic year 2012-13(AERC downloaded from Google website on 18/08/13)

VIMHANS and Life skills

Keeping in mind the increasing complexity of present day life, VIMHANS has developed comprehensive modules for enhancing and empowering the students, parents and teachers to deal more effectively with the challenges of growing up (school interactive programmes). These modules have been created after critical evaluation of latest research in specific developmental areas and are developed along the guidelines provided in the CCE programme of the CBSE. It is based on the ten core guidelines laid down by WHO (childissues@vimhans.com; childadolservices@vimhans.com).

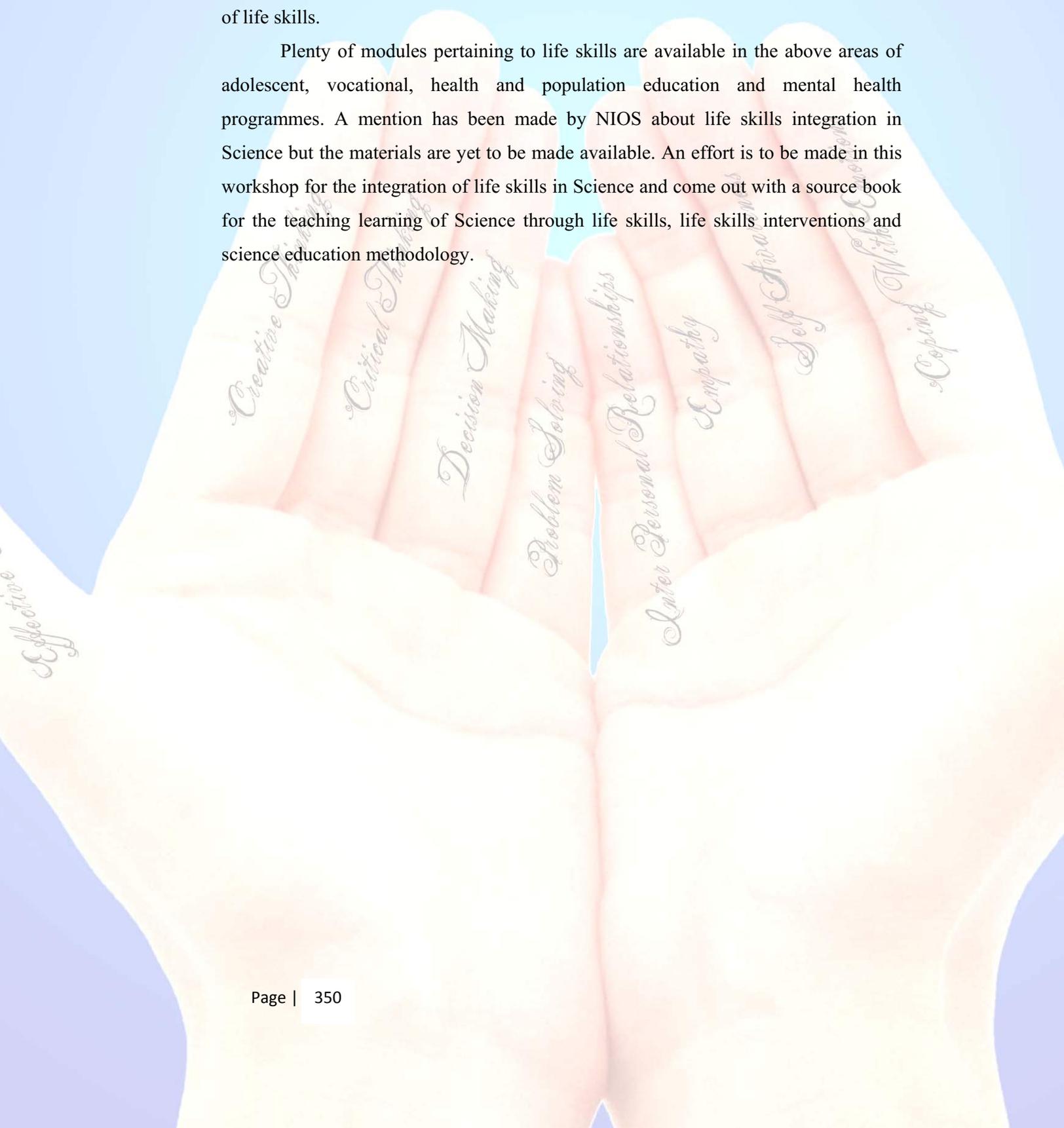
Population education and Life skills

There are additional inputs being made under the National Population Education Programme, one of the major thrust being Adolescent Reproductive and Sexual Health. These concerns have been encapsulated in an emerging curriculum.

Although efforts are on to ensure integration of these concerns in the content and process of school education and teacher education, the inputs are primarily being made separately from subject curricula. Training and resource materials have also been developed under the National Population education Project of the NCERT(AEP, NPEP, Sept 2010) but these are pertaining to life skills in day to day life and not pertaining to content development of Science.

According to the conclusions arrived at in the National Focus Group Position Paper (2006) Science subjects must integrate the health dimensions for topics that are related to health issues and all teacher education courses must include health, yoga and physical education as a compulsory subject and all these include the development of life skills.

Plenty of modules pertaining to life skills are available in the above areas of adolescent, vocational, health and population education and mental health programmes. A mention has been made by NIOS about life skills integration in Science but the materials are yet to be made available. An effort is to be made in this workshop for the integration of life skills in Science and come out with a source book for the teaching learning of Science through life skills, life skills interventions and science education methodology.



Workshop III (23-12-2013 to 27-12-2013)
**Development of Source book in Life Skills Education through the teaching ^
learning of Science streams for XII Standard students at Senior Secondary Level**

Dr. Geetha G. Nair
Associate Professor in Botany
RIE, Mysore

A source book is an original writing, as a document, record or diary that supplies an authoritative basis for future writing, study, evaluation etc. It is a volume, a small collection of such writings usually on a specific subject used in research (google.com). A handbook is a concise manual or reference book providing specific information about a subject (google.com). A manual is a book of instruction for learning a subject it is a small reference book. A source book sets itself apart from a handbook and a teacher's manual in various ways. A sourcebook concerns itself with both theoretical and practical aspects of the teaching-learning process and is for the benefit of the teaching and learning community. We still have not transitioned completely to the highly interactive technology mediated classes of the future with interactive white boards, virtual classrooms etc. And till then, a source book is essential. The objective of a source book is to make available a ready reckoner for the development of life skills considered as a co-scholastic area in most of the curricula but a very much neglected area as well. Most curricula include Life Skills as a co-scholastic area as these are not routinely monitored or assessed. These generic skills help in developmental processes of the brain and an individual develops these latently during the so-called educational process. These form the stepping stones for the furtherance of knowledge in an individual. This proves that life skills as a co-scholastic area is inseparable from scholastic subjects. There is an imminent need for researching into this much neglected co-scholastic area and give it its rightful place with other subjects. This being so as life skills are important not only in learning and development, but also for improving the general quality of life through art education, work education, physical education, science education, adolescence education, vocational education, peace education, Personal-Social & Health education (PSHE), Citizenship /Inclusive education and community living. As life skills are not taught directly in the class-room as yet, a lacuna was felt in the teaching learning process envisaging the development of modules in Life Skills /Life Skills Education. Life

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Curricular interventions also include UNFPA\$ (United Nations Population Education Fund) ongoing support for integration of life skills in the secondary curriculum of National Institute of Open Schooling (NIOS) that enrolls approximately

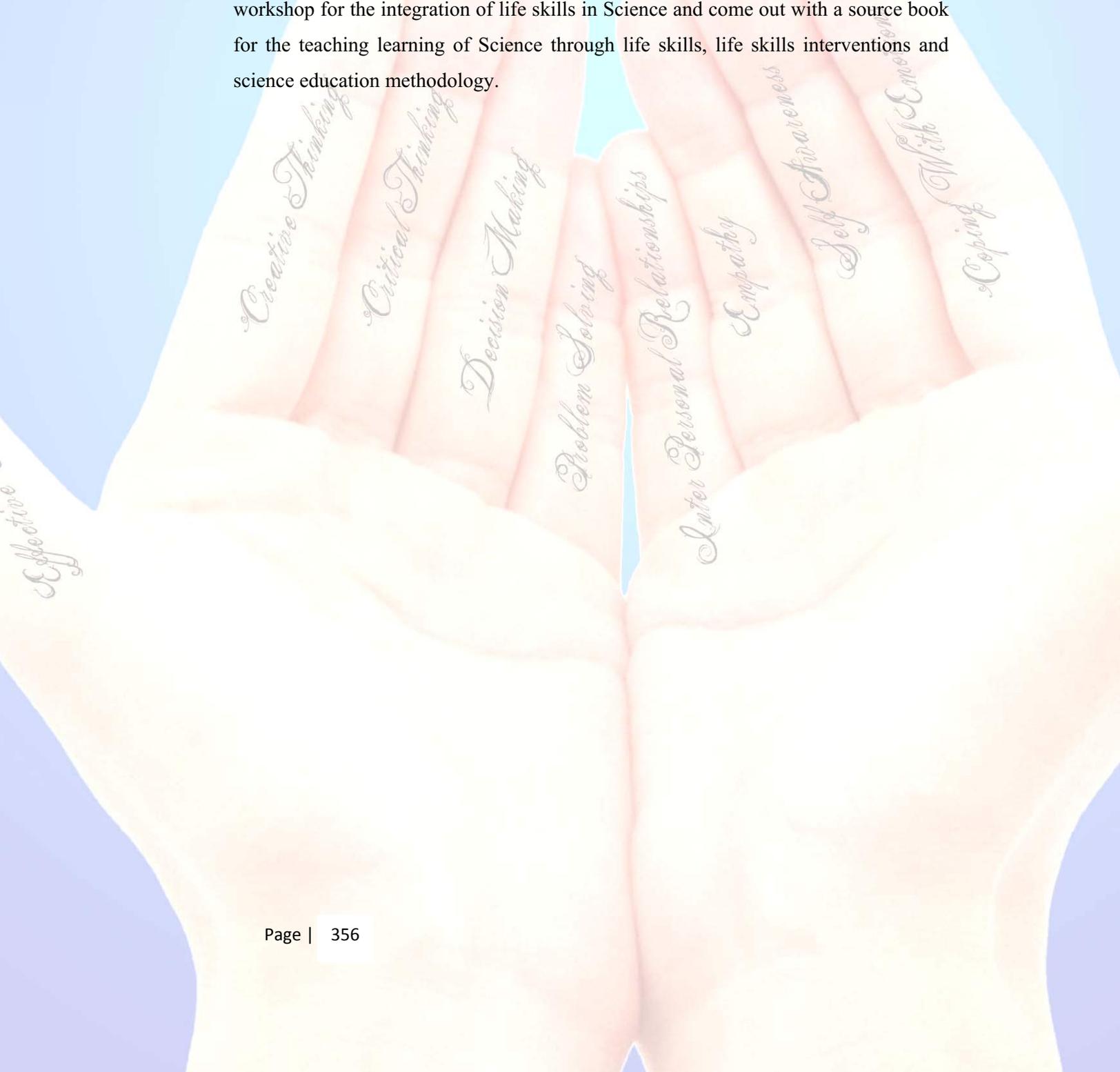
400,000 learners each year. Although NIOS has a system of contact program where the learners can seek clarifications on items that they do not understand; open learners are essentially self-learners with no teachers to guide them on a regular basis. Hence, the learning materials in NIOS assume further importance and are popularly known as teachers in print. Against this backdrop, senior NIOS officials were convinced that life skills enhancement was a worthy initiative that would go a long way in improving the overall quality of their learning materials. In 2009, NIOS took an informed decision to undertake an innovative pilot to integrate life skills in selected lessons and subjects in its secondary curriculum. NIOS is working towards integration of life skills across all the lessons (a total of approximately 150 lessons) in the five subjects (Social Sciences, Home Science, Science, Hindi and English) and the revised learning materials in the 5 subjects should be available to all the learners in the academic year 2012-13 (AERC downloaded from Google website on 18/08/13)

Keeping in mind the increasing complexity of present day life, VIMHANS has developed comprehensive modules for enhancing and empowering the students, parents and teachers to deal more effectively with the challenges of growing up (school interactive programmes). These modules have been created after critical evaluation of latest research in specific developmental areas and are developed along the guidelines provided in the CCE programme of the CBSE. It is based on the ten core guidelines laid down by WHO (childissues@vimhans.com; childadol.services@vimhans.com).

Programs in Life Skills Education (cii website) have been taken up as a Government initiative at several levels (The Srinagar initiative, CII, RBSE etc.). FICCI-SEDF has completed a project along with Rajiv Gandhi Foundation on Life Skills Education to adolescents in ten slums of Delhi (www.ficci.sedf.org). Child Development and Adolescent Health Centre, VIMHANS, under its project Expressions has come out with a Life Skills Module for pre-primary, primary and middle school children (The Hindu, July 2004). RBSE has brought out a textbook on Life Skills Education along with State Government's Medical and Health Department as part of Rural Health Mission (The Hindu, May, 2008). However, there is a lack of material or resources and there is a felt need to develop some of the content areas in Biology/Science to enable Life Skills Education at secondary level. Life Skills Education is designed to facilitate the practise and reinforcement of psychological

skills in a culturally and developmentally appropriate way. This involves promotion of psychological competencies through utilization of available resources and leads to self, family, social and national development.

Plenty of modules pertaining to life skills are available in the above areas of adolescent, vocational, health and population education and mental health programmes. A mention has been made by NIOS about life skills integration in Science but the materials are yet to be made available. An effort is to be made in this workshop for the integration of life skills in Science and come out with a source book for the teaching learning of Science through life skills, life skills interventions and science education methodology.



Life skills education through the teaching learning of science for XII Std students at senior secondary level

By

Dr Geetha G. Nair

What are Life skills?

Life skills have been defined as *the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life* (WHO). *Adaptive* means that a person is flexible in approach and is able to adjust in different circumstances. *Positive behaviour* implies that a person is forward looking and even in difficult situations, can find a ray of hope and opportunities to find solutions. The terms *Eivelihood skills* or occupational/vocational skills refer to capabilities, resources and opportunities to pursue individual and household economic goals and relate to income generation.

Life skills education

We find that behaviour does not always follow the mind. This is when incidents of 'I know but I can't help it' occur. What we need is the ability to act responsibly. Life skills enable us to translate knowledge, attitudes and values into actual abilities. **Life skills Education** is a behaviour development approach designed to address a balance of three areas, viz., knowledge, attitude and skills.

The need for life skills education

High risk behaviour--The host of factors that promote high risk behaviour such as alcoholism, drug abuse and casual relationships are boredom, rebellion, disorientation, peer pressure and curiosity. The psychological push factors such as the inability to tackle emotional pain, conflicts, frustrations and anxieties about the future are often the driving force for high risk behaviour in the teen group for whom life skills are intended.

Who needs life skills?

The age group targeted is mainly 10-18, adolescent years, since young people of this age group seem to be most vulnerable to behaviour related health problems.

Methods for promotion of life skills

- Class discussions
- Brainstorming

- Demonstration and guided practise
- Role plays
- Audio and visual activities,
- Small groups/buzz groups
- Educational games and simulations
- Case studies
- Story telling
- Debates
- Decision mapping or problem trees

NCF, life skills and secondary education

NCF emphasises experiments/technology and problem-solving (a life skill)

- More advanced technological modules (creativity ^a life skill)
- Analysis of environmental issues
- Acquisition of learning skills
- Facility in analysis, synthesis, critical thinking and decision-making (art. 3.5)

NCF, LIFE SKILLS AND ADOLESCENCE EDUCATION/VOCATIONAL EDUCATION

- Adolescents need social and emotional support that may require reinforcement of norms of positive behaviour, acquisition of skills essential to cope with the risky situations (NCF, art 2.3.3, p.16).
- Universal secondary education will not succeed without inclusion of work related skills (NCF, p. 61).

Life skills & Health education

- Age-appropriate context specific interventions focused on adolescent health concerns are needed to provide children opportunities to construct knowledge and acquire *life skills*(nfg position paper,2006).
- According to the conclusions arrived at in the National Focus Group Position Paper (2006) Science subjects must integrate the health dimensions for topics that are related to health issues.

Life skills and mental health

- There is a growing recognition of the examination related stress and its effect on children.
- Programmes for stress management in children and early identification of emotional and mental difficulties in schools (VIMHANS).

Integration of life skills

- Content analysis exercise undertaken by NCERT- textbooks have integrated adolescent education issues in various scholastic subjects.
- NIOS in 2009 has taken an informed decision to undertake an innovative pilot to integrate life skills in selected lessons and subjects in its secondary curriculum(Science being one of them).
- VIMHANS has developed comprehensive modules based on the ten core guidelines laid down by WHO.

The rationale

Plenty of modules pertaining to life skills are available in the above areas of adolescent, vocational, health and population education and mental health programmes. A mention has been made by NIOS about life skills integration in Science but the materials are yet to be made available.

In the present workshop

An effort is to be made for the integration of life skills in Science and come out with a source book for the teaching learning of Science through life skills, life skills interventions and science education methodology.

Source book on Life Skills Education Through Teaching Learning of Science Streams

Objectives of source book in life skills education

What are life skills?

- ^ According to WHO (1994,1997) Life Skills are abilities for adaptive and positive behaviour in facing the challenges of day to day life.
- ^ UNICEF(www.unicef.org) defines life skills as a behaviour change or behaviour development approach designed to address a balance of 3 areas-knowledge, attitude and skills (and this is based on research evidence).

Life skills Education

- Life skills education is designed to facilitate the practise and Reinforcement of psychosocial skills in a culturally and developmentally appropriate way; it contributes to the promotion of personal and social development, the prevention of health and social problems, and the protection of human rights (WHO, 1998).

What is a source book?

- a volume a small collection of writings, usually on a specific subject, used in research.
- an original writing, as a document, record, or diary, that supplies an authoritative basis for future writing, study, evaluation, etc.

The definition of Science

Science (from Latin *scientia*, meaning knowledge) is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. In an older and closely related meaning, science also refers to a body of knowledge itself, of the type that can be rationally explained and reliably applied.

What is learning?

Learning is the process of increasing one's capacity to take action (Kim, 1993).

Learning is both a process and an outcome concerned with knowledge, skills and insight (Mumford and Gold, 2004).

There are four types of learning instrumental, cognitive, affective and self-reflective.

Learning theories are classified as behavioural theories, cognitive, learning theories and social theories.

Learning Science

- -is doing science that is relevant to life
- eg., cutting of a tree the effect on this on forests, environment, man and posterity needs to be wholistically dealt with to make Science relevant, vibrant and addressing real life situations and this can be made possible through interpolation and extrapolation of life skills into Science. Therefore Science Education at +2 level should be oriented to Life Skills Education.

Science Education and NPE(1986)

Science education programmes will be designed to acquire problem solving and decision making skills and to discover the relationship of Science with health, agriculture, industry and other aspects of daily life.

The prime objectives

- To bring equity
- To achieve social change
- To improve the quality of life
- To do away with rote learning and learning how to learn
- To make education true to life
- To make science a composite discipline (NCF, 2005)
- Human resource development thro'creativity of the young

Objectives of Source book-1

The aims of a Source book on life skills education through the teaching learning of Science are to

- Aid the process of learning and development
- Increase intelligence(IQ) (ref. Gonzalez, 1990)
- Improve general mental abilities of the right and left halves of the human brain
- To help one to learn from the physical environment around us (in maths and science) and apply life skills to social situations
- To improve development of theoretical and practical knowledge in Science.

Faculties of the brain

Left half -Logical,Linear,Verbal,Temporal,Rational,Analytic,Abstract,Symbolic, Digital,*Right half*- intuitive,holistic,non-temporal,non-rational,synthetic,analogic, concrete,spatial

Objectives of life skills education through science-2

- To prevent brain drain from our universities
- To build and retain our scientific manpower
- To improve scholastic achievement at all levels of education in science- be it biology, physics, chemistry or maths
- For begetting better career opportunities through entrepreneurship
- For career education and vocational education
- For sustainable development the world over
- To facilitate the growth and development of Science and technology through life skills
- To understand the importance of Science in everyday life
- To promote Science and Scientific thinking and practises through life skills and their deployment

Objectives of life skills education THROUGH Science for day to day life Part-3 (WHO, 1994, 1997)

- To help us make constructive decisions in our lives without ill effects on health(decision making)
- To help us deal constructively with problems in our lives without causing mental stress and physical strain(problem solving)
- To enable us to respond adaptively and with flexibility to the situation in our daily lives(environmental and socio-cultural)(creative thinking)
- To enable us to analyse information and experiences in an objective manner(critical thinking)
- To enable us to express emotions, opinions, and ask for help and advice in times of need(effective communication)

Objectives part-4 (WHO, 1994, 1997)

- To relate positively with people for social support and for mental and social well-being(interpersonal relationships)
- To recognise ourselves, our weaknesses and strengths, our desires and dislikes(self-awareness)
- To imagine what life is like for another person in unfamiliar situations (empathy)
- To recognise emotions in ourselves and others and how they influence our behaviour(coping with emotions)

- To recognise sources of stress in our lives and how they affect us (coping with stress)

Objectives of Life skills education through science

- To use the brain instead of a calculator/computer
- To use limbs instead of a machine
- To enable survival in drastic conditions of constraints in resources, war and natural calamities like a tsunami
- To enable judicious use of existing resources
- To improve quality of human environment

UNICEF(www. unicef.com) criteria

For successful life skills education

- It should address not only knowledge, and attitude change but also behavioural change
- Information based traditional approach (lectures on safe behaviour or effective communication) should be substantiated with exercises and situations where participants can practise what they learn
- Exercises and situations in life skills education for attitudinal and behavioural change should be augmented and reinforced (i.e., repeated, recapitulated, reinforced and reviewed)
- The above three steps should be accompanied by policy development.

UNICEF CRITERIA- the following three components be undertaken together

- Skills

The psychosocial and interpersonal skills which are interlinked with each other

- Content area

The skills must be utilised in a particular content area .For eg., decision making in the content area of drug abuse, HIV prevention or other Health/Biology/ Science content

- Methods

Skills based education relies on groups of people and their interaction in order to be effective; this is through certain fixed methods and tools.

Objectives of Life skills for secondary level students

- Prevention of high risk behaviours like alcoholism, drug abuse, casual relationships, bullying, anger, juvenile delinquency and crime
- Caused by emotional issues, peer pressure, and other concerns of growing up.
- Through knowledge and awareness(science) of the concerns of growing up



DEVELOPMENT OF SOURCE BOOK IN LIFE SKILLS EDUCATION THROUGH THE TEACHING LEARNING OF SCIENCE STREAMS

Dr. Geetha G. Nair

Associate Professor in Botany, RIE, Mysore

Definition of Source book

- A source book is an original writing, as a document, record or diary that supplies an authoritative basis for future writing, study, evaluation etc.
- A sourcebook concerns itself with both theoretical and practical aspects of the teaching-learning process and is for the benefit of the teaching and learning community.

Need for a Sourcebook

- Life skills are important not only in learning and development, but also for improving the general quality of life through art education, work education, physical education, science education, adolescence education, vocational education, peace education, Personal-Social & Health education (PSHE), Citizenship / Inclusive education and community living.
- Life skills form an important component of social psychology and help in improving social behaviour.

What are life skills?

- **Life skills** have been defined as *the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life* (WHO, 1994, 1997).
- **Adaptive** means that a person is flexible in approach and is able to adjust in different circumstances. **Positive behaviour** implies that a person is forward looking and even in difficult situations, can find a ray of hope and opportunities to find solutions.

The life skills (WHO, 1994, 1997)

Solving skills

Problem solving

Decision making

Thinking skills

Critical thinking

Creative thinking

Relationship skills

Inter-personal relationships

Effective communication

Understanding skills

Self-awareness

Empathy

Coping skills

Coping with stress

Coping with emotions

What is Life Skills Education?

- Life skills Education is a behaviour development approach designed to address a balance of three areas, viz., knowledge, attitude and skills.
- Life skills Training is an efficacious tool for empowering the youth to act responsibly, take initiative and take control.
- The Life Skills programme is a school based programme where Life Skills are imparted in a supportive learning environment especially for the age group of 10-18.

Methods used for development of life skills

- **Life Skill Interventions**
 - Class discussions
 - Brainstorming
 - Demonstration and guided practise
 - Role plays
 - Audio and visual activities, e.g.,
 - Small groups/buzz groups
 - Educational games and
 - Simulations
 - Case studies
 - Story telling
 - Debates
 - Decision mapping or problem trees

NCF (2005) and Life Skills

According to NCF (2005), higher secondary stage should be devoted to disciplinary science, education with emphasis on experiments/technology and problem-solving (a life skill). At the secondary stage, the student should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules (creativity ^a life skill) and in activities and analysis of environmental issues.

3.5 NFG position paper, 2006

Age-appropriate context specific interventions focused on adolescent reproductive and sexual health concerns including HIV/AIDS and drug/substance abuse, therefore, are needed to provide children opportunities to construct knowledge and acquire *life skills*, so that they can cope with these concerns that are related to their process of growing up.

Curricular interventions-materials

UNFPA AND NIOS

- UNFPA\$ (United Nations Population Education Fund) supports integration of life skills in the secondary curriculum of National Institute of Open Schooling (NIOS).
- The learning materials in NIOS are popularly known as teachers in print.^In 2009, NIOS took an informed decision to undertake an innovative pilot to integrate life skills in selected lessons and subjects in its secondary curriculum.

VIMHANS

VIMHANS has developed comprehensive modules for enhancing and empowering the students, parents and teachers to deal more effectively with the challenges of growing up (school interactive programmes).

Other governmental initiatives in Life Skills Education

- The Srinagar initiative, CII(cii website)
- Rajiv Gandhi Foundation\$ Life Skills Education to adolescents in ten slums of Delhi(www.ficci.sedf.org).
- Child Development and Adolescent Health Centre,VIMHANS, and its project Expressions(The Hindu,July 2004)
- Textbook on Life Skills Education along with State Government\$ Medical and Health Department as part of Rural Health Mission(The Hindu, May 2008)

In the present programme

A mention has been made by NIOS about life skills integration in Science but the materials are yet to be made available. An effort is to be made in this programme for the integration of life skills in Science and come out with a source book for the teaching learning of Science through life skills, life skills interventions and science education methodology.



APPENDIX IV

WORKSHOP SCHEDULES

Planning Workshop (Format/Tool Preparation)

15-06-2013 to 19-06-2013

Day/date	9.30-11.15 a.m.	11.15-11.30 a.m.	11.30-1 p.m.	1-2 p.m.	2-3.15 p.m.	3.15-3.30 p.m.	3.30-5p.m.
Monday 15/06/13	Approach paper GGN Introduction to the topic of LSEdn. Principal/ Prof.SR/Prof.PLS	TEA BREAK	Tools and modules Discussion	LUNCH BREAK	Reading and discussion on XII Std textbooks Bio- GVG/CP/VT Che-MS/TS	TEA BREAK	Reading and discussion contd Phy-SM/PVS Maths- TVS/M
Tuesday 16/06/13	Analysis of textbooks in groups Bio-GVG/CP/VT;Che-TS/MS;Phy-SM/PVS;Maths-TVS/M		Analysis of textbooks in groups contd^		Analysis of textbooks in groups contd.		Analysis of textbooks in groups contd.
Wednesday 17/06/13	Analysis of textbooks in groups & development of a format		Analysis contd. Development of a format		Analysis contd. Development of a format		Analysis contd. Development of a format
Thursday 18/06/13	Cbse/cce modules in LS- GGN Presentation of Life skill module /source book formats by various group leaders		Study of format of Life Skill modules of NIIT Dev of format contd^		Development of a format using situational analysis/experiential learning -PLS		Development of a format using participatory learning methods CGVM
Friday 19/06/13	Finalisation of format in gps for LS/LSEdn in Science modules		Finalisation of a format PLS/CGVM/GGN		Presentation and discussion on the final format -modules -sourcebook		Conclusions GGN

External Workshop 21-08-2013 to 30-08-2013

Time/ Date	9-10.15 a.m.	10.15-11.30 a.m.	11.30- 11.45 a.m.	11.45-1 p.m.	1-2 p.m.	2-3.15 p.m.	3.15- 3.30 p.m.	3.30-5 p.m.
21/08/13 Wed	Registration	Inaugural Principal, RIEM Key note address on LIFE SKILLS EDUCATION AT SEC. LEVEL	TEA BREAK	Approach paper GGN Importance of Source book in Life Skills Edn	LUNCH BREAK	NCF and Life skills	TEA BREAK	Presentation and discussion of Sourcebook/ Modular format
22/08/13 Thurs	Preparation of modules in groups	Contd^		Contd^		Contd^		Discussions and finalization of Science modules on Creative Thinking and Critical Thinking
	Presentation and validation of Biology modules on Creative thinking and Critical thinking	Presentation and validation of Maths modules on Creative thinking and Critical Thinking		Presentation and validation of Chemistry modules on Creative thinking and Critical Thinking		Presentation and validation of Physics modules on Creative thinking and Critical Thinking		
23/08/13 Fri	Preparation of modules	--contd^		-contd^		-contd^		Discussions and finalization of Science modules on Problem solving and Decision making
	Presentation and validation of Biology modules on Problem solving and Decision making	Presentation and validation of Maths modules on Problem solving and Decision making	Presentation and validation of Chemistry modules on Problem solving and Decision making	Presentation and validation of Physics modules on Problem solving and Decision making	Discussions and finalization of Science modules on Problem solving and Decision making			

Time/ Date	9-10.15 a.m.	10.15-11.30 a.m.	11.30- 11.45 a.m.	11.45-1 p.m.	1-2 p.m.	2-3.15 p.m.	3.15- 3.30 p.m.	3.30-5 p.m.
24/08/13 Sat	Preparation of modules	-contd^	TEA BREAK	-contd^	LUNCH BREAK	-contd^	TEA BREAK	- Discussions and finalization of Science modules on Self awareness and Effective communication
	Presentation and validation of Biology modules on Self awareness and Effective communication	Presentation and validation of Maths modules on Self awareness and Effective communication		Presentation and validation of Chemistry modules on Self awareness and Effective communication		Presentation and validation of Physics modules on Self awareness and Effective communication		
25/08/13 Sun	Preparation of modules	-contd^		-contd^		-contd^		- Discussions and finalization of Science modules on Coping with stress and Emotions
	Presentation and validation of Biology modules on Coping with stress and Emotions	Presentation and validation of Maths modules on Coping with stress and Emotions		Presentation and validation of Chemistry modules on Coping with stress and Emotions		Presentation and validation of Physics modules on Coping with stress and Emotions		Local visits
26/08/13 Mon	Preparation of sourcebook Chs 1, 2 & 3	-contd..		-contd..		-contd^		-Final draft Ch.1,2&3
	Chapter 1 Objectives of Source Book on Life Skills Education writing, presentation and discussion	Chapter 2 Source Book- NCF2005 and Life Skills writing, presentation and discussion		Chapter 2 Source Book- NCF2005 and Life Skills writing, presentation and discussion contd^		Chapter 3 Source Book- Significance of Life Skills Education for Adolescents writing, presentation and discussion		

Time/ Date	9-10.15 a.m.	10.15-11.30 a.m.	11.30- 11.45 a.m.	11.45-1 p.m.	1-2 p.m.	2-3.15 p.m.	3.15- 3.30 p.m.	3.30-5 p.m.
27/08/13 Tuesday	Preparation of sourcebook Chs 4&5	----contd^	TEA BREAK	Contd/Ch 5	LUNCH BREAK	Contd^	TEA BREAK	Final draft Chs 4&5
	Chapter 4 Source Book Life Skills Education & implications for society writing, presentation and discussion	Chapter 4 Source Book Life Skills Education & implications for society writing, presentation and discussion contd^		Chapter 5 Source Book Life skills methodologies-5E\$ writing, presentation and discussion		Chapter 5 Source Book Life skills methodologies 5E\$ writing, presentation and discussion contd^		Local visits
28/08/13 Wed	Preparation of sourcebook Ch. 6 &7	Contd^		Contd.. Ch.7		Contd^		Final draft Ch 6& Ch 7
	Chapter 6 Life Skills Interventions writing, presentation and discussion	Chapter 6 Life Skills Interventions writing, presentation and discussion contd^		Chapter 7 Practical approaches to Life Skills Education writing, presentation and discussion		Chapter7 Practical approaches to Life Skills Education writing, presentation and discussion contd^		
29/08/13 Thurs	Preparation of sourcebook Ch. 8&9	Contd..		Contd..		Contd^		Final draft Ch. 8&9
	Chapter 8 Year end assessments in Life Skills Education IN SUBJECT WISE GROUPS writing, presentation and discussion	Chapter 8 Year end assessments in Life Skills Education (Chemistry) writing, presentation and discussion contd^		Chapter 8 Year end assessments in Life Skills Education (Physics)writing, presentation and discussion contd^		Chapter 9 Appendices Content areas identified for developing and promoting Life Skills- (analytical work)compilation and discussions		Chapter 9 WHO / CBSE documents- Compilation
30/08/13 Fri	Preparation of sourcebook Ch. 9	Contd^		Contd^				
	Chapter 9 Contd^	Chapter 9 NCERT NCF Documents-compilation	Chapter 9 Other resources/ websites compilation	Valediction	T.A/ D.A. disbursement			
Page								

Review Workshop
23/12/13 to 27/12/13

Date/ Day	9-10.15a.m.	10.15-11.30 a.m.	11.30- 11.45 a.m	11.45a.m. to 1.00 p.m.	1.00p.m- 2.00p.m.	2.00p.m.- 3.15 p.m.	3.15- 3.30 p.m.	3.30 p.m- 5.00p.m.
Monday 23/12/13	Registration	Inauguration and address by Chief Guest	TEA BREAK	Review of Module 1 Life skills education thro Science	LUNCH BREAK	Review of Module 1	TEA BREAK	Presentation and discussion Module 1
Tuesday 24/12/13	Group work Review of Module 2-NCF and Life Skills Mo. 3 on Significance of Life Skills for adolescent s & Mo.4 Implications of life skills for society	Review of Modules 2,3 and 4		Presentation and discussion of Module 2		Presentation and discussion of Module 3		Presentation and discussion Module 4
Wednesday 25/12/13	Group work Review of Module 5 Constructivist approach using 5E model Mo 6 Life Skills Interventions	Review of Module 5&6		Presentation and Discussion Module 5		Presentation and Discussion Module 6		Group work Review of training components
Thursday 26/12/13	Group work Review of Module 7 on Practical approaches to Life Skills Education and exemplars in content areas	Review of Module 7		Review of Module 7		Review of Module 7		Presentation and Discussion of Module 7
Friday 27/12/13	Review of Module 8 on Assessment in Life Skills	Review of Module 8		Presentation and Discussion of Module 8		Module 9 Review		Valediction

APPENDIX V

OBSERVATION SCHEDULE

OBSERVATION SCHEDULE FOR EXEMPLARS IN DEVELOPMENT OF LIFE SKILLS THROUGH THE TEACHING-LEARNING OF SCIENCE STREAMS

1. Is the topic selected appropriate?
2. Does the topic hold scope for the development of a life skill?
3. Is the constructive process of learning taken care of in the exemplar?
4. Does the science methodology used cover all aspects of the topic mentioned?
5. Is the methodology stated for development of takeaway life skill adequate and accurate?
6. Are the anchor points for development of life skill well developed?
7. Is the life skill intervention executed out appropriately in the classroom?
8. Need there be any modification in life skill intervention for the topic?
9. Do the associate questions make one go beyond the text?
10. Do the year end evaluations follow CCE model?
11. Any other point of relevance^

APPENDIX VI

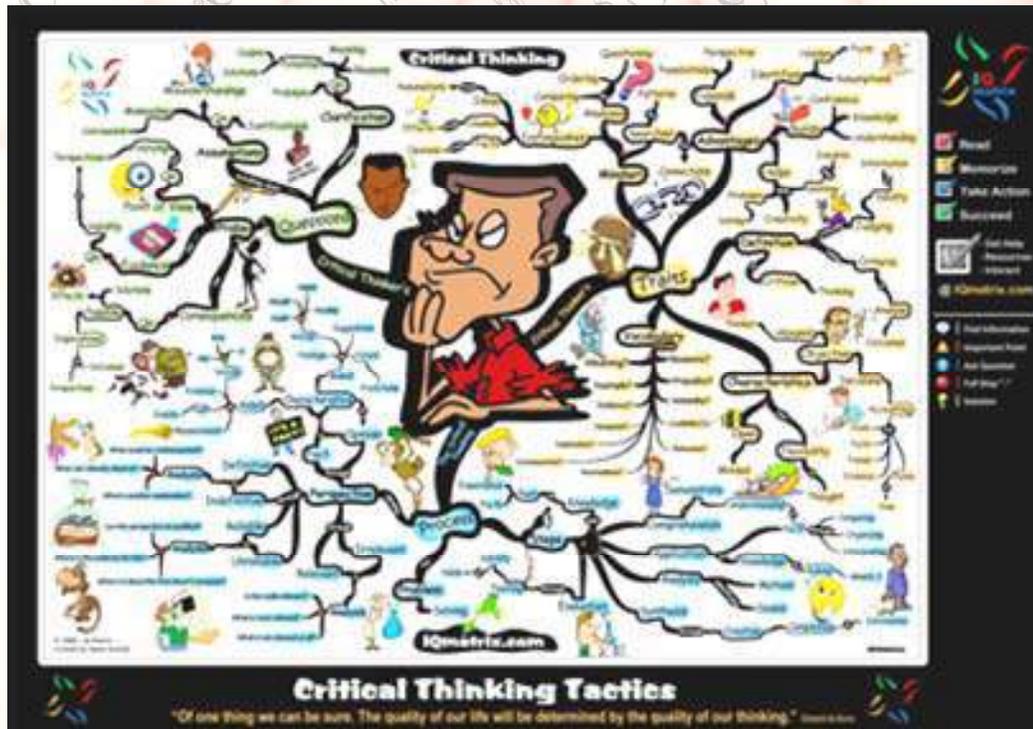
WORKSHEETS ON LIFE SKILLS

Problem Solving and Decision Making

Dr. Subasree

Asst. Prof.

Dept. of Career Counselling





Self Awareness

Dr. R. Subasree

There are three things extremely
hard steel, diamond and to know
one's self

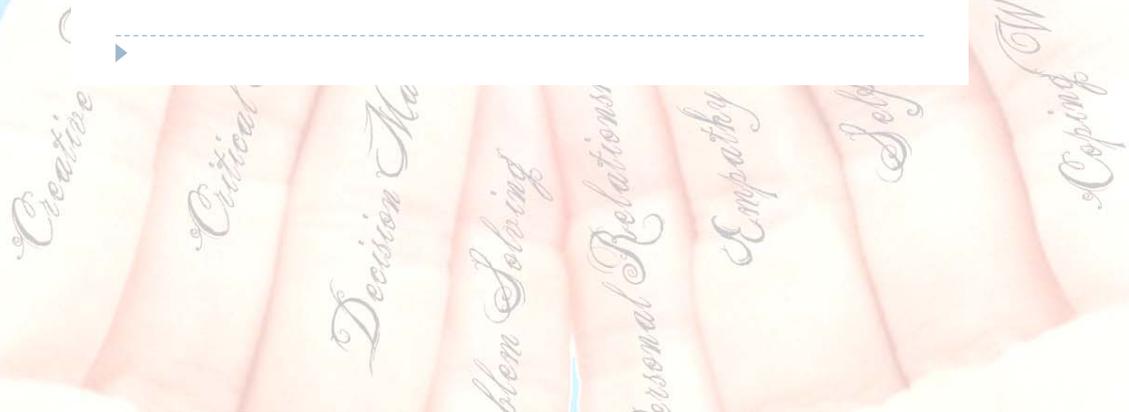
Benjamin Franklin

Who are you?.....

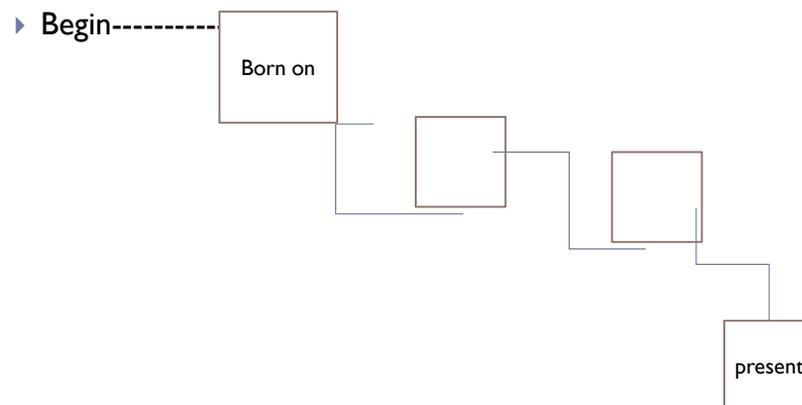


I, Me, I am,

- ▶ To understand ourselves better – To know our Strengths and weaknesses
 - ▶ Its is a recognition of 'self', our character, our strengths and weaknesses, desires, likes and dislikes, and skills.
 - ▶ Helps in building a sense of
 - Self-esteem
 - Self-confidence
 - ▶ Being aware of one's weaknesses
 - ▶ Helps one to utilize the opportunities available in relation to one's abilities
-



Sample Life Map



-
- ▶ The better you understand yourself, the better you are able to accept or change who you are .
 - ▶ **Self Awareness is a Survival Skill**
 - ▶ Awareness – Being alert ,mindful attentive etc.
 - ▶ To understand ourselves better – To know our Strengths and weaknesses.
 - ▶ **Only a Changed Person can Change Others !**
-

Creati

Criti

Decision

Problem Solving

Inter Personal Relatio

Empat

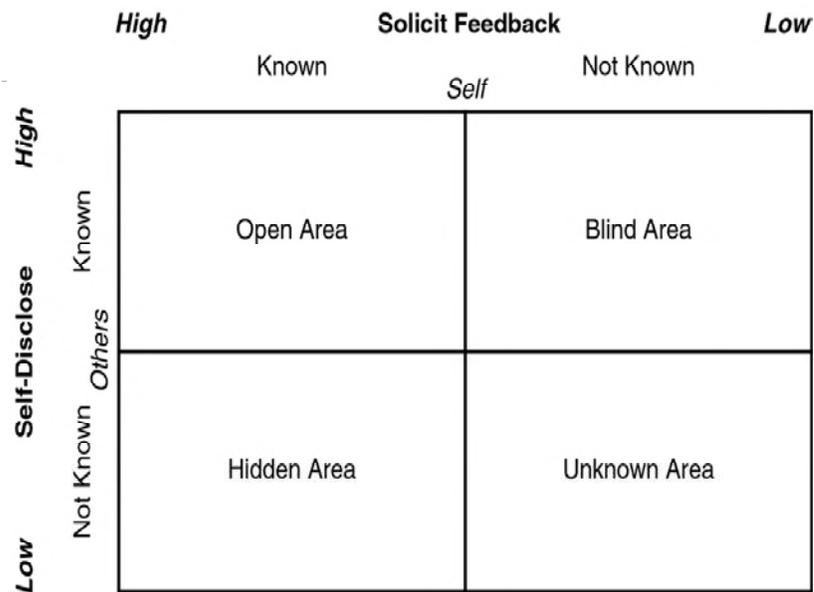
White Coping

Why we need to know our self....?

- ▶ To enhance the self esteem
 - ▶ To develop positive attitudes toward self , others, learning ,work & future.
 - ▶ To develop positive perceptions (Contentment ,happiness and hope)
 - ▶ To become full fledged person, (fully functioning person), and Self-actualizers.
-

How to increase Self Awareness?...

- ▶ I report.....
 - ▶ Me report.....
 - ▶ I and Me report
-



- ▶ **The term self-esteem refers to the overall evaluation of oneself, whether one likes or dislikes.**
- ▶ **Self-awareness is necessary for developing a positive attitude towards life**
- ▶ **It is a pre-requisite for effective communication, interpersonal relationship and developing empathy**

High self esteem vs. Low self esteem

- | | |
|-----------------------------|------------------------|
| ▶ SELF | ▶ Self |
| ▶ Perceives reality | ▶ Avoid reality |
| ▶ Relative un defensive | ▶ Self centered |
| ▶ Natural | ▶ Dependent |
| ▶ Task centered | ▶ Us vs. them |
| ▶ Enjoys being alone | ▶ Hostile |
| ▶ Self reliant | ▶ Conforming |
| ▶ Relationship are intimate | ▶ Critical of others |
| ▶ Acceptance | ▶ Reserved |
| ▶ Creative..... | ▶ Values not clarified |
-

Myself

- ▶ Write a poem about you.
 - ▶ Draw a picture
 - ▶ Represent yourself with available material present here.
-

Life skills scheme launched for adolescent boys

Saksham will help make them self-reliant citizens

Aarti Dhar

NEW DELHI: The Union government on Thursday launched a new scheme for empowerment of adolescent boys.

Saksham is aimed at all-round development of adolescent boys to make them self-reliant, gender-sensitive and aware citizens as they grow up. This will help to address gender violence and channelise their energies for nation-building, Minister of State for Women and Child Development Krishna Tirath has said.

The scheme will cover all adolescent boys (both school-going and out of school) in the age-group of 11-18, subdivided into the categories of 11-14 and 14-18.

Seven States

In the first phase, Saksham will be implemented in 20 districts in seven States, on a pilot basis, for the benefit of nearly six lakh adolescent boys a year. A budget allocation of Rs. 100 crore has been made during the 12th Five Year Plan. During 2014-15, Rs. 25 crore has been allocated for the scheme.

The Rajiv Gandhi Scheme for Empowerment of Adolescent Boys, as it is also called, will also help to address the



The energy and enthusiasm of adolescents will be channelised to help them improve personal skills.

— FILE PHOTO: T. SINGARAVELU

health needs — physical, mental and emotional — of boys and promote awareness of hygiene, nutrition and sexual and reproductive health.

It will also provide vocational skills to those aged above 16 years through the National Skill Development Program (NSDP) for future work-participation, besides life skill education and information on public services.

The structures under the Integrated Child Development Services Scheme (ICDS) will be utilised as a platform. This will be sup-

ported by a dedicated Saksham unit/cell created at the Centre and in the State, district and block levels. The Anganwadi centre is the focal point for the delivery of the services; wherever Anganwadi infrastructure is inadequate, community centre, school or panchayat hall will be used.

The Vocational Service Providers under the National Skill Development Programme, being implemented by the Ministry of Labour & Employment, will be used to offer vocational training.

CBSE schools give stress on life skill development

Staff Reporter

THIRUVANANTHAPURAM: With the Continuous and Comprehensive Evaluation (CCE) system introduced by the Central Board of Secondary Education (CBSE) being extended to classes six, seven and eight, the focus on co-scholastic skills of students has become an integral part of the student evaluation system in CBSE schools from upper-primary classes.

A key component of co-scholastic skills assessed under CCE is development of life skills of students. Life skill training programme under the CCE is targeted at

adolescent students between 10 and 18 years of age. The CBSE has published a set of guidelines to help teachers in imparting life skill education in a manual titled Life Skill Education and CCE.

The manual states that "life skills training is an efficacious tool for empowering youth to act responsibly, take initiative and take control."

According to the manual, life skill education for adolescent students is crucial for developing psychosocial competencies and interpersonal skills, and helps them in making informed decisions, problem solving, crit-

ical thinking, effective communication, building healthy relationships and managing their lives in a healthy and productive manner.

Life skill development also plays an important role in dissuading adolescents from resorting to high risk behaviours such as alcoholism, drug abuse and casual relationships when confronted with emotional issues caused by daily conflicts, entangled relationships and peer pressure.

The manual sets down four basic components for imparting life skill training through participatory

learning: practical activities, feedback and reflections, consolidation and reinforcement and practical application to day to day life challenges.

It suggests, Peer Educators Approach in which a group of student representatives are first trained in life skills through a series of training workshops, who will later impart it to their peers at school. Teaching techniques like class discussions, brainstorming sessions, role plays, educational games and simulations, case studies, story telling, debates, decision mapping and audio and visual activities like arts and

theatre are to be used for the purpose.

"Life skill education has been part of the CBSE system for some time now. However, it is only under the CCE that students are given grades and assessed based on life skill development and attitude as part of assessment of their co-scholastic skills," said Jawahar Navodaya Vidyalaya, Chettachal, Principal K.O. Ratnakaran.

C.P. Kumaran, Principal of Kendriya Vidyalaya, Patnam, said the school had separate classes for life skill training in which teachers specially trained in life skill orientation took classes.