BIOLOGY CURRICULUM OF XI STANDARD (NEW CLASS XI TEXTBOOKS ONLY) VIS-À-VIS THE DEVELOPMENT OF LIFE SKILLS

ERIC Report

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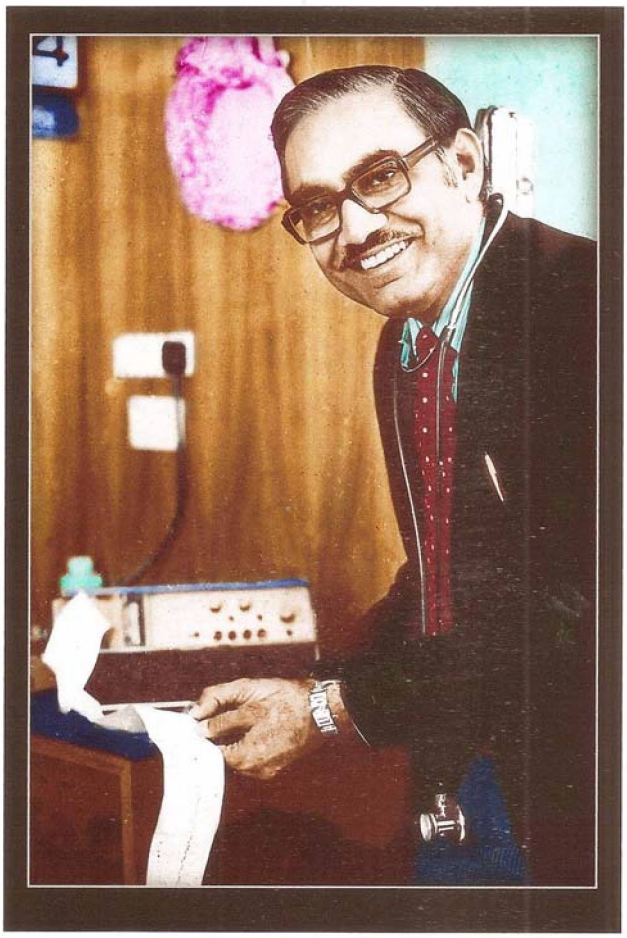
Dedicated to
My Valiachhan



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Dr. K.G. Nair was an internationally renowned Professor of Cardiology. He graduated in 1953 from the K.E.M. Hospital, Mumbai, with the highest marks in the University.

Before he returned to India in 1970, he was an Asst. Professor of Cardiology, Harvard University, Associate Professor of Cardiology at the University of Chicago, and later, Prof. of Cardiology at the University of Pennsylvania Hospital. He was a pioneer in Molecular Cardiology having started his work on RNA polymerase activity in hypertrophying hearts as far back as 1962, and had a PhD in this subject from the University of Chicago (for his pioneering work on cyclic AMP phosphodiesterase in 1960). He had been the President of all major societies in India and a fellow of the American College of Cardiology, Royal Society of Medicine, European Society of Cardiology, the Philippine Society of Cardiology and the prestigious Indian Academy of Sciences. He had organized many memorable international meetings in India and abroad. Recently, he was made a Fellow of the International Academy of Cardiovascular Research and awarded the Howard Morgan Prize for his research work. He has over 200 publications, including contributions to many Text Books, and had given numerous orations in India and abroad. He was the Medical Director of the Holy Family Hospital and was earlier, Director of the Breach Candy Hospital. He is regarded by his colleagues as the Father of Modern Cardiology in India. He was the Chairman of the Research Committee, Hinduja Hospital and Indian Chairman of the Lady Tata Memorial Trust and the Trustee of the Sir Dorabji Tata Trust and on the Governing Body of the Tata Memorial Hospital, Mumbai. Very recently Dr. K.G. Nair had been inducted on the special Advisory Committee to the Prime Minister on research and Health Matters.

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When thou sow a seed once, you reap a single harvest.

When you teach the people you will reap the second harvest.

– Kiang Chung (Chinese Philosopher)

CHAPTER – I

INTRODUCTION

According to a draft concept paper on "Towards a vision of NCERT in early decades of the 21st century" (DERPP, 2005) – "the last decades of the 20th century has seen developments in communication, international trade and commerce, political changes and effects of human activity on environment, the geographical distances have vanished, thanks to the satellite communication and internet. The probability of an individual child settling within a geographical vicinity or among one's own cultural contexts for livelihood, when he/she grows up is reducing drastically".

One of the important attractions for international capital to enter the domestic market is the abundance of skilled manpower and discernible consumers. Basic requirement for such a condition is quality of education provided at school level on which all further education is built. Escalation of technological changes and application of information technologies in commerce and industry coupled with globalisation has made knowledge and information as more critical issues than the capital and labour in competitive global market calling for new skills.

Skills required to be included to prepare children for the new economic order would be different from the currently emphasised skills. The future citizens of the country would increasingly face more open and semi-defined life situations. The education system operating through schooling in the past tended to deal with more defined structure, with more definite answers. But the rapidity of changes taking place cannot afford rigid structured approaches to curriculum and teaching processes.

Individuals who are already in the world of work require constant upgradation of their skills and knowledge. Hence school curricular practices need to generate learning to learn.

1.1 The Life Skills and their Significance

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 – for example, HIV/AIDS, alcohol, tobacco and drug use, war and political instability, unemployment, sexual and other forms of exploitation, and discrimination in its many forms. The causes of the problems and challenges faced are complex and multifaceted and are unlikely to be solved quickly or simply. 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 maintaining and promoting healthy life styles (http://www.unicef.org/teachers).

a. 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.

b. The life skills approach is simply good interactive educational methodology which focuses on more than just information. It is useful in the areas of health and health education, adolescent health behaviour research and practice, in areas such as drug use and HIV/AIDS related risk.

The prime distinctive feature of the life skills approach is its focus on behaviour change – especially to positively develop or change behaviour especially related to well being and healthy functioning in society.

The second distinctive feature of the life skills approach is the existence of a balance of three components

(i) knowledge or information

(ii) attitudes and values

(iii) (life) skills as the most effective method of developing or changing behaviours. (Skill components are inter-personal and psycho-social skills such as assertion, negotiation, decision-making, empathy building, values clarification, stress and coping skills.) Information acquisition strategies might focus mainly on the knowledge component; the life skills approach encompasses and balances all three of these components (K-Knowledge; A-Attitude; S-Skills).

The third distinctive feature of the life skills approach is the goal of making an impact on the risk behaviours associated with the challenges already mentioned. Education systems aspire typically to changes in knowledge alone and never focus on behaviour change in this way. The knowledge focus in education systems presents a significant challenge to advocating for and implementing life skills approaches. The higher goal in the educational context is behaviour change and so the life skills approach presents only that information considered necessary to influencing attitudes and achieving the higher goal of reducing risk behaviours and promoting positive behaviour. This leads to positive outcomes in terms of knowledge, attitudes and values and intermediate skills.

A major finding across the challenges already faced by us is that information is necessary but not sufficient to develop or change behaviours. To have an impact on behaviour, information based approaches in education need to be combined with attitudinal and interpersonal skills, known as 'life skills', which has become a kind of brand name for this approach.

By the year 2010 there will be more adolescents (ages 10-19) alive in the world than ever before, and a significant proportion will live in the Latin America and Caribbean (LAC) Region. This cohort of young people can become either a gift or a burden to their countries depending on the capacity of governments, communities and families to develop the human potential of this generation. Mangrulkar et al., (2001) describes one best-practice model for effectively contributing to the healthy development of adolescents' life skills programs.

Broadly defined, a life skills approach develops skills in adolescents, both to build the needed competencies for human development and to adopt positive behaviors that enable them to deal effectively with the challenges of everyday life. Mangrulkar's paper identifies "Life Skills" as: 1) social and interpersonal skills (including communication, refusal skills, assertiveness, and empathy); 2) cognitive skills (including decision making, critical thinking and self-evaluation); and 3) emotional coping skills (including stress management and increasing internal locus of control).

Theories of human development and adolescent behavior find these specific skills to be essential components of healthy development and the skills that define a resilient child. Research also finds that these particular skills are mediators of

behavior in adolescence. Results of program evaluations find that life skills development can delay the onset of drug use, prevent high risk sexual behaviors, teach anger management, improve academic performance and promote positive social adjustment.

Effective programs help young people develop these skills through interactive teaching methods that include role plays, open discussion, skills rehearsal and small group activities. Informational content is incorporated into the program based on the personal, social and health needs of adolescence within a specific culture. Based on the local context, a life skills program could include content about friendships, bullying, sexual relationships, anger management, perceptions about drug use, methods of birth control or prevention of malaria. Research finds that both skills development and informational content are necessary components of effective programs. Other key aspects are: targeting programs to early adolescents, modeling of skills through peer and social interaction, incorporation of interpersonal problem-solving skills, and the development of internal skills that can support positive outward behaviors.

Program providers need to be skilled in group process, interactive teaching methods, and to be respectful of adolescents. Importantly, they need to be perceived as role models by adolescents. Health care providers, counselors, teachers, parents, and peer leaders can fulfill these requirements, and programs can be applied in a variety of settings including health clinics, community centers, youth centers, churches, and schools.

According to Mangrulkar et al. (2001), by the year 2010, the number of adolescents in the world will be larger than ever before in history – 1.2 billion young people of ages 10 to 19. According to the US Census Bureau (2000), a significant proportion will live in Latin America and the Caribbean (LAC): almost 107 million young people! Will this cohort of young people fulfill its potential as a gift to the Region? The answer, to a large extent, depends upon the capacity of families, governments and communities to develop the human potential of this generation through life skills.

1.2 Statement of the Problem

It is observed that the present generation is more and more technologically literate with the advent and use of computers by even primary children. This rapid technological advance leaves a lacuna somewhere in the development of actual life skills that support the cohesive functionality of body, mind and spirit, and render human beings subservient to machines and technological products. It is important that we do not leave behind our natural skills as we move into an uncertain future. The school child should know to play with the computer as well as be able to work with the hands at manifold tasks; use the brain instead of a calculator/computer; use the limbs instead of a machine for walking; recycle to sustain the environment; create crisis management; survive in drastic conditions of natural calamities or war; manipulate in order to win situations and consistently experiment with new techniques.

The student should be able to understand and assimilate principles of interdependence in the environment and nature; they should identify and establish

linkages between living and non-living resources while making judicious, and rational exploration, exploitation and utilisation of resources; they should understand the cybernetics of natural, socio-cultural as well as bio-physical aspects of life and environment resources. Appropriate life skills related to these aspects and environmental sanitation and population explosion need to be inculcated in the students to improve the quality of human life and quality of human environment.

Students in the +2 stage of education are a transitional group of teenagers, experiencing the pangs of adolescence. Special skills of adaptation and positive behaviour need to be developed in them considering the ambient socio-economic cultural milieu. Science education programmes have to be designed to enable the learner 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 taking care of equity, equality and relevance. Learning science is doing science that is relevant to life for e.g., cutting of a tree – the effect of this on forests, environment, man and posterity needs to be wholistically dealt with. Concern of science educators the world over has been to make it relevant, vibrant and addressing the real-life situations. Students should not find science difficult and boring. The scenario can be changed through extrapolation as well as interpolation of life skills into science and vice versa. In short, science education at the +2 level should be oriented towards citizenship education and life skills education.

Literature reveals that curricular information and concepts are redundant and non-contextual and may very soon be forgotten in a world that is changing exponentially. School or test scores do not always indicate learner's ability to use the

knowledge and skills in similar and new life situations. According to NPE (1986), science education will be strengthened so as to develop in the child well defined abilities and values such as the spirit of thinking, inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility. Reinforced learning of existing curricular information and skills is possible only through incorporation of life-skills in various school curricula.

Also, technological advance has brought in the new digital age which calls for new kinds of skills in the 21st century. We have to adapt ourselves to move into the distant future which will be highly advanced scientifically and technologically and calls for fast forwarding of all our existing life skills because whatever expertise we develop today may fast become redundant in the future.

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 (WHO, 1994). Skills have been mentioned at every step of the elementary and secondary stages of education in the NCF. Science and technology mentioned in NCF emphasizes the development of manipulative skills which are acquired in day-to-day life situations. Also, it has been mentioned that practical activities to be chosen should have relevance for future life through acquisition of skills and values.

During deliberations on Curriculum Review by the Directors of SCERT in NIE, New Delhi, it was said that a negotiated and shared national curriculum needs to be continuously constructed and re-constructed in an inter-locked network of local, regional and national forms. They have clearly stated that curriculum reform needs to

be a social experiment where the needs of rural, tribal, disabled, poor and minority have to be negotiated and shared. The basic needs mean food, clothing and shelter and these needs of society certainly relate to life skills. It has been stated that curriculum review should take note of needs of community (NCERT News, 2005).

The present study is an attempt to guess and estimate how the biology curriculum can meet the needs of the community through the development of life skills.

1.3 Research Questions

An attempt has been made to find answers to the following questions.

1. What is the relevance of the content for living in a given time and space ?
2. What is the evidence that life skills are being developed ?
3. What is the space given in the curriculum for each of the life skills ?
4. What are the indicators in the textbooks for transaction of life skills ?
5. Do exercises address the life skill concepts ?
6. How do teachers address life skills ? Are projects assigned to develop life skills ?

   For e.g, if group discussion is assigned, life skill of communication is incorporated in the textbook

   - if biofeedback is assigned, life skill of empathy comes into play.
   - if ecological topics are assigned, life skill of self-awareness is brought to the fore in textbooks.
7. Whether life skills are developed in the textbook in terms of sustainable development ?

8. What are the envisaged life skills in the curriculum document and NCF in XI standard Biology ? What life skills does it aim at ?
9. What are the life skills already incorporated in the XI standard Biology texts/ curriculum ?
10. What are the minimum levels of learning attained in life skills of XI standard Biology texts ?
11. What are the additional skills that need to be included in the curriculum ?
12. How will you update the present curriculum in the light of observations made in the present studies ?
13. Can we make the curriculum environment, life and learner centred ? i.e. life-skill oriented ?
14. What are the life skills expected from a student who passes XI standard ?
15. Does each unit of the curriculum meet the development in life of a certain set of life skills at least ?
16. What percentage of incorporated life skills are learnt ?
17. Why are many of the life skills not learnt ? Is it because of lack of content, lack of infrastructure in lab, lack of exploratory activities, lack of hands-on experiences, etc. ?
18. How does the existing curriculum compare with the level of life skills expected from XI standard students ?
19. Have minimum levels of life skills been prescribed at the XI standard stage in the National Curriculum Framework ? If not, can we formulate it now ?

1.4 The Hypotheses

If there is a unit on Bacteria, the student learns to culture bacteria through indigenous methods using life skills of problem-solving and creative thinking.

The student is able to stop the growth of bacteria in culture in indigenous ways. Also he/she is able to control the spread of bacteria using local, economically and medically important plants. If the student is able to do this, he/she achieves life skills of problem-solving and creative thinking. If he/she does not achieve it, the life skill is not learnt.

If there are 20 important life skills to be learnt at the +2 stage and these have been achieved as evidenced by related activities performed in class/lab, then minimum levels of skills are achieved.

For e.g., if the question is "How will you culture Bacteria ?"

The student is able to solve it constructively in a series of steps as follows:

1. Bacteria are microscopic organisms.
2. Bacteria are prokaryotic and do not have an organised nucleus.
3. Bacteria contain plasmids, ribosomes and RNA in cytoplasm.
4. Bacteria possess a plasma membrane and wall.
5. Bacteria reproduce by fission.
6. *E. coli* are beneficial bacteria found in human intestine.
7. Bacteria show sexuality and recombination involving transfer of genetic material from one bacterial cell to another.
8. There are three methods of transformation of genetic material viz., transformation, transduction and conjugation.

9. Most of the important work on bacterial genetics has been done on *E. coli*.
10. Bacteria can be drawn in petri-dishes or in culture tubes on a simple culture medium.
11. The culture medium consists of glucose, ammonium salts and additional substances in traces.
12. Bacteria can manufacture vitamins and amino acids from these simple substances.
13. This is a minimal medium and strains of bacteria which grow on this simple medium after incubation (1-2 day period) are called phototrophs.
14. Bacteria can be grown either in liquid medium or on the surface of medium which is made solid by means of agar.

1.5 Rationale of the Study and Conceptual Framework

Education

Education is critical for economic and social development. It is crucial for building human capabilities and for opening opportunities. In terms of human development objectives – education is an end in itself – because economic rate of return in educating the people is secondary – because education is the key to building human capital and the human capital is the vital ingredient in building a nation.

Secondary Education and Life-Long Learning

Secondary education is used generically to mean post-elementary pre-collegiate education of XI through XII standards. It is a crucial and terminal stage of the school system. It is a gateway for higher education and also a vital link to the world of work. While the developed world has reached a stage where secondary education has become universal, it is undergoing a transformation in the developing

countries including India. The greatest pressures in the coming years will be to redefine the role of secondary education consistent with the long-term social and economic development strategy of the country. Traditionally secondary education is viewed as a place where the students pick up skills and competencies demanded in the labour market. However, this role of secondary education has also been questioned on many grounds.

According to Dave (1993), a careful development of education in the last two centuries in different parts of the world has revealed that the 21st century is going to be the century of developing secondary education.

The Significance of Secondary Education

In the first place secondary education must be closely related to the psychological needs of the adolescents for whom it is being designed. Secondly, it should be vitally related to the existing socio-economic situation – in order to equip the youth adequately for the needs of the existing socio-economic situation, it is necessary to give secondary education a vocational bias.

However, secondary education still continues to be essentially teaching and teacher-oriented. The learning process is yet to acquire the central focus of the pedagogical exercise. The creativity of the young which is the basic instrument of human development, has not yet been given the attention it deserves. Covering the syllabus, dictating notes or studying only the made-easy books is becoming a tradition.

The globalization and integration of the world's production and supply chains will influence the Indian economy as well. Some analysts warn us about large-scale

retrenchment and increased unemployment rates in general and especially among the youth in the coming years. To what extent the education sector would contribute to accentuation of such a crisis? Clear answers are not available at this stage, but would depend on the vision of policy planners. The education and training sector should have by now been ready with a contingency plan to address the future cracklings. India is already lagging behind in this area and any further complacency would prove costly to its national pride. At this stage it would be sufficient to recognize that secondary education would not only be critical for the success of economic reforms but also for the growth of education and its sub-sectors.

Secondary education including the senior secondary stage is the keystone of the Indian Educational Arch and as a supplier of inputs like teachers to the primary and to upper primary levels and raw materials for the higher education sector.

As suggested by the Delors Commission (1996), for economic growth to take place a high proportion of population has to have received secondary education.

Primary education by itself is no longer sufficient for obtaining decent employment on a suitable basis. Prof. Kamala Malhotra of UNDP is of same opinion and supports UEE as a priority area but also strengthening of secondary education as simultaneous goals and not sequential. Secondary education plays an important role in developing human resources to meet the changing needs of the labour market.

Secondary education is seen as a preparation for admission to higher education. The 1986 policy provided for the vocational courses to be offered at the +2 stage. It aimed at development of appropriate attitudes, skills and knowledge for self-employment or for meeting the demand of the labour market.

The first plan also highlighted the objectives of the secondary education, as in the **first** place, secondary education must be closely related to the psychological needs of the adolescents for whom it is being designed. **Secondly**, it should be vitally related to the existing socio-economic situation. In order to equip the youth adequately for the needs of the existing socio-economic situation, it is necessary to give Secondary Education a vocational bias. **Thirdly**, secondary education should grow from the education that is being given at the primary stage. The planning of secondary education must also have in view the creation of leadership in the intermediate level because for the majority of students formal education comes to an end at this stage . . . the standards to be attained should be high enough to make the majority of students whose education ends at the secondary stage to be efficient workers, and, on the other, to enable the minority who proceed to higher education to profit from the instructions they receive at these institutions. In view of the role it has to play between the basic and the higher stage, the planning of secondary education requires considerable care and attention.

During the first and second plan period, multipurpose schools also were established. These schools offered one or more practical courses in technology, agriculture, commerce, home science and fine arts, in addition to Humanities and Science. Although the concept of the multi-purpose school was readily accepted by the state governments, certain difficulties were encountered such as the lack of trained teachers in practical subjects, insufficient teaching material, especially text-books and handbooks, limited range of elective courses and inadequacy of educational and vocational guidance facilities. During the 3rd plan, therefore, it was proposed to

concentrate on the consolidation of the scheme by strengthening the institutions already established during the 2nd plan period.

In the Indian context, various commissions and committees have extensively deliberated upon various pros and cons of introduction of vocational education in the Indian schools. The Secondary Education Commission (1952) recommended that post-secondary education should be terminal in nature and that vocational education should start from Grade IX. The Education Commission (1964-1966), while recommending a uniform structure of the School Education, recommended that the vocational education should start from Grade IX and that the vocational education should be a distinct stream at +2 stage. In 1976, following the conceptual framework for implementing vocational education, a centrally sponsored scheme was launched where many states accepted the scheme initially, but soon it was discontinued due to various administrative and other problems. The National Policy on Education (1986), reiterated the role of vocational education and recommended it as a distinct stream intending to prepare students for identified occupations spanning several areas of economic activity. Consequently, vocational education was introduced at +2 stage in 1988 with financial assistance from the Central Government. However, major efforts to promote vocational education were started during the 8th plan period (1992-1997). There is poor response from the educational institutions and disappointing progress in terms of achievement of objectives. There are few states like Maharashtra, Kerala, Tamil Nadu and Gujarat where some success was achieved in the initial phases.

A critical weakness of the contemporary situation lies in the weak and dysfunctional stages between education and the world of work and the lack of

correspondence between the output of educational structure and the labour market. Education theories of the ancient and medieval times were based on the assumption that those who work should not think and those who think should not work.

The Kothari Commission (1966) has drawn attention to the importance of work experience, the transition from the world of school to the world of work. And the development of the requisite manpower for the country with practical training in industry as an integral part of education. Inspite of great hopes that were attached to the introduction of SUPW (Socially Useful Productive Work) as a third dimension, a qualitatively new approach to education has also failed miserably. Those who are aware of the ground realities are highly critical of the scheme, as the SUPW has been reduced to a ritual.

About 65% of the Indian population lives in rural areas. The needs of rural people are as diverse as in urban areas. At the same time, works in these areas are becoming increasingly uncertain and unpredictable due to rapid changes in technology. This has been further accentuated by the new economic and industrial reforms such as restructuring, privatisation, globalisation of trade, redeployment of workers etc. The emergence of new technologies and rural industries will require multi-skills to promote productivity of enterprises and to enhance the mobility and employment security of a person. Hence the role of technical and vocational education and training (TVE&T) will become more and more important in the next millennium (Gandhi, 1919).

The present education system in the country has not been able to fulfill the needs of a large section of the people as it is academically oriented and does not

impart the much needed vocational education and training for developing appropriate skills needed to perform jobs at various levels and to specific standards. As a result, a large majority of educated youth remains unemployed (60 million as per live registers) or under employed. The systemic bias in favor of higher education has produced a vat pool of graduates with higher learning but without professional skills to meet the demands of a rapidly modernizing society. As a result, this group of highly educated people is unable to find adequate jobs or any employment at all, ultimately joining the bandwagon of unemployed and unrecognized people. There are also a large number of skilled workers who are looking for a system through which they can get recognition of their competencies and upgrade their skills as per the needs of the market and employer.

Destiny of India is being made in its classrooms. In a world based on science and technology, it is education that determines the level of prosperity, welfare and security of the people. The point that is attempted to be made is that we will have to be more precise and exact in what we expect from schools. Only then can we start building bridges and roads to reach our target.

Secondary education in India – a perspective of changes, status and needs

Initially with aid from World Bank, there was an expansion in the base and coverage of elementary education. Independence created the need for developing and providing top-level facilities within the country (especially tertiary education). The squeeze for funds affected the secondary sector, most of which already has been a neglected sector.

Although the declared purpose was to give priority to the increase of elementary schooling in order to raise the rate of literacy in the population, what has actually happened is that secondary education had been rising much faster and tertiary education has increased still more rapidly. There is a fairly general tendency for planned targets of increased primary schooling not to be reached, whereas targets are overreached, sometimes substantially, as regards secondary and particularly tertiary education.

Secondary Education and Importance of Quality of Manpower

Throughout human history in virtually every part of the world, we have witnessed flourishing cities and civilizations, which had created a culture of their own. In most cases they declined and perished. We have also witnessed the re-growth of bigger cities at the same place where the ruins of previous cities stood, bringing in with them fresh vigor and strength and a new civilization with people with a fresh will and determination. Empires had fallen and from the ruins new and bigger and stronger empires came to be established at those asides. These examples point to one very significant factor. It had not been the death of material, physical and financial resources (like in the Tsunami Tragedy) or geographical features that had brought about the previous ruins, it had been the failure of human resources and human will that brought about the ruin. It had been regrouping of human resources that brought about a stronger culture and civilization to flourish from the same places. It is well said, “It is the man, not nature, who provides the primary resource, that economic development comes out of the mind of man-in a very real sense, we can say that education is the most vital of all resources”.

The secondary and elementary sector were in the state list at the beginning of the constitution until the 42nd Constitutional amendment came into force from 1975, when these were transformed into the Concurrent List. The bulk of responsibilities of secondary education remained with the state or provinces since 1882. Secondary education till today is predominantly governed by the state, which incurs much higher share of expenditure for it.

A body was created to coordinate the function between the centers and the provinces or states, even though the former had only the advisory role at that time in 1920, called Central Advisory Board of Education, which consisted of representatives of the center and the provinces. A CABE official in India should from time to time summon a representative Committee or Conference so as to keep in touch with the local jurisdiction and to harmonise our policy as a whole. Many years ago the CABE had suggested the formation of the Secondary Council of Education. Such a Council was even constituted and functioned for sometime. What is felt is the need for establishment of a School Council for Education, somewhat on the lines of University Grants Commission, to be constituted as a statutory body by the Ministry of Human Resources. The proposal could be considered and this would be an open body with the present bodies like the NCERT, NIEPA, NCTE, CBSE, and KV coming under its umbrella. An eminent educationist with experience of school education could be its vice-chairman with the Minister of HRD being its Chairman. It will have Minister of Education of all the States as its members, besides other educationists and some representatives of Parliament. One of its main functions could also be to serve as a coordinating body between the center and the State Governments (Mukhopadhyaya

and Narula, 2002).

Even if we ignore the fees paid to the institution, the burden of educating a single child is quite enormous even in the government and government-aided schools. There is of late increased privatization of the social sector including education that is currently blowing in the country, the question of equitable access to quality education becomes all the more pertinent. Many a parameter of quality of education has been found to bear strong positive relationship with the expenditure in education.

At present secondary education appears to be the weakest link in the educational system of the country. Elitist pressures to ensure availability of finances for higher education and to ensure the constitutional directive, to some extent, seek provision of adequate resources for the development of primary education but no such commitments or pressures existed for secondary education. As it is a known fact that the efforts to achieve the goal is on war footing, the problem of shortage of variety of resources will arise when the nation is expecting to achieve universalisation of Elementary Education (UEE) by 2010. From this point of time, the burden of secondary education planning and financing has to be attended to now.

According to Satya Bhusan (in Mukhopadhyaya and Narula, 2002), the agenda for secondary education involves expansion of facilities, curriculum changes, quality and relevance, use of IT for teaching and learning, equity and nurturing of talent, teacher education, vocationalisation (competencies to adapt continuously to changing work environment with the technological changes of life-long learning) and developing open learning system (education is considered as a unique instrument in the process of development of the nation). The Education Commission (1964-1966)

formulations and National policies (1968, 1986 and 1992) highlight the role of education as main instrument of change through human development. The main objectives are to address the problems of development, improvement of productivity by emphasizing work experience, vocationalisation and strengthening scientific and technological education and research. There is an increasing emphasis on human development – a process of enlarging people's choices by expanding human capabilities and functioning – the key areas are knowledgeable, healthy life and access to resources for decent standards of living. In the light of national perceptions, vision of India by 2020 is a developed and learning society without poverty, high quality of education and health standards to face the challenges of the 21st century (Also see UNDP, 1994).

Education will facilitate transition to a developed learning society with four main pillars – learning to learn, learning to be, learning to do, and learning to live together peacefully.

According to TNDhar (2002) action is required to be initiated in many directions so as to ensure that secondary education receives attention and priority in educational plans and that it is enabled to perform the crucial roles that it should in economic development and social modernization. Through Madhyamik Shiksha Abhiyan, Secondary Education is receiving due importance now.

Secondary Education and Life Skills

Skill: When an individual possesses a capability to perform a task with a high order of proficiency, 'it is a skill'. As a capability, skill is extremely difficult to distinguish from the traditional meaning of ability.

Broadly defined, skills are the abilities to deal effectively with the demands and challenges of everyday life. These are a person's ability to maintain a state of mental well-being and to demonstrate the same in adaptive and positive behaviour while interacting with others or his/her environment (UNESCO, 2001). WHO (1994, 1997) 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.

In skill development, the emphasis is more on 'what to do' and 'how to do'. There are strategies, viz., curricular approaches, co-curricular approaches, teacher counseling and peer education which can help students to develop skills in other disciplines (Yadav, 2002).

Life skills form an important component of **learning to be, learning to do and learning to live together peacefully**. CBSE has already come out with several textbooks (graded series from classes I-VIII) on life skills (Shiv Khera, 2010) but there are none that address the needs of the secondary section. Life Skill Education has been a part of the CBSE syllabus and under Continuous and Comprehensive Evaluation (CCE) students are given grades and assessed based on life skill development and attitude as part of assessment of their co-scholastic skills (Little Leaders, 2010). 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 Ninth Five Year Plan (1997-2002) identified the key issues facing secondary education as access, quality and diversification. It proposed revision and modification of secondary curricula to relate them more to work opportunities particularly at middle-level manpower and justified further expansion of vocational education (very much related to skills and life skills) in terms of both economic efficiency and social justice.

According to a report by Anita Joshua (2008), Rashtriya Madhyamik Shiksha Abhiyan (RMSA) has been approved by the Finance Ministry and the decks are cleared for a mission-mode exercise to universalise secondary education. RMSA is already operative. The scheme has been designed along the lines of Sarva Shiksha Abhiyan (SSA) and aims to take secondary education to all 15 and 16-year olds by 2017. In the wake of an anticipated demand for secondary education as a result of SSA, the RMSA was conceived on the premise that eight years of schooling is insufficient, not just to equip a child for the world of work but also to become a competent citizen. As on 2005-06, with the government focusing till date on elementary education, 58.86% of schools are run privately (with 31.08% being unaided) thereby necessitating governmental intervention to increase the capacity to broad-base secondary education.

'The Hindu', Sept 17, 2007 refers to the Prime Minister, Dr. Manmohan Singh mentioning two significant schemes that are ready for launch – one for the universalisation of access for secondary education (SUCCESS) and the other for the

promotion of higher (tertiary) education on a large scale through the establishment of thirty Central Universities, eight Indian Institutes of Technology and five Indian Institutes of Science. There is a four-fold increase in government funding in education in the Eleventh Plan which is a tangible recognition of the importance of the task of upgrading the quality of education.

'The Hindu', Sept 5, 2007 states skills shortage as a big barrier to success. The skill shortage has been attributed to new career options of the economy and massive exodus of local talent and change in technology. Changing job scenario now requires higher skill levels necessitating specialised training that goes beyond mere schooling and university degrees. Schools and colleges do not turn out industry-ready candidates, with experienced people lacking technical skills, management and leadership skills apart from emotional (these being life skills) like persistence, self-discipline and self-awareness; and other skills such as problem-solving and decision making.

According to 'The Hindu', July 17, 2008, beneath the glitter of impressive economic growth rates, India faces a silent crisis – a shortage of skills. The working age population is projected to increase 68.4% by 2026 and only a skilled work force can better utilise this demographic dividend and thereby improve global competitiveness. There is a National Policy on Skills development which reflects national concern that the increased work force would be wasted. The draft policy conceptualises widening the training framework to include school or institution-based training, training by industry and life-long learning. Life-long learning or education presupposes universal literacy, provides opportunities to youth, housewives,

agricultural and industrial workers and professionals to continue education of their choice at their own pace and promotes open and distance learning.

As mentioned already, life skills form an important component of learning to be, learning to do and learning to live together peacefully. 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. "While education should continue throughout the life span of an individual since there are particular developmental tasks and problems to be solved, it at the same time takes place among different life-spaces. These life-spaces are home, school, community and media, each playing by themselves a very important role in the total development of an individual. As a life-long learner an individual should **have more awareness of the surrounding world of changes in all walks of life, of expansion and obsolescence of knowledge, of changes in life roles as well as psychological conditions at different stages of life. "The curriculum areas or subjects of study should be selected in such a manner that they provide a basis and choice for further education both in general and professional fields"**.

Article 1.2.6 of this document stresses 'Linking Education with Life Skills' – because education basically suffers from the gap between the content and the living experience of its pupils and because education in its real sense should prepare pupils to face the multifarious challenges that they are bound to face in the society. Life skills have been defined here as abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life by developing in them generic skills related to wide variety of areas such as

health and social needs. It is through these skills that pupils can fight the challenges of drug violence, teenage pregnancy, AIDS and many other health related problems.

Knowledge and proficiency in these skills for instance, would also make pupils aware of issues such as consumer rights, questioning the quality of goods and services that are available to them, writing to the manufacturers, public utilities and civic authorities on the quality of goods and services that they expect. Core life skills such as problem solving, critical thinking, communication, self-awareness, coping with stress, decision-making, creative thinking, interpersonal relationships and empathy are considered to be of critical importance for a successful living.

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.

"An important characteristic of life-skills is that they are temporal and spatial in nature" and is a life-long learning / education process as mentioned under clause 1.2.17 as well. In contrast to value education which changes with time, period and culture, is prescriptive and result-oriented, life skills education does not change with time, period and culture, is participative and process-oriented. Therefore it is more relevant to focus on life skills that are the building blocks of life. Life skills are comprehensive and include various areas like thinking, behaviour and emotions – the final target being self-awareness, self-esteem, acceptance of others and living a healthy life (NIMHANS, 2002).

Mangrulkar et al. (2001) provides seven theories which forms the foundation for justifying skills development and differing perspectives on why these skills are important. Each of these theories gives the rationale for development of life skills education. (1) Some theories focus on behavioural outcomes justifying skills development as a way to move adolescents towards the behaviours that developmental expectations, cultural contexts and social norms find appropriate. (2) Others focus more on the acquisition of skills as the goal itself, since competency in problem-solving inter-personal communication and resolving conflict can be seen as crucial elements of healthy human development. (3) Finally some theoretical perspectives view life-skills as a way for adolescents to actively participate in their own process of development and the process of constructing 'social norms'. (4) By teaching young people how to think rather than what to think, by providing them with the tools for solving problems, making decisions and managing emotions, and by engaging them through participative methodologies, skills development can become a means of empowerment.

Science Education and Life Skills

According to National Policy on Education (1986) **Science Education will be strengthened so as to develop in the child well-defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility. Science education programmes will be designed to enable the learner 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 NCF (2005) states the following with relation to the development of skills and Science.

Article 2.3.3 on p. 16 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 a time when the given and internalized norms and ideas are questioned, while at the same time the opinions of the peer group become very important. **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" and therefore, the present study**. Also, the present study on Life Skills in XI standard students gains importance from the fact that absence of sufficient knowledge in this regard or the absence of life skills to handle these changes at a very vulnerable stage of their life may affect their extra-curricular activities as well as academic activities in an adverse way leaving a life-long negative impact.

According to Clause 3.1.4 (p. 40) "The foundational role of the skills . . . extends all the way upto secondary and senior secondary classes as new needs arise in the subject areas. 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", necessitating the present study.

Clause 3.3.1 (p. 49) states that "at the secondary stage students should be engaged in learning Science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analyses on issues concerning the environment and health, including reproductive and sexual health". Making Science a composite discipline at the secondary stage necessitated survey of the textbooks for life skills incorporated already and those that need to be incorporated in future as regards environment, health, reproductive and sexual health.

According to clause 3.6, ". . . the health needs of adolescents predominantly relate to sex and sexuality . . . culturally a very sensitive area . . . they are deprived of opportunities to get the appropriate information. 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 . . . and acquire life skills, so that they cope with concerns, related to the process of growing up", therefore, the present study.

According to 'The Hindu' (Staff Reported, 2010), the Continuous and Comprehensive Evaluation (CCE) System introduced by the CBSE has been extended to classes six, seven and eight and 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 Skills training programme under the CCE is targeted at adolescent students between 10 and 18 years of age. The manual published by CBSE (Staff Reporter, 2010) states that life skills training is an efficacious tool for empowering youth to act responsibly, take initiative and take control. Life Skills Education and development helps 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. Four basic training components have been suggested like participatory learning, practical activities, feedback and reflections, consolidation and reinforcement and practical application to day-to-day life challenges. According to the manual, peer educators' approach where student representatives trained in life skills through 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 will later impart it to peers at their school. Literature review (ref. Chapter II) also has brought out the importance of life skills and life skills training techniques in making students life savvy. Therefore, it is high time life skills are given their own importance and status as co-scholastic skills at the secondary level as well keeping in mind the importance of Life Skills and Skills in general as the cutting edge for the economic survival of the nation.

Work-Centred Education and Life Skills

Work is defined as an educational activity with an inherent potential for inclusion (NCF 2005, p. 59 & 60). Productive work makes one appreciate the worth of social life. Work creates inter-dependence, entails discipline, greater self-control, focusing of mental energies and keeping emotions under check. Productive work is a powerful means for transforming the education system and "would need to find a place at the centre of the curriculum in order to act as a powerful corrective to the 'bookish' information-oriented and generally unchallenging character of school education and, in turn, **help relate the latter to the life needs of the child". Work is a pedagogic medium** in knowledge acquisition, developing values and **multiple-skill formation**.

"A set of work-related generic competencies (basic, inter-personal and systemic) could be pursued at all stages of education. This includes **critical thinking, transfer of learning, creativity, communication skills, aesthetics, work motivation, work ethic of collaborative functioning and entrepreneurship-cum-social accountability"**. As these are all Core Life Skills required by Secondary stage students about to enter the world of work, Life Skills Education is a must-have in the secondary curriculum. NCF (2005, p. 61) further states that Universal Secondary Education will not succeed without inclusion of these work related skills or competencies.

According to Bharat et al. (2002) certain in-built buffers of the society are not available to today's adolescents as a norm viz., the extended family system, a smaller community which is personal and closed, a uniform culture in the smaller circle of

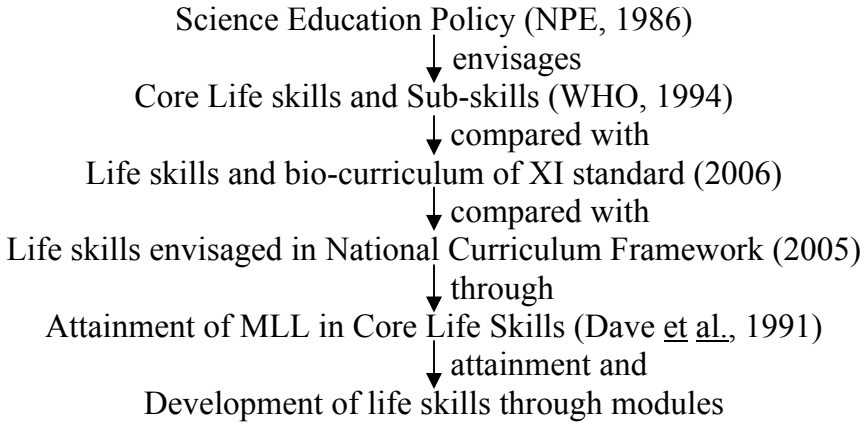
living and the traditional ways of thinking and behaviour. Therefore, there is tremendous stress among adolescents along with rising suicide and crime rates. The values of a stable society and family have to be replaced with the skills of individual that would enable him/her to be stable amidst rapid transition in the environment.

Life skills are used every moment in various situations – choosing friends/ career, developing or breaking habits, following discipline, understanding one's needs, solving problems, inter-acting with teachers and parents. Life Skills are the building blocks of one's behaviour and need to be learnt adequately to lead a healthy, meaningful and productive life. **Values are the foundations of a person but they change with time/period and culture. Life skills education suits any time, period or culture and are participative**.

This project and study is an effort to direct the technology savvy, the couch potatoes and the arm-chair dialogue deliverers to become more life-oriented and to direct them to life skill acquisition.

Conceptual Framework

Figure 1: Conceptual Framework of the Present Study



The conceptual framework envisages all the WHO skills (WHO, 1994) and the skills mentioned in columns 7, 8, 9 and 10 mentioned in the proposal (see Appendix). The core life skills mentioned in Col. 8 are discussed in the following pages. The skills mentioned in Col. 9, 10 and literature review pertain especially to those which are under National Curriculum Framework (2005) (Ref. Analysis of NCF 2005 under Results). Life skills and their sub-skills can be defined as given in the pages that follow.

Definitions of WHO Life Skills

Life skills are abilities for adaptive and positive behaviour that enable us to deal effectively with the demands and challenges of everyday life.

Described in this way, skills that can be labelled as life skills are not only innumerable, but also their nature and definitions are likely to differ across cultures and settings. However, analysis of the life skills field suggests that there is a core set of skills that are at the heart of skill-based initiatives for the promotion of the health and well being of children and adolescents. These, along with their importance are listed below.

- **Decision Making:** helps us to deal constructively with decisions about our lives. This can have consequences for different dimensions of our lives.
- **Problem Solving:** enables us to deal and manage constructively with problems in our lives. Significant problems that are left unresolved can cause mental stress and give rise to accompanying physical strains.
- **Creative Thinking:** contributes to both decision making and problem solving by enabling us to explore the available alternatives and various consequences of our

actions or non-action. It helps us to look beyond our direct experiences. Even if no problem is to be solved, or no decision is to be made, creative thinking can help us to respond adaptively and with flexibility to the situations of our daily lives.

- **Critical Thinking:** is an ability to analyse information and experiences in an objective manner. Critical thinking can contribute to our quality of life. This is becoming an important concern in all sectors.
- **Effective Communication:** means that we are able to express ourselves, both verbally and non-verbally, in ways that are appropriate to our cultures and situations. This means, not only being able to express opinions and desires, but also needs and fears. It may also mean being able to ask for advice and help in time of need.
- **Interpersonal Relationship:** helps us to relate in positive ways with the people we interact with. This will enable us to make and sustain friendly relationships, which can be of great importance to our mental and social well being. It also enables us in keeping good relations with family members, who are an important source of social support. It may also mean being able to end relationships amicably.
- **Self-Awareness:** includes our recognition of ourselves, of our character, of our strengths and weaknesses, desires and dislikes. Developing self-awareness can help us to recognise when we are stressed or under pressure. It is also often a prerequisite for effective communication and building interpersonal relations, as well as for developing empathy.

- **Empathy:** is the ability to imagine what life is like for another person, even in a situation that we may not be familiar with. Being empathetic can help us to understand and accept others who may be very different from ourselves, which can improve social interactions
- **Coping With Emotions:** involves recognising emotions in ourselves and others; being aware of how emotions influence behaviour, and being able to respond to emotions appropriately. Intense emotions, like anger or sorrow can have negative effects on our health if we do not react appropriately.
- **Coping With Stress:** is about recognizing the sources of stress in our lives, recognizing how this affects us, and acting in ways that help to control our levels of stress. (WHO, 1994; Murthy and Rao, 2005)

Components Of Life Skills And Their Operational Definitions

Decision Making

1. **Emotional Stability:** is the ability to manage emotions and remain calm in any decision-making situation.
2. **Objectivity:** is the ability to describe decision-making situations/problems exactly as they are without being influenced by one's own or others' feelings, opinions and beliefs.
3. **Self-knowledge:** is the ability to make a realistic analysis of what one is capable of doing and what one is not capable of doing before making a decision.
4. **Knowledge of the situation:** is the ability to describe the context of the decision-making situation as well as its elements and their inter-relationships.

5. **Analytical Ability:** is the ability to identify elements of the given decision-making situation by analysing it.
6. **Divergent, Thinking Ability:** is the ability to think of diverse courses of action in any decision-making situation.
7. **Synthetic Ability:** is the ability to synthesise different available possible courses of action and to generate one's own course of action in decision-making situations.
8. **Anticipation Of Consequences:** is the ability to predict the possible consequences of choosing a possible course of action.
9. **Logical Thinking:** is the ability to think systematically and sequentially using valid principles of logic.
10. **Rationality:** is the ability to take decisions or arrive at a conclusion on the basis of valid reasons or logic and NOT impulsively or by trial and error or on the basis of one's own feelings, opinions and beliefs.
11. **General Intelligence:** is the general mental ability to understand, think, learn and apply relevant procedures in decision-making situations.

Problem Solving

1. **Self Knowledge:** is the ability to understand and learn about one's own, capacities, emotionalities, and actions in dealing with problems in various situations of life.
2. **Positive Attitude:** is the ability of being hopeful and confident of approaching the problems in life.

3. **Divergent Thinking:** is the ability to think in multiple ways, views and manage a problem from different perspectives.
4. **Objectivity:** is the ability to view one's own problem from a third person's perspective as they are.
5. **Rationality:** is the ability to solve problems based on reasons and logic than using crude methods or trial and error.
6. **Logical Thinking:** is the ability to understand and deal with the problem in a systematic and orderly fashion.
7. **Analytical Ability:** is the ability to breakdown and understand various aspects/ components of the problem.
8. **Synthetic Ability:** is the ability to put together and understand various aspects/ components of the problem.
9. **Anticipation Of The Consequences:** is the ability to infer/foresee the after-effects of the problem and/or the possibilities of the success/failure of the strategies used in the management of the problem.

Creative Thinking Skill

1. **Divergent Thinking:** is the ability to think in different ways on one issue.
2. **Innovativeness:** is the ability to think in new ways of doing things, different from the routine ways, which is cost effective if implemented, and worthy of emulation.
3. **Novelty:** is the ability to generate new ways of thinking which the individual/ group had not used in the past.
4. **Fluency:** is the ability to generate fluently many ideas about a situation without any discontinuity .of thoughts.

5. **Flexibility:** is the ability to shift perspectives while thinking and generate as many as ideas as possible.
6. **Originality:** is the ability to think very differently from the large majority of people on different social situations – disregard of their social approval.
7. **Elaboration:** is the ability to think in such a way where one is capable of expanding different issues to different proportions in a connected manner.
8. **Unconventionality:** is the ability to think very differently from the practiced conventional ways of thinking by the group on any issue of social life.
9. **Independence:** is the ability to think without being influenced by the views of others.

Critical Thinking

1. **Analytic And Synthetic Abilities:** are the abilities to analyse different components of a social and personal situation and put them together meaningfully in order to understand the situation better by weighing different pros and cons.
2. **Objectivity:** is the ability to analyze social and personal situations based on pros and cons dispassionately by delinking personal feelings and subjectivity.
3. **Anticipation Of Consequences:** is the ability to anticipate the consequences of any line of thinking in social and personal situations.
4. **Intelligence:** is the general ability to weigh the strengths and weaknesses of any situation in the process of its understanding.
5. **Logical Thinking:** is the ability to think and reason systematically on all social and personal situations of life based on objective principles. The two methods of reasoning include inductive and deductive modes.

Effective Communication

1. **Analytic Ability:** is the ability to analyse different components of a piece of information, in order to understand its content.
2. **Synthetic Ability:** is the ability to integrate different pieces of information available in different domains, thereby creating a meaningful picture of different sets of information into an organised whole.
3. **Expressive Skills:** refer to the ability to present one's thoughts/ideas/feelings as effectively as possible through the use of spoken or written language apart from/along with the use of gestures.
4. **Non-verbal Skills:** refer to the ability to express and understand thoughts/ideas/ feelings through body postures, facial expressions and actions without the use of language.
5. **Postures:** refer to the general way of holding the body, especially back, shoulders and head when standing, walking or sitting which keep conveying some meaning.
6. **Gestures:** refer to the ability to use the movement of the body appropriately, especially hands and arms to enhance the intent of communication.
7. **Presentation:** is the ability to express thoughts/ideas/feelings formally as suitable to the demands of different types of situations.
8. **Assertiveness:** is the ability to put across one's views persuasively with a strong sense of conviction.
9. **Creativity:** is the ability to use different alternative ways to reach out to people suitably and successfully.

10. **Objectivity:** is the ability to participate in a communicative situation without any preconceived notions about persons involved or the content of communication.
11. **Sensitivity:** is the ability to be sensitive to the feelings of others in social situations in order to communicate effectively.
12. **Patient Listening:** is the ability to receive auditory inputs with full respect in a sustained manner in any conversation, without interrupting others, until they are completed.
13. **Imaginability:** is the ability to foresee consequences of a communicative situation which enables one to modulate the communication suitably.
14. **Reacting On The Spur Of The Moment:** is the ability to react to any situation instantaneously, making sense.

Interpersonal Relationship

1. **Empathy:** is the ability to feel with others in social situations which can lead to the development of good interpersonal relationships.
2. **Sympathy:** is the ability to feel for others in social situations which can lead to the development of good interpersonal relationships.
3. **Sensitivity:** is the ability to be sensitive to the feelings, emotions and needs of others in social situations which can lead to the development of good interpersonal relationships.
4. **Tolerance:** is the ability to endure and respect feelings, views, attitudes, etc., of others in interpersonal interactions irrespective of our agreement or disagreement on them.

5. **Positive Attitude:** is the ability to see the positive aspects in others and appreciate them in interpersonal relationships.
6. **Accepting Others As They Are:** is the ability to accept others with their strengths and weaknesses as it exists without showing any personal bias or prejudice about them in interpersonal relationships.
7. **Reciprocality:** is the ability to demonstrate a healthy attitude of give and take in social situations with others while interacting.
8. **Etiquette:** is the ability to show behaviour that is appropriate to different social situations which can earn respect and facilitate good interpersonal relationships.
9. **Healthy Distance:** is the ability to take only that much of liberty as the relationship empowers and demands and not misuse the liberty between any two individuals in any social situation.
10. **Lack Of Prejudices And Stereotypes:** is the ability to interact with people without being governed by preconceived notions about individuals/groups in any social situation.
11. **Effective Communication:** is the ability to express the thoughts and feelings in non-threatening ways.

Self Awareness

1. **Identify Strengths And Weaknesses:** is the ability to identify one's own strengths as well as weaknesses without any personal bias or prejudices.
2. **Objectivity:** is the ability to understand one's own strengths, weaknesses, emotions and feelings against a set of criteria.

3. **Introspectionability:** is the ability to assess one's own behaviour for their appropriateness or inappropriateness/adequacy or inadequacy shown in different life situations.
4. **Accepting Self As It Is:** is the ability to accept one's own self as a whole, in terms of his/her strengths and weaknesses, which makes the person unique.
5. **Openness:** is the ability to welcome thoughts or opinions from others if they are useful, despite they being contradictory to one's own initial conviction or belief.
6. **Reflectivity:** is the ability to use processes of seeing, understanding, pausing and evaluating one's own self in relation to his strengths and weaknesses in order to improve one self.

Empathy

1. **Sensitivity:** is the ability to sense the feelings, needs, emotions and actions of other people in social situations.
2. **Objectivity:** is the ability to assess the requirement of assistance to others in need, in society, excluding ones own personal biases and prejudices towards the individual or the group.
3. **Social Inclination:** is the ability to develop and show the attitude that as a member of the society one has to do some thing for the welfare of the society and its members as and when situation arises.
4. **Social Responsibility:** is the ability to feel responsible for the society by way of understanding the feelings, needs, emotions and actions of people in a social situation and also contribute to the welfare of society and its members.

5. **Social Obligation:** is the ability to feel that it is one's duty to understand the feelings, needs, actions and emotions of people in society where one lives and extend help voluntarily in different situations without even being asked for.

Coping With Emotions

1. **Empathy:** Ability to feel with others in different emotional situations.
2. **Sympathy:** Ability to feel for others in different emotional situations.
3. **Objectivity:** Ability to understand the emotions as they are and not based on personal biases.
4. **Emotional Intelligence:** Ability to identify one's own feelings, feelings of others, regulate one's emotions and handle situations involving different emotions.
5. **Self Awareness:** Ability to be aware of internal changes and different reactions given to different emotional situations in social and personal situations.
6. **Analytic And Synthetic Ability:** Analytic ability refers to evaluating the situation in terms of what has led to the emotional situation, and what would be the likely result. Synthetic ability refers to the ability to organise and use the appropriate emotions in response to the emotional situations.
7. **Sense of Proportion:** Ability of an individual to be aware of the intensity of his emotional reaction and be able to sense whether the same is required for the situation.
8. **Emotional Shock Absorbers:** Ability to withhold any emotional shock potential of disturbing the individual directly, by trying to be non-emotional, rational and capable of understanding the sources and meaning of emotionally disturbing news.

9. **Resilience:** Ability to recover quickly from any emotionally disturbing situation and get back to mental cheerfulness.

Coping With Stress

1. **Recognisability:** is a group of abilities to identify or become aware of ones own feelings of stress, the course or origins of that experience of stress, an appraisal of the barriers or obstacles that seemingly impede resolution of the stress as well as setting of goals appropriate and adequate for bringing about a relative end to ongoing stressful experiences.
2. **Planning ability:** is a group of abilities to draw blueprints or schemes for enabling short term or long term future courses of action by including effective consideration towards the act, manner or practice of handling time constraints within the gamut of planning for coping or bringing about a relative end to ongoing stressful experiences.
3. **Objectivity:** is an ability to be in a state, quality or attitude of being impersonal, external or uninvolved to a problem or situation being examined or under focus.
4. **Empathy:** is an ability to develop identification with or understanding of another person's situation, feelings and motives.
5. **Resilience:** is the ability to maintain mental cheerfulness by recovering quickly from change or misfortune.
6. **Reality Orientation:** is the ability to perceive or be aware of the objective world in relation to ones self across place, time or person.

7. **Self-awareness:** is the ability to develop realization of oneself as an individual entity or personality, including ones feelings, traits or behaviors covering both good and bad.
8. **Relaxationability:** is the ability to rejuvenate or refresh ones body and mind so as to bring it back to an optimal state of functioning.
9. **Entertainability:** is the ability to amuse, please or indulge in diversions that enables the individual to get back to optimal state of functioning.
10. **Stability:** is the ability of being constant, firm, steadfast and resistant to change.

Based on the skills mentioned above and in the project proposal, the present scenario, concomitant problems and solutions thereof, the work carried out in this report could be projected as given below in Figures 2 and 3.

Figure 2: Conceptual Framework for the Development of a Life Skill Curriculum for XI standard Biology Curriculum

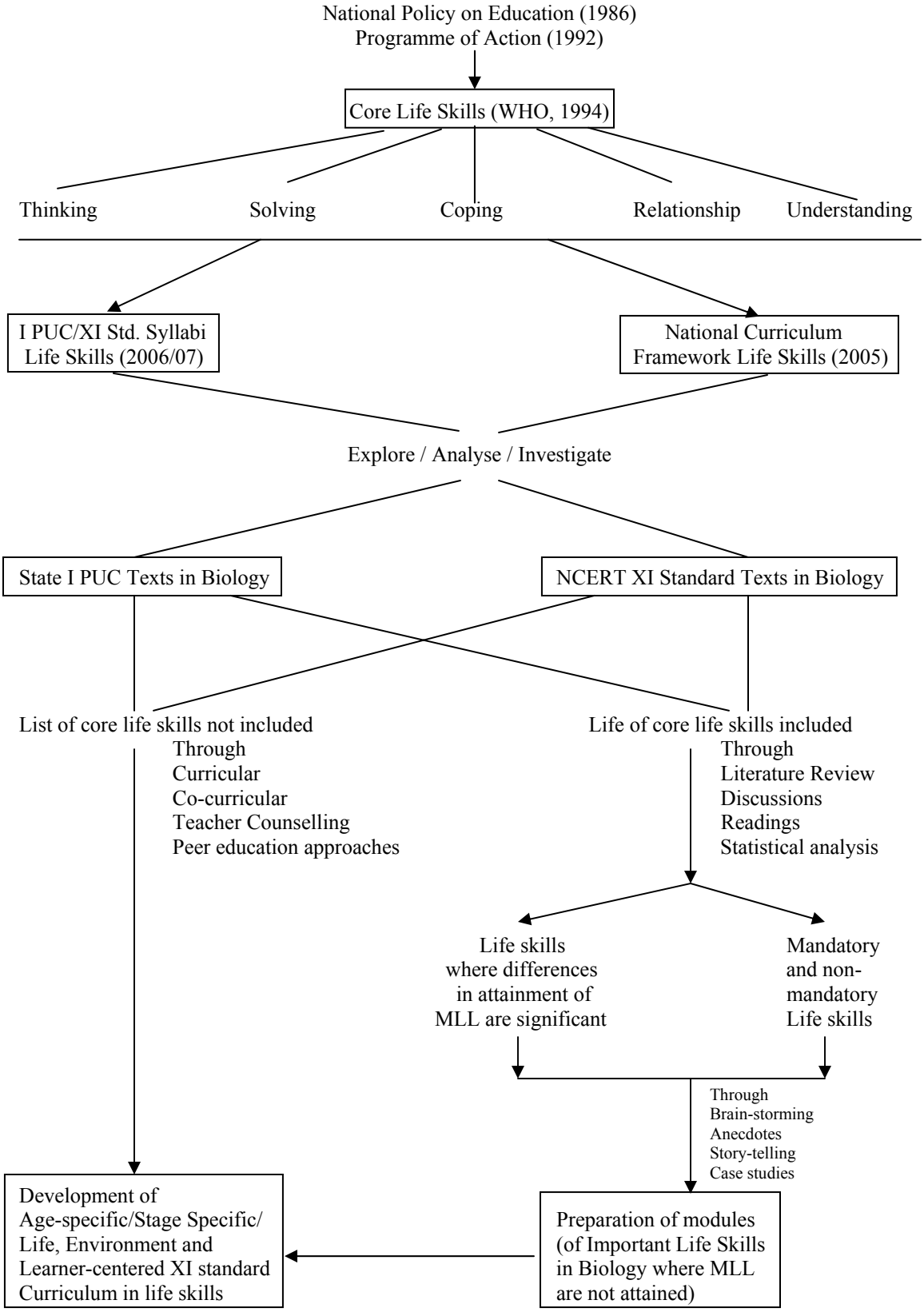
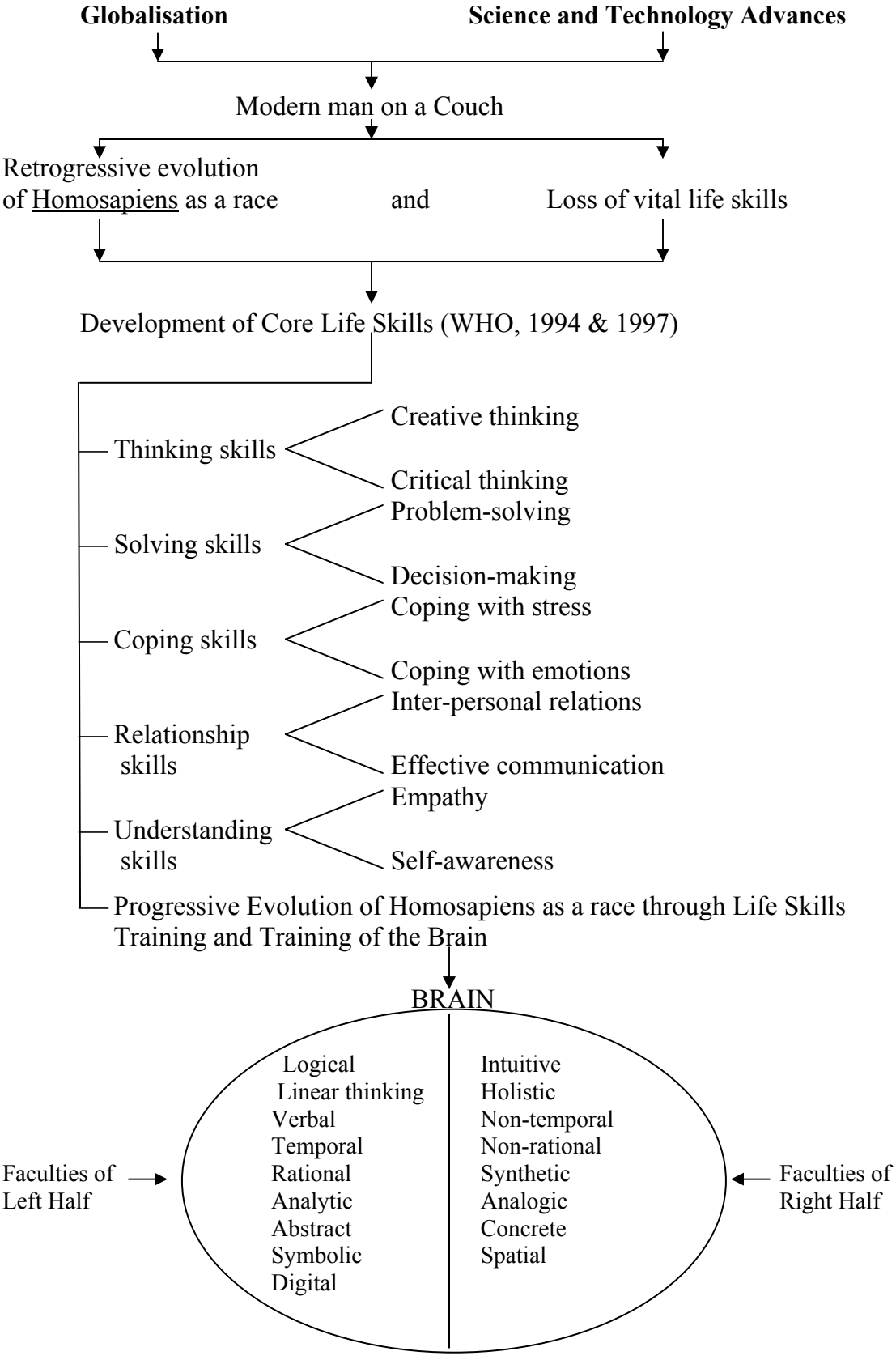


Figure 3: Conceptual Framework for the Development of the Biological, Environmental and Psychosocial perspectives of the present study in a Global Village

Globalisation Disadvantages in terms of Life Skills Development		**Science and Technology Advances** Advantages
1. Minimisation of brain function, e-waste, technological waste (lack of critical thinking, and creative thinking)	**G** **L**	1. Computers and Robots
2. Humans as consumer goods; sadness quenched through expenditure; family, food, friendship and nature lose value; slow societal suicide; increase in cycle of work and consumption; staggering environmental toll (Lack of self-awareness life skills/lack of coping with stress and coping with emotions life skills)	**O** **B** **A**	2. Materialism; Consumerism
3. Defunct/reduced limbs in addition to coccyx and appendix, and nails (Lack of self-awareness and empathy life skills)	**L**	3. Transportation made easy; Revolution in automobile industry (cars, aeroplanes, ships, submarines, space vehicles); Migration to space and space voyages.
4. Rapid communication but no inter-personal contacts (Lack of inter-personal relations and effective communication)		4. Mobile revolution and Net.
5. Depletion and waste; Increase of non-recyclable substances (Lack of self-awareness and coping life skills).	**V**	5. Mushrooming industries, sky scrapers and residential areas.
6. Increase in longevity and population explosion; Upside down inverted population pyramid with more of old people (Lack of self-awareness, empathy and coping skills)	**I** **L**	6. Science of medicines and drugs; Bionanotechnology.
7. Loss of reduce, reuse and recycle principles; depletion of natural resources; destruction of surroundings (Lack of self-awareness and coping life skills; lack of problem-solving and decision-making skills)	**L** **A**	7. Sophisticated machinery and nano biotechnology.
8. In times of a natural catastrophe like the Tsunami tragedy, man is unable to meet his own basic needs and is thrown off gear (Lack of basic skills of procuring food and meeting basic needs)	**G** **E**	8. Green revolution; white revolution (food and food products increase); clothing and shelter amenities increase world over.

Figure 3: Conceptual Framework (continued)



"We will need to ensure far greater availability of educational opportunities at the higher education level so that we have not just a literate youth but a skilled youth, with skills which can fetch them gainful employment. As our economy booms and as our industry grows, I hear a pressing complaint about an imminent shortage of skilled employees. As a country endowed with huge human resources, we cannot let this be a constraint".

— Prime Minister Manmohan Singh
Independence Day Speech, 2006

CHAPTER – II

LITERATURE REVIEW

According to Mangrulkar et al. (2001) by the year 2010, the number of adolescents in the world will be larger than ever before history – 1.2 billion young people of ages 10 to 19. According to the US Census Bureau, 2000, a significant proportion will live in Latin America and the Caribbean (LAC): almost 107 million young people (U.S. Census Bureau, 2000). Will this cohort of young people fulfill its potential as a gift to the Region? The answer, to a large extent, depends upon the capacity of families, governments and communities to develop the human potential of this generation.

Kumar (2009) stresses the importance of quality and equality in education. Quality is related to social outcomes and positive social outcomes are found in societies with greater equality. Both health and education are projected as enabling factors for nurturing human life. He draws attention to the three roles of education, viz. skill-imparting and disposition inducing roles which are the core aspects of education and its intrinsic quality.

2.1 What are the Key life Skills?

Life skills fall-into three basic categories, which complement and reinforce each other:

- Social or interpersonal skills, including communication, negotiation/refusal skills, assertiveness, cooperation, empathy.

- Cognitive skills, including problem solving, understanding consequences, decision making, critical thinking, self-evaluation.
- Emotional coping skills, including managing stress, managing feelings, self-management, and self monitoring.

Life skills described in this paper do not encompass technical/vocational skills. Development of these skills is closely linked to a pedagogy of active learning. Through participative teaching methods, such as role play, debates, situation analysis, and one-on-one problem solving, life skills programs can actively engage young people in their own development process.

Before we proceed, a note of caution is in order. A focus on individual skill development is a powerful methodology for promoting adolescent health, but it must be placed within a wider context. Adolescents in the Latin America and Caribbean often face multiple threats to their health including poverty, political violence and a lack of employment opportunities. Strategies that affect the larger political, media, family and community environment are also needed for long-term sustainable change. A comprehensive youth health agenda includes: (1) policies that advocate for services, employment opportunities and a quality educational system, (2) training of professionals to work with this population, (3) implementation of intervention, prevention and health promotion services, (4) organizational networks to support youth, (5) research that tests effective strategies and explores youth issues, and (6) channeled resources to fund these strategic efforts (PAHO, 1998a). Within this agenda life skills represents a much needed and, effective, model for health promotion programming.

Skills development has formed a part of adolescents programming around the world, whether within youth development, asset building, pregnancy prevention, life planning, social and emotional learning, health education or substance abuse prevention initiatives. Decision making has long been a part of pregnancy prevention models, refusal skills are seen as critical to drug abuse prevention, and communication skills have been used to help aggressive or anti-social youngsters. But with the move towards a comprehensive programming that addresses multiple behaviors and competencies, the life skills approach is beginning to be recognized as an effective unifying framework. Innovative youth programs around the world incorporate skills development around issues of rights and citizenship, and creative conflict resolution.

While higher education is becoming an attainable goal for young people in certain countries of the LAC Region (e.g., Argentina, Chile, Costa Rica, Panama, Peru, Uruguay and Venezuela, all with tertiary enrollment rates exceeding 25 %), the vast majority of young people in LAC will not have that opportunity (Guadilla in World Bank, 1999). Employment and youth unemployment estimates range from 35 to 66 percent-remains a problem (PAHO, 1998). Data from household surveys in 15 countries show that youth (15 to 24 years old) who neither study nor work represent between 12% and 40% of poor households (ECLAC, 1997). The future for these young people, disconnected from society's educational system, without social security benefits, or other opportunities to gain capacity-building skills is very uncertain.

Poverty and extreme inequality continue to plague the LAC region. Opportunities and wealth in LAC continue to be very unevenly distributed. The chance to earn a living wage, to get an education, to access health services, and to live free of disease and poverty varies widely from country to country and within countries. In Haiti, more than 70% of the population lives below the level of absolute poverty, and 13% of young people ages 15-19 are illiterate. By contrast, 71% of young people in Argentina and 88% in Chile have a secondary education, some of the highest levels in the world (World Bank, 1999). Young people growing up in rural areas have multiple disadvantages compared to their urban counterparts. In Latin America, illiteracy is 2 to 6 times higher in rural than urban areas, and the limited access to basic services (health and nutrition) is further exacerbated by the generally low educational attainment of women in rural areas. Many factors for rural children, such as poverty, geographic isolation, and the need to use children as domestic labor, severely limit their opportunities to pursue education beyond primary school. In Chile, rural youth have an average of only 8.8 years of education, in Honduras, 5.3 years of education, and Brazilian rural youth attain only 4.2 years of education (IDB, 1998).

Another challenge to LAC governments is to provide services and opportunities for the nearly 40 million individuals from ethnic minorities (World Bank, 1999). Indigenous populations have the lowest educational attainment and highest poverty rates in the region, making them among the most disadvantaged groups in the world.

And, there is concern that economic globalization and trade liberalization will exacerbate these disparities as skilled and educated young people reap the benefits from these trends, while the unskilled and under-educated face greater marginalization and exclusion.

Cognition (cognitive development) can be defined as the process of organizing and making meaning of experience (Newman and Newman, 1998). According to Piaget, human beings make meaning of the world through interaction with the environment. From infancy through 18 months, babies learn about the environment through their direct sensory experience. By ages 5 or 6, they develop more complex tools for understanding the world through language, imitation, imagery, and symbolic play and drawing. Moving into early adolescence, the child begins to understand causal relationships and logic, and is becoming more sophisticated in problem solving. Piaget believed that by adolescence, a person is able to conceptualize about many variables, allowing for the creation of a system of laws of rules for problem solving. (Piaget, 1972)

While Piaget focuses clearly on an individual's interaction with the environment, social constructivists believe that knowledge is the result of social interaction and language, and thus is a shared experience. Vygotsky, a prominent cognitive theorist, proposed that new levels of understanding begin at an inter personal level: originally between infant and adult, and then through continuous social interaction. He conceptualized that the distance between the actual and the potential stage of development of a child is determined by his or her problem solving capacity, when working alone vs. collaborating with adults and other, more capable

peers (Newman and Newman, 1998; Vygotsky, 1978). Seen from this perspective, the social environment has a strong influence on the structure of one's thinking, and cognitive skills can be enhanced by more extensive structured, high quality interactions with others.

Research done in the United States finds patterns of developmental asymmetry of skills in girls and boys: boys are more psychologically at risk than girls throughout the years of childhood, and then girls (stronger and more psychologically resilient than boys in childhood) are suddenly at high risk in adolescence (Gilligan, 1993). Boys in childhood are more likely than girls to suffer from depression, develop learning disorders, and show many forms of out of control or out of touch behaviors. In early adolescence, girls' depression and related suicide attempts rise, often having shown no signs in childhood. Gilligan argues that boys' crisis revolves around finding ways to connect with others, and that for girls it is to find their own (ibid). This idea could have many implications for how skills, such as perspective taking, empathy and assertiveness, are developed differently in boys and girls.

According to Mangrulkar et al. (2001), there are critical changes that take place from middle childhood to adolescence. The biological transformations of puberty, the psychological changes that accompany an emerging sexuality, changing relationships with peers and family, and the growing ability for early adolescents to think abstractly, to consider multiple dimensions of problems, and to reflect on themselves and others represent a critical moment in human development. Whether young people move through these changes acquiring the requisite skills to make a healthy transition to adulthood, depends in large part upon the opportunities afforded

to them from their environment. “With rapid change comes a heightened potential for both positive and negative outcomes, creating important opportunities for families, schools, and out-of-school programs to interact with adolescents in a way that fosters growth and development” (Eccles, 1999).

Human development theories single out late childhood to early adolescence as a critical moment of opportunity for building skills and positive habits, since at that age there is a developing ability to think abstractly, to understand consequences, and to solve problems. The wider social content of early and middle adolescence provides varied situations in which to practise life skills with peers and other individuals outside of the family. Skills and competencies are recognised as important in a child’s developmental pathway, and in developing a sense of oneself as an autonomous individual.

Social Learning theory had two profound influences on the development of life skills and social skills programs. One was the necessity of providing children with methods or skills for coping with internal aspects of their social lives, including stress reduction, self control and decision-making. Most life and social skills programs address these skills. The second was that, to be effective, life and social skills programs need to replicate the natural processes by which children learn behavior. Thus, most life and social skills programs include observation, role-play, and peer education components in addition to plain instruction.

Skills development not only becomes a question of outward behavior, but of internal qualities (such as self- efficacy) that support those behaviors (Bandura, 1977a).

Richard Jessor's theory recognizes that adolescent behavior (including risk behaviors) cannot be reduced to a single source, but is the product of complex interactions between people and their environment. Problem-Behavior Theory is concerned with the relationships among three categories of psychosocial variables: (1) the personality system; 2) the perceived environmental system; and (3) the behavioral system. The personality system includes ''Values, expectations, beliefs, attitudes, and orientations towards self and society." The perceived environmental system concerns perceptions of friends' and parents' attitudes toward behaviors. And similar to Bandura, the behavioral system is usually described as a certain set of socially, unacceptable behaviors (the use of alcohol, tobacco, and other drugs, sexual behavior by persons below a certain age, delinquency, etc.). Each psychosocial system contains variables that act as instigators or controls on problem behavior. The strength of these variables results in proneness – the likelihood that problem behavior will occur (Jessor, Donovan, and Costa, 1991).

In more recent years, Jessor and the Problem-Behavior Theory have described two other systems of influence, the social environment (which includes factors such as poverty and family structure) and biology/genetics (including variables such as family history of alcoholism and high intelligence (Jessor, 1992). The biological genetic system of influence (like much genetic research) may be useful to identify children with a genetic propensity for particular risk behaviors (like alcoholism), but is still limited in its use in prevention. The social environment domain identifies other variables (behaviors such as poor school performance) that correlate with risk behaviors (such as the use of alcohol and other drugs). These variables, if changed,

will affect others-regardless of the workings of the causal links among the variables. Developing skills such as values clarification (to better understand one's own values and beliefs and critical thinking (to clearly recognize and analyze the values of the social environment) can have an impact on behavior, and can be even more effective in coordination with programs that affect other variables, such as poverty reduction programs, clinical health service or school dropout prevention (Jessor, 1992).

Teaching interpersonal cognitive Problem solving (ICPS) skills to children at a young age can reduce and prevent negative inhibited and impulsive behaviors. Research shows differing levels of interpersonal thinking skills in children displaying positive social behaviors versus children displaying early high-risk behaviors (including antisocial behaviors, inability to cope with frustration, and poor peer relations). The defining skills focus on the ability to generate alternative solutions to an interpersonal problem and secondly, the ability to conceptualize the consequences of different behaviors. Relations between these problem solving skills and social adjustment were found not only in preschool and kindergarten children, but also in adolescents and adults.

An intervention based on this research, the ICPS intervention (also called "I Can Problem Solve"), develops interpersonal cognitive problem-solving skills starting in preschool, with the ultimate goal of preventing later and more serious problems by addressing the behavioral predictors early in life. Solving hypothetical dilemmas, thinking aloud, role playing, and providing performance feedback are some methodologies for teaching these skills. Research done with preschool and kindergarten children found that those receiving the ICPS training became better able

to cope with typical everyday problems than those who did not. By learning to consider more solutions and consequences they became better able to cope with frustration, better able to wait, and less overemotional and aggressive when goals could not be satisfied immediately (Shure and Spivack, 1980). Thus, problem-solving, especially as applied to social or interpersonal-situations, and starting early in life, is for the development of life skills.

Howard Gardner (1993) published "Frames of Mind", challenging the prevailing view of human intelligence as an uncomplicated set of cognitive and symbol-using capacities, acknowledging primarily only verbal/linguistic and mathematical/logical abilities. Gardner proposed the existence of eight human intelligences that take into account the wide variety of human thinking capacities. These include linguistic, logical/mathematical, musical, spatial, bodily/kinesthetic, naturalist, interpersonal and intrapersonal intelligences. This theory - postulates that all human beings are born with the eight intelligences, but they are developed to different degrees in each person, and that in developing skills or solving problems individuals use their intelligences in different ways.

Researchers have expanded the thinking on the two "personal" intelligences; interpersonal intelligence, the ability to understand and discern the feelings and intentions of others, and intrapersonal intelligence the ability to understand one's own feelings and motivations.

Daniel Goleman popularized the idea in his book, Emotional Intelligence, which argues that knowing how to manage one's emotions is a skill at least as important for success in life as intellect (Goleman, 1997).

Resilience theory argues that there are internal and external factors that protect against the social stressors or risks of poverty, anxiety, or abuse. If a child has strong protective factors, he or she can resist the unhealthy behaviors that often result from these stressors or risks. "Internal protective factors include self-esteem and internal locus of control; while external factors are primarily social supports from family and community, such as positive role models or health services (Luthar and Zigler, 1991; Rutter, 1987). According to Bernard (1991), the characteristics that set resilient young people apart are social competence, problem solving skills, autonomy, and a sense of purpose. Although the social environments of these young people are marked by risk, they also have "protective qualities, including caring and supportive relationships, high expectations, and opportunities for youth participation, and involvement". (Meyer and Farrell, 1998, p. 472).

"Recent findings in behavioral epidemiology indicate that mental health problems, social problems, and health-risk behaviors often co-occur as an organized pattern of adolescent risk behaviors" (Greenberg et al., 1999). Programs that teach social and emotional skills had positive effects in multiple realms, such as decreasing aggression in boys, decreasing suspensions and expulsions, decreasing drug use delinquency, increasing academic test scores, and increasing positive attachments to school and families (Hawkins et al., 1992).

The core constructivist psychology is that individual development, including higher mental function, is rooted in social sources. A child's cognitive development is thought to be a collaborative process, developed through interactions with other people and with the environment. Thus, the individual is not the center of knowledge-

making but rather gets his or her learning and understanding through social interaction (Vygotsky, 1978).

The constructivist perspective has three important influences on a life skills approach. One is the significance of peer collaboration as the basis for learning skills, especially problem-solving skills. Secondly, the constructivist approach highlights the importance of the cultural context in infusing any life skills curriculum with meaning; the adolescents themselves co-create "the content through the interaction of the factual information with their particular cultural environment. Finally, this perspective acknowledges that the development of skills through the interaction of the individual with the social environment can influence both the learners and the environment (peer group, classroom, youth group, etc).

2.2 Life Skill Categories

Life skills belong to three categories, viz., social, cognitive and emotional coping skills.

Social Skills

- communication skills
- negotiation / refusal skills
- assertiveness skills
- interpersonal skills (for developing healthy relationships)
- cooperation skills

Cognitive Skills

- decision making/problem solving skills (understanding the consequences of actions and determining alternative solutions to problems)

- critical thinking skills (to analyse peer and media influences)

Emotional Coping Skills

- managing stress
- managing feelings, including anger
- skills for increasing internal locus of control (self management, self-monitoring).

Examples of life skills categories that focus on social competencies, violence prevention, and general health promotion are;

- Skills related to social knowledge, perception, and emotional encoding and decoding, perspective taking, interpersonal reasoning, and interpersonal problem-solving (Bierman and Montimy, 1993).
- Cooperation, assertion, responsibility, empathy, and self-control (Gresham and Elliott, 1989).
- Social entry skills, conversational skills, conflict-resolution and problem-solving skills, and anger-control skills (Guevremont et al., 1990).
- Decision making/problem solving, creative thinking/critical thinking, communication/interpersonal relationships, self-awareness/empathy, and coping with emotions/stress (WHO, 1993).

Life Skills

Social Skills	Cognitive Skills	Emotional Coping Skills
• Communication skills • Negotiation/refusal skills • Assertiveness skills • Interpersonal skills (for developing healthy relationships) • Cooperation skills • Empathy and perspective taking	Decision making/problem solving skills • Understanding the consequences of actions • Determining alternative solutions to problems Critical thinking skills • Analyzing peer and media influences • Analyzing one's perceptions of social norms and beliefs • Self evaluation and values clarification	• Managing stress • Managing feelings, including anger • Skills for increasing internal locus of control (self-management, self-monitoring)

These three skill categories are not employed separately, but rather complement and reinforce each other. For example, a program aimed at promoting social competence in children would teach ways to communicate feelings (a social skill), to analyze different ways of handling social situations (a cognitive skill), and to manage their reactions to conflict (an emotional coping skill). The following section gives an overview of these categories of skills and explores the research that supports their use in various programmatic contexts.

Life Skills I: Social Skills

The adolescent years represent a very challenging time as relationships with parents, peers and others become more complex. Effective social interactions are a critical factor for successful functioning in the home, school and work.

One perspective on social skills, linking them directly to behavioral outcomes, is the social skills deficit model. This model hypothesizes that children who fail to

develop the skills for interacting with others in a socially acceptable manner early in life are rejected by their peers and engage in unhealthy behaviors (violence, the abuse of alcohol and other drugs, etc.). One of the best predictors of chronic delinquent offending and violence in adolescence is antisocial behavior in childhood (Pepler and Slaby, 1994). Research has also indicated that about half of young children rejected by their peers do not have social deficit but rather a high rate of aggressive behavior learned at home (Patterson, 1986). These children tend to respond to their rejection by peers with aggression, initiating a cycle of aggressive behavior and peer aggression that escalates as the children get older (Bierman and Montimy, 1993). Young people with deficits in social skills may band together, thus reinforcing their isolation from their mainstream peers, as well as their unhealthy behaviors. Thus, the children who do not learn to share toys, smile at peers, take turns during play in preschool may find themselves involved in a peer group, defined by fighting and the abuse of alcohol and other drugs in adolescence.

From a prevention and health promotion perspective, research supports the development of skills including communication, assertiveness, refusal, and negotiation.

- In the area of substance abuse, prevention programs have focused on assertiveness training and communication strategies for refusal and negotiation, combined with problem solving and decision-making skills and relaxation techniques (Botvin et al., 1998; Hansen, 1992).

- In the area of preventing high-risk sexual behaviors, interventions have combined knowledge-based education with social skills training, including teaching negotiation skills and refusal skills, to produce changes in contraceptive behavior of adolescents (Nangle and Hansen, 1993). High risk behaviours of adolescents were related to deficits in communication skills, assertion skills and problem-solving skills (ibid, p. 127).
- Many conflict resolution and violence prevention programs are geared towards developing social skills and understanding about alternatives to violence. One project, Resolving Conflict Creatively Program (RCCP) targets "problem-solving and communication skills used in deescalating conflict", including active listening, expression of feelings, perspective taking, negotiation, and encountering bias" (Sadowski, 1998). "Social skills training ... focuses on increasing positive social skills with which to handle inevitable social disagreement and conflict ... As they employ these skills, anger is reduced through improved communication, and the consequences of uncontrolled anger are therefore reduced" (Deffenbacher et al, 1996).

Perspective taking and empathy are two critical social skills. While research has supported the idea that children's social awareness begins from an egocentric perspective, it has also found that even young children have an awareness of others' feelings, and often respond to the distress of others' based on their level of empathic understanding. Programs in violence prevention have successfully taught specific skills that link perspective taking and empathy to appropriate behaviors. Young

people are found to show increased skill in identifying and relating to another person's feelings if a real-life role model demonstrates empathy for a character in a distressful situation (Feshbach, 1982; Shure and Spivack, 1988). Guiding children to practice these empathic responses within conflict situations can build habits of thinking and caring about other people's perspectives and feelings and help them to come up with nonviolent solutions instead of resorting to aggression (Slaby and Guerra, 1998).

Life Skills II: Cognitive Skills

Most adolescent programs using a life skills approach combine both social skills and key cognitive skills: problem solving and decision-making. "Problem solving" is identified as a course of action that closes the gap between a present situation and a desired future one. This process requires that the decision maker be able to identify possible courses of action or solutions to a problem and to determine which is the best alternative solution (Beyth-Marom et al., 1989). According to Bandura's social learning theory, people who experience developmental difficulties are those who are less able to set appropriate goals and to generate ways of achieving those goals (Bandura, 1977). The work of Shure and Spivack reiterated the importance of problem solving and goal setting in healthy development. Young people need to "learn how, not just what to think earlier on" (Shure and Healey, 1993). In some prevention research that idea is applied to skills that help children to resist peer and media influences by learning how to think critically about messages from peers and the media (Botvin, et al., 1998).

Another crucial aspect of cognition is related to self-evaluation or being able to reflect on the value of one's actions and qualities to self and others, and is related to expectancy or the degree to which one expects that one's efforts to shape life's outcomes and actually determine the results. People who believe they are causally important in their own lives tend to "engage in more proactive, more constructive and healthier behaviors related with positive outcomes." Research found correlations between this kind of thinking and behaviors such as smoking cessation, contraceptive use among females and males, and academic achievement (Tyler, 1991).

Social-cognitive models explore how cognition interacts with the family/peer context and existing beliefs/values to affect behavioral outcomes. The "habits of thought" model is one such social-cognitive model, mostly applied to modifying aggressive behaviors. Interventions address an individual's content of thought (by modifying beliefs that support violence), process of thought (by developing skills in social problem solving), and style of thought (by managing impulsive processing of thought) (Pepler and Slaby, 1994).

Finally, research has shown decision-making to be much more complicated than a simple rational process (Beylh-Marom et al., 1989). Management of difficult choices, especially under stress, involved both cognitive thinking skills (identifying issues or problems, determining goals, generating alternative solutions, envisioning possible consequences) and emotional coping skills (calming oneself under stress, listening carefully and accurately, determining the best choice) (Elias and Kress, 1994).

Life Skills III: Emotional Coping Skills

Skills for coping with emotions through learning self-management and controlling stress (often incorporating social problem-solving skills) are a critical dimension of most life skills programs. The bulk of the research in this area focuses specifically on anger reduction or conflict management, but social competency programs and substance abuse prevention programs also acknowledge their importance. Cognitive-relaxation coping skills target emotional and physiological arousal, and focus on increasing skills for emotional control. Relaxation techniques are taught to help young people calm down so that they are better able to think about and deal effectively with frustration and provocation (Deffenbacher et al., 1996, p. 150). Managing anxiety is another important emotional coping skill. "Anxious children tend to have distorted perceptions of the degree of threat present in certain situations, and lack the self-efficacy or effective coping skills to manage their internal distress." (Greenberg et al., 1999)

Emotional coping skills also include strengthening an internal locus of control, or a belief in personal control and responsibility for one's life, and in a generalized expectation that one's actions will be reinforced. Aspects of this include: learning to delay gratification of short-term rewards, to put forth personal efforts in the service of actualizing goals, and to seek help in times of distress. While patterns of thinking are an important determinant of locus of control, Bandura (1977a) describes the importance of motivation for setting goals and initiating tasks, and perseverance to the task. Programs that effectively develop these three skill sets (social, cognitive, emotional coping skills) in adolescence can have a powerful impact on development,

providing young people with the competencies needed for growth. However, as we will discuss later, skills acquisition alone is not enough. It needs to be combined with informational content addressing the social and developmental tasks relevant to this stage in life.

2.3 Life Skills and Secondary School Education

According to the Ministry of External Affairs, Education holds the key to economic growth and social transformation. Though the major indicators of socio-economic development, viz., the growth rate of the economy, birth rate, death rate, infant mortality rate (IMR) and literacy rate, are all interconnected, the literacy rate has been the major determinant of the rise or fall in the other indicators. There is enough evidence in India to show that a high literacy rate, especially in the case of women correlated with low birth rate, low IMR and increase in the rate of life expectancy. The recognition of this fact has created awareness on the need to focus upon literacy and educational programmes, not simply as a matter of social justice, much more to foster proper economic growth, social well-being and social stability (FICCI-BISNET.online).

Secondary education which has a 2+2 structure and starts with classes IX-X leading to higher secondary classes XI-XII prepares young persons in the age group 14-18 years for entry into the world of higher education and work. The number of secondary and higher secondary schools has increased from 7,416 in 1950-51 to 1,52,049 in 2004-05. The intervention of the Central Government in Secondary Education has primarily been in two areas: (1) through apex level bodies and (2) through various commissions on secondary schools.

Central Government supports autonomous organisations like NCERT, CBSE, Kendriya Vidyalaya Sangathan (KVS) and Navodaya Vidyalaya Sangathan (NVS) and Central Tibetan School Administration (CTSA); the first one for providing research and policy support to the Central and State Governments; CBSE for affiliating secondary schools and the remaining three for their own school systems. There are 919 functional Kendriya Vidyalaya and 539 Navodaya Vidyalayas which are pace setting schools in the country.

In the current education scenario, a large number of students are completing the upper primary classes, it is therefore necessary to provide access to secondary education. In accordance with this the recent budget (2007-08) has announced to double the provision for secondary education from Rs. 1,837 crores to Rs. 3,794 crores.

Secondary education is a very important segment of school education comprising Classes VIII, IX and X and higher secondary education consists of classes XI and XII, otherwise called plus Two. In most States, plus Two is part of school; in a few, it is called junior college and is part of college education. The number of secondary schools in India rose from 7,416 in 1950-51 to 1,16,820 in 1999-2000. Between 1990 and 1999, 37,000 secondary schools were opened. The First Five Year Plan allocation for secondary education was Rs. 20 crores which rose to Rs. 2,600 crores in the Ninth Plan - yet it is only one per cent of the GDP. The IX plan lays emphasis on the revision of curricula so as to relate these to work opportunities. Pre-vocational training and employment oriented courses are stressed at the secondary level along with hands-on training. Open-learning system is to be expanded. In PM's

Convocation Address at Goa University, Dr. Manmohan Singh termed 11th Five Year Plan as India's Educational Plan and emphasised the fact that over 19 percent of the total control gross budgetary support would be spent on the sector during the plan period. Outlay on education has been increased from 7.7% of the total central gross-budgetary support in the 10th Five Year Plan to over 19 percent in the 11th Plan (Ruhela and Nayak, 2011).

The XI Five Year Plan (2007-12) suggests a long term vision for improving access and quality of secondary education and for re-orienting this to the needs of the coming generation and the knowledge economy and these are possible through life skills education.

It also asks for recommendations regarding policy, programme priority and financial outlays in respect of adolescents and youths.

There are two reasons why secondary education should be considered important. First, it is the bridge between upper primary school and higher education or to the world of work, if one has opted for vocational education in these classes. So it is a watershed in one's learning career. Secondly, it consists of students between the years 14 and 18-20, the teen years, which are the most perplexing times in a child's life. These are the adolescent years when physical changes take place which affect the child in some form or other. Unless the right guidance is given during these crucial years, there is scope for the child to go off-track, either through irresponsible sex behaviour, or recourse to bad company, leading to indulging in drugs and violence, and ultimately to depression and may be even suicide.

According to CABE (2005), there is an increasing demand for secondary education accelerated by UEE. The sky rocketing demand may lead to frustration of the growing aspiration of the people and risk the fast growing Indian economy. The report project growth and demand for secondary education till 2020 and estimates the implications of the demands.

First and foremost, we have to look at the teaching skills that teachers have in their subject and in communication. This is important in any sphere of education but more important in the secondary stage and up. Classes have to be joyful and interesting and promote inquisitiveness in adolescent children, encouraging them to think independently.

Vocationalisation is a part of secondary education and has not been a success in our country. We have to ensure that we get the best teachers for vocational subjects and arrange for hands-on experience. Anyway, the view that only vocational schools should teach vocations and other schools need do nothing to teach life skills is a wrong notion. Driving, cooking, swimming these are coping skills and they should find a place in the curriculum.

According to Jennifer Yamin Ali (2007) there are many lessons that young students will learn through the secondary school experience. However, if parents and teachers were to view the secondary school as the canvas on which young people's hopes and possibilities are painted, then more attention would be paid to the deciphering of codes in their lives and the ascertaining of relevant needs. By so doing, it is more likely that a student's talents and gifts would be unearthed and developed by encouraging practices that stretch the young person towards a lifestyle of self-

discovery. It is only through varied experiences that this can be accommodated. The concept of self-discovery from an early age is crucial if we view the secondary school experience as a journey that may well determine the course of one's adult life. While academic preparation is one of the main goals set out by the curricula, it is the unwritten curriculum that really equips students for life at the higher academic levels.

Notwithstanding the skills that can be learnt within a classroom environment, many adults will testify to the richness of their own learning through participation in extra- or co-curricular activities. These activities require time management skills responsible attitudes, and personal sacrifice. They also engender a sense of self-confidence and improved personal interaction skills. Within the offerings of the secondary school, then, the young student has the option of personal development through the exposure to all that a school has to offer. Parents are advised to monitor and encourage participation, and to welcome the opportunities that schools provide to enhance their children's overall growth.

Performing on stage or in a competition of some sort are unforgettable school experiences. Whether it is the cricket match, steelpan practice, the art competition, or the dramatic production, the involvement in and commitment to such activities provide invaluable lessons for a young student. Constructive use of free time provides the frame for the student's sense of accomplishment, and the inclination and desire to continue on such paths in their adult life.

Whether it is at tertiary level institutions or in the workplace, the young adult is expected to be competent at decision making, goal setting, and personal management. The secondary school provides for these through class or projects,

committees, and group work, to name a few. Adhering to deadlines and regulations is an excellent way to prepare oneself for life after secondary school. Some other ways in which schools can encourage psychological and social growth in young students are by developing systems that encourage peer tutoring, and even by students tutoring teachers in areas such as computer literacy, modern entertainment, or games.

Schools may also be used as centres for parent-and-child life-skills development, either during or after school hours. Seen as a continuation of the primary school and as a nurturing partner of the home, the secondary school is expected to be a model of ideal practice on the part of all staff-ancillary, non-academic, academic, and administrative. Because secondary school students are at a particularly challenging stage of physical and emotional development, it is important to constantly guard one's tone and message when communicating with them, whether it is oral communication or in the wording of notices and rules.

If schools today are inclined to complain about the students' home environment, surely it is the school that should strive to be the caring and inspiring organisation from which students can learn for life.

Students entering secondary school must do so with the understanding that secondary school is much like a gym – you are required to stretch all your capabilities, and you will need to monitor yourself for much of the time. Secondary school is the place for students to shape themselves into the persons they want to be.

The Aga Khan School curriculum (www.agakhanschools.org/pakistan/akhss) strives to create a harmonious balance between academic demands, sporting and cultural activities and community life. It challenges its pupils to be intellectually

inquisitive and socially conscious. The School believes that while what students know is important, the true measure of a student's education is the ability to analyse what they do not know.

Developing critical thinking and analysis is therefore at the core of the School's mission. The School also encourages students to respect and appreciate other people's cultures, social structures, values and beliefs. Taken together, these objectives are designed to help equip children with the tools they will need to make their way in school, society and an increasingly interdependent world.

Again, the present content of the school course in biology is traditional in nature. The concept of biology as a method of inquiry by means of accurate and confirmable observations, quantitatively and mathematically analysed, and controlled experimentation should be impressed on the minds of the young learners. Earth sciences should be introduced in secondary school, geology and geography being taught as an integrated subject. There are also many areas in chemistry, physics and biology to which certain topics in the study of earth sciences can be naturally related.

The following themes are stressed in the Aga Khan School curriculum (www.agakhanschools.org/pakistan/akhss) of secondary stage:

- Planning Makes a Difference: Stresses the importance of personal and career planning.
- Being Responsible: Emphasizes the importance of personal responsibility.
- Building Character: Defining the person you are, and choosing to become by clarifying attributes and characteristics of behavior.

- Solving the Problem: Presents a scenario requiring students to use problem solving techniques.
- Life Skills: Illustrates the importance of everyday life tasks such as money management, being a consumer, work and the family, health skills and citizenship responsibilities.
- Preparing for Career Success (for grades 10-12) provides students with the most current career information and thoroughly covers a variety of social issues affecting today's workers and the workplace, including tech-prep, ethics in the workplace, sexual harassment, and the complex set of problem-solving skills needed to successfully handle the challenges facing two-wage-earner families.

According to Brown et al. (2003), in 1999, 277 principals from all of the secondary schools in the Durban Metro and Mtunzini districts in Kwazulu Natal Province were interviewed about the teaching of life skills education in their schools. The interviewers returned to the schools in 2001 to re-interview the principals, noting whether the same principal was in charge. The results presented are based on 257 matched pairs. Response rates at both times were greater than 95 percent. The surveys asked about the characteristics of the schools, the comprehensiveness and coverage of life skills education, demographic information about the respondents, and their attitudes about reproductive health issues and about teaching sexuality in school. No data were collected on the quality of teaching of the life skills curriculum.

The key findings were that more than-90 percent of schools offered life skills education in 2001, a significant increase from 1999. Life skills education coverage

increased dramatically between 1999 and 2001, when the percentage of schools that taught any of the 11 life skills topics, according to principals' reports, rose from 60 percent to 93 percent. There is an even greater increase in the percentage of schools that teach the six-core life skills (contraception/pregnancy prevention, HIV prevention, care for people living with HIV and AIDS, prevention and symptoms of STDs, relationships and negotiation, and self-esteem/decision making), from 20 percent in 1999 to 66 percent in 2001. The percentage of schools with teachers trained for life skills increased from 76 percent to 94 percent. Findings from the larger transitions study of adolescents between the ages of 14 to 22 support the increase in life skills education that was found in principals' data. Adolescents reported higher levels of exposure to the core life skills topics in the 2001 survey as compared to 1999 survey. Instruction in at least one format (either as an independent subject, integrated into other courses, or as a special presentation) of the following topics increased by 15 percent or more: STD prevention and symptoms, HIV prevention, care for people living with HIV and AIDS, relationships with the opposite sex, and self-esteem/decision making. These improvements were similar for males and females.

African, Asian, and mixed-race schools and schools with high-risk student bodies achieved the greatest expansion of life skills instruction. Schools that are predominantly African, Asian, or racially mixed show the greatest increases in providing instruction in any life skills area and in the core life skills topics. In 1999, those schools where the principal perceived the students to be at high risk of pregnancy and HIV infection were significantly less likely to offer life skills education than schools where the students were not at risk. By 2001, according to

principal reports, schools with high-risk students showed the greatest improvement in offering life skills education.

To sum up, by 2001, most secondary school students in the Durban Metro and Mtunzini districts had been exposed to information to help them reduce their risk of pregnancy and HIV/STIs. This represents an important increase since 1999. The greatest expansion of life skills instruction was found in the "African, Asian, and mixed-race schools and in schools where the principals perceived the student bodies to be at high risk. Despite the overall positive picture, more resources are still needed for schools lagging behind or that do not currently offer any life skills education.

Some of the life skills topics included for study in Durban Metro Schools and Mtunzini districts in Karagaha National Province were:

- Reproductive biology
- Human growth and development and the life cycle
- Understanding sexuality
- Self-esteem, assertiveness, and decision making
- Relationships: communication and negotiation with your partner
- HIV/AIDS transmission and prevention
- HIV/AIDS: looking after people with AIDS
- STDs: prevention and symptoms
- Drugs and alcohol
- Contraception/preventing unwanted pregnancy
- Violence and sexual abuse-child abuse, incest, rape, and coercion

The Committee on Home-School Co-operation (CHSC) of the education and Manpower Bureau of the Hong Kong Special Administrative Region Government commissioned Consumer Search to conduct a survey on "Parents views on the Essential Life Skills of Junior Secondary School Students" in April 2006.

The objectives of the survey were to understand the views of parents on nine essential life skills to be acquired by junior secondary school students and to explore the approaches used by parents at home to nurture and train their children to master four basic life skills including "time management" "handling household chores", managing personal finance" and "self-learning".

The survey was conducted from April 27 to May 17, 2006 through telephone and covered residential households that had children aged 12 to 15. 535 questionnaires were completed with an overall response rate of 50.0%. At 95% confidence level, the maximum sampling error was ± 4.4%.

In the opinions of interviewed parents, more girls than boys tended to use "Reading books other than text books" and "Visiting libraries, museums, space museum and country parks etc" to nurture their own self-learning skills. Although over a quarter of the Interviewed parents mentioned that their children be regularly "Taught by a tutor", the same proportion of interviewed parents mentioned that their children did not have such learning experience, especially amongst parents with lower education attainment and lower family income. Reminding them on a regular basis" (40.0%) was also the most common method used by parents in helping children to enhance their self-learning skills, especially amongst parents using authoritarian

method of parenting. Besides, about a quarter of the interviewed parents adopted 'Training them at early age" and nearly two in ten adopted "Visiting libraries, museums, space museum and country parks etc" to cultivate their children's self-learning skills, especially amongst parents using authoritative method of parenting. Also more than ten percent of the parents mentioned "Creating reading atmosphere at home" to help their children. Seventeen point six percent of the interviewed parents did nothing to help their children enhance their self-learning skills, particularly amongst those who were of lower education attainment.

The objectives of the survey were to understand the view of the Parents on nine essential life skills to be acquired by Junior Secondary School Students and to obtain information on whether appropriate training had been provided at home on four essential life skills. The results indicated that the interviewed parents generally regarded the nine life-skills to be acquired by children aged 12-15 as important. More parents ranked "Take initiative in learning", "Know how to get on well with other people" and "Able to manage one's emotion" as some very important life skills to be acquired. On the contrary, "Able to assist with households chores" was considered as relatively less important. Parents at large did not rely much on schools for the training of their children on the selected life-skills that include "Self-learning", "Managing time", "Handling household chores" and "Managing personal finance". Parents of "Indulgent Style" of parenting considered that the schools should play a more significant role in enhancing children's ability in "self-learning". Although the tendency to rely on schools was not obvious amongst the parents, the survey findings indicated that only some parents were serious in training their children at early age

and setting a good example to nurture their children reviewing teaching methods across the four surveyed life-skills at home. Not too many parents would use positive reinforcement to encourage their children to learn. Most parents would only remind their children on a regular basis.

Some of the interviewed parents had double standards on the expected life skills acquired by boys and girls. Overall parents considered some life skills such as "Know how to take care of one's appearance" and "Take initiative in learning" more important to girls than boys in junior secondary school.

The survey findings also indicated that parents generally perceived girls performed more satisfactorily than boys in self-discipline, doing household chores and self-learning. In general, parents considered more girls had acquired the abilities of 'Time management", "Handling household chores" and "Managing one's personal finance" at an early age.

Generally speaking, parents should choose suitable nurturing method according to the individual development needs of their children, thus providing all around training to their children in school and also at home. The main life skills for age group 12-15 studied were: (1) know how to take care of one's appearance (grooming, a biological phenomenon); (2) able to manage one's time effectively; (3) able to manage one's finances; (4) able to assist with household chores; (5) able to manage one's emotion; (6) know how to get on well with people; (7) take initiative in learning; (8) know how to make use of information technology; (9) able to develop one's potential.

The survey was carried out to understand the view of the parents on nine essential life skills to be acquired by Junior Secondary School students and to obtain information on whether appropriate training had been provided at home on four essential life skills. The results indicated that the interviewed parents generally regarded the nine life-skills to be acquired by children aged 12-15 years as important. More parents ranked "take initiative in learning", "know how to get on well with other people" and "able to manage one's emotion" as some very important life skills to be acquired. On the contrary, "able to assist with household chores" was considered as relatively less important (CHSC, 2006).

"Education is a powerful means" for reducing poverty and inequality. The LAC Region has made significant progress over the years in expanding access to schooling or young people at all levels. Children are getting a better start in life, as early childhood education is rapidly expanding in the Region. Enrolment rates in pre-schools in LAC rose from 3.4 % in 1960 to almost 23% in 1996. And close to 85% of the primary school age population is now enrolled in school (World Bank, 1999). However LAC continues to lag behind other Regions in educational performance and competitiveness. One key reason has been the slow expansion of secondary school enrollment in LAC. In today's highly competitive economy, obtaining at least a secondary education is becoming a necessity for making a living. The average educational attainment of workers in OECD (Organization for Economic Cooperation and Development) countries is 11.1 years, and for East Asia (excluding China) it is 8.1 years, while LAC workers only obtain an average of 5.4 years (UNDP, 1994). Investing in universal secondary schooling must be a priority for the Region. Many

Asian countries, faced with similar demographic patterns in the past, invested in universal secondary education. Many analyses found this was a significant contributing factor to the Asian "economic miracle" of the 1980s.

Chelini (1991) assessed and compared the achievement of class VII students in respect of basic understandings and skills based on a content analysis of the textual experts and opinions of experts in the new language subjects. The study revealed that the highest number of concepts acquired by any student was 39 (out of 63) in Science, 28 (out of 38) in Mathematics and 30 (out of 41) in Social Studies. That is to say that majority of the students who enter the secondary stage are found deficient in more than one of the basic understandings and skills needed in science, mathematics and social studies.

Meintzes and Pretorius (2007) have conducted an empirical study for preparing learners for life after secondary schools as they need a basic understanding of the four contexts (i.e. communication in relationships, communication in group decision-making, communication and organisational networks, and communication and media). A questionnaire was used where both quantitative and qualitative data will be gathered. The quantitative section of the questionnaire was analysed through the use of basic statistical analysis and the qualitative section with the use of the Morse and Field approach of "content analysis".

There are many lessons that young students will learn through the secondary school experience. However, if parents and teachers were to view the secondary school as the canvas on which young people's hopes and possibilities are painted, then more attention would be paid to the deciphering of codes in their lives and the

ascertaining of relevant needs. By so doing, it is more likely that a student's talents and gifts would be unearthed and developed by encouraging practices that stretch the young person towards a lifestyle of self-discovery. It is only through varied experiences that this can be accommodated.

The concept of self-discovery from an early age is crucial if we view the secondary school experience as a journey that may well determine the course of one's adult life. While academic preparation is one of the main goals set out by the curricula, it is the unwritten curriculum that really equips students for life at the higher academic-levels.

Notwithstanding the skills that can be learnt within a classroom environment, many adults will testify to the richness of their own learning through participation in extra- or co-curricular activities.

These activities require time management skills responsible attitudes, and personal sacrifice. They also engender a sense of self-confidence and improved personal interaction skills. Within the offerings of the secondary school, then, the young student has option of personal development through the exposure to all that a school has to offer. Parents are advised to monitor and encourage participation, and to welcome opportunities that schools provide to enhance their children's overall growth.

Performing on stage or in a competition of some sort are unforgettable school experiences. Whether it is the cricket match, steelpan practice, the art competition, or the dramatic production, the involvement in and commitment to such activities provide invaluable lessons for a young student. Constructive use of free time provides the frame for the student's sense of accomplishment, and the inclination and desire to

continue on such paths in their adult life.

Whether it is at tertiary level institutions or in the workplace, young adult is expected to be competent at decision making, goal setting, and personal management, for example. The secondary school provides for these through class or projects, committees, and group work, to name a few. Adhering to deadlines and regulations is an excellent way to prepare oneself for life after secondary school. Some other ways in which schools can encourage psychological and social growth in young students are by developing systems that encourage peer tutoring, and even by students tutoring teachers in areas such as computer literacy, modern entertainment, or games.

Schools may also be used as centres for parent-and-child life-skills development, either during or after school hours.

Seen as a continuation of the primary school and as a nurturing partner of the home, the secondary school is expected to be a model of ideal practice on the part of all staff - ancillary, non-academic, academic, and administrative. Because secondary school students are at a particularly challenging stage of physical and emotional development, it is important to constantly guard one's tone and message when communicating with them, whether it is oral communication or in the wording of notices and rules.

If schools today are inclined to complain about the students' home environment, surely it is the school that should strive to be the caring and inspiring organisation from which students can learn for life.

Students entering secondary school must do so with the understanding that secondary school is much like a gym where they are required to stretch all their

capabilities, and monitor themselves for much of the time. Secondary school is the place for students to shape themselves into the persons they want to be.

Not much work has been done in the area of life skills in India. A bird's eye-view of the 5th and 6th survey of Education shows some work done on skills by Murugesan (1988), Usha Abraham (1991) and Gupta (1991).

Research studies have focused on the assessment or development of skills in students such as the studies by Bhattacharya and Choudhari (1993) on "Major Biology Teaching Skills and their Identification" and Swamy (1995) on "Effect of inquiry training model of teaching science on science process skills, creativity and curiosity of secondary school students".

Gender issues have a significant role to play in Science Education at secondary level. Six percent of all the studies could be classified as having gender as an important variable. This is a world-wide trend and gender issues have relevance for research and policy implementation. What is the relation of gender to science learning? From the earliest possible stages, girls and boys are treated differently by those close to them, differing expectations are held from those and later the vast media constantly bombards them with messages of what it is to be male and female (Sixth Survey, 1993-2000).

Research in the area of creativity of science has been mentioned in surveys of Educational Research. The research by Rajyalakshmi (1996) focused on creativity and cognitive preference styles in Biology. Nanda and Pal (1994) focused on cognition and achievement. Pachaury (1997) aimed at uncovering the perceptions of Indian scientists regarding creative students. No difference was found in the

perception of scientists and experts in creativity regarding the characteristics of creative students. Some of the traits common to both and ranked most desirable were: curious, courageous in convictions, independence in judgement and preoccupied with tasks. Traits ranked by both the groups as least desirable in students were: timidity and haughtiness.

Padma Ramachandran (2004) cites two reasons for the importance of secondary education. Firstly as a bridge between upper primary school and higher education or to the world of work. Secondly as the most perplexing times in a child's life between the years 14 and 18-20. She has refuted the view that only vocational schools should teach vocations and other schools need do nothing to teach life skills. According to her, driving, cooking, swimming, etc. are coping skills and they should find a place in the curriculum.

According to Sharma (2003), in a secondary school of Kathmandu, most of the teachers were not aware of the concept of Life Skills. Maternal education was significantly associated with higher life skill levels in adolescents. Connectedness and family support were other important factors influencing the level of life skills in the adolescents.

By 2001, most secondary school students in the Durban Metro and Mtunzini districts of Kwazulu-Natal Province had been exposed to information on life skills with greatest expansion of life skills instruction being found in the African, Asian and mixed-race schools where the principals perceived the student bodies to be at risk (Brown et al., 2003).

The 11 life skills topics studied under life skills education were:

1. Reproductive Biology
2. Human growth and development and the life cycle
3. Understanding sexuality
4. Self-esteem, assertiveness and decision-making
5. Relationships – communication and negotiation
6. HIV/AIDS transmission and prevention
7. HIV/AIDS looking after people
8. STDs – prevention and symptoms
9. Drugs and alcohol
10. Contraception
11. Violence and sexual abuse

Mannix (1995) has prepared a unique collection of 190 illustrated activity sheets with related exercises, discussion questions, and evaluation suggestions to help students acquire the basic skills necessary to achieve independence and success in everyday living. The major topics covered are interpersonal skills, communication skills, academic and school skills, practical living skills, vocational skills and life style choices and problem-solving skills.

Mannix (1995 and 2009) and Mannix (1998) has written books that provide a unique collection of 180 and 513 illustrated activity sheets with related exercises, discussion questions, and evaluation suggestions to help students acquire the basic skills necessary to achieve independence and success in everyday living. Mannix (1998) has written on social skills.

For quick access, all of these ready-to-use materials are printed in a big spiral-bound format for easy photocopying and organized into seven sections. Here's an overview of some of the major topics (and sample activity titles) covered in each section:

Interpersonal Skills – Activities focusing on Uniqueness of Myself and others (Spotlight on Me); Friendship Skills (qualities of a Good Friend); Being Part of a Family (Members of a Family).

Communication Skills – Lessons that teach Understanding Others (Being a Careful Listener); Expressing Yourself (Be Convincing); Conflict Resolution (Compromising).

Academic and School Skills – Activities related to Reading (Reading on the Job); Writing (Proofreading); math (Improving Math Skills); Study Skills (Taking Notes).

Practical Living Skills – Activities focusing on Getting Information (What Do You Need to Know?); Money Management (Making a Budget); Travel (Using a Timetable); Driving (Car Insurance); Home Management (Home Repairs, Preparing a Meal).

Vocational Skills – Lessons featuring Present Skills and Interests (What Are You Good At?); School Record and Planning (Finishing High School); Working (Interviewing).

Lifestyle Choices – Activities covering Values (What Are Values?); Personal Habits and Choices (Teens and Drinking); Sexual Issues (Teenage Pregnancy, HIV and AIDS); Reputation (How You Appear to Others); Stress (Stressful Events and

Situations).

Problem-Solving Skills – Lessons on Handling Problem Situations (Adjusting to change); Making Decisions (Needs vs. Wants); Resource Management (Staying on Task); Goal-Setting (Realistic Goals); Risk- taking (Learning from Mistakes), etc.

Also included is a list of parent activities which can be reproduced and given to parents to use in conjunction with the activities being worked on in class. One may supplement this list with own activities and/or worksheets and these activities are completely flexible. One can use them in any order for a variety of purposes to introduce, teach and/or reinforce specific life skills. Moreover, the activities can easily be modified to meet individual or group needs.

Communication is a very broad concept and is defined through the use of a variety of theories and classified according to four communication contextual themes being, communication in relationships, communication in group decision making, communication and organisational networks and communication and media (Littlejohn 2002). However, 'one cannot not communicate' as it emphasizes that we are always affecting others' perceptions, whether we want to or not (Littlejohn 2002).

Sharma (2003) carried out a descriptive, cross sectional survey of adolescents from class VIII, IX, and X of a public co-educational secondary school of Kathmandu done with the help of self-administered questionnaires prepared in English and translated into Nepali. Focus Group Discussions consisting of boys only, girls only and a mixed group comprising of one student from each section of each class were conducted to confirm the results of the study. All the data obtained from the questionnaire survey were edited, coded and entered into EPI info Version 6.

A total of 347 adolescents participated in the study. 176 adolescents (51%) had life skill scores above the mean, and was termed as having "high level" of life skills and 171 (49%), had "low level" of life skills scores. Mother's education was significantly associated with increased level of life skills in adolescents (P=.001).

It was found through the above study that most of the teachers were not aware of the concept of life skills. Maternal education was significantly associated with higher life skill levels in adolescents. Connectedness and family support were other important factors influencing the level of life skills in the adolescents.

Tuttle, Campbell-Heider and David (2006) conducted a group intervention study for positive adolescent life-skills training for High-Risk Teens. This study tested the addition of a cognitive behavioural skill-building component called Positive Adolescent Life Skills (PALS) training to an existing intervention for urban adolescents to enhance resiliency. In previous pilot work with the existing intervention, called Teen-club, it was found that the participants in group meetings and intensive case management reported an enhanced ability to connect with positive resources. Results suggest that the PALS component strengthened the existing intervention and lend preliminary support for continuation of this combination of interventions. Future research with larger numbers is needed.

Social skills form an important category of life skills (Mangrulkar et al., 2001). No matter how clever you are, attractive or good at your work, your life can be miserable and unfulfilled if you have difficulties coping in social situations. You may have problems initiating and sustaining friendships, reading social situations or peoples non-verbal signals so as not to present as being gauché particularly when

life's script changes and what is required is a flexibility in response that you cannot summon up. Most of us have experienced these difficulties for a time but when they occur for most of your life then the effects can be soul-destroying particularly during adolescence (www.havering.gov.uk/index).

2.4 Life Skills and Career, Career Success and Technical Education

According to EMC (2007), although the students at the academy are often adept at acquiring academic skills and knowledge, life skills – such as attendance, problem solving, and being on time--can be harder to master and can lead to their dropping out of school. Staff enhance students' life skills by integrating community and service learning into instruction whenever possible. Once a week, the school schedule allows time for off-campus activities at community service projects, the public library, or other local institutions. A traveling history course takes students to important historical sites in the region, such as Indian Mounds Park and Mankato; students read books such as Black Elk Speaks. Opportunities like these expand students learning experiences and helps them build academic, personal, and social skills simultaneously. It is all about integrating academics with career education and community services.

According to EMC corporation 2007 preparing for Career Success (for grades 10-12) provides students with the most current career information and thoroughly covers a variety of social issues affecting today's workers and the workplace, including tech-prep, ethics in the workplace, sexual harassment, and "the complex set of problem-solving skills needed to successfully handle the challenges facing two-wage-earner families".

Some of the topics included in the programme for career success are as follows (EMC, 2007).

Unit 1: Getting ready for the world of work

1. Preparing for life's way tasks

2. Knowing yourself – interests and aptitudes

3. Knowing yourself – values and goals

4. Problem solving – making choices

5. Researching and understanding correct information

6. Looking ahead – education and training

Unit 2: Finding a Job and Achieving Success

1) Expressing Yourself: Effective Communication

2) Conducting the Job Search

3) Applying and Interviewing for a Job

4) Taking Responsibility for Your Job Success

5) Making Progress on the Job

Unit 3: Understanding the World of Work

1) Defining Roles, Rights, and Responsibilities

2) Managing Career Change and Growth

3) Adapting to a Changing Workplace

4) Connecting Economics and Work

5) Starting a Business

Unit 4: Living on Your Own

1) Managing Your Income
2) Being a Wise Consumer
3) Achieving Wellness
4) Accepting Civic Responsibility
5) Balancing Your Career and Your Life

MindLab also provides an attractive full or part time income working from home, flexible working hours, the satisfaction of self employment, a network of like-minded individuals and enables you to make a positive contribution to children's development, their families and the wider community by helping children to improve scholastically, build better personal relationships and learn how to tackle life's problems and challenges (Suri Poulos, 1994).

MindLab teacher-training can help broaden teachers abilities, enable them to exercise their creativity, imagination and judgement and provide the satisfaction of making a real difference by teaching children critical life skills in a fun environment.

Rapid societal changes, including innovations in technology, information exchange, and communications, have increased the demand for internationally competitive workers and for an educational system designed to meet that demand. Today's students will be employed through much of the twenty -first century and will, therefore, need increasingly advanced levels of knowledge and skills. To obtain and retain high-wage employment that provides job satisfaction, they will also need to continue to learn throughout their lives. The career education and consumer, family, and life skills standards identify key career development and life skills that students

must accomplish in order to achieve continuing success in various life roles related to continuing education, career development, and personal growth.

Members of the business and industry communities have identified vital career and technical education skills. The Secretary's Commission on Achieving Necessary Skills (SCANS, 1992) identified productive use of resources, interpersonal skills, information, systems, and technology as essential workplace competencies. The SCANS foundation skills include basic skills, personal qualities, and the ability to identify and solve real problems, reason effectively, and apply critical thinking skills.

To compete in this global, information-based economy, students must be able to identify and solve real problems, use appropriate tools, reason effectively, and apply critical thinking skills. The career and technical education and consumer, family. and life skills standards identify key career education and consumer, family and life skills which can also enhance personal behavior and professional conduct in life and careers. In addition to the SCANS report, the National Career Development Guidelines and National Standards for School Counseling Programs were used as resources. Educators may find these national standards as well as the national standards documents in other areas very useful resources.

At the high school level, career and technical education programs establish necessary pathways for entering the world of work as well as continuing education, such as college, post-secondary vocational-technical education, specialized certification and/or registered apprenticeships. They also support lifelong learning. These essential elements include preparation for postsecondary pursuits as well as providing an essential foundation in everyday living skills. In essence, career and

technical education is the application of life, academic, and occupational skills demonstrated by student-centered experiences in courses related to the sixteen States' Career Clusters supported by state vocational technical directors from across the country.

The career clusters include: agriculture, food, and natural resources; architecture and construction; arts, audio/video technology and communications; business, management, and administration; education and training; finance; government and public administration; health science; hospitality and tourism; human services; information technology; law, public safety and security; manufacturing; marketing, sales and service; science, technology, engineering, mathematics; and transportation, distribution, and logistics. A number of vocational student organizations have been created to enhance and support career development.

Career and technical education programs enable students to:

- Describe and integrate basic skills, thinking skills, and personal qualities, as defined by the SCANS Report;
- Address self-knowledge, career planning, and employability skills utilizing technology, information, and other resources;
- Enhance academic achievement and motivation for learning;
- Explore career education and planning;
- Acquire necessary employability and interpersonal workplace skills; and
- Pursue specific courses and programs designed to lead to employment or post--secondary options in occupations included within sixteen States' Career Clusters.

Consumer and family life skills are required to be a functioning member of society and the standards of consumer and family life skills are:

A. Career Awareness and Planning

B. Employability Skills

C. Critical Thinking

D. Self-Management

E. Interpersonal Communication

F. Character Development and Ethics

G. Consumer and Personal Finance

H. Safety

Career and technical education, formerly called Practical Arts, is the application of life, academic, and occupational skills. These courses typically include business education, family and consumer sciences, and other courses related to careers and life skills. Career and technical education programs establish necessary pathways for secondary vocational technical education programs, entering the world of work, continuing education (such as college, post secondary vocational-technical education, specialized certification and/or registered apprenticeships), and lifelong learning.

Those students electing courses in career and technical education should demonstrate both teamwork and problem-solving skills through a structured learning experience. This could consist of an experiential, supervised educational activity designed to provide students with exposure to the requirements and responsibilities of specific job titles or job groupings, and to assist them in gaining employment skills

and making career and educational choices. The experience may be either paid or unpaid, depending on the type of activities in which the student is involved. Examples include, but are not limited to: apprenticeships, community service, cooperative education, internships, job shadowing, school-based experiences, vocational student organizations, paid employment, and volunteer activities. Structured learning experiences must meet all state and federal child labor laws and regulations.

Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will learn (refer Core Curriculum Content Standards, 2006):

A. Career Awareness

1. Re-evaluate personal interests, abilities, and skills through various measures including self assessments.
2. Evaluate academic and career skills needed in various career clusters.
3. Analyze factors that can impact an individual's career.
4. Review and update their career plan and include the plan in a portfolio.
5. Research current advances in technology that apply to a selected occupational career cluster.

B. Employability Skills

1. Assess personal qualities that are needed to obtain and retain a job related to career clusters.
2. Communicate and comprehend written and verbal thoughts, ideas, directions, and information relative to educational and occupational settings.
3. Select and utilize appropriate technology in design and implementation of teacher-approved projects relevant to occupations and/or higher educational settings.

4. Evaluate the following academic and career skills as they relate to home, school, community, and employment:
    - Communication
    - Punctuality
    - Time management
    - Organization
    - Decision making
    - Goal setting
    - Resources allocation
    - Fair and equitable competition
    - Safety
    - Employment application skills
    - Teamwork
5. Demonstrate teamwork and leadership skills that include student participation in real world applications of career and technical education skills.

All students electing further study in career and technical education also:

1. Participate in a structured learning experience that demonstrates interpersonal communication, teamwork, and leadership skills.
2. Participate in simulated industry assessments, when and where appropriate.
3. Prepare industry-specific technical reports/projects that incorporate graphic aids, when and where appropriate.
4. Demonstrate occupational health and safety skills related to industry-specific activities.

They will also demonstrate:

A. Critical Thinking

1. Apply communications and data analysis to the problem solving and decision making processes in a variety of life situations.
2. Describe and apply constructive responses to criticism.
3. Apply the use of symbols, pictures, graphs, objects, and other visual information to a selected project in academic and/or occupational settings.
4. Recognize bias, vested interest, stereotyping, and the manipulation and misuse of information while formulating solutions to problems that interfere with attaining goals.
5. Apply knowledge and skills needed to use various means of transportation within a community.

B. Self-Management

1. Revise and update the personal growth plan to address multiple life roles.
2. Apply project planning and management skills in academic and/or occupational settings.
3. Compare and contrast methods for maximizing personal productivity.

C. Interpersonal Communication

1. Model interpersonal and effective conflict resolution skills.
2. Communicate effectively in a variety of settings with a diverse group of people.

D. Character Development and Ethics

1. Analyze how character influences work performance.
2. Identify and research privileges and duties of citizens in a democratic society.

3. Discuss consequences and sanctions when on-the-job rules and laws are not followed.
4. Compare and contrast a professional code of ethics or code of conduct from various work fields and discuss similarities and differences.
5. Apply a professional code of ethics to a workplace problem or issue.

E. Consumer and Personal Finance

1. Analyze factors that influence gross and net income.
2. Design, implement, and critique a personal financial plan.
3. Discuss how to obtain and maintain credit.
4. Prepare and use skills for budget preparation, making predictions about income and expenditures, income tax preparation, and adjusting spending or expectations based on analysis.
5. Use comparative shopping techniques for the acquisition of goods and services.
6. Analyze the impact of advertising, peer pressure, and living arrangements on personal purchasing decisions.
7. Evaluate the actions a consumer might take in response to excess debt and personal financial status.
8. Analyze the interrelationships between the economic system and consumer actions in a chosen career cluster.

F. Safety

1. Engage in an informed discussion about rules and laws designed to promote safety and health.
2. Describe and demonstrate basic first aid and safety procedures.

3. Analyze the occurrence of workplace hazards.
4. Practice the safe use of tools and equipment.
5. Implement safety procedures in the classroom and workplace, where appropriate.
6. Discuss motor vehicle safety, methods of defensive driving, and the importance of personal responsibility on public roads/streets.

According to New Jersey Core Curriculum Content Standards, 2006, rapid societal changes including innovations in technology, information exchange and communications have increased the demand for internationally competitive workers and for an educational system designed to meet that demand. Today's students will be employed through skills of the 21st century and will therefore need increasingly advanced level of knowledge and skills. To obtain and retain high-wage employment that provides job satisfaction, they will also need to continue to learn throughout their lives. The career education and consumer and family and life skills standards identify key career development and life skills that students must accomplish in order to achieve continuing success in various life roles related to continuing education, career development and personal growth. In 1992, the Secretary's Commission on Achieving Necessary Skills (SCANS) identified productive use of resources, interpersonal skills, information systems and technology as essential workplace competencies. The SCANS foundation skills include basic skills, personal qualities, and the ability to identify and solve real problems, reason effectively and apply critical thinking skills.

Ryan and Ryan (2009) provides students of grades 10 to 12 with the most current career information and thoroughly covers a variety of social issues affecting

today's workers and the workplace. Students decide how to handle real-life situations described in realistic scenarios by answering critical thinking questions at the end of each case study. Topic related case studies are given in each chapter. Case studies on personal and career planning, personal responsibility, building character, problem-solving techniques and life skills are mentioned. Case studies on life skills illustrates the importance of every day life tasks such as money management, being a consumer, work and the family, health skills and citizenship responsibilities.

2.5 Life Skills and Quality of Education (www.cii.online.org)

To augment government initiatives for improving the quality of school education, CII in partnership with UNESCO and State Governments is supporting the long-term phased initiative for Quality Education in select schools of Delhi and Uttar Pradesh.

The pilot project aims at a long-term strategy to significantly reduce the number of out of school children as well as to improve the overall levels of retention and achievement. The project entails a multi-pronged approach, involving strategies for the facilitation of across-the-board improvements in the entire curriculum. This includes teaching/learning materials, classroom transactions, teacher training, quality-assessment tools and examinations, regular evaluation of teaching/learning practices by trained supervisors while simultaneously building community/school linkages. Innovative use of technology for strengthening quality school education will be an integral part of the project.

The project will focus on stimulating the innate curiosity of children through active participatory learning; developing life skills and vocational skills; and creating

a child- friendly, hygienic and pleasing environment so that going to school will be a motivating and rewarding experience for all children. The project will ensure convergence of this initiative with other ongoing programs so that there is no duplication of time and effort.

Specific aims of the project include:

- To improve the quality of classroom transactions
- To ensure a clean, hygienic, attractive environment in school so that children are encouraged to come to school and learn.
- To enable and empower teachers to use innovative pedagogical tools for a creative, burden free and joyful teaching learning process.
- To strengthen the PTA's, SMC's.
- To work in close co-ordination with the local DIETs to build the capacity of teachers.
- To invite, motivate and encourage stakeholders' participation, contribution and ownership in the project.
- To promote gender parity and equality in the select project schools.
- To improve the quality of the school health programmes.
- To strengthen linkages between the neighbourhood communities and the school.
- To improve the quality of regular assessment.
- To have trained supervisors regularly evaluate teaching/learning practices, with a view to constantly monitoring quality
- To improve school administration processes

- To improve principals' management and leadership ability and skills through training
- To provide children's opportunities for all-round personality development by integrating modules on life skills, value education, and vocational skills into the school curriculum and encouraging many students to participate in the co-curricular activities organized by schools.

The Quality Life Skills Education Project in Srinagar aims to reinforce quality life skills education in select government schools of Srinagar, by motivating, enabling, and empowering principals as well as teachers to integrate life skills education into the existing curriculum. This is being done to providing a full range of information, support, and services to adolescents and enabling them to cope with diverse challenges and risks in their environment, especially empowering them to make informed decisions and choices to lead a dignified, healthy, and secure life.

According to Indian American Council, India needs to collaborate with foreign countries for sharing strategies on delivering life skills, education and for sharing success stories on the vocational skills, education and training programs in schools.

In recent years, great changes have taken place in the field of education. Not only have these changes influenced the techniques and methodologies of imparting education, but also challenged in certain ways, the very purpose and objectives of higher education. (NNE, 2000-07)

Education is becoming far too expensive to be supported by public funds alone. Delay in release of funds by the State Governments is a constant source of

anxiety. Under these circumstances, Universities have no choice but to resort to diverting funds from development grants. The need is therefore felt to take a closer look at the financing of higher education and the possible areas of improving efficiency. Some measures that can be adopted are suggested –

- Financing higher educational institutions should be the responsibility of the Government.
- There is an urgent need to expand the opportunities for higher education since secondary school education does not equip the student to meet the vast and varied job requirement (herein lies the importance of the present work on the incorporation of life skills in XI standard Biology curriculum).
- At least 30% of the cost of higher education must be met by the student.
- As other costs go up, there must be an annual increase in fee structure as is being done by universities and colleges in Maharashtra.
- A rational fee structure which is supportive to both students as well as universities can be established.

As we enter the new millennium, we must admit that higher education is indeed in a state of turmoil. Over the last several years, there has been a phenomenal increase in the enrolment of students, with the population increasing from 2, 50,000 to over 60 lakhs in 1996. By the turn of the century we can easily account for 9000 colleges, eight million students and over 4,50,000 teachers.

Uneven and unbalanced expansion has resulted in a growing mismatch between the supply and demand in the labour market. The decline in the quality of

teaching, poor infrastructure, high drop-out rates does not keep up with the changing needs of the society. The skills and areas of specialisation of graduates does not reflect the real needs of the productive sectors which is very important for improving the economy of the country.

2.6 Life Skills Curricula/Life Skills Topics in Schools

FICCI-SEDF (www.ficci-sedf.org) in collaboration with Rajiv Gandhi Foundation initiated a project titled "Empowering Adolescents through Life Skills Education" which covers 10 slums of Delhi. A 5-day curriculum has been developed on Life Skills Education to be implemented during training session with out-of-school children in project areas. 279 adolescents have been imparted Life Skills Education and 1359 adolescents trained as Peer Educators.

The RBSE (The Hindu, 2006) has started four-day training programmes for teachers to apprise them of special needs of adolescent needs. It has prepared a textbook for life skills education in association with the State Government's Medical and Health Department as part of the National Rural Health Mission with help from United Nations Population Fund. The prescribed text book would be taught to 11^{th} standard students in the Government schools.

The Child Development and Adolescent and Health Centre of the Vidyasagar Institute of Mental Health and Neurosciences (VIMHANS) has tested and compiled a 3-part series "Life Skills Module" after various workshops held in 82 schools (both primary and adolescent groups conducted over four years) in the capital under its project 'Expression'. WHO will recommend the module for various educational boards (NCERT, CBSE) across the country (The Hindu, 2004).

2.7 Life Skills Approach

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 - for example, HIV/AIDS and other sexually transmitted diseases, alcohol, tobacco and other drug use, war and political instability, also unemployment, sexual and other forms of exploitation, and discrimination in its many forms.

The causes of these problems are complex and multifaceted, and so they are unlikely to be solved quickly or simply. 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 maintaining and promoting healthy lifestyles. 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. (Mangrulkar et al., 2001)

Where did the life skills approach come from?

The life skills approach has evolved from a number of influences, and indeed the basic approach may be utilised under a variety of other names, not just as the catchy brand name of 'life skills'. At its simplest, the life skills approach is simply good interactive educational methodology which focuses on more than just information. Although useful in more contexts than that of health alone, an important influence has been adolescent health behavior research and practice, in areas such as

drug use and HIV/AIDS related risk. A major finding-reinforced across the extensive field is that information is necessary but not sufficient to develop or change behaviors. To have an impact on behaviour, information based approaches need to be combined with attitudinal and interpersonal skills, known as life skills', which has become a kind of brand name for this approach.

What distinguishes the life skills approach from others?

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. This focus on behaviour change as a primary objective distinguishes life skills from other approaches, such as information only approaches which are used for simple information acquisition but are not generally effective in making an impact on behaviour.

A second distinguishing factor of the life skills approach is the existence of a balance of three components: (i) Knowledge or information, (ii) Attitudes and values and (iii) Skills as the most effective method of developing or changing behaviors. This skill component consists of interpersonal and psycho-social skills such as assertion, negotiation, decision making, empathy building, values, clarification, stress and coping skills. Whereas information acquisition strategies might focus mainly on the knowledge component, the life skills approach encompasses and balances all three of these components (KAS).

Practical experience shows that behaviour is substantially more difficult to change and requires more intensive approaches than knowledge and attitude change. While information is necessary for behaviour change it is not sufficient to be effective

primarily because the necessary balance of all three essential components (KAS) is not achieved. 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.

An assumption is made here that some behaviours need to change because they are associated with significant risks related to the challenges mentioned above. As such, the goal of the life skills approach is to make an impact on these risk behaviours. Education systems have not typically focused on behaviour change in this way, and very often aspire to changes in knowledge alone. A history of content or knowledge focus in education systems presents a significant challenge to advocating for, and implementing life skills approaches. In this context the higher goal is behaviour change, and so the life skills approach is distinct in not presenting all the information that there is to know about a topic, but rather, presents only that information considered necessary to influencing attitudes and achieving the higher goal of reducing risk behaviours and promoting positive behaviour. A direct consequence of achieving this overall goal is the achievement of positive outcomes in terms of knowledge, attitudes and values and intermediate skills. This is very important as drastic changes in behaviour should be the outcome of education.

A series of handouts have been prepared to help communicate key elements of the approach. These pages can be used to increase your own expertise or to advocate for the implementation of a Life Skills Approach in your school system.

Handouts from teachers in Armenia have been compiled for the Life Skills Approach. It shares teacher experiences, student achievement and parental responses

(Botvin, 1996).

Primary UNICEF Resource on the Life Skills Approach

"Life skills based health, education focuses on sharing knowledge, attitudes and skills which support behaviours that help young people take greater control of their lives – by making healthy life choices, gaining greater resistance to negative pressures, and minimising harmful behaviours" (http://www.unicef.org//teachers/ 2001).

A life skills approach for education has been found to be apt because –

- Social, cognitive and emotional coping skills are essential components for healthy development in childhood and adolescence, and are needed for making a successful transition from childhood to adulthood.
- Life skills programs can specifically address the needs of children growing up in disadvantaged environments that lack opportunities to develop these skills.
- Social competence and problem-solving skills are among the characteristics that define a resilient child.
- Knowing how to manage emotions and interpersonal relationships is as important to success in life as intellect.
- Health promotion and prevention programs focusing only on transferal of information are less effective than programs incorporating skills development.
- The social, cognitive and emotional coping skills targeted by life skills programs are shown to be mediators of problem behaviors.
- Life skills have an impact on multiple adolescent, health 'and development needs.

- A life skills approach helps schools address multiple demands for prevention education curricula by presenting a comprehensive, unified approach to meeting many needs.
- Communication skills, decision-making skills, critical thinking skills, and negotiation skills needed for healthy development are also skills that are valued by employees in the workplace.
- Life skills programs promote positive social norms that can impact the greater environment of adolescent health services, schools, staff and families.

Also, research shows that life skills programs can

- Delay the onset age of the abuse of tobacco, alcohol, and marijuana (Hansen, Johnson, Flay, Graham and Sobel, 1988)
- Prevent high-risk sexual behavior (Kirby, 1994; Schinke, Blythe and Gilchrest, 1981)
- Teach anger control (Deffenbacher, Oetting, Huff and Thwaites, 1995; Deffenbacher, Lynch, Oetting and Kemper, 1996; Feindler, et al, 1986)
- Prevent delinquency and criminal behavior (Englander-Golden et al, 1989)
- Improve health-related behaviors and self-esteem (Young, Kelley and Denny, 1997)
- Promote positive social adjustment (Elias, Gara, Schulyer, Branden-Muller and Sayette, 1991)
- Improve academic performance (ibid)
- Prevent peer rejection (Mize and Ladd, 1990)

Effective life skills program providers (those who help individuals to develop life skills) can be

- teachers
- counselors
- peer leaders
- social workers
- health workers
- parents
- psychologists
- physicians
- other trusted adults

It is essential that life skills program providers should be perceived by adolescents as

- credible
- trustworthy
- high status
- positive role model
- successful
- competent

Life skills program providers should be (qualities)

- competent in group processes
- able to guide and facilitate
- respectful of children and adolescents

- warm, supportive and enthusiastic
- knowledgeable about specific content areas relevant to adolescence
- knowledgeable about community resources

Information in a Life skills Program

"The combination of general skills training with domain-specific instruction may be the most effective way to prevent particular social problems" in a life skills program.

Domain specific instruction can include the following informational content –

- Negotiate sexual relationships
- Resolve conflicts without violence
- Prevent parasites or ringworm
- Refuse drugs and alcohol
- Develop positive peer relationships
- Critically analyze media messages
- Prevent anemia or iron deficiency
- Assert rights as a citizen
- Access community health services

Life Skills Programs: Teaching Methodology

Effective skills programs replicated the natural processes by which children learn behaviour – this being the teaching methodology. Skills can be practised through natural processes like modeling, observation and social interactions.

When people mentally rehearse or actually perform modeled response patterns, they are less likely to forget, than when they neither think about them nor practice what they have seen. Therefore the following processes also can be utilised for teaching life skills, viz., role-play, situation analysis, small group work, debates, one-on-one rehearsal, decision-mapping or problem trees, literature content analysis, relaxation and trust-building exercises and games.

Life Skills Programs: Provider Training

An effective training for those who teach life skills or provide the life skills program should tell them to: establish an effective, safe and supportive program environment; model the skills addressed in the program; access resources for health information and referral; apply interactive teaching methodologies: role plays, dramatizations, debates, small group work, open discussions; manage group process; address sensitive issues in adolescence; provide constructive criticism and positive reinforcement and feedback.

2.8 Life Skills and Health Education

According to Laura Keenan (2008), the government recently proposed introduction of Adolescence Education Programme in CBSE affiliated schools to promote gender awareness, combating rapid spread of HIV and empowering the young to protect themselves against sexual exploitation. This approach (sexuality education model) has been a failure in USA and UK. However, the "life skills" model is considered more comprehensive and discursive, and is designed to encourage young people to consider the responsibilities of growing up. Life skills programmes have been effective in Uganda according to the World Health Organisation.

If the life skills approach is to be important in prevention efforts that are part of a national education or health curriculum, there must be sufficient political will to support the initiative at the country level. Public health professionals, educators and social service providers are in a unique position to make the case for adopting this important intervention.

In order to mobilise support for the Life Skills intervention in school curricula, decision makers must appreciate the methodologies capability to promote students' psychosocial development and improved overall well-being. Policy makers must understand that by using the Life Skills approach one can simultaneously address a variety of issues threatening the health and well-being of youth (e.g. conflict, violence, smoking, depression). This approach also can prevent substance use by passing on to students the skills for conflict resolution, stress management, decision making, and drug refusal. In generating the political commitment needed to spur the adoption of the Life Skills methodology, the connection between these skills and improved health, maturity, and emotional intelligence must be made clear. The cost-effectiveness and economic benefits of the approach also must be argued.

Political support also can be generated by connecting the school-based Life Skills program with a broader campaign or national priority; such as a national tobacco control campaign or a citywide youth development initiative.

Integration into existing initiatives such as Jeevan Vigyan Shiksha, National Green Corps, NSS, Health Camps and Clubs, along with the support of intersectoral partnerships can help ensure a broader community of participants, increased public attention, and sustainability of the program. When looking for appropriate campaign

with which to partner, moving beyond the health and education sectors – that is, the traditional advocates of substance use prevention – and linking up with other social welfare and children's rights initiatives can help ensure a broader base of support for the Life Skills initiative.

The health sector can certainly play an important role in advocating the adoption of the life skills methodology.

The life skills approach has enormous economic benefits accruing through actual acquisition of life skills, and thereby psychosocial benefits and economic improvement. e.g. if time is money, time management skills also help in the acquisition of money.

Hanewinkel and ABhauer (2004) tested the life-skills approach to smoking prevention in a study. In total 1024 pupils (mean age 11.4 years, SD = 0.90) from Austria, Denmark, Luxembourg and Germany were recruited as an experimental group, and a sample of 834 matched pupils served as a control group. While the pupils from the control group received no specific intervention, the pupils in the experimental group participated in an intervention programme which was based on the life-skills approach and consisted of 21 sessions. The aims of the programme were to promote fundamental social competencies and coping skills. In addition, specific information on cigarette smoking was given and skills for resisting social influences to smoke were rehearsed. The programme was conducted by trained school teachers during a course of 4 months. Anonymous questionnaires were administrated (1) before the programme was implemented and (2) 15 months after the programme had started. Teachers as well as pupils showed a high level of satisfaction with the

programme idea and the materials. With regard to the outcome variables, the programme had no differential effect on current smoking (4-week prevalence). The programme showed a weak effect ($P < 0.1$) on lifetime smoking prevalence and experimental smoking. There was also an effect of the programme on smoking knowledge, on the social competencies of the pupils as well as on the classroom climate. No effects were found on susceptibility to smoking among never-smokers, attitudes towards smoking and the perceived positive consequences of smoking. The results indicate that prevention programmes that are run for only a few months can have a positive impact on variables considered to be protective with regard to smoking uptake.

Kelly et al. (1987) stated that psycho-social stress or the individual's ability to deal with it has important consequences for his health in a negative or positive sense e.g. life events and war, adolescence. Management and prevention of stress are important in health education. Coping skills and their enlargement should be an effective approach to avoid such stressors. Even school teachers need to be trained in early detection and management of mental health problems amongst children.

Infohut Project

In 2005 Executive Director of the Lutheran Communion in Southern Africa (LUCSA) the Rt Rev Dr A Moyo with young IT Professionals met the Board of education department of Education KZN.

They made a presentation to the Board on the Infohut project concept whose aim is to create an HIV and AIDS free generation using computers as a platform to disseminate vital information on HlV and AIDS and the challenges the young people

are facing in Africa, simultaneously equipping them with IT skills to enable them to access the main stream of commerce and business, there by curbing some of the major contributors to the spread of HIV / AIDS such as unemployment.

The youths involved in the training programmes are identified in consultation with the schools and churches in the areas where the project is being set up. The identified youths are then given basic IT and HIV and AIDS training that equips them with skills not only to teach computer education in schools, but also to maintain them and to be HIV and AIDS peer educators in the school. These youths are stationed on site to train the educators in the school as well as all the learners. After school hours the Infohut is open to members of the surrounding community for access to the internet or to obtain basic IT qualifications to enhance their employment opportunities or to acquire computer skills for use in their work places. The advantage is that they will not need to travel to cities to get that kind of training. They will now have them right where they live at a minimal fee set at a level that ensures that the project sustains itself. This essentially is a school and/or community which is responsible for its administration and maintenance using the youths based on site and trained by LUCSA. LUCSA continues to walk with the school or community to ensure that both the IT and HIV and AIDS components remain integral aspects of the training programme in the school and the community.

Basic to the Infohut project is the merging of IT and LIFE Skills training in a way that they are delivered simultaneously. Learners have access to a specially designed IT and Life skills learning programme that will not allow learners to separate IT from life skills. This programme capitalizes on the fact that IT has

become a major communication tool. Youths of today turn their ears away the moment somebody begins to talk about HIV and AIDS, which means the conventional methods of communicating information on HIV and AIDS are no longer effective. At the same time we all know that youths are very much attracted to computers, let alone those in remote rural areas who may never have seen a computer in their lives. There is an African saying that you bait fish with what you know the fish would like to eat. LUCSA sees this project as potentially a very effective way of reaching youths with basic life skills and of creating a generation that is free of HIV and AIDS.

The CONCEPT of an INFO HUT came from an African hut (iqhugwane in Zulu), located in a village, where the young and the old, especially the disillusioned, flock for wisdom and information to meet the challenges of life.

The first Infohut was set up at Hlamvana High School at Esikhawini near Empangeni in KwaZulu Natal. The setting up of the infrastructure was followed by the training of 23 trainers (15 females and 8 males) who have now completed their training in HIV and AIDS and are now fully equipped to roll out the fully integrated IT and HIV and AIDS Programme in schools with computers.

The goal of Infohut is to create generation of youths free of HIV and AIDS by:

- Empowering the youths with skills and information to fight against HIV and AIDS.
- Providing access to information on HIV and AIDS prevention, care and treatment.
- Creating jobs for school leavers and the unemployed teachers.

- Involving pupils and their teachers in community HIV and AIDS education programs.
- Training HIV and AIDS counselors and IT educators, computer technicians for schools.

The project is implemented by LUCSA with Mega training IT Institute in Zululand providing the computer training, service and support. The University of Zululand will assist with the baseline survey when the project is ready for launching. The entire project is funded by LUCSA and it is hoped that both the private and public sectors will contribute to the project as it unfolds and people begin to see its effectiveness and its impact on the participating communities and schools. INFOHUT programme uses animated educational material that integrates HIV and AIDS and IT training.

The youths undergoing training are unemployed School leavers identified by schools, churches and the community leaders. The project has the effect of keeping school leavers away from drugs, alcoholism and crimes of all kinds, and instills a sense of hope in them as they acquire some skills for their living. The main advantage of INFOHUT as compared with similar projects is that it walks with the school. It does not dump computers in the schools and then go away, it provides training, technical support and incorporates the local youths in the process.

Infohut impact analysis

- Improved quality of education in rural, semi-urban and urban centers
- Increased access to information not only on AIDS but also in other areas of study.

- Availability of modern infrastructure in communities who on their own would not afford it.
- Reduced HIV infection amongst the youths.
- Improved employment opportunities for youths.
- Reduction in crime rate and drug abuse.

Pan American Health Organization (2000), along with other United Nations organizations, non-governmental organizations, country governments and others, has been building the infrastructure for making an agenda for youth development a reality. Policies and legislation that protect and promote young people are being created in many countries, with the participation of young people. There are expanding opportunities for health and social service professionals to build their skills to work with the adolescent population. And a growing research base about best practices in adolescent and youth development is providing them with the tools and the program models to do so more effectively than ever.

Mangrulkar et al. (2001) describes one best-practice model for contributing to the healthy development of adolescents: a life skills approach. A key aspect of human development -- as important to basic survival as intellect -- is the acquisition of socio-cognitive and emotional coping skills. This approach, sometimes referred to as skills-based education, builds skills in these particular areas to strengthen an adolescents protective factors, promote the competencies necessary to make a healthy transition to adulthood, and promote his or her adoption of positive behaviors. Effective programs apply skills to issues relevant to an adolescent's developmental tasks and social

context, such as developing a sexual identity, understanding peer pressure, or managing emotions. This has been shown to impact on behaviors. For more than a decade, research on interventions that address these specific skill areas has shown their effectiveness in promoting desirable behaviors, such as sociability, improved communication, effective decision making and conflict resolution, and preventing negative or high-risk behaviors, such as use of tobacco, alcohol and other drugs, unsafe sex, and violence.

Mangrulkar et al. (2001) aims to

- present the theoretical and research foundations of a life skills approach;
- define life skills and the effective teaching methodologies for developing hem;
- analyze the challenges of implementing life skills programs in the Region; and
- develop a common language and vocabulary to advance the approach.

Mangrulkar's paper is intended for government policy makers and program planners in the health, education and youth sections, consultants from PAHO (2000) and other agencies in child and adolescent health, and program planners in non-governmental organisations.

Health – Sexual and reproductive health is a fundamental aspect of all human beings and encompasses the right to sexual integrity, safety, privacy, equality, expression, education, and access to care. Adolescence is a critical time in the development of sexual identity, how one will care for him or herself sexually and think about their sexuality through adulthood. The biological changes of puberty, greater independence from the family during the teenage years in some cultures,

cultural and family expectations about gender and sexuality, cognitive development, and emotional growth time will shape an adolescent's sexual development. Thus, the period of adolescence represents an opportune time to address sexual and reproductive issues. By many indicators, mostly looking at behaviors and outcomes, these issues continue to be a cause for concern (Schutt-Aine, 2001).

While the life skills approach is viewed as an alternative to single-problem programs, this analysis highlights the serious threats that young people in Latin America and the Caribbean face from violence, HIV/AIDS, early pregnancy, and substance abuse. Mangrulkar et al. (2001) argues that the most effective life skills programs blend skills development with content on the issues relevant to the local context.

Twenty-six countries of the region have established National Adolescent Health programs, although many only recently (Rodriguez-Garcia et al., 1999). In countries with experienced national programs, such as Colombia and Costa Rica, health professionals are trained to work with young people in health, education, and community settings. Health services specifically targeting adolescents deal with issues of reproductive health, mental health, and nutrition.

One key struggle has been to incorporate effective health promotion strategies into adolescent health services and programs. This is a challenge for the health sector in general, with a traditional focus on curative services in clinics and hospitals. Health promotion is especially critical in the field of adolescent health, given that many habits are formed during this stage of life (Burt, 1998). One recent ally in this struggle is health sector reform, occurring to some extent in all countries of the Region. The

primary components of reform include decentralization of governance, community participation in local decision-making, a focus on primary health care and adoption of health promotion strategies. Health reform strategies could support adoption of life skills through:

- Greater openness of the health sector to testing innovative models of health promotion, such as life skills
- Community participation, which can facilitate training community leaders to work with young people
- Young people's participation in health to promote peer leader training
- A focus on the family as a whole can facilitate teaching parents to work with their adolescents on life skills
- A move towards cost-effectiveness can encourage adoption of comprehensive programs, such as life skills
- Greater collaboration between sectors can facilitate partnerships between health, education and youth development for reaching young people.

Education reform could also have an impact on adolescent health programming and policies. Research has shown that a better education leads to better health outcomes, and that better health leads to greater school achievement (World Bank, 1999).

The climate of reform between education and health promotion programs provides an opening for countries in Latin America and the Caribbean to adopt a life skills approach to adolescent health promotion. Mangrulkar et al. (2001) provides the

theoretical and conceptual foundations of this life skills approach, describes what is known about its effectiveness, begins to build a common language around skills development and provides guidance on how life skills can be implemented most effectively. Theories about the way human beings, and specifically, children and adolescents grow, learn and behave provide the foundation of a life skills approach. These theories are not mutually exclusive and all contribute to the development of a life skills approach. This section analyzes seven theories; child and adolescent development, social learning, problem behavior, social influence cognitive problem solving, multiple intelligences, risk and resilience.

Mangrulkar et al. (2001) has put forward seven theories to provide the foundations of a Life Skills Approach – there are theories of how children and adolescents grow, learn and behaviour. Understanding the complex, biological, social and cognitive changes that occur from childhood through adolescence is at the core of most theories of human development (Table No. 1).

Table 1: Implications of Theories for Developing Life Skills

Slaby et al. (1995); Tyler (1991); Newman and Newman (1998)	Child and Adolescent Development Theory	• Early adolescence (10-14) is singled out as a critical moment of opportunity for building skills and positive habits, since at that age there is a developing self-image and ability to think abstractly and to solve problems. • The wider social context of early and middle adolescence provides varied situations in which to practice new skills with peers and other individuals outside of the family. • Developing skills and competencies are recognized as critical to a child's developmental pathway and sense of oneself as an autonomous individual.
Bandura (1977a,b); Ladd and Mize (1983)	Social Learning Theory	• Teaching life skills needs to replicate the natural processes by which children learn behavior (modeling, observation, social interaction). • Children need to develop the internal skills (self-control, stress reduction, self-management, decision-making) that can support positive outward behaviors.
Richard Jessor (1992); Jessor Doccovan and Costa (1991)	Problem-Behavior Theory	• Behaviors are influenced by an individual's values, beliefs and attitudes, and the perception of friends and family about those behaviors. Therefore, skills in values clarification and critical thinking (to evaluate oneself and the values of the social environment) are an important aspect of life skills program.
McGuire (1964,65); Evans (1976, 1978, 1998); Hansen (1992)	Social Influence Theory	• Peer and social pressures to engage in unhealthy behaviors can be defused by addressing them before the child or adolescent is exposed to those pressures, thus pointing towards early prevention, rather than later intervention. • Teaching children resistance skills is more effective at reducing problem behaviors than just providing information or provoking fear of the results of the behavior.
Shure and Spivack (1980)	Cognitive Problem Solving	• Poor problem-solving skills are related to poor social behaviors, indicating the need to include problem- solving as an aspect of life skills programs. • Teaching interpersonal problem-solving skills at earlier stages in the developmental process (childhood, early adolescence) is most effective.
Howard Gardner (1993); Goleman (1997); Weisberg et al. (1998); Hawkins et al. (1992)	Multiple Intelligence (Including Emotional Intelligence)	• A broader vision of human intelligence points towards using a variety of instructional methods to engage different learning styles. • Managing emotions and understanding one's feelings and the feelings of others are critical to human development and can be learned, by children in the same way as reading and arithmetic.
Luther and Zigler (1991); Rutter (1987); Bernard (1991)	Resilience and Risk Theory	• Social-cognitive skills, social competence, and problem solving skills can serve as mediators for behavior. • The specific skills addressed by life skills programs are part of the internal factors that help young people respond to adversity and are the traits that characterize resilient young people.
Vygotsky (1978)	Constructivist Psychology Theory	• The learning process occurs through social interaction in peer learning, cooperative groups, or open discussion situations. • Developing life skills in adolescents, like other processes of teaching and learning, is infused with layers of cultural beliefs and values. • Developing skills through the interaction of the individual and the social/cultural environment can lead to changes both in the individual and in the environment (peer group, classroom, family, youth group).

The implications of human development theories for life skills programs are:

- Late childhood to early adolescence is singled out as a critical moment of opportunity for building skills and positive habits, since at that age there is a developing ability to think abstractly, to understand consequences, and to solve problems.
- The wider social context of early and middle adolescence provides varied situations in which to practice new skills with peers and other individuals outside of the family.
- Skills and competencies are recognized as important in a child's developmental pathway, and in developing a sense of oneself as an autonomous individual.

Many of the risk factors that threaten the health and well-being of adolescents (e.g., poverty, mental illness in family members, racial injustice) are out of the range of what most health promotion and prevention programs can do. Life skills programs address the mediating factors that research shows can be influenced to promote health and well-being (Table No. 2).

Table 2: Risk Factors and Life Skills as Resilience or Protective Factors of Healthy Child and Adolescent Development

Risk Factors	Protective (Resilience) Factors
Individual Characteristics	
• Constitutional handicaps: perinatal complications, neurochemical imbalance, sensory disabilities • Skill developmental delays: low intelligence, social incompetence, attention deficits, reading disabilities, poor work skills and habits • Emotional difficulties: apathy, emotional immaturity, low self-esteem, poor management of emotions • School problems: scholastic demoralization and school failure	• Cognitive skills • Social-cognitive skills • Social competence • Problem solving skills • Internal locus of control • Sense of purpose • Positive sense of humor • At least average intelligence
Family and Social Characteristics	
• Family circumstances: low social class, mental illness or substance abuse in the family, large family size, child abuse, stressful life events, family disorganization, communication deviance, family conflict, and poor bonding to parents • Interpersonal problems: peer rejection, alienation, and isolation	• Secure attachment to parents • High expectations from family members • Secure attachment to peers or other adults modeling positive health and social behaviors
Risk Factors	**Protective (Resilience) Factors**
Environmental Characteristics	
• Little emotional and social supports • Harsh or arbitrary student management practices in schools • Availability of alcohol, tobacco and illicit drugs and of firearms and weapons in school/community • Community laws and norms favourable to substance use, firearms and crime • Community circumstances: neighborhood disorganization, extreme poverty, racial injustice, high unemployment.	• Connection between home and school • Caring and support, sense of "community" in classroom and school • High expectations from school personnel • Youth participation, involvement and responsibility in school tasks and decisions • Opportunities for youth participation in community activities • Community norms and laws unfavourable to substance use and firearms

(Bernard, 1991; Kottiavenco et al., 1997; Luthev and Zigler, 1992; Rutter, 1987)

The Louis Reid College of Counselling Studies, New South Wales, New England offers a Bachelor of Counselling Studies in Life Skills Education enabling people who undergo the course to work as Alcohol and drug workers, Counsellors, Education Managers, Education Officer and Public Education Officers (NSW website.online; ABS website.online).

The Australian Bureau of Statistics (Of National Centre for Education and Training Statistics) conducted an international survey program, viz. 2006 Adult Literacy and Life Skills Survey to provide a rich data set that enables comparison of Australians Literacy Skill levels to those of other countries. A sample of 8,988 persons aged 15-74 years was surveyed over four key domains of prose literacy, document literacy, numeracy and problem-solving. This survey also has data on use of technologies, social capital and well-being. A health literacy domain has been derived from responses to relevant technical material included in the four key domains. The results from ALLS show that document literacy levels tend to decrease with age (high number of people of have level 3 which is minimum level of literacy required to meet complex tasks in everyday life) (ABS website). This will be of interest to policy makers, researchers, educators and the community.

The life skills approach to smoking prevention was tested in a study where in total, 1024 pupils (mean age 11.4 years, SD = 0.90) from Austria, Denmark, Luxembourg and Germany were recruited as an experimental group and a sample of 834 matched pupils served as a control group. The pupils in the experimental group participated in an intervention programme which was based on the life skills approach and consisted of 21 sessions. The aims of the programme were to promote

fundamental social competencies and coping skills. The results indicated that prevention programmes that are run for only a few months can have a positive impact on variables considered to be protective with regard to smoking uptake. (Hanewinkel and Azhauer, 2004)

James et al. (2006) states that the evaluation of the Department of Education's Life Skills Program on HIV and AIDS prevention among Grade 9 students in 22 randomly allocated schools in Kwazulu-Natal, South Africa showed only a significant increase in student knowledge about HIV/AIDS in the intervention group compared with the control group.

Rajput et al. (2000) prepared a detailed document consisting of recommendations for the updating and modification of curriculum of all the subjects including health and physical, and art of healthy and productive living for higher secondary, secondary and primary classes. It has been stressed that health and physical education has to be concerned with total health of the learner and the community. It should aim to develop desirable understanding, attitude and practices with regard to nutrition, health and sanitation, physical strength and fitness of the learner, family and the community. The general education of the first ten years must help develop a system that promotes an integral development of body, mind and spirit. Health, physical and mental has been expressed as the primary wealth in life. Therefore health and physical education must be perceived as an integral part of curriculum at all stages of education.

Coping and thinking skills especially the former are indispensable for mental health and therefore health education falls within the purview of life skills education.

According to BBC News (www.bbc.co.uk), the Independent Advisory Group of the Department of Education and Skills, England has called for Personal, Social and Health Education (PSHE) to be a statutory part of the curriculum like citizenship. PSHE embraces other matters besides sex education and health, such as personal finance and legal and human rights.

Purnima (1996) studied the health, personal hygiene and nutritional status of 300 rural teenager girls aged 13 to 18 years. The anthropometric measurements showed an increase with age, which was in accordance with psychological change taking place in adolescence.

Uppal and Gautam (2000) have written a book containing modern updated contents enlisted under fifteen topics namely concept of physical education which includes topics such as health education and family life education.

The evaluation of the Department of Educations' Life Skills program on HIV and AIDS prevention among grade 9 students in 22 randomly allocated schools in Kwazulu-Natal, South Africa, showed only a significant increase in student knowledge about HIV/AIDS in the intervention group compared with the control group (James et al., 2006).

Ajuwon et al. (2006) explored the reproductive health knowledge, sexual behaviour and experience of sexual coercion among secondary school students in North Eastern States of Nigeria. It was found that students low reproductive health knowledge and involvement in risky sexual activities predispose them to undesirable reproductive health outcomes. Young persons had low levels of knowledge and understanding of reproductive health issues. Interventions including peer education,

training of teachers and development of youth friendly centres are recommended to meet the reproductive health needs of adolescents in the north-eastern regions of the country.

Botvin (1979-2006) developed the Life Skills Training Program (for promoting health and personal development) and created the National Health Promotion Associates as the national training centre to support providers teaching the program. He is an expert on drug abuse prevention; Professor of Public Health and Psychiatry; Director of the Cornell University Institute for Prevention Research; advisor and consultant to WHO, National Institute on Drug Abuse, etc.

2.9 Life Skills and MindLab

According to Suri Poulos (1994) and MindLab Services and Products of MindLab Europe Limited, the MindLab method is a unique technique for developing thinking abilities and life skills through games. Over the past decade the MindLab method has gained popularity worldwide thanks to specialised training programmes for teachers and educational institutions and a range of educational products and projects.

The MindLab method is deeply rooted in the distinctive concept that games are a powerful experiential tool which contributes to improvement of thinking skills, deepens awareness of thinking processes and imparts skills which help us better manage our emotional and social world. The game experience which is central to the MindLab Method, is simultaneously enjoyable, exciting and engaging. As a result the experience inspires and acts as a catalyst for deeper learning. Both the MindLab group's accumulative experience and commissioned academic research projects

which have assessed the effectiveness of the method, have conclusively proven that the MindLab method significantly improves students thinking skills and life competencies.

The MindLab Group which was established in 1994, is the recognised leader in life skills education for children. Each year the group has grown and now operates in over 30 countries throughout the world including the U.S., Spain, Italy, Portugal Hungary, Israel, Japan, Korea, Singapore, India, Australia, Saudi Arabia, Mexico, Chile, Colombia, Costa Rica, Nicaragua, Ecuador and Uruguay. The group organises a wide range of programmes such as MindLab learning programmes in community centres, kindergartens, primary and secondary schools, teacher seminars and certification training, workshops in schools and other educational institutions, gifted and talented programmes, holiday and summer programmes, experiential parent and child game playing evenings, multicultural programmes, thinking games events and the MindLab Olympics.

The MindLab Group International is also involved in a variety of joint projects with leading educational and academic bodies. MindLab Europe Ltd. represents the MindLab Group in Europe.

MindLab learning can be fun as one can watch children playing board games with each other, running a three legged race or playing football - they're not only having fun but also learning co-operation, teamwork, role clarity, strategy and tactics.

At the heart of MindLab is the belief that the most productive way of learning is through fun and hands-on experience and that game playing provides the perfect tool. Today's busy lifestyles and passive entertainment from computer games,

television and automated toys often leaves little time for our children to develop key social, emotional and thinking skills through active face to face interaction with their friends and peers. At MindLab they offer children the chance to discover and develop these essential skills. Using specially selected board games, puzzles, social and card games from around the world, the carefully planned, yet fun-packed curriculum captivates children's attention and systematically helps them to develop crucial thinking skills, social skills and emotional skills.

Table 3: Essential Skills

Thinking skills	Social skills	Emotional intelligence
Decision making Problem solving Spatial thinking Logical thinking Memory training Planning and execution Grouping and sequencing Mathematical thinking Probability studies Scientific thinking Research methods Effective questioning Resource management Tactics and strategy Investigate skills Creative thinking	Social cooperation Communication Team work Collaboration Influencing Conflict resolution Competition	Self discipline Self confidence Personal responsibility Winning and losing gracefully Learning from one's mistakes Self esteem Anger management Management of emotions

Most importantly, MindLab shows children how to use these skills at home with their family, with their friends, in their communities and in their classes at school - helping them to improve scholastically, build better personal relations, relate to and cooperate with others and learn how to tackle life's problems and challenges.

MindLab has four different curricula to cover different age ranges and abilities and the weekly sessions are grouped into courses, which focus on different thinking skills, such as problem solving, resource management, planning and sequencing, and information analysis. The lessons are structured so that children are given the opportunity to learn new games and experiment with the learned strategies and thinking concepts in a fun and safe environment. Children's confidence and self-esteem quickly grows as they see their success and receive recognition for losing gracefully, good gamesmanship, helping others, integrity and successfully applying the strategies.

Children take home MindLab exercise books and are encouraged to discuss what they have learnt and play the games at home - such family interaction 'further enriches family life and often parents rediscover for themselves the great fun to be had playing games !

The MindLab demands excellence from teachers who are typically fully qualified teachers or trainers with a passion for child development. They are CRB-vetted and have completed the MindLab teacher training certification and assessment process. Teachers are encouraged to support, observe, work with and recognise the ability of each individual pupil, enabling them to work at their own unique pace. All classes are periodically checked. To ensure that MindLab's high standards are always maintained, ongoing professional development, training and support is provided to our teachers.

More than 1 million students in over 30 countries have benefited from the MindLab programme, making MindLab the world's leading provider of life skills education to children.

The positive impact of MindLab on children's development is supported by research. According to a new study from Yale University, the MindLab method significantly improves children's performance on standardised maths, verbal and problem solving tests. This follows an earlier study, which also demonstrated that MindLab produces a substantial and lasting improvement in children's strategic reasoning and problem solving skills.

Primarily aimed at children between the ages of 4-14, MindLab helps the development of children across the full spectrum, from the exceptionally bright to those with learning and behavioural challenge for those who may be shy and insular to those that can be over excitable. Children with all personality types and abilities and from all different backgrounds benefit from and relate to the games. Each game in the curriculum is chosen for the different intelligences and talents it brings out in children: whether it be spatial, strategic, logical, mathematical or interpersonal.

Parents consistently report that they have seen their child's confidence improve and their enjoyment of learning increases following their participation in the MindLab programme. MindLab gets kids thinking about thinking. It gives them strategies that help them to think before they act and the vocabulary to discuss these strategies with others. It does all this using games that are so much fun that the kids don't even realize how much they're learning each day.

MindLab classes are held in a variety of formats and venues including:

- Weekly classes in the school day;
- After-school or breakfast clubs;
- Weekly classes at community centres, village halls or leisure centres;
- Holiday clubs;
- Summer camps;
- Gifted and talented programmes;
- Multicultural or community outreach programmes;
- Pre-school programmes;
- MindLab Plus special purpose study groups.

MindLab provides all the resources needed to bring this enrichment programme to schools including: trained MindLab teachers, games, curriculum and exercise books for the pupils.

In the game of noughts and crosses, for example, children discover that the best starting move is the centre of the grid – because it creates the most possibilities for winning – while also learning to think ahead. Through Connect 4, another MindLab game, children learn the "traffic light" principle: "red light" to stop and think about what their opponent is trying to do, "orange light" to gather as much information as they can and look at all their options before choosing the best one and finally "green light" to act. MindLab helps children understand how to apply winning strategies such as these to games, and most importantly, to life.

A typical lesson features the following structure:

1. The teacher leads an opening activity, puzzle or story to introduce the central theme of the class and engage the children.
2. The teacher explains the aims and rules of a week's game.
3. The children have plenty of time to enjoy and play the game in groups (usually pairs or foursomes). The children are completely absorbed in the fun and challenge of the game.
4. The teacher leads a discussion about the game strategies the children have been using. The teacher then describes new game strategies, thinking concepts or models that relates to the game and can help the children improve their playing.
5. The children learn the benefit of these new tools through their experience of playing the game again in groups.
6. The teacher discusses with the children how they can apply these new thinking tools to the game and to real life situations.
7. The teacher encourages the children to relate their feelings and thoughts during the lesson. The teacher reinforces the social and emotional intelligence lessons learnt by awarding a "MindLab medal" for the week to the child who has stretched the most in that area.

A recent study by Professor Don Green of Vale University (Green and Gendelman, 2003) examined whether the analogy-based teaching approach used by MindLab improves strategic reasoning and problem solving skills. The research indicated that the children who were exposed to MindLab demonstrated a substantial and statistically significant improvement in these skills in comparison with the control

group who had not been exposed to MindLab.

According to a new study from Yale University (Green and Gendelman, 2004) the MindLab method significantly improves children's performance on standardised maths, verbal and problem solving tests.

University College London research published in 2003 found that those who regularly engaged in logic and memory games such as cards, chess and backgammon performed better on short-term memory, mathematical reasoning and vocabulary tests than those who did not.

The MindLab learning programme has won wide support from universities throughout the world: **Northumbria** (England), **The Weizman Science Institute** (Israel), **Bar Ilan University** (Israel) and **Ben Gurion University** (Israel).

MindLab UK hosted the first MindLab International Olympics in Oxford two weeks later. Four teams participated from Israel, 1 from Spain and the gold and silver winners from the UK National Olympics.

The International MindLab Olympics opened up a whole new dimension of learning opportunities and experiences. For example, during the master class run by one of the developers of the MindLab programme on the first day, watching the children work in mixed pairs from different countries to solve game puzzles was a joy to watch, although they had no common language, they communicated in other ways and worked together effortlessly and efficiently. The children continued to get to know each other and their new surroundings through activities such as a boat trip on the Thames and a walking tour of Oxford, including the hall where Harry Potter was filmed.

Although MindLab is much more than the Olympics, it is a truly exciting event and a life changing experience for the children, parents, and teachers, who participate.

2.10 Life Skills and Citizenship Education/Inclusive Education

According to the project proposal, students in the +2 stage of education are a transitional group of teenagers and adolescents and therefore need special skills of adaptation and positive behaviour considering the ambient socio-economic cultural milieu and therefore science education in the +2 curriculum should be oriented towards Citizenship Education.

Citizenship concept addresses religious and ethnic diversity and have increasingly heightened profile in the media as well as within education and public policy agendas – it means being politically literate and calls for mutual respect and understanding. Citizenship education helps us avoid social strife, political polarization, potential security threats and economic stagnation and therefore was a compulsory subject in secondary schools of Britain four years ago.

The skills (political, social and civil) of Citizenship or democratic participation are listening skills, communication skills, organisational skills, leadership skills and decision-making skills (apart from skills of participation and responsible action). Citizenship education is all about personal empowerment about giving people confidence to know that they can make a difference and life skills form an integral part of citizenship education. Citizenship was introduced as a new statutory foundation subject in secondary schools and part of the non-statutory framework within Personal, Social and Health Education (PSHE) in primary schools in

September 2002 in Britain (Kiwan, 2008). She proposes an inclusive model of citizenship with institutional multiculturalism and relationship between citizen and state. According to the author, citizenship education is shared public culture and has three dimensions, i.e., civil, political and social, and one of the common learning outcomes of the three dimensions is skills and aptitudes. According to Crick Report (QCA, 1998), it is not just knowledge of citizenship and civic society, it also implies developing values, skills and understanding. Citizenship education is perceived to be instrumental in addressing social fragmentation and exclusion.

2.11 Life Skills and Peace Education

According to Pillsbury (2004) 'Life Skills' refers to programmes on peace education (including conflict resolution and human rights education), sexual and gender-based violence, land mine awareness, HIV/AIDS and Environmental Education.

Education is primarily the responsibility of governments. Unfortunately, for a variety of reasons, governments are often unable to fulfill their roles during wars and disasters – as education is denied to millions of children and adolescents. Ten out of almost 30 countries currently affected by or emerging from conflict; more than 27 million children and youth (including refugees and internally displaced persons) do not have access to formal education. Education in emergencies, chronic crises and early reconstruction is a necessity that can be both life-sustaining and life-saving. It sustains life by offering structure, stability and hope for the future, during a time of crisis, particularly for children and adolescents. Quality education with psychosocial

support and appropriate training can also help heal bad experiences, build skills and support conflict resolution and peace building.

Quality education for emergencies is often not seen as a priority during acute and prolonged crisis. Children and adults without access to formal and non-formal education opportunities are vulnerable to a future of poverty and violence and lack of complex skills needed to contribute to their society's peaceful reconstruction and development. Apart from food, water, shelter and health care, quality education is one of the key pillars of humanitarian assistance.

2.12 Life Skills and Vocational Education

Sandra Rothboeck and Vinita (2003) have proposed a new learning approach which emphasises systemic changes for skills enhancement at the macro-level and self-directedness at the group and individual level. This approach intends to promote continuous learning and includes not just workplace related outcomes but also life skills, as the latter are imperative for effective utilization of learning in all life spheres. This is advocated through the competency-based training or CBT approach.

In this approach the content of learning includes both technical skills addressing aspects of efficiency, quality consciousness, finish of the product/service, basic skills of literacy and computation, and life skills related to a vision, innovation, identity, communication, problem-solving, decision-making, critical thinking, team work, democratic functioning, participation and political articulation (within a group). The traditional vocational training and educational systems are insensitive to changing market requirements.

Jain (2008) says that there is lack of inclusiveness in India's economic growth. The country's ever-growing informal economy contrasts with the industry's constant desperation for a skilled work force, indicating the 'jobless' nature of much of the growth and widening gap in skills for workers. In this context a National Conference on Approaching Inclusive Growth through Skills Development was held in New Delhi on 12-13 February 2007 jointly organised by UNESCO and German technical cooperation. Policy makers and representatives from other fields came together to discuss strategies for coping with the present and future demands of educational, technical and life skills for employment and income generation. The discussion centred on unlocking the potential of informal economy through skills development.

While the USA boasts of 1500 VET programmes imparting specific skills, India's programmes covered only 171 trades, imparting low quality skills. It was stressed that vocational education and training institutes have outdated, structurally rigid, centralised syllabi and bored teachers without much sense of market conditions or of imparting multi-skills relevant for life-long learning processes. This was because regular academic education and vocational training are perceived as separate and alternate categories and not as options of an integrated life skills education.

The Modular Employable Skills Programme has been proposed for implementation in the immediate future. This programme provides minimum level of skills that could lead to gainful employment.

The skills development strategies included training on Life Skills, Meta skills and Business skills as an essential part of all training programmes in the informal

sector, with the integration of life-coping skills preferably starting in elementary school.

The issue of skills development in the informal sector is the single most important instrument to strike the balance between growth figures and their uneven distribution, between high unemployment rates and the industry's call for a skilled work force.

2.13 Life Skills and UNESCO

UNESCO (2001) reached a consensus that secondary education should be given top priority and that the objectives and functions of secondary education need to be redefined for the 21st century with respect to general and vocational education. It was opined that secondary education should focus on interdependence of academic and vocational subjects and their interdependence in the overall education of adolescent learners of both genders. That secondary education is about preparation for life and should reflect the reality of life in the 21st century that encompasses a seamless to-and-fro between continued learning and the world of work. With respect to cognitive and behavioural outcomes, it was concluded that as other socialising agencies have a declining role, schools should take greater responsibility for helping learners acquire life skills.

Member nations sought UNESCO's assistance for reconstructing secondary education to ensure a consideration of learner's diversified needs and provide them with knowledge and life-long skills including vocational learning. It was suggested that future UNESCO activities should center on Life Skills and Lifelong Education as one of the themes besides vocational education.

Getting Ready for the Outside World (GROW) is Riverview's 10 month post-secondary component (1-3 years) for students who have completed secondary school (or a similar program) and is designed to provide students with the skills that will assist them in functioning more independently within the adult world.

In life skills classes, students-focus on real-life topics such as effective listening and communication skills, use of technology, relationship skills, self-advocacy, personal safety and self-awareness. Consumer issues instruction addresses practical skills such as time and task management, budgeting, money skills, planning, estimation and problem-solving. Staff-training is provided to encourage faculty to be creative and flexible to ensure all students to reach their full potential. Social skills guidance is given to all students and they participate in a comprehensive sexuality education program with an emphasis on human development, relationships, personal skills, sexual behaviour, sexual health, and society and culture. Career awareness is increased through their exposure to a variety of vocations.

To augment government initiatives for improving quality of school education, C11 in partnership with UNESCO and state governments is supporting the long-term phased initiative for Quality Education in select schools of Delhi and Uttar Pradesh. The pilot project focuses on stimulating the innate curiosity through active participatory learning, developing life skills and vocational skills, and creating a child-friendly, hygienic and pleasing environment so that going to school will be a motivating and rewarding experience for all children.

The Quality Life Skills Education project in Srinagar aims to reinforce quality Life Skills Education in select government schools of Srinagar, by motivating,

enabling and empowering principals as well as teachers to integrate Life Skills Education into the existing curriculum. This is being done to provide a full range of information, support and services to adolescents and enabling them to cope with diverse challenges and risks in their environment, especially empowering them to make informed decisions and choices to lead a dignified, healthy and secure life.

The strategies for implementation include a needs-assessment study, preparation of modules for grades V to XII, training of principals and teachers, preparation of a facilitator's handbook for different levels and guest lectures. In addition, there will be residential camps for boys and girls on life skills education, provision of a counselor's services to the schools on a rotation basis, and regular monitoring and evaluation by trained supervisors (www.ciionline.org)

2.14 Development of Life Skills Programs

Life Skills Program Content

While some programs attempt to teach life and social skills generically, research indicates effective programs includes normative content and teaching children to apply skills to specific behaviors (Tobler and Stratton, 1997; Dusenbury and Falco, 1995; Donaldson, Graham, and Hansen, 1994; Hansen, 1992; Caplan, Bennetto, and Weissberg, 1991; Dodge, Pettit, McClaskey, and Brown, 1986; Hawkins and Weiss, 1985) Accurate and developmentally appropriate content of relevance to young people (for example, sexuality, substance use, nutrition and fitness, or interpersonal conflict) provides a context for learning skills. Recent research shows that skills are not automatically and consistently applied to every problem or social task encountered. Rather, to produce a meaningful effect on

development or behavior, adolescents need to practice and apply learned skills to specific, relevant social tasks".

Perhaps a crucial question to ask is: who determines what those relevant social tasks are? While life skills programs focus on teaching adolescents more how to think, rather than what to think, values and beliefs will always be implicit in any program. In some, the transmission of values may be an explicit goal, for example in a life skills program that incorporates youth citizenship. Two of the skills mentioned in this paper are critical thinking and values clarification. Life skills programs should facilitate a critical evaluation of social norms and peer influences, and can help young people explore their own values and personal meaning through self evaluation. Importantly, whether the values are implicit or explicit, the specific content of a life skills program should be determined locally, through dialogue and participation of adults and adolescents, and based on the local health risks and competencies of young people.

Research and theory supports the incorporation of specific kinds of content into a skills program: perceptions (e.g., actual vs. perceived levels of drug use by peers), stereotypes (e.g., gender bias in the media), community statistics (e.g., level of volunteerism of teenagers), health information and help-seeking information or community resources (e.g., where can I get free counseling for depression). Programs based on social influence theory effectively addressed the attitudes of young people about specific behaviors, such as marijuana use, and life skills training programs by Botvin effectively modified the perceptions of young people about peer drug use (Evans, 1998; Botvin et al., 1990).

The following table gives an overview of information content areas on which life skills can be applied:

Table 4: Information Content to Accompany the Development of Life Skills

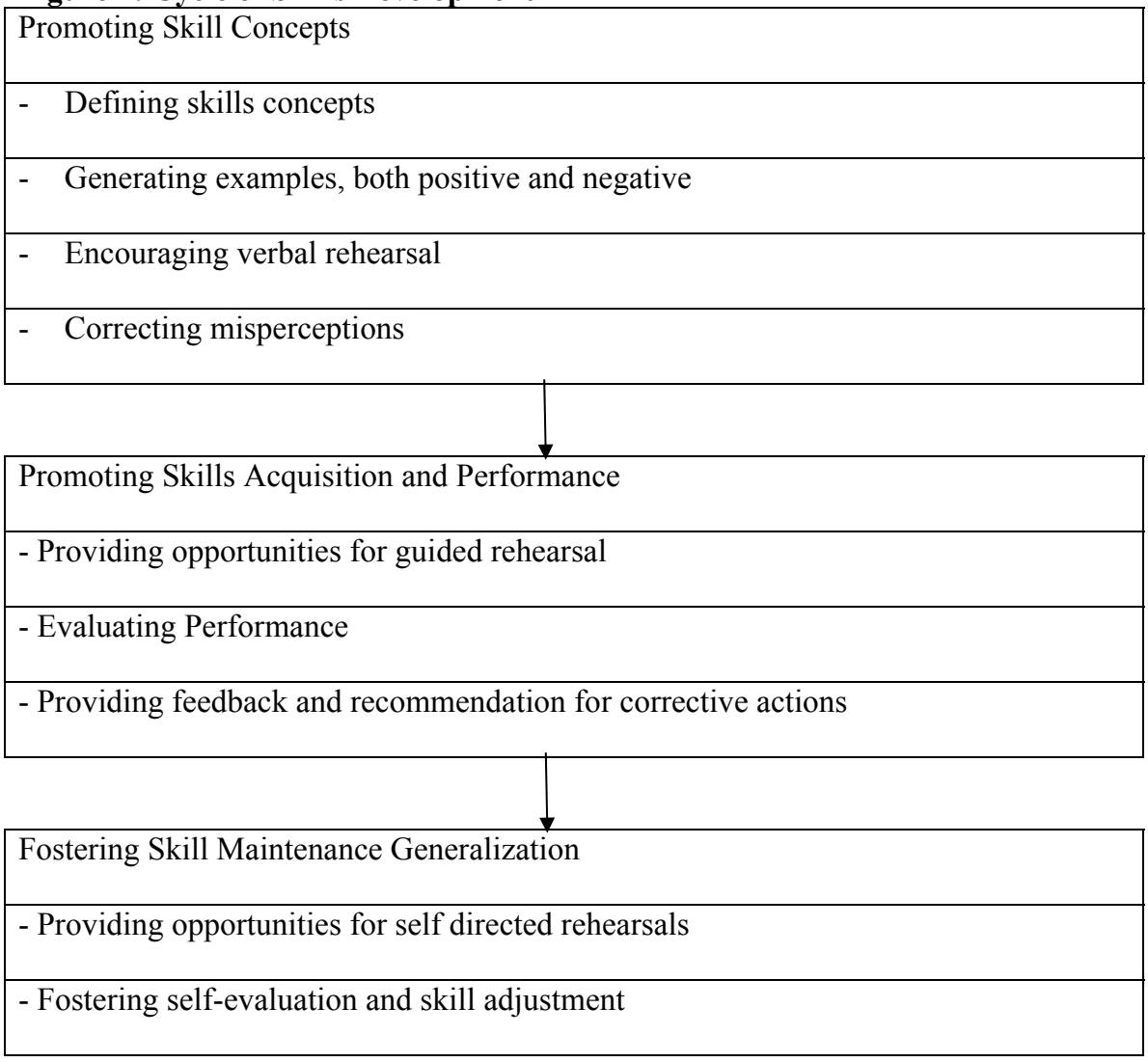
Specific Content Areas	Violence Prevention/ Conflict Resolution	Stereotypes, beliefs, attributions, and cognitive scripts that support violence
		Identifying potential situations of conflict
		Levels of community violence
		Myths about violence perpetuated by the media
		Roles of aggressor, victim, and bystander
	Alcohol, Tobacco and other substance use	Social influences to use alcohol, tobacco and other drugs
		Potential situations for being offered a substance
		Misperceptions about levels of alcohol, tobacco, and other drug use in community/ by peers
		Effects of alcohol tobacco, and other drug use
		Community resources to address drug use in the community
	Interpersonal relationships	Friendships
		Dating
		Parent child relationship
	Sexual and Reproductive Health	Information about STDs/HIV/AIDS
		Myths and misconceptions about HIV/AIDS
		Myths about gender roles, body image perpetuated by the media
		Gender equity (or lack of it) in society
		Social influences regarding sexual behaviors
		Dating and relationships
		Information about sexual anatomy, puberty, conception and pregnancy
		Local rates of HIV/AIDS, STDs, teenage pregnancy
		Alternative methods of birth control
		Locating and seeking services
	Physical Fitness/ Nutrition	Healthy foods
		Exercise/sports
		Preventing anemia and iron deficiency Eating disorders
		Body image

Life Skills Program Teaching Methodology

The methodology for developing skills is a critical aspect of effective programming. Research and theory show that not only is a life skills approach made more effective by using interactive teaching methods. But that skills are learned through interaction, role playing, open discussions, small group activities and other techniques that are an integral part of the approach. Research has shown that children as young as 5 years of age can be engaged in skills development using these methods.

A model of skills development is shown in the following Figure No. 4.

Figure 4: Cycle of Skills Development



The methods for skills acquisition involve cooperative learning, peer support, continual opportunities for rehearsal, accurate feedback and constructive criticism, and modeling of skills by other peers and adults. Some of the possible methods of skills acquisition, many of which are not loud and boisterous activities, include:

- Role playing
- Situation analysis
- Small group work
- Debates
- One-on-one rehearsal
- Decision mapping or problem trees
- Literature content analysis
- Relaxation and trust-building exercises
- Games

Life Skills Program Providers

Program providers for life skills programs require a blend of professional and personal qualities. Some individuals bring these to the job and others must be trained to acquire them. Who can teach life skills effectively? Usually life skills programs are offered by social workers, counselors, teachers, and psychologists or other health care providers. It is essential that the leader is a role model who is successful or competent, possesses high status, and has control over rewarding resources (Bandura, 1977a). Health care providers often fulfill these expectations as do many teachers, community leaders and parents. However, many adults will need to

unlearn authoritarian and didactic approaches to learn to become effective program providers.

Same age or older peer leaders have been included in many studies testing social influence and competence enhancement approaches to substance abuse prevention (Botvin et al., 1998) and in social skills training approaches to promote children's social interaction (Elliot and Gresham, 1993). Peer leaders have been found to play a role in social influence approaches to behavior change given that they are generally credible and accessible role models (Botvin et al., 1998; Tobler, 1992). Peer leaders usually assist an adult program provider and have specific and well-defined roles (Botvin et al., 1998; Perry and Jessor, 1985). An added benefit of using peer leaders is that the young leader himself or herself benefits from the position as a role model and program provider (Tobler, 1992).

Parents are in a unique position to affect the behavior of their children. Indeed, children develop skills such as communication, problem solving, and critical thinking through modeling at home. Interest continues to grow in training parents on how to enhance their own skills thereby improving the social and emotional learning, problem-solving and communication skills of their children (Shure, 1999). More research is needed to understand the different teaching methodologies, theoretical background, skill set and training of a life skills program that would involve parents.

Providers of life skills programmes should have the following characteristics:

- Competence in group process; someone who can enhance interaction and simultaneously focus and direct the group (Tobler, 1992).

- Ability to act as a guide as opposed to being dominating (ibid).
- Respect for the adolescent and his or her freedom of choice and individual self-determination (ibid).
- Personality traits that include: warm, supportive, and enthusiastic (Ladd and Mize, 1983).

Life Skills Program Training

Given the challenging methods posed by a skills-based approach, ensuring adequate training for program providers can be a key factor in program effectiveness. Health and education sector reforms in Latin America and the Caribbean provide an opening for training health professionals and teachers in a new way: using active teaching methods, focusing on the whole child and adolescent, and building skills in conjunction with providing information. The community participation aspect of health and education sector reform could provide the opportunity to train and involve community leaders, counselors, health workers, peer educators, as well as parents.

In many ways, training of life skills programs mirrors the teaching principles of the programs they are trained to implement. Provider training should incorporate active teaching methodologies that include what is known about adult learning styles. The trainer models the activities (e.g., open discussion, role plays, and cooperative group work), and the participants require extensive opportunities for practicing those methods. Combined with feedback, this model mimics the skills development, process discussed earlier for adolescents.

Developers of Teenage Health Teaching Modules, a skills-based health education curricula, trained program providers on how to:

- Establish the program environment where open communication is valued, constructive problem-solving occurs, and positive peer interaction is valued;
- Use interactive teaching strategies;
- Model skills and apply skills to particular behaviors, including how to give encouragement and praise to reinforce positive social norms (O'Donnell et al., 1995, p. 90);
- Teach complex social skills;
- Provides resources for health information and referral; and
- Deal with sensitive issues (Blaber, 1999).

The specifics of training vary widely in terms of design, length, content and methodology. Results from research on staff training, mostly for life skills programs that address specific behaviors, found:

- A multiple approach to staff development is important, and includes continued training and booster sessions – (Hansen, 1992; Botvin, 1986).
- Approaches to training should fit the skills level of the providers (Gingiss, 1992).
- Active participation of providers in making decisions about program adoption is important.
- In terms of length of program training, research in alcohol and drug abuse prevention programs found that training should be at least 10 sessions long (a session equal to about 45 minutes) in the first year, at least 5 sessions long in

the subsequent years, and at least 3 years in duration for effectiveness (Dusenbury et al., 1997b)

- Pairing experienced life skills program providers with new trainees is an effective strategy for training (Dusenbury and Falco, 1995)

Life skills development can be and has been incorporated into programs in a wide variety of settings, including health clinics, schools, hospitals, community centers, early childhood centers, schools, and youth centers. The following are some examples of life skills programs in different settings. (Mangrulkar et al., 2001)

- Doctors, nurses, psychologists, counselors, and community health workers throughout Latin America and the Caribbean have begun to form teams to provide not only curative health services, but also health promotion services. Life skills programs can be implemented in youth participation programs, counseling groups, and peer education programs by Health and Family Welfare Department.
- Many NGOs around the Region provide reproductive health services, after-school programs, counseling programs and youth leadership programs, making them a potential setting for life skills programs.
- School reform provides opportunities for school activities to include parent training in life skills, and for peer education and counseling programs to incorporate a life skills approach.
- Parenting programs are beginning to take hold in many community and health centers, providing an opportunity for life skills training for parents.

Life Skills Evaluation

Life skills programs generally analyze changes in skills levels, attitudes and beliefs, as well as changes in behavioral outcomes. These can be both self assessed and assessed by program providers and parents. In the substance abuse prevention arena, the following are often the critical skills measured: assertiveness, refusal skills, locus of control, decision-making, and problem-solving (Botvin, 1986). The Social Skills Rating System (SSRS) (Gresham and Elliot, 1990) is one of many different rating systems that have been used to assess students social skills, including cooperation, assertion, empathy, and self-control. Social and emotional adjustment can be measured through many different scales including the Survey of Adaptational Tasks of Middle School (Elias et al., 1992), This survey asks teachers, parents and students about adjustment in middle school (generally ages 10-14 in the United States). Other scales include the Self-Perception Profile for Children, which measures children's perceptions of personal competency (Harter, 1985). More research that measures skills, competency, adjustment and other key components of life skills programs is needed for the Latin American and Caribbean Region.

Changes in attitudes and knowledge is another component of an evaluation plan. In the area of violence prevention, a number of self-report measures assess the attitude and knowledge of adolescents about violence. For example, the Beliefs Supporting Aggression Scale (Slaby and Guerra, 1988) measures normative beliefs about aggression, and the Attitude Towards Conflict Scale (Lam, 1989) measures how young people feel about different methods for resolving conflicts.

Since life skills programs tend to be comprehensive in scope, it is important to acknowledge proposed effects beyond changes in individual behaviors, attitudes or skills. Changes in social norms or norms among peers, changes in program providers, and changes in connection to community, family, parent or school are all potential effects and should be measured.

Existing life skills programs give examples of measures, indicators and evaluation plans that can be adapted and tested in the local context. (Mangrulkar et al., 2001)

Life Skills Implementation

At the heart of implementation is a planning process that begins with assessment. Ensuring a fit between the program to be used, the interests and needs of providers and young people, and local conditions and resources is essential. A customized conceptual framework relevant to specific national or local issues has to be generated.

We must provoke debates about the importance of prevention and skill building for young people, or we are sitting on a time bomb. We must provoke arguments about how to address them with the chief technocrats and have these issues feature prominently on the public agenda. We must clarify our language about health promotion and life skills. We must also learn to be more savvy in using the media and health promotion so as to do a better job of selling itself.

In advocating for life skills or skills-based health education, it is not always obvious which arguments or approaches work best with which audiences. What may be obvious or appeal to health and education planners first, may not be the most

persuasive issue.

As program providers are paid very low wages, live below the poverty level and take on second jobs to survive, responding to the concerns of providers and considering ways to develop their own life skills to achieve immediate and long lasting benefits in their personal and professional lives should be one priority for program implementation.

Coordination between competing curricula and programs is one of the challenges, especially for schools, in incorporating adolescent health promotion programs. Many of the program-directors frequently field complaints by over worked teachers about having to implement "yet one more program." In one common example, the health ministry relies on teachers to take a lead role in prevention during epidemics of malaria or dengue, as well as to implement separate health education programs on alcohol use, sexual education, and prevention of HIV in the Americas.

In order for a life skills program to take hold and expand, the program's successes, lessons learned and materials need to be, disseminated in some way. In Colombia teachers who have used the life skills curriculum and directors of schools who have seen its impact are doing their own marketing; the teachers teaching life skills curriculum can train others in participative methodologies and help in implementing a life skills curriculum. Others noted that an influential leader can best promote an effective life skills program. (Mangrulkar et al., 2001)

Without adequate and appropriate materials, the ability to spread the use of a life skills approach is very limited. Materials often need to be adapted to local needs, but practitioners often don't know how to do that without undermining the core

aspects of the approach. Revision is made more difficult when health patterns, issues, and the research base change continuously.

There should be,

1. Free distribution of materials by the government or other agency.
2. Free licensing and permission that allows individual states, cities, or school districts to print their own from a master copy.
3. Selling of materials for a modest fee to cover basic costs.

Many valuable lessons have been learned from existing programs in LAC, which can be helpful for guiding new life skills initiatives (Mangrulkar et al., 2001). Those key lessons are:

- Strong advocacy requires a clear understanding of the life skills approach and clear arguments, adapted to particular audience and setting, for its effectiveness.
- Data on local needs is critical for determining program objectives.
- Buy-in and involvement of local program providers from the beginning, at the needs assessment stage, is key to program effectiveness and sustainability.
- Program providers themselves have health needs that should be taken into account in program implementation, and can potentially be addressed through life skills programs.
- The life skills approach can serve as a unifying framework for the many competing and duplicative adolescent health programs in a particular setting.
- Support and technical assistance for curriculum development (which can involve either adapting pieces of existing curricula or developing original curricula) is needed at the Regional or country level.

- Planning for all stages of the program, from needs assessment through institutionalization of the program, is key to sustainability.

Life Skills Strategies for Future

Pan American Health Organization (1998b, 2000) proposes the following strategies for promoting adolescence health:

(1) Support countries to carry out programmatic and evaluation research on effective life skills programs. Important research questions include:

- What age is appropriate for developing specific life skills?
- How does skills development differ by gender?
- How should a life skills program differ when implemented in different settings (e.g., a health clinic, a school or youth groups)?
- How should a life skills program differ when implemented by different program providers (e.g. social workers, counselors, volunteers, health personnel, teachers, parents or peer leaders)?
- What is the cost of a basic life skills program package?
- What modules should an effective provider training include?
- What short and long-term impact does skills acquisition have on adolescent developmental needs, protective and risk factors, and behaviors? What impact does it have on program providers, parents and the environment?
- How can a life skills approach best be adapted for parenting programs?

(2) Support intersectoral and interdisciplinary collaboration around the issue of life skills by coordinating adolescent health promotion efforts at the Regional and country level.

(3) Support countries in the pilot testing of a variety of life skills programs that are

- targeted towards the developmental and skills needs of girls
- applied in different settings (health centers, youth centers, schools, church groups)
- targeted towards different populations (urban/rural adolescents, younger/older adolescents, indigenous populations)
- implemented by different program providers
- targeted towards different skills needs and issues

(4) Support the advocacy of a life skills approach. A dialogue can be continued through regional conferences and meetings to develop a shared language and framework for the Region.

(5) Support development of networks of life skills program models, research, human resources, and institutions in a region.

(6) Mobilize resources for a life skills agenda. The Pan American Health Organization works with other partners to channel resources to move ahead this agenda that could make life skills programs a reality for the healthy development of adolescents around the Region.

2.15 WHO and Life Skills

Many international agencies, including UNICEF and the World Health Organization (WHO) have supported local programs in their work. The World Health Organization has been a strong advocate, developing conceptual papers and curricula and convening working groups and training for governmental and non- governmental

agencies throughout the world (WHO 1999, 1996, 1993). The Global School Health Initiative and the Health Promoting Schools Network have adopted life skills as a priority strategy for school health in many parts of the Latin America and Caribbean.

2.16 Life Skills Program Design

The following are questions that can help you design a framework for a life skills program:

Vision

la. What change do you want to affect in the healthy development of children and adolescents in the future – How? Why?

lb. How does your vision relate to larger national or local efforts in the education, health and youth sectors?

2. What are the major issues for the healthy development of children and adolescents that are important to address in your community or country?

3. What specifically are your core beliefs about the capacities of:

Children (ages 4-10) Adolescents (ages 11-19)

4. What theory(ies) best fits with your vision of change. the issues to be addressed, and your core beliefs about the capacities of children and young people? Are you trying to change individual behaviors? Promote resilience? Prevent specific behaviors? Change social norms in the classroom or community?

5. What particular skills, for what age group, and what content will your program address?

Target age group _____

Skills	Content
Social Skills	
Cognitive Skills	
Emotional Coping Skills	

6. Explain your program: What is the simplest explanation of your life skills initiative?

Why do you think developing these skills in adolescence is important? Is the goal of life skills program target issues of importance to the public?

2.17 Life Skills and Minimum Levels of Learning (MLL)

Hitherto a lot of emphasis has been laid down for minimum levels of learning at primary level. For achievement of life skills at the primary or secondary level, it is very essential that minimum levels of learning are laid down. An attempt has been made in this study to ascertain MLL attained in various life skills and paired life skills incorporated in the NCERT Biology Textbooks of the XI standard. CBSE has already come out with books on Life Skills Development for stages I to VIII. But whether MLL in life skills is attained through these books is not known. MLLs oriented specially designed curricula may become necessary even in life skills at the secondary stage very soon.

The NPE 1986 called for paying immediate attention to laying down minimum levels of learning which all children completing different stages of education should achieve. Keeping this policy directive in view, a working group on Early Childhood and Elementary Education was set up for the formulation of Eighth Five Year Plan. The report of this working group states "In terms of outcomes it shall have to be ensured that minimum levels of learning are laid down with respect to primary and upper primary stages, and an appropriate evaluation system created to ensure achievement at least of the prescribed levels of learning.

In the context of these exercises and the specifications made by the Eighth Plan Working Group, the Department of Education, MHRD, organised a Seminar in December 1989 on the theme, 'Basic Learning Needs and Levels of Attainment'. Various issues related to basic learning of the children at the primary stage, the need for specifying Minimum Levels of Learning and creation of appropriate mechanism for assessment of learner were discussed during the Seminar. On the issue of laying down MLL, the Seminar recommended initiating concrete efforts at the national level.

The Department of Education, MHRD, Government of India, set up the Committee on Minimum Levels of Learning on 5th January 1990. The Committee published its report regarding MLLs after August 1990, after conducting several meetings in consultation with the State governments. The report is entitled "Minimum Levels of Learning at Primary Stage" (MHRD, NCERT, New Delhi). Under Article 4.1 (II) p. 8, it states:

To ensure learning upto mastery by every child in the class – In operational terms 80% or more of the children mastering at least 80% of the prescribed learning levels should be the performance target for the teacher henceforth.

It is assumed that in every State in India, including Karnataka State, this target of 80% has been accepted and efforts are going on in the past few years towards achieving this target.

The above target was set up in order to improve the quality of primary education along with quantity. To achieve such qualitative improvements in primary education, several inputs, were applied to the educational system at the district level in Karnataka, such as specially designed MLLs-oriented curriculum textbooks, teacher guide, OB kits, inservice training of teachers, etc. Some of these inputs were also applied in non-DPEP districts also with a view to bringing about a qualitative improvement in primary education. The DIET staff play an important role in the whole exercise (Rajkumar S., 1994). In the context of such investments made by the Government and the time and energy devoted by the Educational functionaries, the need arises to assess the actual performance level of students.

What are Minimum Levels of Learning (MLLs)?

a) MLLs can be specified in a variety of ways. For instance, MLLs can be stated as Expected Learning Outcomes defined as observable terminal behaviours. One may also go for a taxonomic analysis of learning objectives such as knowledge, comprehension, application, analysis, synthesis, evaluation and accordingly indicate the expected learning competencies expected to be mastered by every child by the end of a particular class or stage of education. The MLLs have been stated in terms of

competencies. Each competency can be further delineated in terms of sub-competencies while specifying the content inputs or while designing specific measures of learning.

b) It may be noted that a set of MLLs actually represent the rational criteria adopted for judging the adequacy of the curricular inputs provided and the learning outcomes to be expected. There can be no finality with respect to any set of MLLs.

MLLs meet three purposes – a) improve learning attainments, b) serve as performance goals for the teacher, c) serve as output indication for the system – And for meeting these purposes, MLLs should have the attributes of achievability, understanding and evaluability.

Achievability

Achievability is a basic characteristic of MLLs. MLLs should correspond to learning objectives that are achievable by all learners so as to

- serve as performance objectives and goals.
- to ensure learning upto mastery level by every child in the class.
- to reduce disparities, and bring equality according to local conditions.

Communicability

MLLs are realistic and achievable, and should be set in a language and form that are easily understandable to all the teachers. MLL should also be understandable to the instructor, the parent and the community.

Evaluability: MLLs should serve as effective blue prints for continuous and comprehensive evaluation of learner students and should have a well-defined goal of acquiring a mastery level.

Learning continuum: MLLs should be set in as simple and comprehensive manner as possible and learning has been seen as 'continuum' in which units are sequenced hierarchically so that the clusters of competencies in one unit build as directly as possible on the competencies in the preceding unit.

This will make MLL more enjoyable and meaningful, and the achievement of MLLs will be facilitated.

What is the significance of MLL in a curriculum?

(i) The importance lies in the fact that majority of school children can barely read their own textbooks even after spending as many as five years in a school. Considering that, opportunity for education is not likely to be available beyond the primary stage and what they learn here must sustain them throughout their lives, it becomes imperative that the educational system makes sure that these precious school years of children are not wasted. That all children irrespective of their condition and school condition reach minimum levels of learning before they finish primary education that would eventually enable them to understand their world and prepare them to function in it as permanently literate, socially useful and contributing adults.

(ii) Laying down Minimum Levels of Learning should be viewed as part of a larger curriculum endeavour attempting to move towards greater relevance and functionality in primary education. The implications of this exercise are lightening the curriculum, making the process of understanding and application meaningful, ensuring the acquisition of basic competencies and skills, and permitting mastery learning.

Thomas T.N. (1990) conducted a study titled “Impact of Differential Curricula on MLL in Mathematics of V Class”. The main objectives of this study were to compare the CBSE and state curriculum in Mathematics of primary education to evaluate the MLL in mathematics of students of V class and to compare the MLL in mathematics of V class with CBSE and State curriculum in relation to sex and locality management. Three schools of three districts were randomly selected for study. Results show that CBSE curriculum could only develop mastery of overall competency in significant percentage of students.

Lalithamma (1991) conducted a project titled “Mysore Minimum Levels of Learning Project”. The main objectives of this project were to ensure achievement of MLLs by all children in primary schools (especially in the backward areas) and to change the content complexion, structure and practices of the academic programmes in standards I to V, to improve teacher’s quality to produce teacher’s manuals, to plan and try out an experimental programme in selected schools. Seventy-five Kannada medium schools have been taken and the project was limited to three subject areas of Kannada, Mathematics and Environmental Studies. Instructional and evaluation materials were prepared in the three areas for classes I, II and III. Orientation and training were provided to teachers through conferences and workshops.

Ramakalyani (1993) conducted research to investigate the teacher’s perception of Minimum Levels of Learning (MLLs), to find out whether expected MLLs in Maths at the terminal stage of primary education (standard IV) could at least be mastered at the upper primary classes of V and VI. Students belonging to different categories of schools representing the levels of curriculum followed, locality,

management and language of instruction were considered for the study. This facilitated looking into the differences and gains in mastery of the competencies/ MLLs in different educational contexts.

The expected level of mastery fixed for this study was that '80% or more students should master at least 80% of the competencies'. The achievement of MLLs for the terminal stage of primary education, ranged from zero percent for rural schools to 70% for private CBSE schools. The overall competency, ranged from zero percent for rural and urban Government schools to 59% for CBSE schools.

From the reviews of MLL-related research, there seems to be an urgency shown by the government and educationists to ensure Minimum Levels of Learning at the school level. Attainment of MLL differs from school to school and is influenced by several factors. The researcher seems to be flexible with respect to the level of mastery required for considering that competency is achieved by the learner. The most common level of mastery expected is 80% students achieving 80% or more competencies.

In the term "Minimum Levels of Learning", "Learning" means desirable and durable change in learner's knowledge, understanding, values, attitudes and motor skills. The word 'levels' refers to standards or levels of performance and 'minimum' refers to a quantum of competencies which ought to be acquired by each and every learner having undergone through a stipulated time frame of learning. 'Minimum' is not necessarily optimum. This minimum does not mean that it sets the upper limit of learning for all children. There will be children who can learn beyond the minimum

levels specified in the report. Such fast learners should be encouraged to achieve more than what is contained in the MLLs report (Prakash and Roka, 1995).

In the context of MLLs, competencies are learning objectives. When a competency has been developed in a student he/she would be able to perform specific task related to that competency.

What are the salient features of the MLLs Approach ?

These are 'Mastery Learning', 'Competency-based Teaching' and 'Competency-based Comprehensive and Continuous Evaluation'.

1. Mastery Learning – The MLL approach implies that each competency should be developed at the mastery level. The competencies for each subject and each grade have been arranged from simple to more complex. Each competency must be learnt thoroughly which then provides the basis for learning the next competency, and so on. When a competency is learnt thoroughly we say that the competency has been mastered.

In our context, mastery learning means that all the competencies or almost all the competencies are to be mastered by all the children or almost all the children. Suppose there are 20 competencies to be learnt by a group of 20 children in the class. If all these 20 competencies are thoroughly learnt by all the 20 children, we may say that these competencies have been fully mastered by the class. This is often expressed as 100 x 100. If 80% of the competencies are mastered by 80% of the children (80x80), this may also be considered acceptable. Mastery learning is the key aspect of the MLLs approach. In day-to-day teaching-learning situation ensuring mastery of

competencies by the learners is the target for the teacher. Ultimately, it will help us produce learners with increased learning.

2. Competency-based Teaching – A competency serves as a basis for selecting and arranging appropriate teaching-learning activities with a view to meeting learning needs of learners. This calls for child-centred and activity-oriented competency-based teaching. As a teacher one should be clear about the competency/competencies to be developed amongst students. This helps in deciding a) suitable content, b) appropriate teaching methodology, c) suitable teaching aid, d) appropriate evaluation techniques and e) necessary remedial measures for those facing learning difficulties.

3. Competency-based Continuous and Comprehensive Evaluation – Since a learner can acquire the next competency only if he/she has mastered the earlier related competency, one has to assess whether or not a learner has mastered the competencies by evaluating his/her achievement on regular basis. This means that the scheme of evaluation has to be continuous. But routine evaluation has two drawbacks: 1) the tests used for evaluating learner's achievement measure only knowledge of content and not much attention is paid to evaluate achievement of competencies. 2) Also, evaluation is done only in the cognitive areas of learning such as knowledge, understanding and mental skills and evaluation of non-cognitive areas of learning such as attitudes, personality, qualities, values and psychomotor skills is seldom carried out. A procedure of evaluation which adequately measures both cognitive and non-cognitive learning outcomes is commonly known as comprehensive evaluation (Prakash and Roka, 1995).

Continuous Comprehensive Evaluation should start with pre-testing. Pre-testing should be carried out right in the beginning of the academic session and this will help you know whether or not the learners are prepared to acquire the related competencies to be developed in the new class. One has to organise suitable remedial programme for those children who are not ready to learn competencies of the new class.

In a class, evaluation moves simultaneously as a regular process along with organised teaching-learning activities. The continuity in evaluation has to be viewed in two ways. 1) Simultaneous assessment of the development of the competency amongst his/her learners while developing the competency; 2) Periodical assessment of the development of cluster of inter-related competencies which may be termed as periodical test held six to seven times in an academic year followed by a summative/ annual test at the end of the year.

We have already defined MLLs as Expected Learning Outcomes. There is a subtle difference between Expected Behavioural Outcome or intended behavioural goals set up before learning and Real Learning outcomes or actual behavioural goals attained after learning in our curriculum model. Put simply, an EBO needs to be further defined as a MLO – a more quantified concrete-statement of behavioural goal (Dave et al., 1991).

There are again two parts of this poser: (i) How many children should attain a defined minimum standard (level)? and (ii) What should this standard be? Since it is a minimum standard, without which a desired functional goal cannot be obtained, all children must be helped to reach this level. If the learning outcomes are measured,

what percentage of scores be considered as minimum? *To follow the convention and for the sake of simplicity, the range of 35-49% marks (scores) on a fairly reliable test is considered as a 'minimum' grade; (40-49% range as 'average' grade); 50-59% range as 'good'; 60-79% range as 'excellent' and 80-100% range is considered as a 'mastery' grade or 'mastery' level learning (Dave et al., 1991). The above scale has been followed in the present study to determine Minimum Levels of Learning (MLL) in life skills with 50% as the cut off point.*

The power to question is the basis of all human progress.

— Indira Gandhi

CHAPTER – III

METHODOLOGY

The following account describes what had to be done, how it was done what data were necessary, what data-gathering devices were employed, how sources of data were selected and how the data were analysed and conclusions drawn.

Not much work has been done in the area of Secondary Education and XI standard or PUC I syllabi in India or abroad (ref. Introduction and Literature Review). We developed the foundation of ideas on which our studies was built through literature review (Ref. chapter II).

3.1 Design of the Study

Research design is a choice of an investigator about the components of his project and development of certain components of the design. It has the following components – research method or research strategy, sampling design, choice of research tools, and choice of statistical techniques. Research design is a mapping strategy which is based on sampling technique.

The research method used here was a survey method, concerned with the present and attempting to determine the status of the phenomena under investigation. The survey was mostly conducted using the questionnaire research tool which is most frequently used in this type of research. These are employed for school and educational survey and also for educational administration. Some of the constraints on this type of survey method are planning and developing a questionnaire, getting

adequate information through the questionnaire and establishing and validating the data through the questionnaire, the large representative sample, analysis of data where mostly descriptive statistics only can be used and misrepresentation of the questions due to the respondent's willingness or impersonality.

Pupil achievement is measured here using check-lists, rating scales and score cards.

This study is concerned with the generalised statistics with data abstracted from a number of individual cases. It is essentially cross sectional.

3.2 General area of Study

The general area of study comprised the CBSE Syllabus as given below.

CBSE Syllabus (2007-08)

COURSE STRUCTURE

Class XI (Theory)

Time: 3 Hours

One Paper **70 marks**

1. Diversity in living world	07
2. Structural organization in animals and plants	10
3. Cell: Structure and function	17
4. Plant physiology	18
5. Human Physiology	18
Total	**70**

I Diversity in Living World ***(25 Periods)***

Diversity of living organisms

Classification of the living organisms (five kingdom classification, major groups and principles of classification within each kingdom).

Systematics and binomial System of nomenclature

Salient features of animal (non chordates up to phylum level and chordates up to class level) and plant (major groups; Angiosperms up to subclass) classification.

Botanical gardens, herbaria, zoological parks and museums.

II Structural Organisation in Animals and Plants (30 Periods)

Tissues in animals and plants.

Morphology, anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence, flower, fruit and seed.

Morphology, anatomy and functions of different systems of an annelid (earthworm), an insect (cockroach) and an amphibian (frog).

III Cell: Structure and Function (40 Periods)

Cell: cell wall, cell membrane and cell organelles (plastids, mitochondria, endoplasmic reticulum, Golgi bodies/dictyosomes, ribosomes, lysosomes, vacuoles, centrioles) and nuclear organization.

Mitosis, meiosis, cell cycle.

Basic chemical constituents of living bodies.

Structure and functions of carbohydrates, proteins, lipids and nucleic acids.

Enzymes: types, properties and function.

IV Plant Physiology (40 Periods)

Movement of water, food, nutrients and gases, Plants and Water Mineral nutrition, Respiration, Photosynthesis, Plant growth and development.

V Human Physiology (45 Periods)

Digestion and absorption.

Breathing and respiration.

Body fluids and circulation.

Excretory products and elimination.

Locomotion and movement.

Control and coordination.

Practicals

Time: 3 Hours	***Marks: 30***	***60 Periods***
1. Experiments and spotting		*20 marks*
2. Record of one investigatory project and Viva based on the project		*5 marks*
3. Class record and Viva based on experiments		*5 marks*
		30 marks

A. List of Experiments

1. *Study and describe three common flowering plants (Solanaceae, Fabaceae and Liliaceae).*
2. *Preparation and study of T.S. of dicot and monocot roots and stems (normal).*
3. *Study of osmosis by potato osmometer.*
4. *Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves).*
5. *Study of distribution of stomata in the upper and lower surface of leaves.*
6. *Comparative study of the rates of transpiration in the upper and lower surface of leaves.*
7. *Test for the presence of sugar, starch, proteins and fats. To detect them in suitable plant and animal materials.*
8. *Separate plant pigments through paper chromatography.*
9. *To study the rate of respiration in flower buds/leaf tissue and germinating seeds.*
10. *To study effect of different temperatures on the activity of salivary amylase on starch.*
11. *To test the presence of urea in urine.*
12. *To detect the presence of sugar in urine/blood sample.*
13. *To detect the presence of albumin in urine.*
14. *To detect the presence of bile salts in urine.*

B. Study/Observation of the following (spotting)

1. *Study parts of a compound microscope.*
2. *Study of the specimen and identification with reasons – Bacteria, Oscillatoria, Spirogyra, Rhizopus, mushroom, Yeast, liverwort, moss, fern, Pines, one monocotyledon and one cotyledon and one lichen.*
3. *Study of the specimen and identification with reasons – Amoeba, Hydra, Liverfluke, Ascaris, leech, earthworm, prawn, silkworm, honeybee, snail, starfish, shark, Rohu, frog, lizard, pigeon and rabbit.*
4. *Study of tissues, and diversity in shapes and sizes of plant and animal cells (e.g. palisade cells, guard cells, parenchyma, collencryma, sclerenchyma, Xylem, Phloem, Squamous epithelium, muscle fibers and mammalian blood smear) through temporary/permanent slides.*
5. *Study of mitosis in onion root tip cells and animals cells (grasshopper) from permanent slides.*
6. *Study of different modifications in root, stems and leaves.*
7. *Study and identify different types of inflorescences.*
8. *Study of imbibition in seeds/raisins.*
9. *Observation and comments on the experimental set up on:*
    a. *Anaerobic respiration*
    b. *Phototropism*
    c. *Apical bud removal*
    d. *Section due to transpiration*
10. *To study human skeleton and different types of joints.*
11. *Study of external morphology of earthworm of cockroach and frog through models.*

NEW SYLLABUS
BIOLOGY (THEORY)
FIRST YEAR P.U.C. I (2007-08)

PART I (BOTANY)		PART II (ZOOLOGY)	
TOPICS IN GENERAL BIOLOGY		TOPICS IN GENERAL BIOLOGY	
B.1 BIOSYSTEMATICS	2	Z.1 INTRODUCTION	3
B.2 CELL BIOLOGY	10	Z.2 BIOMOLECULES	4
TOPICS IN BOTANY		Z.3 ORIGIN OF LIFE & ORG. EVOLUTION	5
B.3 DIVERSITY OF LIFE ON EARTH			
KINGDOM MONERA	1	TOPICS IN ZOOLOGY	
KINGDOM PROTISTA	1	Z.4 DIVERSITY OF ANIMAL LIFE	12
KINGDOM MYCOTA	1	Z.5 ANIMAL TYPE STUDY	3
KINGDOM METAPHYTA	10	Z.6 ANIMAL RESOURCES	8
B.4 PLANT TAXONOMY & ECONOMIC BOTANY	3		
B.5 ELEMENTARY PLANT PATHOLOGY	2		
TOTAL			**70 HOURS**

(NOTE: The above distribution of chapters with corresponding teaching load is to facilitate setting of question papers in botany and zoology sections separately. However, the actual teaching programme for every week could be on the basis of one hour each for General Biology topics, Botany topics and Zoology topics as indicated above.)

PART I (BOTANY)
THEORY (35 hours)
I. GENERAL BIOLOGY TOPICS

B.1 BIOSYSTEMATICS — 2 Hours

1.1 Introduction – (a) Need, history and types of classification (Artificial, Natural and Phylogenetic)
(b) Species concept, Binomial nomenclature with example, Rules and advantages of binomial nomenclature.

1.2 Linnaean hierarchy – Kingdom to species with examples (*Cocos nucifera* and *Homo sapiens*).

1.3 The five-kingdom system of classification in detail – General characters of kingdom Monera, Protista, Mycota, Metaphyta and Metazoa.

B.2 CELL BIOLOGY — 10 Hours

2.1 CELL STRUCTURE (3 Hours)

2.1.1 Structure and functions of cell components – cell wall, plasma membrane (fluid mosaic model), endoplasmic reticulum, plastids (brief), mitochondria (brief), Golgi complex, Ribosomes, Lysosomes, Centrosome, vacuole and nucleus – nuclear envelope (nuclear pores and nuclear lamina) nucleoplasma, nucleolus and chromatin. A brief account of ergastic substances (mention about reserve food, secretory and extretory substances with examples).

2.1.2 Differences between plant cell and animal cell.

2.2 CHROMOSOMES (3 Hours)

2.2.1 Discovery, shape, size and number of chromosomes, Autosomes and allosomes: Karyotype and ideogram.

2.2.2 Chemical composition and function.

2.2.3 General structure – Concept of centromere (primary constriction), secondary constriction, satellite, kinetochore, telomere.

2.2.4 Types of chromosomes based on the position of centromere.

II. BOTANY TOPICS

B.3	DIVERSITY OF LIFE ON EARTH	18 Hours

3.1 **KINGDOM MONERA AND OTHER SIMPLE LIVING FORMS** (6 Hours)

3.1.1 PRIONS AND VIROIDS (0.5 Hour)

Concept of prions and viroids – definition, discovery, chemical nature with one example of disease each – Creutzfeldt-Jacob disease (CJD) and Potato spindle tuber disease (PSTV).

3.1.2 VIRUSES (2 Hours)

3.1.2.1 Introduction – living and non-living properties of viruses.

3.1.2.2 Types of viruses – Plant viruses, Animal viruses, Bacterial viruses, DNA viruses and RNA viruses (Only definitions with examples to include the following: Viral diseases in plants – Tobacco Mosaic, Cauliflower Mosaic, Potato Mottle, Leaf mosaic of tomato and Banana Bunchy Top; viral diseases in animals – Rabies, Dog distemper; Viral diseases in man – Japanese Encephalitis, Poliomyelitis, Hepatitis-B, Herpes, AIDS and Conjunctivitis).

3.1.2.3 Structure of T. Bacteriophage, multiplication of T. phage (Lytic cycle only).

3.1.3 BACTERIA (2.5 Hours)

3.1.3.1 Introduction

3.1.3.2 Classification of bacteria based on mode of nutrition (Heterotrophic bacteria – parasitic, saprophytic and symbiotic – and Autotrophic bacteria – photosynthetic and chemosynthetic; definition and one example for each group).

3.1.3.3 Ultrastructure of the bacterial cell.

3.1.3.4 Reproduction in bacteria – asexual reproduction by binary fission, endospore formation and sexual mechanism (genetic recombination in bacteria – transduction. transformation and conjugation with details of HFR conjugation only).

3.1.3.5 Importance of bacteria.

(a) Beneficial aspects – Scavenging, Fermentation, Retting, Antibiotics, Ecological importance, Importance in Genetic engineering and Importance in mineral extraction.

(b) Harmful aspects

Food spoilage and food poisoning.

Bacterial diseases – Brief and introductory information on the following diseases: Citrus canker, Anthrax, Cholera, Gastric ulcer, Tuberculosis and Syphilis (details of treatment are not required).

(c) A brief introduction on Archaea and their importance.

3.1.4 CYANOBACTERIA (1 Hour)

3.1.4.1 Introduction

3.1.4.2 Structure and reproduction of *Nostoc*.

3.1.4.3 Differences between bacteria and cyanobacteria.

3.1.4.4 Importance of cyanobacteria.

3.2 **KINGDOM PROTISTA** (1 Hour)

3.2.1 General characters.

3.2.2 Mentioning the following divisions with suitable examples.

Chrysophyta (Diatoms),Euglenophyta *(Euglena)* and Protozoa (to be studied in Zoology).

3.2.3 Taxonomic position of Algae with reference to the five-kingdom classification choosing the following example: Desmids (typical members of Protista) and *Spirogyra* (A member of metaphyta) are both included in division Chlorophyta (Green Algae).

3.2.4 Importance of Algae (in brief).

3.3. **KINGDOM MYCOTA** – The Fungi (1 Hour)

3.3.1 General characters of Fungi.

3.3.2 Mentioning divisions with suitable examples. Zygomycota - *Rhizopus;* Ascomycota - *Saccharomyces;* Basidiomycota - *Agaricus;* Duteromycota - *Cercospora.*

3.3.3 Importance of Fungi; A brief account of mushroom culturing (paddy straw mushroom culturing).

3.4 **KINGDOM METAPHYTA** (10 Hours)

3.4.1 BRYOPHYTA (1 Hour)

3.4.1.1 General characters of Bryophytes.

3.4.1.2 Mentioning classes with suitable examples - Hepaticopsida-*Riccia;* Anthocerotopsida - *Anthoceros;* Bryopsida - *Funaria.*

3.4.2 PTERIDOPHYTA (1 Hour)

3.4.2.1 General characters of Pteridophytes.

3.4.2.2 Mentioning classes with suitable examples: Psilotopsida - *Psilotum;* Lycopsida - *Selaginella;* Sphenopsida *Equisetum;* Pteropsida - *Nephrolepis*.

3.4.3 GYMNOSPERMS (1 Hour)

3.4.3.1 General characters of Gymnosperms

3.4.3.2 Mentioning classes with suitable examples - Cycadopsida – *Cyeas*; Conireropisda – *Pinus*; Gnetopisda - *Gnetum.*

3.4.4 ANGIOSPERMS (7 Hours)

3.4.4.1 General characters of Angiosperms – Typical dicotyledonous and monocotyledonous plants (*Brassica* & grass) and differences between dicotyledons and monocotyledons.

3.4.4.2 Study of the Angiosperm flower.

Technical terms used in description of flower – Actinomorphic, Zygomorphic, Unisexual, Bisexual, Pedicellate, Sessile, Bracteate, Ebracteate, Bracteolate, Ebracteolate, Homochlamydeous, Heterochlamydeous, Complete flower, Incomplete flower, Epigynous, Hypogynous and Perigynous flowers.

The parts of the flower:

(a) Accessory whorls:

(i) Concept of perianth.

(ii) Calyx - Polysepalous and Gamosepalous conditions with one example each.

(iii) Corolla - Polypetalous and Gamopetalous conditions.

(iv) Aestivation - definition and types – Valvate, Imbricate and Twisted types with one example each.

(b) Essential whorls:

(i) Androeclum - parts of a stamen, adelphy, syngeny, synandry and epipetaly, Anther lobes-monothecous and dithecous conditions with one example each.

(ii) Gynoecium - parts of gynoecium, concept of carpel, Types of gynoecium – apocarpous and syncarpous gynoecium.

Types of gynoecium based on number of carpels – monocarpellary, bicarpellary, tricarpellary and multicarpellary conditions. Nature of ovary of gynoecium with reference to locule – unilocular, bilocular, trilocular and multilocular conditions. Placentation - definition, types – marginal, axile, basal and parietal.

3.4.4.3 Internal structure of essential parts

(a) T.S. of mature anther and structure of the pollen grain (Microsporogenesis not needed)

(b) Structure of a mature anatropous ovule (Megasporogenesis not needed)

3.4.4.4 Pollination in Angiosperms

Definition, self and cross pollination, types (Autogamy, Allogamy, Geitonogamy, Xenogamy, Cleistogamy, Homogamy), Agents (Anemophily, Zoophily-Entomophily, Ornithophily and Hydrophily) with examples, (Pollination mechanisms net needed).

3.4.4.5 Fertilization in Angiosperms

Definition, a brief account of double fertilization and its significance (Embryogeny not required)

3.4.4.6 The Angiosperm fruit

Definition, types of fruits - Simple fruits - fleshy fruits (drupe and berry), Dry fruits (capsule, cypsela and cremocarp) and Pome (apple), Aggregate fruits - etaerio of follicles, Multiple fruits - Sorosis.

3.4.4.7 The Angiosperm seed

Concept of seed.

A typical dicotyledonous seed (Example: Bean seed)

A typical monocotyledonous seed (Example: Maize grain)

B.4	TAXONOMY AND ECONOMIC BOTANY	3 Hours

4.1 TAXONOMY (1.5 Hours)

4.1.1 An outline of classification system of Engler and Prantl.

4.1.2 Distinguishing characters and plants of economic interest of the following families of angiosperms:
Malvaceae - (Hibiscus, Cotton, Lady's finger).
Apocynaceae - (*Catheranthus roseus, Rauwolfia serpentlana, Plumeria alba and Nerium indicum*)
Musaeeae - (*Muso paradisiaca* and *Ravenala madagasccriensis*)

4.2 ECONOMIC BOTANY (1.5 Hours)

4.2.1 Introduction

4.2.2 Oil yielding plants – Groundnut and Sunflower.

4.2.3 Cereals and millets - Rice and Jowar.

4.2.4 Pulses - Pigeon pea and Bengal gram.

4.2.5 Medicinal plants - *Adathoda vasica, Ephedra gerard/ana, Dryopteris, Santa/um a/bum, Gymnema sylvestre, Ocimum sanctum, Phyllanthus emblica.*

4.2.6 Spices - Pepper, doves and cardamom. Beverages - Coffee, cocoa and tea.
(Mentioning scientific names, family. parts used and uses only).

B.5	ELEMENTS OF PLANT PATHOLOGY	3 Hours

Symptoms, etiology, type and nature of pathogens, and methods of control with reference to the following diseases:
i. Banana bunchy top
ii. Tikka disease of groundnut
iii. Crown gall (of any common dicot plant).

PART II (ZOOLOGY)
THEORY (35 hours)
III. GENERAL BIOLOGY TOPICS

Z.1	INTRODUCTION TO BIOLOGY	3 Hours

1.1 Definition of Biology and its main branches - Botany and Zoology.

1.2 Scope of Biology.

1.3 Branches of Biology (definitions only)

1.4 Classical branches – morphology, cytology, histology, anatomy, physiology, developmental biology, biosystematics, genetics, ecology, organic evolution and palaeontology.

1.3.2 Interdisciplinary branches – biophysics, biochemistry and biostatistics.

1.3.3 Applied branches and career prospects – agriculture, entomology, sylviculture, pathology, apiculture, microbiology and bioinformatics.

1.4 Role of biology in dispelling myths and disbeliefs.

Z.2	BIOMOLECULES	4 Hours

2.1 CARBOHYDRATES
Definition
Classification - monosaccharides (ribose, deoxyribose, glucose, fructose and galactose), oligosaccharides (maltose, sucrose and lactose) and polysaccharides (starch, glycogen, cellulose, pectin, chitin and agar agar). Biological significance.

2.2 PROTEINS
Definition
Classification - simple proteins (albumins, globulins, histones, actin, myosin and keratin), conjugate proteins - Chromoproteins (haemoglobin), glycoproteins (mucin of saliva), phosphoproteins (casein of milk) and lipoproteins (lipovitelline of egg yolk).
Biological significance of amino acids and proteins.

2.3 LIPIDS
Definition
Classification: Simple lipids - oils (vegetable oils and oils of animal origin), fats (butter) and waxes (bees wax), Compound lipids, phospholipids (lecithin and cephalin) and sphingolipids (cerebrosides), Related compounds - steroids (estrogen, progesterone and testosterone).
Biological significance.

2.4 ENZYMES

Definition, properties, classification based on functions.

Mode of action - induced fit theory of Koshland.

2.5 NUCLEIC ACIDS – Occurrence, basic chemical composition (nucleoside and nucleotide), mention of types (DNA and RNA) and functions (structural details are not required).

Z.3 ORIGIN OF LIFE AND ORGANIC EVOLUTION 5 Hours

3.1 ORIGIN OF LIFE (2 Hours)

3.1.1 Introduction.

3.1.2 Concept of abiogenesis and biogenesis (experimental evidences not required).

3.1.3 A.I. Oparin's Theory of chemical evolution of life (Views of Haldane and Sidney Fox to be mentioned).

3.1.4 Stanley Miller's experiment in support of chemical evolution.

3.2 ORGANIC EVOLUTION (3 Hours)

3.2.1 Introduction

3.2.2 Darwin's theory (DDT resistance in mosquitoes and industrial melanism in Peppered moth, to illustrate natural selection to be quoted as examples).

3.2.3 Brief account of Mutation theory.

3.2.4 NeoDarwinism –

Introduction, Darwinian concept vs NeoDarwinian concept (gene pool and gene frequency), Hardy - Weinberg law and sources of variations as evolutionary force - sexual reproduction, genetic drift, gene flow, mutation and isolation (reproductive and geographic).

IV. ZOOLOGY TOPICS

Z.4 DIVERSITY OF ANIMAL LIFE 12 Hours

4.1 Introduction.

4.2 Outline classification of kingdom Animalia (only the major phyla to be considered).

4.3 Major animal phyla:

4.3.1 Non-chordata (animals without backbone) - General characters and classification up to classes with suitable examples of the following phyla: Protozoa, Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca and Echinodermata.

4.3.2 (a) Chordata (Animals with backbone) - Fundamental characters and classification of chordata up to subphyla – Hemichordata, Urochordata, Cephalochordata and Vertebrata with suitable examples.

(b) Subphylum Vertebrata - Salient features with examples of

(i) Superclass Pisces: Class Chondreichthyes and Class Osteichthyes);

(ii) Superclass Tetrapoda: Amphibia, Reptilia, Aves and Mammalia.

(c) Differences between non-chordates and chordates.

(Note: (1) Outline classification as treated in 'A Manual of Zoology' Vol. I and Vol. II (1971) by Ekambarantha Ayyar.

(2) Salient features of classes of Invertebrate phyla not to be given]

Z.5 TYPE STUDY: COCKROACH – *Periplaneta* sp. 3 Hours

5.1 Morphology (Structure of head capsule and compound eye not required), Digestive and nervous systems.

Z.6 ANIMAL RESOURCES 8 Hours

6.1 SERICULTURE

6.1.1 Definition.

6.1.2 Main aspects - moriculture, rearing of silkworms and reeling.

6.1.3 Brief account of moriculture: definition, methods (row and pit systems) and its importance.

6.1.4 Types of silk - mulberry and non-mulberry (Tasar, Eri and Muga)

6.1.5 Diseases of mulberry silkworm· Pebrine, Muscardine or Calcino, Flacherie and Grasserie (Listing of diseases and causative organisms only).

6.2 AQUACULTURE

6.2.1 Definition.

6.2.2 Areas - fin fisheries and shellfisheries.

6.2.3 Pisciculture: definition, capture fisheries and culture fisheries.

6.2.4 Inland fisheries - procedure.

6.2.5 Monoculture, monosex culture and polyculture (composite fish farming) - meaning with examples.

6.3 DAIRY

6.3.1 Definition.

6.3.2 Types of indigenous cattle with examples based on utility – draught, milching and dual purpose (Cow breeds – Sindhi, Sahiwal, Amrithmahal, Hallikar, Ongole and Haryana: Buffalo breeds – Murrah, Surti, Mehsana and Nagpuri).

6.3.3 Examples of high yielding exotic breeds (Holstein, Red Dane, Jersey and Brown Swiss).

6.3.4 Nutritive value of milk.

6.3.5 Utility of cattle - biogas, leather, gelatin and organic manure.

6.4 POULTRY

6.4.1 Definition

6.4.2 Types of indigenous fowls with examples based on utility. layers, broilers and dual purpose (Aseel, Chittagong, Ghagus, Basra and Kadaknath).

6.4.3 Examples of exotic breeds (White Leghorn, Cornish, Rhode Island, Red Plymouth Rock and New Hampshire).

6.4.4 Giriraj - origin and salient features.

6.4.5 Nutritive value of egg.

6.4.6 Diseases (Respiratory mycoplasmosis, Fowl pox candidiasis, Raniketh and Fowl cholera) - Mentioning of diseases and causative organisms only

65 VERMICULTURE

Definition and procedure.

Vermicompost - degradation of organic wastes and role of Earthworm in soil fertility.

I. PRE-UNIVERSITY BIOLOGY PRACTICALS
PART I (BOTANY)

BP-I INTRODUCTION AND STUDY OF MONERA

(a) Study of microscopes - simple and compound and their use.

(b) Observation and identification of examples belonging to the following groups:

(i) Viruses - e.g., Any virus - infected plant such as mosaic infected bean plant.

(ii) Bacteria - Gram stained lactobacilli; an example of bacterial disease of plants such as Citrus canker.

(iii) Cyanobacteria - Permanent slide of *Nostoc*.

BP-II STUDY OF GENERAL CHARACTERS AND IMPORTANT EXAMPLES OF THE FOLLOWING GROUPS

(a) Algae - Chlorophyta - e.g., *Spirogyra.*

(b) Fungi - Basidiomycetes - e.g., *Agaricus.*

(c) Bryophyta - e.g., *Riccia* - thallus.

(d) Pteridophyta - e.g. *Nephrolepis* - Plant body.

(e) Gymnosperms - e.g., *Cycas* - plant body, sporophylls and seed (external study only).

BP-III ANGIOSPERMS

(a) A typical plant body of a dicot (Brassica or any other commonly available plant) and a monocot (grass plant) - General description of the vegetative plant body.

(b) Leaf and its modifications in the following examples:

(i) Simple leaf (*Hibiscus*)

(ii) Pinnately compound leaf (*Cassia*)

(iii) Palmately compound lef (*Oxalis*)

(iv) Phyllotaxy - Alternate leaves (*Hibiscus*), Opposite leaves (*Vinca*) and Whorled leaves (Nerium)

(v) Insectivorous leaf (*Drosera or* Nepenthes) - either specimen or photograph.

(vi) Propagation through leaves (*Bryophyllum*)

BP-IV ANGIOSPERMS – THE FLOWER (e.g. *Hibiscus*)

Study of an angiosperm flower to learn the following skills:

(a) To make a technical description of a flower.

(b) To prepare and mount a T.S. of the ovary and to mount a single stamen.

(c) To derive the floral diagram and floral formula of a flower.

BP-V ANGIOSPERMS – THE INFLORESCENCE

Study of the following types of inflorescence:

(a) Racemose types - Simple raceme (*Crotalaria*), Spike *(Achyranthes),* Compound spadix *(Cocos nucifera)* and Capitulum *(Tridax)*

(b) Cymose types - Solitary cyme *(Hibiscus),* Helicoid cyme *(Hamelia),* Dichasial cyme (*Jasminum or Clerodendrum)* and Palychasial cyme *(Calotropis).*

(c) Special types· Cyathium (*Euphorbia)* and Hypanthodium (Ficus).

BP-VI ANGIOSPERMS – THE FRUIT AND THE SEED

(a) Types of fruit: Cypsela (Sunflower), Legume (Bean), Capsule (Lady's finger), Berry (Tomato), Drupe (Mango or coconut), Aggregate of follicles *(Michelia),* Sorosis (Jack), Syconus *(Ficus)* and Pome *(Apple).*

(b) Types of seed: Dicotyledonous and exalbuminous seed (Bean) and monocotyledonous and albuminous seed (Maize).

BP-VII ANGIOSPERMS – TAXONOMY

Study of any one member of each of the following families with reference to distinguishing features, floral diagram and floral formula.

(a) Malvaceae (Example suggested: Hibiscus *rosa-sinensis).*

(b) Apocynaceae (Example suggested: *Vinca rosea*)

(c) Musaceae (Example suggested: *Musa* sp)

BP-VIII CYTOLOGY

(a) Study of plant cells in a peeling of onion or tomato pulp

(b) Observation of slides of onion root tip squash (either fresh preparation or permanent slide) to study the following stages of mitosis: (i) Prophase (ii) Metaphase (iii) Anaphase (iv) Telophase.

SUGGESTED ACTIVITY: A comparative study of appearance of bacteria through light microscope, transmission electron microscope and scanning electron microscope using photographs of some common microbe such as *Escherichia coli.*

PART II (ZOOLOGY)

ZP-I MICROSCOPIC OBSERVATION

Observation of culture particularly for *Paramecium* (permanent slide also to be observed) and identification of other microorganisms with the aid of books and making their drawings.

ZP-II ANIMAL TAXONOMY

(a) Protozoa - *Amoeba* and *Euglena*.

(b) Porifera· Sycon.

(c) Coelenterata – Hydra, *Aurelia* and A*straea* (stony coral).

ZP-III ANIMAL TAXONOMY

(a) Platyhelminthes - *Planaria* and Tapeworm

(b) Nematoda - *Ascaris* (male and female)

(c) Annelida - Earthworm and Leech.

ZP-IV ANIMAL TAXONOMY

(a) Arthropoda - Prawn *(Palaeman orPenaeus),* Scorpion and Millipede.

(b) Mollusca - *Unio* and Octopus.

(c) Echinodermata - Starfish.

ZP-V ANIMAL TAXONOMY

(1) Chordata - Pisces - Shark and Carp.

(2) Chordata - Amphibia - *Bura* (Toad)

ZP-VI ANIMAL TAXONOMY

(a) Chordata -Reptilia - Chamaeleon.

(b) Chordata - Aves - Pigeon.

(c) Chordata - Mammalia - Bat.

ZP-VII LIFE CYCLE OF SILKMOTH (*Bombyx mori*)

Adult moth (male and female), silkworm, cocoon and pupa.

ZP-VIII DISSECTION OF COCKROACH

(a) Digestive system

(b) Nerve cord.

II YEAR PREUNIVERSITY SYLLABUS (2007-08)

BIOLOGY: PART I (BOTANY)

THEORY (37 hours)

I GENERAL BIOLOGY TOPICS

B.1 MOLECULAR BIOLOGY (6 HOURS)

1.1 NUCLEIC ACIDS

1.1.1 DNA – Occurrence, DNA as the genetic material (with the experiment of Avery as evidence), chemical composition, structure (Watson-Crick model), Semiconservative method of replication.

1.1.2 RNA – Occurrence, chemical composition, brief account of structure and functions of genetic RNA, rRNA, mRNA and tRNA (clover-leaf model).

1.2 THE GENE, THE GENETIC CODE AND GENETIC CONTROL OF PROTEIN SYNTHESIS – Concept of gene (prokaryotic and eukaryotic), genetic code and its characteristics, genetic control of protein synthesis (transcription and translation) and Lac operon concept.

B.2 BIOTECHNOLOGY (8 HOURS)

2.1 INTRODUCTION (1 HOUR) Scope of biotechnology

2.2 GENETIC ENGINEERING (1 HOUR)

Introduction: Tools used in genetic engineering – Vectors (plasmid pUC18), Enzymes (REN and Ligase), Host cell (*E. coli*) and Bioreactors.

2.3 RECOMBINANT DNA TECHNOLOGY AND ITS APPLICATIONS (1 HOUR)

Insulin synthesis to be used as an example.

2.4 A BRIEF ACCOUNT OF: (1.5 HOURS)

a) DNA fingerprinting b) Gene therapy

c) Human genome project d) Monoclonal antibodies

2.5 IMPROVEMENT OF CROP PLANTS (1.5 HOURS)

Breeding techniques: Tissue culture technique – organ culture e.g.: stem ; transgenic plants e.g.: Golden rice.

2.6 IMPROVEMENT OF ANIMALS (1.5 HOURS)

Breeding techniques and stem cell culture, transgenic animals e.g.: Cattle.

2.7 HAZARDS AND SAFEGUARDS OF GENETIC ENGINEERING

(0.5 HOUR)

II BOTANY TOPICS

B.3 PLANT HISTOLOGY AND ANATOMY (5 HOURS)

3.1 INTRODUCTION: Definition and general classification of plant tissues.

3.2 MERISTEMS (1 HOUR)

Definition, structure and classification based on position, origin and function (theories on apical organization not required).

3.3 PERMANENT TISSUES (3 HOURS) – Distribution, structure and functions of:

3.3.1 Simple tissues: Parenchyma (Chlorenchyma and Aerenchyma), Collenchyma (angular, lacunar and lamellar) and Sclerenchyma – Fibres (Intraxylary and Extraxylary), Sclereids (Macrosclereids, Brachysclereids, Astrosclereids and Osteosclereids)

3.3.2 Complex tissues: Xylem and Phloem

3.4 Definition of the terms: Primary and secondary vascular tissues, exarch xylem, endarch xylem, collateral conjoint open and collateral conjoint closed vascular bundles, radial arrangement of vascular tissues.

3.5 SECONDARY GROWTH IN DICOT STEM (1 HOUR)

(This part shall be taught only after studying primary structure) – intrastellar and extrastelar secondary growth.

PLANT PHYSIOLOGY

B.4 WATER RELATIONS OF PLANTS (7 HOURS)

4.1 FUNDAMENTAL CONCEPTS (2 HOURS)

4.1.1 Importance of water to plants.

4.1.2 Significance and definitions of the following: Imbibition, Diffusion, Osmosis, Endosmosis, Exosmosis, Plasmolysis, Deplasmolysis, Turgor pressure, Wall pressure, Osmotic pressure (Concept of DPD not to be introduced).

4.1.3 Water potential and its components.

4.2 ABSORPTION OF WATER (1 HOUR)

4.2.1 Structure of root hair.

4.2.2 Sources of water for plants (available water and non-available water).

4.2.3 Region of absorption of water in plants.

4.2.4 Entry of water from soil into xylem of root.

4.2.5 Active and passive absorption of water (active absorption to show osmotic and non-osmotic processes).

4.3 ASCENT OF SAP (1 HOUR)

4.3.1 Definition and evidences to show the involvement of xylem (the Balsam plant experiment).

4.3.2 Composition of xylem sap.

4.3.3 Transpiration pull theory – merits and demerits.

4.4 LOSS OF WATER IN PLANTS (2 HOURS)

4.4.1 TRANSPIRATION

4.4.1.1 Definition and types.

4.4.1.2 Structure of a typical stomatal apparatus (dicot example only).

4.4.1.3 Mechanism of stomatal movement – Steward's Starch hydrolysis theory and K^+ pump theory.

4.4.1.4 Factors influencing the rate of transpiration (external).

4.4.1.5 Significance of transpiration.

4.4.1.6 A brief note on antitranspirants.

4.4.2 GUTTATION

A brief account of guttation – occurrence, causes and structure of hydathode.

4.5 TRANSLOCATION OF SOLUTES (1 HOUR)

4.5.1 Definition and evidences in support of involvement of phloem in the process (Girdling experiment and Tracer method).

4.5.2 Composition of phloem sap.

4.5.3 Munch's mass flow hypothesis with merits and demerits.

4.5.4 Vein loading.

B.5 BIOENERGETICS (8 HOURS)

5.1 INTRODUCTION (1 HOUR)

Light as the source of energy and ATP as energy currency.

5.2 PHOTOSYNTHESIS (3.5 HOURS)

5.2.1 Definition.

5.2.2 Ultrastructure of the chloroplast

5.2.3 Photosynthetic pigments and their role; composition of photosystems I and II. (Molecular structures and formulae not required).

5.2.4 Mechanism – light reaction – cyclic and noncyclic photophosphorylations; Dark reaction (C_3 pathway – Calvin cycle) – (details of regeneration steps not required); C_4 pathway and CAM (definition and examples only).

5.2.5 Influence of external factors on photosynthesis: Blackman's law of limiting factors.

5.2.6 Significance of photosynthesis.

5.3 RESPIRATION (3.5 HOURS)

5.3.1 Definition and types (aerobic and anaerobic).

5.3.2 Ultra structure of mitochondrion.

5.3.3 Mechanism of aerobic respiration – Glycolysis, Krebs cycle and Terminal oxidation.

5.3.4 Anaerobic respiration – Mechanism of fermentation in the presence of yeast and lactic acid bacteria.

5.3.5 Role of external factors, respiratory quotient (RQ) and its significance and Pasteur effect.

B.6 GROWTH AND GROWTH REGULATORS IN PLANTS (3 HOURS)

6.1 GROWTH (1 HOUR)

Definition, regions of growth, phases of growth and growth curve.

6.2 GROWTH REGULATORS (2 HOURS)

6.3 Definition.

6.4 Role of the following plant hormones (Details of experiments on discovery of hormones not required):

i. Auxins

ii. Gibberellins

iii. Cytokinins

iv. Abscissic acid

v. Ethylene

6.2.3 Synthetic growth regulators and their applications (with reference to IAA, IBA, NAA, 2,4-D, BAP and Ethephon).

BIOLOGY: PART II (ZOOLOGY)

THEORY (38 HOURS)

III GENERAL BIOLOGY TOPICS

Z.1 GENETICS (6 HOURS)

1.1 MENDELIAN GENETICS (2 HOURS)

1.1.1 Mendel and his work.

1.1.2 Definitions of the following terms: Allele, Phenotype, Genotype, Homozygous and Heterozygous.

1.1.3 Principles of inheritance: unit characters, dominance, law of segregation (purity of gametes) and law of independent assortment.

1.1.4 Monohybrid cross, Dihybrid cross and Test cross.

1.2 DEVIATIONS FROM MENDELIAN LAWS (3 HOURS)

1.2.1 Incomplete dominance: E.g.: Flower colour in *Mirabilis jalapa*.

1.2.2 Multiple allelism: E.g.: ABO blood groups and their inheritance in man; Blood typing; Rh factor with a not eon erythroblastosis faetalis.

1.2.3 Sex linked inheritance in man: E.g.: Inheritance of colour blindness and hypertrichosis in man.

1.3 GENETIC DISORDERS IN MAN (1 HOUR)

1.3.1 Chromosomal disorders – Down's syndrome, Klinefelter's syndrome, Turner's syndrome and Cri-du-Chat syndrome.

1.3.2 Gene disorders – Sickle cell anemia; haemophilia.

Z.2 BIODIVERSITY (8 HOURS)

2.1 DEFINITION AND TYPES (1 HOUR)

Ecosystem or habitat diversity, Species diversity and Genetic diversity.

2.2 BIODIVERSITY PROFILES OF INDIA AND KARNATAKA (1.5 HOURS)

Species diversity, Endemic species, Threatened species and Endangered species.

2.3 BENEFITS OF BIODIVERSITY (1 HOUR)

2.3.1 Economic: Traditional crop varieties and lesser known plants and animals of food value, medicinal plants . . . harvested from wild habitat.

2.3.2 Ecological / Social – For controlling soil–water regimes and hydrology, for efficient organic residue management and soil fertility management.

2.3.3 Ethical – Cultural, Spiritual and Religious belief systems centred around the concept of sacred species, sacred groves and sacred landscapes.

2.3.4 BIODIVERSITY DEPLETION (1 HOUR)

Anthropocentric causes – urbanization, expansion of agriculture, deforestation, pollution, acidification of soil and water, mining activities, desertification and loss of soil fertility.

2.5 INTELLECTUAL PROPERTY RIGHTS (0.5 HOUR)

Patenting life forms.

2.6 CONCEPT OF ECOSYSTEM SUSTAINABILITY (2 HOURS)

Conservation of natural resources based on traditional ecological knowledge (TEK):

2.6.1 Conservation of water-rain water harvesting and watershed management.

2.6.2 Conservation of soil – Prevention of soil erosion and maintenance of soil fertility; methods of soil conservation.

2.6.3 Conservation of forests – Afforestation and maintenance of biosphere reserves.

2.6.4 Conservation of wild life – i. Setting up of national parts, sanctuaries, bioreserves and zoos ii. Habitat improvement.

2.7 GLOBAL ISSUES (1 HOUR)

Concept, causes, effects and control measures of the following:

2.7.1 Global warming and greenhouse effect.

2.7.2 Ozone layer depletion.

2.7.3 Acid rain.

2.7.4 Nuclear winter.

IV ZOOLOGY TOPICS

Z.3 MAN IN HEALTH AND DISEASES (18 HOURS)

3.1 CONCEPT OF HOMEOSTASIS – THE CENTRAL DOGMA IN PHYSIOLOGY (1 HOUR)

3.1.1 Definition

3.1.2 Meaning of internal environment.

3.1.3 Factors to be kept constant to achieve homeostasis

3.1.4 An example to illustrate homeostasis – regulation of blood glucose level by liver and pancreas through negative feedback

3.1.5 A note on Diabetes mellitus.

3.2 BODY DEFENCE AND IMMUNITY (2 HOURS)

3.2.1 Introduction

3.2.2 Nonspecific body defences: a) Surface barriers b) Cellular and biochemical defences: phagocytosis, natural killer cells, interferons and inflammatory response.

3.2.3 Specific body defences (immunity): Antigen and antibody, role of B and T lymphocytes.

3.2.4 Types of immunity: Active (infection and vaccination) and Passive (from mother and immune serum γ-glubulins).

3.3 DIGESTION (3 HOURS)

3.3.1 Gross anatomy of human digestive system (structure of tooth not required).

3.3.2 Components of food (concept of balanced diet).

3.3.3 Physiology of digestion of carbohydrates, proteins and fats.

3.3.4 Disorders: Causes, symptoms and prevention of hyperacidity and ulcer, jaundice and its types and hepatitis.

3.4 CIRCULATION (3 HOURS)

3.4.1 Introduction

3.4.2 Gross anatomy of the human heart.

3.4.3 Mechanism of working of heart – cardiac cycle, stroke volume, cardiac output, complete double circulation.

3.4.4 Origin and conduction of heart beat.

3.4.5 Mechanism of blood clotting (Best and Taylor theory).

3.4.6 Blood pressure – hypotension and hypertension.

3.4.7 Disorders – causes and symptoms of myocardial infarction and cyanosis.

3.5 RESPIRATION (3 HOURS)

3.5.1 Gross anatomy of human respiratory system.

3.5.2 Mechanism of respiration:

i. Breathing (inspiration and expiration)

ii. External respiration (exchange of oxygen and carbon dioxide between alveoli and blood).

iii. Internal respiration (exchange of oxygen and carbon dioxide between blood and body cells).

iv. Cellular respiration (to be taught under the topic B.5 'bioenergetics').

3.5.3 Disorders: Rhinitis, Asthma and bronchogenic carcinoma.

3.5.4 Artificial breathing.

3.6 EXCRETION (2 HOURS)

3.6.1 Introduction.

3.6.2 Gross structure of nephron.

3.6.3 Physiology of urine formation.

3.6.4 Chemical composition of urine.

3.6.5 Disorders: a. Renal failure – acute and chronic

b. Renal calculi.

3.6.6 Kidney replacement therapy: a brief note on dialysis (haemodialysis and continuous ambulatory peritoneal dialysis) and kidney transplantation.

3.7 NERVOUS SYSTEM (4 HOURS)

3.7.1 Components – CNS, PNS and ANS.

3.7.2 Human brain – structure (sagittal section only) and functions (functional areas of cerebrum not required).

3.7.3 Human spinal cord – structure and functions.

3.7.4 Meaning of reflex arc and reflex action.

3.7.5 A brief study of the endocrine functions of the pituitary.

3.7.6 Disorders: Meaning, causes and symptoms of epilepsy, Parkinson's disease, Alzheimer's disease and Huntington's chorea.

3.7.7 Alcoholism and its effects.

3.7.8 Narcotic drugs – meaning, listing of types (stimulants, depressants, analgesics and hallucinogens) and their effects. Drug abuse and addiction, Efforts to counter alcoholism and drug menace.

Z.4 CONTINUITY OF LIFE (6 HOURS)

Part A Developmental biology (Basics of sexual reproduction)

4.1 GAMETOGENESIS

4.1.1 Spermatogenesis – formation of spermatids and spermiogenesis (details of spermiogenesis are not required).

4.1.2 Ultrastructure of human sperm.

4.1.3 Oogenesis

4.1.4 Generalized structure of ovum.

4.2 FERTILIZATION

4.2.1 Definition

4.2.2 Types – external and internal

4.2.3 Mechanism

4.2.4 Significance

4.3 EARLY DEVELOPMENT OF FROG

4.3.1 Structure of egg

4.3.2 Cleavage

4.3.3 Blastulation

4.3.4 Gastrulation

4.3.5 Derivatives of primary germ layers.

Part B Human Reproduction

4.4. A BRIEF ACCOUNT OF

4.4.1 Fertilization

4.4.2 Implantation

4.4.3 Placenta

4.4.4 Role of gonadotropins and sex hormones in males and females (meaning of menstrual cycle to be highlighted).

4.5 FERTILITY CONTROL

4.5.1 Need for fertility control.

4.5.2 Survey of family planning methods: Spacing methods (Barriers, IUDs, Hormonal and Physiological) and Terminal methods (Tubectomy and Vasectomy).

4.6 INFERTILITY CONTROL

4.6.1 Meaning and causes of infertility in males and females.

4.6.2 Remedial methods (Assisted conception methods) – IVF, ET, GIFT and ZIFT (details of GIFT and ZIFT not required).

4.7 SEXUALLY TRANSMITTED DISEASES

Meaning, causative organisms, mode of infection, symptoms and preventive measures of gonorrhoea, syphilis and AIDS.

BIOLOGY CLASS XI (NCF, 2005, Vol. II)

I. *Diversity in Living World*

Diversity of living organisms.

Classification of the living organisms (five kingdom classification, major groups and principles of classification within each kingdom).

Systematics and binomial system of nomenclature.

Salient features of animal (non-chordates upto phylum level, and chordates up to class level) and plant (major groups; Angiosperms up to subclass) classification.

Botanical gardens, herbaria, zoological parks and museums.

(Periods 25)

Practicals

Study the large variation of living organisms in the neighbourhood, note their behaviour, characteristics, and categorize them into groups based on some common features. Study preserved specimens, at least one representative of each group, to understand correlations between the characteristics of organisms and their systematic position. Learn how to collect, press, dry and prepare plant specimens with labels (common and weedy species) for the herbarium/museum.

II. *Structural Organisation in Animals and Plants*

Tissues in animals and plants.

Morphology, anatomy and functions of different parts of flowering plants; Root, stem, leaf, inflorescence, flower, fruit and seed.

Morphology, anatomy and functions of different systems of an annelid (earthworm), an insect (cockroach) and an amphibian (frog).

(Periods 30)

Practicals

Study different types of tissues in plants and animals (temporary preparations and permanent slides). Prepare and study transverse section of roots and stems to identify different tissues. Study of locally available plants and animals for their external morphology. Description of three common flowering plants in semi-technical terms (Solanaceae, Fabaceae and Liliaceae) and try to group them based on flower characteristics. Study the anatomy of roots, stems (through hand sections) and leaves (through permanent slides). Study of one vertebrate and one invertebrate for their morphology and internal organisation (through charts and models).

III. *Cell: Structure and Function*

Cell: Cell wall, cell membrane and cell organelles (plastids, mitochondria, endoplasmic reticulum, Golgi bodies / dictyosomes, ribosomes, lysosomes, vacuoles, centrioles) and nuclear organisation.

Mitosis, meiosis, cell cycle.

Basic chemical constituents of living bodies.

Structure and functions of carbohydrates, proteins, lipids and nucleic acids.

Enzymes: Types, properties and function.

(Periods 40)

Practicals

Observe suitable animal and plant cells (sections and smears) to highlight similarities and differences. Study of mitosis in onion root tip and animal cells (permanent slides). Test for carbohydrates (glucose and starch), proteins and fats, and

their detection in suitable plant and animal materials. Study the activity of the enzyme amylase / trypsin / papain (using milk powder as substrate).

IV. *Plant Physiology*

Movement of water, food, nutrients and gases.

Plants and water.

Mineral nutrition.

Respiration.

Photosynthesis.

Plant growth and development.

(Periods 40)

Practicals

Demonstrate requirement of chlorophyll and light for photosynthesis. Separate plant pigments using paper chromatography. Study rate of respiration in different plant materials. Demonstrate anaerobic respiration. Study transpiration in plants using Cobalt Chloride method. Study imbibition of water by seeds or raisins. Study plasmolysis and osmosis. Study the effect of apical bud removal on plants.

V. *Human Physiology*

Digestion and absorption.
Breathing and respiration.
Body fluids and circulation.
Excretory products and elimination.
Locomotion and movement.
Control and coordination.

(Periods 45)

Practicals

Study diversity of foot habits in different parts of the country and discuss the sources of carbohydrates, proteins, fats and other nutrients. Test different food items for macro-nutrients. Effect of temperature and pH on activity of salivary amylase. Study of permanent slides of human blood cells. Testing urine for urea and sugar. Study of the human skeleton, types of joints.

3.3 Samples

Six schools/colleges were selected from Mysore (Urban) for this study based on their proximity to the Institute, the syllabi and PUC I/II or XI/XII standard level teaching. The schools/colleges were:

1. Jagadguru Shivrathreeshwara Samsthe College, Saraswathipuram – PUC I
2. Jagadguru Shivrathreeshwara Samsthe College, Saraswathipuram – PUC II
3. Sadvidya College – PUC I, II levels
4. Kendriya Vidyalaya – XI and XII standards
5. Sharada Vilas – PUC I, II levels
6. Demonstration Multipurpose School, RIEM – XI and XII standards

Care was taken to assure that the both CBSE as well as State schools were included among the selected schools; that the schools taught XI and XII standard syllabi and the colleges had Pre-University Level Teaching (viz. PUC I and PUC II levels syllabi).

Sample consisted of six groups pertaining to 6 institutes taken for study were as follows:

Table 1: Sample size for the study

School/ College	Syllabus	XI/PUC I		XII/PUC II		Staff
		QI	QII (IS)	QI	QII (IS)	
1.JSS I	State	22	22			1
2.JSS II	State			32	32	1
3.Sadvidya	State			33	33	2
4.Sharada Vilas	State			31	31	2
5.Kendriya Vidyalaya	CBSE	22			29	1
6. DMS	CBSE	20			18	4
				10		

Sample size varied from 20-35 students per class.

3.4 Variables

Variables selected for the study were the syllabi (NCERT/CBSE/State Syllabi); the levels of learning (XI/XII standard or PUC I/PUC II) and the gender (Boys/Girls).

Variables are the conditions or characteristics that the experimenter manipulates, controls or observes.

The independent variables are conditions or characteristics that the experimenter manipulates or controls in her attempt to ascertain their relationship to observed phenomena and here it is the NCERT, CBSE and State syllabi, gender or sex and levels of learning i.e. XI or XII standard and PUC I and PUC II levels.

The dependent variables are the conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes independent variables and here in this study it is the scores or percentage attainment of life skills and Minimum Levels of Learning (MLL).

3.5 Tools and their construction, administration and scoring

Data were gathered using three types of tools, viz. the evaluation tool, check-list tool and questionnaires. Totally eight tools were constructed (Refer Appendix). Wherever there were constraints on planning the questionnaire only few topics were chosen for tool preparation as in I PUC Questionnaire.

1. Evaluation Tool: This was prepared based on the life skills to be looked for in the XI standard textbooks and was used to screen or analyse the textbooks for life skills incorporated. Using the evaluation tool, the space given in curriculum for life skills

was studied along with the extent to which projects or activities or experiments are built into the curriculum. (Appendix Tool 1)

2. Check lists: For surveying skills in textbooks three checklists were prepared using the evaluation tool. These checklists were used to prepare the questionnaire tool (Appendix Tools 2, 3, 4).

3. Questionnaire: Questions were selected from the checklists or topics were selected directly from the XI standard textbook (I & II PUC and NCERT Texts) and framed into questions based on the life skills required to answer a specific question. Each question was answered in steps with each step constituting a learning level with yes/no options to be attempted by the students. The questionnaire was made using constructivistic approach and consisted of several life-skill based questions culled out from the textbooks and split into various learning levels to be answered by the students. Scale of learning process was developed by assigning numerical weightage to each learning level. The numerical weightage was totaled up to get maximum score (Appendix Tools 5, 6, 7).

For e.g., the question is "How does food reach different parts of the human body?" – this is a life skill based question requiring problem-solving skill. The student solves the problem constructively as follows through the following process in which each step is a learning level and is given numerical weightage accordingly (i.e. according to the learning level).

Learning levels	Step-wise process	Numerical weightage (Score)
LL-1	Food is ingested.	1
LL-2	Food is chewed by the teeth.	2
LL-3	Food is mixed by muscular action of tongue.	3
LL-4	Food enters stomach through peristaltic movements of food-pipe.	4
LL-5	Food is digested by HCl, pepsin and other intestinal juices.	5
LL-6	Food results in the formation of chyme.	6
LL-7	Villi of the intestine absorb directly the brokendown products of food.	7
LL-8	The food is directly assimilated into the blood.	8
LL-9	Food products reach the different parts of the body through the circulatory system.	9
Maximum score		45

'Yes' was scored as 1, 'No' as 0 and 'No response' as 2. The scores for each questions and its learning levels were entered in an excel worksheet and subjected to statistical analysis. Four separate questionnaires were prepared – 1 for DMS/KV (Central), 1 for I PUC (State) and 1 for II PUC (State) and the fourth one was an interview schedule common to all levels.

4. Interview Schedule (Questionnaire)

This was a questionnaire tool (see Appendix Tool 8). The tool was prepared based directly on the WHO life skills (1994) and their definitions and interpretations. Ten major life skills and their constituent subskills were included. Each definition of life skill/sub-skill was framed into a question to be answered by the students. The schedule aimed at assessing the extent to which life skills were already attained by the students who had passed out from XI standard or I PUC or who were on the verge of completion of XI standard/I PUC. Therefore these were intended for II PUC or XII standard but have been administered to the XI standard or I PUC at the term-end

wherever necessary due to lack of availability of XII/II PUC samples. This schedule has been administered to the XI/I PUC students as well. Prior to the administration of the schedule the students were briefed about the WHO skills and their growing importance.

Tools 5, 6 and 7 were labelled questionnaire I (QI) for all practical purposes as these were textbook content based and Tool 8 was labelled as Questionnaire II (QII) as this was life-skill based. Both the questionnaires (QI and QII) were administered to all the six schools or PU colleges.

Though the textbook analysis was to be on XI standard students, wherever there were constraints on availability of XI standard or I PUC students, these were administered to the II PUC students based on the fact that they have just passed out from I PUC.

The time allotted was one hour for questionnaire I which was solely textbook content based and 45 mins for the Interview schedule which was purely life skill based. The QI was to test achievement of life skills already incorporated in the textbooks and the QII was for overall achievement of 10 WHO life skills. The table below gives an overview of sample (including staff), variables and tools (table 2).

Table 2: List of Sample and Variables and Tools administered

Sl. No.	Name of School/ College	Variable 1 Syllabi State/CBSE/ NCERT	Variable 2 Level XI/XII	QI/QII	Variable 3		No. of staff for tool validation
					No. of boys	No. of girls	
1	Kendriya Vidyalaya	CBSE	XII	XII	3	26	1
2	Kendriya Vidyalaya	CBSE	XI	I	10	12	
3	Sarada Vilas	State	I PUC	II	31	-	2
4	Sarada Vilas	State	I PUC	I	30	1	
5	Sadvidya	State	II PUC	II	11	20	2
6	Sadvidya	State	II PUC	I	7	20	
7	DMS	NCERT	XI	I	13	7	4
8	DMS	NCERT	XII	II	10	8	
9	DMS	NCERT	XII	I	5	5	
10	JSS I	State	I PUC	I	-	21	2
11	JSS I	State	I PUC	II	-	22	
12	JSS II	State	II PUC	I	-	32	
13	JSS II	State	II PUC	II	1	31	

3.6 Data Entry

DMS XI

QI On an excel sheet, responses given by 27 students were recorded as 281 learning levels for the entire questionnaire.

DMS XII

Q.I On an excel sheet responses given by 10 students were recorded as 281 learning levels for the questionnaire as a whole.

DMS XII

Q.II On an excel sheet, responses given by 20 students were recorded as 96 learning levels for the questionnaire as a whole.

JSS PUC I

Q.I On an excel sheet, responses given by 22 students were recorded as 79 learning levels for the questionnaire as a whole.

JSS PUC I

Q.II On an excel sheet, responses given by 23 students were recorded as 96 learning levels for the questionnaire as a whole.

JSS PUC II

Q.I On an excel sheet, responses given by 33 students were recorded as 446 learning levels for the questionnaire as a whole.

JSS PUC II

Q.II On an excel sheet, responses given by 33 students were recorded as 98 learning levels for the questionnaire as a whole.

KV I

Q.I On an excel sheet, responses given by 23 students were recorded as 281 learning levels for the questionnaire as a whole.

KV II

Q.I On an excel sheet, responses given by 30 students were recorded as 92 learning levels for the questionnaire as a whole.

Sadvidya

Q.I On an excel sheet, responses given by 33 students were recorded as 446 learning levels for the questionnaire as a whole.

Sadvidya

Q.II On an excel sheet, responses given by 33 students were recorded as 96 learning levels for the questionnaires as a whole.

Sharada Vilas

Q.I On an excel sheet, responses given by 33 students were recorded as 97 learning levels for the questionnaire as a whole.

Sharada Vilas

Q.II On an excel sheet, responses given by 31 students were recorded as 79 learning levels for the questionnaire as a whole.

On an excel sheet, the number of students were entered on the x-axis and the questions with their learning levels were entered on the Y-axis. Each 'Yes' marking against various learning levels was assigned a score of '1'; a 'No' marking was assigned a score of '0' and a 'No attempt' was assigned a score of '2'.

Next the prepared checklists and the respective questionnaires were analysed for the life skills required for arriving at or developing each learning level of the questions. Some questions necessitated the use of 2 life skills, some necessitated the use of 3 life skills. A majority of them needed only one major life skill.

These life skills and the paired life skills were analysed statistically for their frequencies of occurrence. As the same content questionnaire I was administered to DMS and KV, for Sharada Vilas and JSS (PUC I), JSS and Sadvidya Schools

(PUC II), the frequencies of occurrence of these single/paired life skills were compared accordingly and analysed for standard deviation, mean, t-test, anova, etc.

Each life skill of each school was compiled as one excel sheet for data entry and number of levels of learning pertaining to questions requiring that particular life skill were totalled as follows.

I. There were 15 sheets for Sadvidya and JSS II

Sheet No.	Life skills	No. of questions	Learning levels (number of items)
I	Critical Thinking	20	116
II	Effective communication	23	82
III	Self-awareness and effective communication	2	11
IV	Creative Thinking + Self awareness	1	9
V	Creative Thinking + Critical Thinking	1	2
VI	Self-awareness	21	60
VII	Decision-making	9	30
VIII	Creative thinking	10	52
IX	Problem-solving + Effective communication	6	33
X	Creative thinking + Problem solving	2	5
XI	Decision-making + Critical thinking	2	2
XII	Problem-solving	7	28
XIII	Critical thinking + Effective communication	2	7
XIV	Self-awareness + empathy + coping with emotions	1	4
XV	Decision-making + effective communication	1	3
Total			444

As questionnaires 1 for JSS II and Sadvidya were the same, these 2 samples were considered together in excel sheets under 15 headings representing 15 life skills/life skill pairs for the calculation of percentage life skill attainment (PLS), standard deviation, mean, standard error and minimum levels of learning.

II. There were 12 sheets for DMS and KV

Sheet No.	Life skills	No. of questions	Learning levels (number of items)
I	Decision-making	1+1	14+5
II	Problem-solving	8	94
III	Effective communication	3	28
IV	Creative thinking	6	45
V	Critical thinking	3	24
VI	Critical thinking and decision-making	3	21
VII	Self-awareness	1	4
VIII	Creative thinking + self-awareness	1	4
IX	Creative thinking + problem-solving	1	13
X	Creative thinking + critical thinking	1	6
XI	Problem-solving + critical thinking	1	6
XII	Problem-solving + decision-making	1	10
Total			274

As questionnaires I for DMS and KV were the same due to similarity in syllabi, these 2 samples were considered together in excel sheets under 12 headings representing 12 life skills/life skills pairs for the calculation of percentage life skill attainment (PLS), standard deviation, mean, standard error and minimum levels of learning.

III. There were 7 sheets for JSS PUC I and Sharada Vilas

Sheet No.	Life skills	No. of questions	Learning levels (number of items)
I	Decision-making + Critical thinking	3	11
II	Critical thinking	6	28
III	Effective communication	3	10
IV	Creative thinking	2	10
V	Effective communication + self-awareness	1	4
VI	Decision-making	2	8
VII	Problem-solving + critical thinking	1	5
Total			76

As the questionnaires I for JSS PUC I and Sharada Vilas were the same, these 2 samples were compared and considered together in excel sheets under 7 headings

representing 7 life skills or life skill pairs for statistical analysis and calculation of mean, PLS attainment, standard deviation, standard error and minimum levels of learning.

IV. As Questionnaire II or Interview Schedule on Life Skills (WHO) was the same for all the six school/college samples these were compared together on excel sheets under 11 different headings representing WHO life skills and statistically analysed for mean, standard deviation, PLS attainment, standard error, ANOVA (variations within groups and between groups) and minimum levels of learning in each life skill. The sub-skills were not considered separately. Each life skill had a maximum score which was sum of scores of all its sub skills. Each life skill was considered as follows.

Sheet No.	Life skills	No. of questions	Learning levels (number of items)
I	Why life skills?	17+4	21
II	Life skill 1 Decision-making and subskills	11	11
III	Life skill 2 Problem-solving and sub-skills	9	9
IV	Life skill 3 Creative thinking and subskills	9	9
V	Life skill 4 Critical thinking and subskills	5	5
VI	Life skill 5 Effective communication and subskills	14	14
VII	Life skill 6 Interpersonal relationship and subskills	2	2
VIII	Life skill 7 Self-awareness and subskills	4	4
IX	Life skill 8 Empathy and subskills	5	5
X	Life skill 9 Coping with emotions and subskills	2	2
XI	Life skill 10 Coping with stress and subskills	9	9
Total			91

Questionnaire I or Content Questionnaire was prepared with the intention of assessing attainment of life skills already incorporated in the XI standard syllabi or

textbooks and was preferably administered to the XI standard students of CBSE syllabi and I PUC students pursuing the state syllabi.

Questionnaire II or Interview Schedule on life skills was prepared with the intention of assessing whether any of the life skills (WHO) have been attained by them for their day-to-day life dealings after pursuing the XI standard or I PUC Bio-syllabi.

Therefore, QI was always administered to XI/I PUC level and QII to the XII/II PUC level. Availability of the right sample has been a constraint on the study in the state level colleges. In such cases, the QI and II were administered to the II PUC students alone (e.g. Sadvidya and Sharada Vilas) for the purpose of comparative studies.

3.7 Validation

To make a significant contribution to the development of knowledge, an experiment must be valid. Two types of experimental validity have been described. These are internal and external validity (apart from statistical and construct validity.

An experiment has internal validity if the independent variables have a genuine effect on the dependent variables.

The observed variable relationships are not of much practical value if they are valid only in the experimental setting and only for those participating. Therefore external validity is the extent to which the observed variable relationships can be generalised to other settings, other treatment variables, other measurement variables and other population.

Experimental validity is an ideal for it is unlikely that it can ever be completely achieved. When experimental controls are tightened to achieve internal validity, this reduces the generalisability of the experiment. Some compromise is inevitable between internal and external validity.

There has been constraints on validation in this study as well.

1) During the course of the study the subjects have become older. Therefore instead of only XI standard students, XII standard students also have been taken into consideration in the experimental design.
2) Selection bias or random assignment of subjects to the tools administration.

The textbooks were screened for life skills using the Evaluation Tool and a Check-list prepared of important questions with life skills. The checklist formed the basis for the preparation of the content questionnaires of state colleges and CBSE/ NCERT schools studied here. All the questions in content questionnaires for PUC I, PUC II (i.e. state level) and CBSE/NCERT schools were scaled for the teaching-learning process and the same self-questionnaires which were administered to the students were also given to the teachers for validation. Their responses were incorporated into the questionnaire wherever adequate or necessary.

The tools were administered to totally 11 teachers across the six institutions taken here for study. Teachers were requested to go through the learning process and compare it with teaching process. Teachers were experts in the area of Biology and engaged currently in teaching Biology Syllabi of NCERT/CBSE and State levels. Feedback was obtained from them as follows for the purpose of validation of Questionnaire I.

Are the questions/learning levels mentioned simple ? Yes/No

Are the questions/learning levels mentioned moderate ? Yes/No

Are the questions/learning levels mentioned tough difficult to attempt? Yes/No

Are the questions/learning levels adequate for XI standard ? Yes/No

Are the questions/learning levels clear and lucid? Yes/No

Do the questions reflect a particular life skill? Yes/No

Feedback was obtained from the teachers as follows for the purpose of validation of Questionnaire II.

Is the questionnaire difficult to attempt? Yes/No

Is comprehension of questions difficult? Yes/No

Are the questions repetitive? Yes/No

Is the time given sufficient? Yes/No

How much time do you require to answer the questionnaire? 1 hr ? Yes/No

Can you correlate Questionnaires I and II? Yes/No

Do students require a mediator for Questionnaire II? Yes/No

The feedback and suggestions obtained from experts were integrated into the questionnaires for finalisation of tools.

Not by force shall the youth learn, but through play.

— Plato

CHAPTER – IV

RESULTS – I

At the initial stage, as a prelude to analysis, the XI standard DMS Biology Textbook was browsed through in detail and a number of skills already incorporated in the text comprehended in general. This was later categorised into life skills as mentioned by the World Health Organisation (WHO, 1994).

The life skills and their sub-skills studied here are as follows (ref. Chapter I – Definitions of terms).

LS 1 Decision-making

- Objectivity
- Self-knowledge
- Analytical ability
- Divergent thinking ability
- Synthetic ability
- Logical thinking
- Rationality

LS 2 Problem-solving

- Divergent thinking
- Objectivity
- Rationality
- Logical thinking

- Analytical ability
- Synthetic ability

LS 3 Creative Thinking

- Divergent thinking
- Innovativeness
- Elaboration
- Originality
- Unconventionality

LS 4 Critical thinking

- Analytic and synthetic abilities
- Objectivity
- Intelligence
- Logical thinking

LS 5 Effective Communication

- Analytic ability
- Non-verbal skills
- Presentation
- Creativity
- Objectivity

LS 6 Interpersonal relationships

LS 7 Self-awareness

- Objectivity
- Introspectionability
- Reflectivity

LS 8 Empathy

- Objectivity

LS 9 Coping with emotions

- Objectivity
- Self-awareness
- Analytical and synthetic ability
- Sense of proportions

LS 10 Coping with stress

- Objectivity
- Reality orientation

All the subskills mentioned earlier were considered, but more emphasis was given to subskills mentioned herein under the biological context. Critical thinking and creative thinking are THINKING skills; Decision-making and problem-solving are SOLVING SKILLS; Inter-personal relationships and Effective communication are RELATIONSHIP SKILLS; Coping with stress and coping with emotions are COPING SKILLS; Self-awareness and Empathy are the UNDERSTANDING SKILLS – these being the five pairs of generic skills studied here.

The textbooks of NCERT (NCERT, 2006) and of PUC-I and PUC-II (Rao, 2006) were analysed using evaluation tool and checklist prepared for Biological Content and related Life Skills there of (ref. Appendix for Tools).

The same evaluation tool was used for analysing in detail life skills incorporated / mentioned in NCERT Biology Syllabus, NCF 2005, CBSE Biology Syllabus and Conceptual Framework of the project proposal. The results of the Analysis for Life Skills are presented in the succeeding pages.

4.1 Results of Analysis I

Life Skills in Textbooks of NCERT Biology XI Standard

- Skill to define 'living' (Effective Communication)
- Skill to study and identify diversity in the living world (Critical thinking)
- Skill to study different taxonomic categories (Critical thinking)
- Skill to identify the living and distinguish it from non-living (Critical thinking)
- Skill to define the living state (Effective communication)
- Skill to characterise life/living (Effective communication)
- Skill to recognise characteristics of living organisms (Decision-making)
- Skill to sense and respond to surroundings (Self-awareness)
- Skill to understand/identify (Self-awareness)
- Skill to characterise organisms (Effective communication)
- Skill to differentiate (Critical thinking)
- Skill to discuss (Effective communication)
- Skill to think (Critical thinking)
- Skill to compare (Critical thinking)
- Skill to organise and discuss (Effective communication)
- Skill to understand the plant kingdom (Self-awareness)
- Skill to study Evolutionary relationships (Self-awareness)
- Ability to resolve difficulties in classification (Decision-making;Problem-solving)
- Skill of commenting (Effective communication)
- Skill of explanation (Effective communication)

- Skill of differentiation (Critical thinking)
- Skill of description (Effective communication)
- Skill to identify a basis for classification (Critical thinking)
- Skill to assign a systematic position to a newly organised species (Critical thinking)
- Skill to categorise (Critical thinking; Effective communication)
- Skill to recognise segmentation (Self-awareness)
- Skill of organisation (Critical thinking)
- Skills of division and categorization (Critical thinking)
- Skill of comprehension (Self-awareness)
- Skills of distinguishing (Critical thinking)
- Skills of reasoning (Critical thinking)
- Skills of matching (Critical thinking)
- Skill to identify different parts of a plant and describe them (Effective communication)
- Skill of knowing features which distinguish (Critical thinking; Self-awareness)
- Skill of understanding arrangement (Self-awareness)
- Skill of recognising patterns (Critical thinking)
- Skill of understanding symmetry (Critical thinking)
- Skill of understanding arrangement of patterns (Critical thinking)
- Writing and sketching skill (Critical thinking)
- Skill of making semi-technical descriptions (Effective communication)

- Skill to identify tissues and tissue system (Critical thinking)
- Skill of observation of the transverse section of young stem of a plant (Critical thinking)
- Skill to identify organs and organ systems (Critical thinking)
- Skill of increasing fertility of soil by the earthworms (Problem-solving)
- Skill of recognition of body organs (Critical thinking)
- Skill of recognition of sexes in animals (Critical thinking)
- Skill to identify different members of the frog family (Problem-solving and Critical thinking)
- Skill to identify organ systems in different animals (Critical thinking)
- Skill to identify frogs as amphibians that can live on land and in water (Critical thinking)
- Skill to identify diverse types of connective tissues in the body (Critical thinking)
- Skill to recognise diversity of life forms (Self-awareness; Critical thinking)
- Skill to recognise and identify biomolecules (Self-awareness; Critical thinking)
- Skill to understand cell cycle and cell division (Critical thinking)
- Skill to question oneself (Critical thinking)
- Skill to overview (Problem-solving)
- Skill to propose a theory (Decision-making; Creative thinking; Critical thinking)
- Skill to explore, research and investigate (Critical thinking)
- Skill to invent (Problem-solving; Creative thinking)
- Skill to conclude/infer (Problem-solving)

- Skill to propose a hypothesis (Critical thinking; Creative thinking)
- Skill to think logically and scientifically (Critical thinking)
- Skill to formulate a theory (Critical thinking; Creative thinking)
- Skill to modify a theory (Critical thinking)
- Skill to modify an existing hypothesis (Critical thinking; Creative thinking)
- Skill to overview or recollect previous knowledge on a topic (Problem-solving)
- Skills of recognising similarities in organisation of shapes, structure and functions (Self-awareness)
- Skill to recognise characteristic features (Self-awareness)
- Skills of determining sizes in different units (Critical thinking)
- Skill to study minute details (Critical thinking)
- Skill to recognise different shapes (Critical thinking)
- Skill to recollect (Critical thinking)
- Skill to study and recognise details (Decision-making)
- Skill to study details of DNA packaging (Critical thinking)
- Skill to distinguish correct from incorrect (Critical thinking)
- Skill to identify and characterise primary and secondary metaboliites, biomacromolecules, proteins, etc (Critical thinking)
- Skill to analyse chemical composition (Critical thinking)
- Skill to identify and classify enzymes (Critical thinking)
- Skill to identify polysaccharides (Decision-making; Critical thinking)
- Skill to identify nucleic acids (Critical thinking; Decision-making)

- Skill to understand the structure of various molecules (Self-awareness)
- Skill of understanding linkage of bonds (Self-awareness; Critical thinking)
- Skill to understand the metabolic basis of life (Self-awareness)
- Skill of understanding high rates of chemical conversion (Self-awareness; Critical thinking)
- Skill to learn nature of enzyme action (Problem-solving; Critical thinking)
- Skill to understand inhibition and rate of reaction etc (Self-awareness)
- Skill of identifying various molecules and understanding their structure (Critical thinking)
- Skill of understanding chemical/physical phenomena (Self-awareness)
- Skill of building models of chemicals (Creative thinking)
- Skill of carrying out qualitative tests (Creative thinking; Problem solving)
- Skill of describing important properties of molecules (Effective communication; Self-awareness)
- Skills of understanding/comprehending complex phenomena like mitosis/ meiosis/ cell cycle/replication and cell growth (Critical thinking)
- Skill of comprehending intercellular/active nuclear structure like chromosome and the DNA (Problem solving; Decision-making)
- Skill to understand structure of cell (Critical thinking)
- Skill to identify key events of cell division (Critical thinking)
- Skill to comprehend the importance of various cellular processes (Critical thinking)

- Skill of understanding the importance of conservation of special chromosome number of each species (Critical thinking)
- Skill of understanding cellular events and representing these through diagrams (Critical thinking; Creative thinking)
- Skill of analysing and interpreting various events (Critical thinking; Problem solving)
- Skill to understand means of transport (Critical thinking)
- Skill to understand long distance uptake and transport of H_2O (Critical thinking; Creative thinking)
- Skill to comprehend various phenomena like diffusion, facilitated diffusion, water potential, osmosis, plasmolysis and imbibition (Critical thinking)
- Skill to identify these phenomena in day-to-day life activities and surroundings (Critical thinking; Problem solving)
- Skill of understanding the transient nature of water (Self-awareness)
- Skill of understanding cohesive, adhesive and surface tension properties of water (Self-awareness)
- Skill to understand the significance of transpiration in plants (Self-awareness)
- Skill to understand translocation of food in phloem and translocation of sugars (Self-awareness)
- Skill to perform simple experiments like girdling (Critical thinking; Problem solving)

- Skill to differentiate between diffusion and osmosis, transpiration and evaporation, osmotic pressure and osmotic potential, imbibition and diffusion, apoplast and symplast pathways of movement of water in plants, guttation and transpiration (Self-awareness; Critical thinking)
- Skill to study and understand mechanisms (Critical thinking)
- Skill to evolve techniques (Critical thinking)
- Skill to improvise (Creative thinking)
- Skill to explain (Effective communication)
- Skill to identify (Critical thinking)
- Skill to make new discoveries and techniques (Critical thinking;Creative thinking)
- Skill to grow plants through hydroponics (Problem-solving; Creative thinking)
- Skill to name similar components – analogous, homologous (Critical thinking)
- Skill to recall (Critical thinking)
- Skill of identifying deficiency symptoms in plants (Critical thinking)
- Skill to distinguish between the true and false (Critical thinking)
- Skill to hypothesise (Critical thinking)
- Skill to experiment (Creative thinking)
- Skill to conclude (Critical thinking; Problem-solving)
- Skill to infer (Problem-solving)
- Skill to explain conclusions and inferences (Problem-solving; Effective communication)
- Skill to think out several solutions to a problem (Critical thinking)

- Skill to represent processes in equational form (Creative thinking)
- Skill to prove or process a fact or statement (Creative thinking; Critical thinking)
- Skill to justify (Critical thinking)
- Skill to draw conclusion or infer from graphs, figures, illustrations and diagrams (Creative thinking)
- Skill to understand processes of light reaction etc., transport and splitting of H_2O, etc (Critical thinking)
- Skill to understand synthesis of molecules (Self-awareness; Critical thinking)
- Skill to put forward a hypothesis (Critical thinking)
- Skill to consider and opt for various possibilities (Decision-making; Critical thinking)
- Skill to verify (Creative thinking; Critical thinking)
- Skill to contribute to existing knowledge (Critical thinking; Creative thinking)
- Skill to compare (Critical thinking)
- Skill to distinguish (Critical thinking)
- Skill to recognise processes of respiration, fermentation in plants (Critical thinking)
- Skill to elucidate (Problem-solving)
- Skill to summarise/generalise (Effective communication)
- Skill to measure growth using a variety of parameters (Creative thinking)
- Skill to understand conditions necessary for growth (Self-awareness)
- Skill to understand developmental processes (Self-awareness, Empathy)

- Skill of choosing correct responses (Decision-making)
- Skill of naming (Critical thinking; Decision-making)
- Skill of matching organ with production (Decision-making; Critical thinking)
- Skill to maintain and moderate the respiratory rhythm (Self-awareness)
- Skill to explain process of expiration and inspiration (Effective communication)
- Skill of understanding the functions of heart (Self-awareness)
- Skill to count cardiac cycles per minute (Self-awareness; Problem-solving)
- Skill to measure duration of a cardiac cycle (Problem-solving)
- Skill to use stethoscope (Problem-solving)
- Skill to detect lub dub or hear with stethoscope (Problem-solving)
- Skill to read and analyse ECG (Problem-solving; Critical thinking)
- Skill to distinguish synthetic and parasynthetic neural signals (Critical thinking)
- Skill of measuring and checking BP of an individual (Critical thinking; Problem solving)
- Skill to understand what is Coronary Artery disease (Self-awareness; Critical thinking)
- Skill to understand heart failure (Critical thinking)
- Skill to understand double circulation (Critical thinking)
- Skill to understand built-in mechanism of kidneys (Self-awareness)
- Skill to explain processes and mechanisms (Effective communication)
- Skill to understand and explain muscular contractions (Self-awareness; Effective communication)

- Skill to identify streaming, ciliary movements, movements of fin, limbs, wings, etc (Critical thinking)
- Skill to identify movements exhibited by plants (Critical thinking;Self-awareness)
- Skill to understand generation and conduction of nerve impulse (Self-awareness)
- Skill to explain our body parts and retract from body cold (Effective communication)
- Skill to understand mechanism of hearing (Self-awareness)
- Skill to understand status of human neural system (Self-awareness)
- Skill to understand (Self-awareness)
- Skill to understand the parts of human endocrine system (Self-awareness)
- Skill to understand structure, location and functions of different glands pituitary, thyroid, adrenal, thymus, pancreas, testes, ovary, . . . (Self-awareness)
- Skill to understand that chemicals are hormones which coordinate, integrate and regulate the human body (Self-awareness; Critical thinking)

As seen above, the content is categorised into life skills and 7 of the 10 life skills advocated by WHO are encountered in these textbooks. Inter-personal relationship skills and skills of coping with emotions, and coping with stress though have not been integrated into the content of the textbooks at this stage. Also skills of self-awareness and empathy are less encountered at this stage. Thinking and solving skills get a lot of importance as should be the case in a Science and Biology Curriculum.

4.2 Results of Analysis II

Life Skills in NCERT 2005 Biology Syllabus (NCF, 2005, Vol. II)

Syllabus for Upper Primary, Secondary and Higher Secondary Classes

Unit I: Diversity in Living world

- To know the meaning of being 'alive' (Self-awareness)
- To understand that living organisms show a very large diversity in form and structure (Self-awareness)
- To understand classification (Critical thinking)
- To understand the necessity for classification (i.e. it is organization of living organisms into categories for ease of study) (Critical thinking)
- To understand that there are several levels of organization, the highest being a Kingdom and the lowest a Species (Self-awareness; Critical thinking)
- To understand the Binomial system of classification (Critical thinking)
- To understand the importance of zoological parks, botanical gardens, herbaria and natural museums as taxonomical aids (Self-awareness)

Unit II: Structural Organisation in Animals and Plants

- To understand the importance of light and electron microscopy as tools for the study of tissues, cells and cell organelles (Critical thinking; Creative thinking)
- To know levels of organization in living things – from cells – tissues – organs and organ system (Critical thinking; Creative thinking)
- To understand division of labour in the living body (Critical thinking; Self-awareness)

- To understand increasing complexity in organisms from lower to higher level (Self-awareness)
- To know that both plants and animals have a wide range of organization (Self-awareness)
- Ability to understand that floral characteristics form the basis of classification and identification of angiosperms (Critical thinking)
- Ability to employ floral characteristics for classification and identification of gymnosperms (Problem-solving)
- Ability to know wide range in morphology and anatomy in the structure of animal body (Self-awareness)

Unit III: Cell Structure and Functions

- To understand the structure and design of cell organelles for tasks such as synthesis, break down, respiration and transport (Critical thinking; Self-awareness)
- To understand cell division as essential processes (Critical thinking; Self-awareness)
- To understand that mitosis and meiosis are similar in animals and plants (Critical thinking; Self-awareness)
- To understand that living bodies contain different categories of micro and macro molecules (Critical thinking; Self-awareness)
- To recognize four broad categories of macro molecules (Critical thinking)

- To understand that proteins form a major macro group (Critical thinking; Decision-making)
- To know that proteins provide structural support, mediate many physiological functions like catalysis, reference, transport and sensing (Critical thinking Decision-making)
- To recognize enzymes as an important class of proteins responsible for all metabolic activities of the cell (Decision-making)
- To recognize carbohydrate as major energy reserves (Decision-making)
- To understand carbohydrates also have the function of providing structural support to majority of living organisms (Critical thinking)
- To understand that lipids serve as major components of membrane, as energy reserve, and some hormones (Critical thinking)
- To understand the structure of DNA – as a double helical structure (Self-awareness; Critical thinking)
- To understand nucleic acids are the genetic material and are responsible for determining protein synthesis (Self-awareness; Critical thinking; Decision-making)

Unit IV: Plant Physiology

- To understand cell to cell movement of water, food, gas and nutrients is dependent on concentration gradients and diffusion (Decision-making; Problem-solving)

- To recognize that substances are moved against concentration gradient through active transport (Decision-making; Problem-solving)
- To understand that plants lose water through their stomata (Decision-making)
- To know that transpiration is responsible for transport of water over larger distances (Decision-making)
- To understand water moves up short distances through pressure (Critical thinking)
- To know that plants require a variety of mineral nutrients for their growth and development (Self-awareness)
- To understand that some plants are able to fix atmospheric N_2 (Self-awareness)
- To understand that green plants use the C_3 pathway to fix CO_2 and synthesise simple sugars in the presence of sunlight (Self-awareness)
- To identify that some plants have the C_4 pathway (Self-awareness)
- To identify that sugars are oxidized by all living organisms to release energy (Self-awareness)
- To know some organisms derive energy from food anaerobically (Self-awareness)
- To know that energy is trapped as ATP and utilized for all metabolic activities (Self-awareness)
- To know that growth regulators regulate growth and development in plants (Self-awareness)

Unit V: Human Physiology

- To know that food is broken down enzymatically in stages (Self-awareness)
- To understand that the process of exchange of gases takes place at organ, tissue, cell and organelle levels leading to oxidation of sugar in the cells (Decision-making)
- To know that gases, nutrients as well as waste products are transported in the body through the vascular system (Decision-making; Self-awareness)
- To know that the various components of the blood are involved in diverse functions (Self-awareness; Decision-making)
- To know that the metabolic waste produced in the body are eliminated by excretory system (Self-awareness)

4.3 Results of Analysis III

Analysis of NCF 2005 for Life Skills at Secondary and Higher Secondary Stage

Life Skills in National Curriculum Framework (NCF, 2005)

Life Skills mentioned therein for Science at Secondary and Higher Secondary Stages:

- To observe the physical and biological environment carefully, to look for meaningful patterns and relations, to use new tools to interact with nature; to build conceptual models to understand the world (Critical-thinking; Creative thinking)
- To understand the scientific method involving several inter-connected steps like observation (Self-awareness)
- To verify or falsify theories through observations and controlled experiments (Critical thinking)
- To arrive at the principles, theories and laws governing the natural world (Critical thinking; Decision-making; Problem solving)
- To recognize science as an expanding body of knowledge (Critical thinking)
- To make science play a liberating role helping people escape from vicious cycles of poverty, ignorance and superstition (Critical thinking; Self-awareness; Empathy)
- To develop skills of flexibility, innovation and creativity (Critical thinking)
- To encourage asking of questions, to understand how social factors influence the development of science (Self-awareness)
- To promote honesty, objectivity, cooperation, freedom from fear and prejudice (Empathy)
- To inculcate in the learner concern for life and preservation of environment (Self-awareness; Empathy)

- Ability to solve problems, etc (Problem-solving)
- To look for regularities and patterns in scientific method (Critical thinking)
- To make hypothesis (Creative thinking; Critical thinking)
- To devise qualitative or mathematical models (Creative thinking)
- To deduce the consequences (Problem-solving)
- To understand and make observations (Critical thinking)

Higher Secondary Stage

Life skills included in pages 26, 40, 46, 48, 49, 50, 56, 57, 68 and 70 of NCF 2005 were as follows:

- Emphasis on experiments/technology and problem solving (Creative thinking; Problem solving) (p. 49)
- Develop basic capabilities like language forming (Decision-making; Self-awareness) (p. 26)
- Sustain relationships with social world, natural world, one's self, promote emotional richness, sensitivity, ethical and moral values (Interpersonal relations and Empathy, Sensitivity, Objectivity, Social inclination, Social responsibility, Social obligation) (p. 26)
- Capabilities of work and action (Problem-solving, Objectivity, Rationality) (p. 26)
- Skills of Yoga (Health and Physical Education) (Coping with stress and coping with emotions) (p. 26)
- Critical thinking skills (p. 40)
- Inter-personal communication skills (p. 40)

- Negotiation / Refusal skills (p. 40)
- Decision-making / Problem-solving skills (p. 40)
- Coping and self-management skills (p. 40)
- Observation of Physical and Biological Environment (Decision-making; Objectivity) (p. 46)
- Observe patterns and relations (Decision-making; Objectivity) (p. 46/49)
- To use new tools to interact with nature (Creative thinking-novelty) (p. 46/49)
- To build conceptual models to understand the world (Creative thinking; Innovativeness-independence) (p. 46/49)
- To understand scientific method with several inter-connected steps (Problem-solving; Self-knowledge and Analysis and Synthetic ability) (p. 46/49)
- To look for regularities and pattern (Problem solving;Divergent thinking)(p.46/49)
- To make hypothesis (Problem-solving; Rationality) (p. 46/49)
- To devise qualitative models (Critical thinking; Originality; Unconventionality) (p. 46/49)
- To devise mathematical models (Critical thinking; Originality; Unconventionality)
- To deduce their consequences (Critical thinking; Anticipation of consequences) (p. 46/49)
- To verify or falsify theories through observations and controlled experiments (Critical thinking; Analytic and Synthetic abilities; Logical thinking) (p. 46/49)
- To arrive at the principles, theories and laws governing the natural world (Critical thinking; Objectivity; Intelligence) (p. 46/49)

- To recognise science as an expanding body of knowledge (Self-awareness; Reflectivity; Objectivity; Introspectionability) (p. 46/49)
- To make science play a liberated role helping people escape from vicious cycle of poverty, ignorance and superstition (Self-awareness; Objectivity) (p. 46/49)
- To develop skills of flexibility, innovation and creativity (Creative thinking) (p. 46/49)
- To encourage asking of questions (Decision-making; Critical thinking; Logical thinking) (p. 48)
- To understand how social factors influence the development of science (Self-awareness; Reflectivity) (p. 48)
- To promote honesty, objectivity, cooperation, freedom from fear and prejudice (Interpersonal relationships; Sensitivity; Positive attitude; Reciprocality; Tolerance) (p. 48)
- To inculcate in the learner concern for life and preservation of environment (Empathy, Sensitivity, Objectivity, Social inclination, Social responsibility, Social obligation) (p. 48)
- Ability to solve problems (p. 48)
- To support enquiry skills (Effective communication; Analytical and Expression skills) (p. 48)
- To use Science education as an instrument to achieve social change (Empathy; Sensitivity; objectivity) (p. 49)
- To use textbooks as instrument for bringing equity (Empathy; Sensitivity; Objectivity) (p. 49)

- To work with hands and tools (Creative thinking)
- To design advanced technological modules (Creative thinking)
- To analyse issues concerning environment and health (Problem-solving; Coping skills)
- To stimulate investigative ability (Critical thinking; Effective communication) (p. 50)
- To promote co-curricular and extra curricular activities (Inter personal relationship) (p. 50)
- To cope with concerns related to the process of growing up (Coping with stress; Coping with emotions) (p. 57)
- To provide opportunities to construct knowledge (Creative thinking; Rationality) (p. 57)
- To reason out abstractly (Problem-solving; Rationality; Logical thinking) (p. 68)
- To thinking logically (Problem-solving; Logical thinking) (p. 68)
- To understand and generate knowledge (Creative thinking; Self-awareness) (p. 68)
- To understand self in relation to society (Self-awareness) (p. 70)
- To plan, explore careers (Self-awareness) (p. 70)
- To adjust to personal, social and emotional crisis (Coping with stress; Coping with emotions) (p. 70)

4.4 Results of Analysis IV

Life Skills included in CBSE Biology syllabus (2007-08)

General:

1. To understand the underlying principles that are common to both animals and plants (Critical thinking; Self-awareness)
2. To be able to highlight the relationships of biology with other areas of knowledge (Critical thinking)
3. To understand the connection of the study of Biology with other areas of knowledge (Critical thinking)
4. To understand the connection of the study of Biology to real life problems (Empathy; Self-awareness)
5. To be able to use biological innovations in everyday life (Critical thinking; Problem solving)
6. To be able to use Biological inventions/ discoveries in environment (Creative thinking; Problem solving)
7. To be able to use the biological inventions/ discoveries in nature (Creative thinking; Problem solving)
8. To be able to use biological inventions/ discoveries in medicine (Problem solving)
9. To be able to use biological inventions/ discoveries in health (Creative thinking; Problem-solving)
10. To be able to use biological inventions/ discoveries in agriculture (Creative thinking; Self awareness)

11. To be able to understand and explain basic principles of Biology (Critical thinking; Self-awareness)
12. To be able to learn emerging knowledge (Decision-making; Self-awareness)
13. To be able to relate emerging knowledge and understand its relevance to individual and society (Decision-making; Self-awareness; Critical thinking)
14. To encourage national / specific attitude to issues related to population, environment and development (Self-awareness; Empathy)
15. To develop awareness of environmental issues and problems and the appropriate solutions (Self-awareness)
16. To be aware of variations amongst the living (Self-awareness)
17. To develop respect for the diversities among the living (Self-awareness; Critical thinking)
18. To be able to appreciate that the most complex biological phenomenon are also built on essentially simple processes (Critical thinking)

Unit 1:

1. To be able to understand the diversity in the living world and living organisms (Self-awareness)
2. To ask to classify living organisms into five kingdoms and major groups (Critical thinking)
3. To be able to use principles of classification within each Kingdom (Decision-making; Problem-solving)
4. To be able to understand and use the binomial system of nomenclature (Problem-solving)

5. To be able to ask to list out salient features of animal and plant groups (Critical thinking)
6. To understand the importance of maintenance of botanical gardens, herbaria, zoological parks and museums (Self-awareness)

Unit 2:

1. To understand and know tissues of different kinds in plants and animals (Self-awareness)
2. To develop an understanding of the morphology, anatomy and functions of different parts of flowering plants like the root, stem, leaf, inflorescence, flower, fruit and seed (Self-awareness)
3. To develop an understanding of the morphology, anatomy and functions of different systems in an annelid (earthworm), an insect (cockroach) and an amphibian (frog) (Self-awareness)

Unit 3:

1. To understand the structure and function of cell wall, cell membrane and cell organelles (Self-awareness)
2. To understand mitosis, meiosis and the cell cycle (Critical thinking; Self-awareness)
3. To know the basic chemical constituents of living bodies (Critical thinking; Decision-making)
4. To understand the structure and functions of carbohydrates, proteins, lipids and nucleic acids (Critical thinking)

5. To understand the types, properties and function of enzymes (Critical thinking; Self-awareness)

Unit 4:

To understand the movement of water, food, nutrients and gases, plants and water, mineral nutrition, respiration, photosynthesis, plant growth and development (Critical thinking; Self-awareness)

Unit 5:

To understand the following processes:

- digestion and absorption (Critical thinking)
- breathing and respiration (Critical thinking; Problem-solving)
- body fluids and circulation (Critical thinking; Self-awareness)
- excretory products and elimination (Critical thinking; Problem-solving)
- locomotion and movement (Critical thinking; Problem-solving)
- control and coordination (Critical thinking; Problem-solving)

4.5 Results of Analysis V

Life Skills taken into consideration in the Conceptual Framework of the Project Proposal

From Column 7:

1) To be able to develop actual life skills that supports the cohesive functionality of body, mind and spirit (Coping skills; Understanding skills)
2) To be able to develop life skills, that do not render one subservient to machines and technological products (Coping skills)
3) To be able to work with hands at manifold tasks (Creative thinking)
4) To be able to use the brain instead of calculator or computer (Critical thinking)
5) To be able to use limbs (legs) instead of machine operated car or automobiles (Problem solving)
6) To be able to put back or recycle materials to sustain the environment (Problem-solving)
7) To be able to preserve the environment around for posterity (Problem solving; Decision making)
8) To be able to keep the environment clean and unpolluted (Self-awareness)
9) To be able to develop the mental abilities of analysis and inference (Problem solving)
10) To be able to improve crisis management skills (Problem solving)
11) To be able to create crisis management skills (Problem solving)
12) To be able to tackle emergencies (Problem solving)
13) To be able to survive in drastic conditions (Problem solving)

14) To be able to adapt to environment with flexibility (Decision making)

15) To be able to experiment with new techniques (Creative thinking)

16) To develop ingenuous thinking skills (Critical thinking)

17) To be able to manipulate (Problem solving)

18) To be able to develop spirit of thinking (NPE, 1986) (Thinking skills)

19) To be able to develop spirit of enquiry (NPE, 1986) (Thinking skills; Solving skills)

20) To be able to develop creativity (NPE, 1986) (Creative thinking)

21) To be able to develop objectivity (Creative thinking)

22) To be able to develop the courage to question (Critical thinking)

23) To be able to develop an aesthetic sensibility (Self-awareness)

24) To be able to understand and assimilate principles of interdependence in the environment and nature (Self-awareness)

25) To be able to identify and establish linkages between the assemblages of living and non-living resources and their utility (Decision-making)

26) To be able to make judicious and rational exploration and exploitation and utilization of resources (Coping skills)

27) To be able to live a life of quality and dignity (Coping skills; Decision making)

28) To have life skills of sustainable management of resources (Coping skills)

29) To have life skills of cybernetics of natural socio-cultural as well as bio- physical aspects of life and environmental resources (Coping skills; Understanding skills)

30) To develop life skills to improve quality of human life (Coping skills; Understanding; Relationship skills)

31) To develop life skills to improve quality of human environment (Coping skills)

32) To develop life skills for environmental sanitation (Self-awareness; Empathy)

33) To develop life skills for management of population explosion (Decision-making; Self-awareness)

34) To develop special skills of adaptation and positive behaviour for the ambient socio-cultural milieu (Coping skills)

35) To develop problem-solving abilities (Problem solving)

36) To develop decision making abilities (Decision-making)

37) To be able to relate science with health (Self awareness)

38) To be able to relate science with agriculture (Self awareness)

39) To be able to relate science with industry (Self-awareness)

40) To develop abilities for adaptive and positive behaviour that enable individuals to deal effectively with demands and challenges of everyday life (WHO, 1994) (Coping; Understanding skills)

41) To develop manipulative skills acquired in day to day life situations (Problem solving)

Col. 9 (NCF 2005)

42) To develop skilled manpower through quality education at school level (NCERT, 2005) (Decision making; Problem solving)

43) To enable international capital to enter domestic market through skilled manpower and discernible consumers (Problem solving)

44) To prepare children for a new economic order with more open and semi-defined life situations (Decision making; Problem solving)

45) To make formulation and implementation of quality school curriculum as the cutting edge for the dignified survival of the nation (Problem solving)

46) To empower all to satisfy their basic needs (Decision making)

47) To empower all to be productive in an increasingly technological society (Decision making)

48) To develop in the child well-defined abilities and values such as the spirit of enquiry, creativity, objectivity, the courage to question and an aesthetic sensibility (Creative thinking; Critical thinking)

49) To enable children to acquire necessary skills, attitudes and habits to keep themselves healthy and participate in games and sports sustainable for their age (Critical thinking)

50) To make children sensitive to the environment and the need for its protection (Self-awareness)

51) To make children sensitive enough to nurture and preserve the environment (Self-awareness)

52) To help children reconcile human life with the crisis of the environment (Self-awareness)

53) To enable the younger generation to re-interpret and reevaluate the past with reference to new priorities and emerging outlooks of a changing societal content (Self-awareness)

54) To enable development of basic capabilities like language (Thinking skills)

55) To develop sustenance of relationships (with social world, natural world and one self) (Relationship skills)

56) To enable promotion of emotional richness in children (Coping; Understanding skills)

57) To enable promotion of sensitivity and values which form the basis of ethics and morality (Relationship skills; Self awareness; Empathy)

58) To develop capabilities of work and action (Thinking; Coping skills)

59) To develop coordination of bodily movements (Coping skills)

60) To develop ability of handling tools and technologies (Problem solving)

61) To develop ability to manipulate and organize things and experiences (Problem solving)

62) To develop ability to communicate (Effective communication)

63) To develop life skills such as critical thinking skills, interpersonal communication skills, negotiation/ refusal skills/ decision making / problem solving skills, coping and self-management skills, dealing with demands and challenges of everyday life (All WHO Life Skills)

64) To stimulate investigative ability, inventiveness and creativity (Creative thinking)

Additional Skills in Conceptual Framework

Column 10

65) Skills of working with hands/legs (Coping skills)

66) Skills of using limbs instead of machines or vehicles in this technological age (Coping skills; Self-awareness)

67) Skills for analysis and inference (Critical thinking)

68) Skill of improvising in emergencies (Creative thinking; Problem solving)

69) Skill of experimentation with new techniques (Problem solving)

70) Psychomotor skills (Thinking skills; Coping skills)

71) Cognitive skills (Thinking skills)

72) Skill of sustaining environment (Self-awareness)

73) Skill of managing environment (Self-awareness)

74) Skill of environment resource management (Self-awareness)

75) Skill of management of socio-cultural and physical aspects of life (Self-awareness)

76) Life adjustment skills (WHO skills)

77) Content skills (Thinking skills)

4.6 Conclusions

Analysis I

There is lack of inclusion of coping skills and inter-personal relationship skills in the text which are two of the important WHO skills (1994). There is a need to incorporate these in the text in the form of chapters on Reproductive Biology (included in the XII standard textbooks); Sexuality and on HIV/AIDS and other epidemics and diseases affecting the living relationships among human beings and the coping capacities of affected individual.

An entire unit could be devoted at this stage to the various applied aspects of the various chapters for e.g., for the chapter on Musculo-Skeletal system the applied aspects would pertain to diseases of the bones like ricket, osteoporosis, arthritis, fractures, etc (Please see modules in Chapter VII).

As stated by Prof. Krishna Kumar in his book on 'What is Worth Teaching ?' – A healthy man will of course be happy but an educated man need not necessarily be happy. This is because good health is basic to education and education to the quality of life. Inclusion of chapters on coping and inter-personal relationship skills are important through applied aspects of day-to-day life replete with activities/modules to gain the respective skills.

Analysis II

Solving, Thinking and Understanding skills flood the academic pursuits in NCERT Bio Syllabus – 2005.

Diversity in the living world is an apt unit for expanding on inter-relationships in the plant world and their inter-dependence on other plants and animals. This will

also highlight homoestasis and checks and balances in the eco system. Therefore, a chapter on Natural Resources and Ecosystem would be welcome here to stress the development of coping and relationship skills in the living world.

Diseases of the digestive, excretory and circulatory system could be highlighted in Unit V to emphasise development of coping skills.

Analysis III

To sustain relationships with social and natural world is an important point mentioned on p. 26 of National Curriculum Framework – 2005 – necessitating the inclusion of chapters on the Ecosystem, Food chains, Food webs, Food pyramids, Natural resources and their utilisation and Conservation. Man forms a part of the largest ecosystem viz. Biosphere.

Skills of Yoga also are mentioned on p. 26 under health and physical education and Yoga facilitates development of coping skills. Yoga is actually pranic healing involving inhalation and exhalation of breath and fine tuning the body using respiratory and muscular movements. A chapter on Yoga as applied aspect of respiratory and musculo-skeletal systems would be welcome in the Biology Texts.

Page 48 of the NCF mentions "to inculcate in the learner concern for life and preservation of the environment". These can be developed only through chapters on conservation of animal and plant life. This develops empathy i.e. objectivity, sensitivity, social inclination, social responsibility and social obligation. A chapter on first-aid will not be amiss here.

Psychology is mentioned as a paper in NCF – Biology Vol. II. A chapter on the Basics of Psychology would make the textbooks an instrument for bringing equity

(p. 49 of NCF, 2005) and promote life skills of empathy and sensitivity among students. Along with relevant modules for development of coping skills, psychology would help students to adjust to personal, social and emotional crisis (p. 70, NCF, 2005). It may please be noted at this stage that personal, social and health education (PSHE) is a part of the secondary curriculum in UK and other countries (Kiwan, 2008).

Analysis IV

It need not be gainsaid that the content knowledge here projects the development of thinking and solving skills and some understanding skills. All the life skills have not been brought in into the CBSE syllabus. CBSE has brought out a series of books on Life Skills Education from VI, VII to VIII standard along with CCE (ref. Bibliography). It would be welcome if life skills development is integrated in the form of exercises/ modules in the various chapters/units of the syllabus here.

Analysis V

The Conceptual Framework has taken into consideration all the five pairs of Solving, Thinking, Understanding, Coping and Relationship skills as advocated by WHO (1994).

Analysis VI

The I PUC and II PUC syllabi and texts (please refer Chapter III and checklist tools of Appendix) shows a combination of various life skills. An analysis and quick browse through the tools evinces Thinking, Solving and Understanding skills. Only coping and relationship skills are conspicuous by their absence despite a thorough analysis and sieving of the textbooks. Topics that could be included in the Textbooks/

Syllabi both at the State/CBSE/NCERT level for coping and inter-personal relationship skills could be health topics pertaining to the individual chapters already included and topics on Environmental Science which bring out the relationships between man and man, and man and nature. Health topics (please see modules in Chapter VII) could mention how to cope with diseases of an epidemic proportion like AIDS, and also cancer and other occupational diseases.

A review of the analysis of textbooks and syllabi is an eye-opener to the fact that many of the WHO life skills form an integral part of the Science and Biology curricula. One cannot be performing scientific activities without a combination of solving and thinking skills in particular. These skills are woven into the very fabric and concept of what is Science. We teach the content of Science and Biology in classes without paying sufficient attention to the development of thinking and solving skills in students. At the end of a period of study, students are assessed for memorization for assimilation of the content but not for the life skills involved therein. It is imminent that assessment of life skills forms a part of Science and Biology Curricula.

Major Premise . . . All men are mortal

Minor Premise . . . Socrates is a man

Conclusion . . . Socrates is mortal

— Aristotelian Syllogism

CHAPTER – V

RESULTS – II

STATISTICAL ANALYSIS OF DATA

This set of results comprises statistical analysis of life skills attained by students in the six schools of Mysore. The data were entered on MS-Excel with a scoring of 'one' for yes, 'zero' for No and 'two' for No response. The questions were closely scrutinised (please refer Tools in Appendix – both questionnaires and checklists of each of the six schools) for the WHO Life Skills AND Life Skill pairs required for answering and developing the learning levels mentioned therein. Each life skill/life skill pair was entered on a separate excel sheet and the total scores of all the questions pertaining to that particular life skill/life skill pair determined by totaling up the weightage assigned to each learning level. Mean, Standard Deviation, percentage analysis, t-test, Anova and attainment in terms of MLL were determined.

5.1 Comparison between JSS and Sharada Vilas Schools in Life Skills

Descriptive Statistics for the Two Schools JSS and Sharada Vilas

Mean and standard deviation were studied for assessing individual variation in the attainment of life skills. (Table 1)

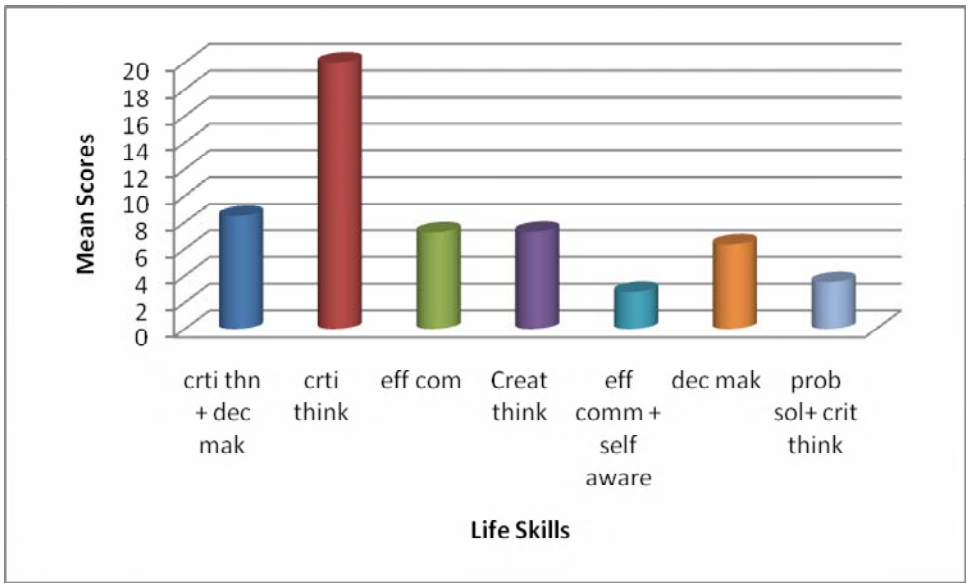
Table 1: Group statistics for JSS1-Sharada Vilas (PUCIQI)

	Minimum	Maximum	Mean	Std. Deviation
Critical thinking + Decision making (LS1)	3	11	8.48	1.904
Critical thinking (LS2)	6	28	20.98	4.323
Effective communication (LS3)	3	10	7.25	1.898
Creative thinking (LS4)	2	10	7.29	1.797
Effective communication + Self-awareness (LS5)	1	4	2.79	.936
Decision making (LS6)	2	8	6.35	1.814
Problem solving + Critical thinking (LS7)	0	5	3.52	1.260
LSTT	18.00	76.00	56.6538	11.94577
PLS1	27.27	100.00	77.0979	17.31353
PLS2	21.43	100.00	74.9313	15.43828
PLS3	30.00	100.00	72.5000	18.98142
PLS4	18.18	90.91	66.2587	16.33554
PLS5	25.00	100.00	69.7115	23.39795
PLS6	25.00	100.00	79.3269	22.67154
PLS7	.00	100.00	70.3846	25.20205
PLSTT	23.38	98.70	73.5764	15.51398

N = 52

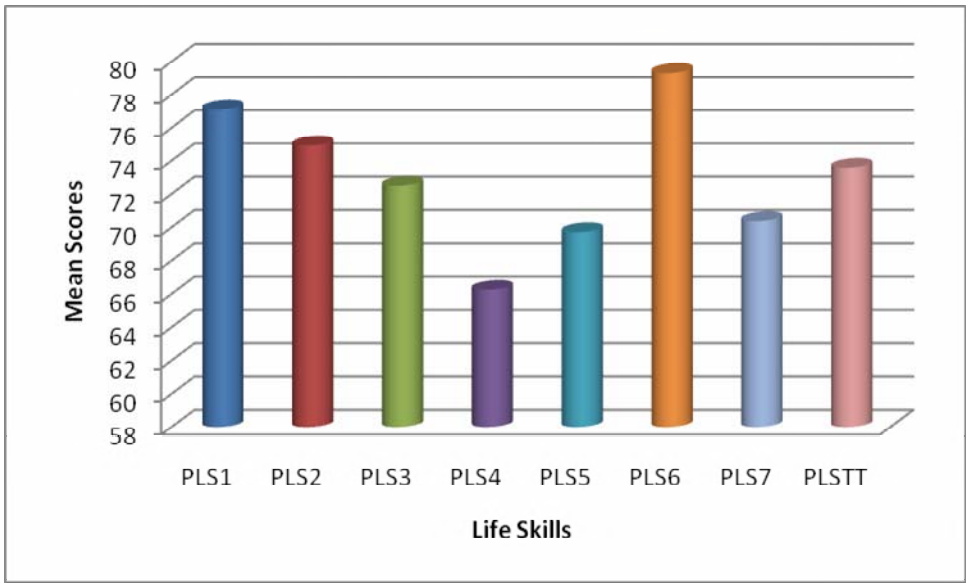
Graph 1

Mean scores of attainment of paired/individual life skills of JSS1-Sharada Vilas



Graph 2

Percent Mean scores of attainment of paired/individual life skills of JSS1-Sharada Vilas



Hypothesis: There is no individual variation in the mean attainment of life skills.

The above two schools for which the same content questionnaire (QI) was administered to the PUI shows that out of the skill pairs/skills for the schools studied all the seven paired / individual life skills studied here viz., critical thinking and decision making, critical thinking, effective communication, creative thinking, effective communication and self awareness, decision-making, problem-solving, critical thinking have a standard deviation of the mean individual attainment of these skills less than 10, indicating thereby that there is less individual variation in the attainment of these paired individual life skills.

The descriptive statistics for the percent life skills for these two schools shows that the SD of the mean is more than 10 and therefore there is wide individual variation in the attainment of percent of individual and total life skills in these schools. Therefore the hypothesis is rejected.

Group Statistics for the Two Schools JSS and SV

Percentage analysis of life skills was studied to assess total assessment of life skills in a group. (Table 2) t-test was done to test for equality of means and their significance.

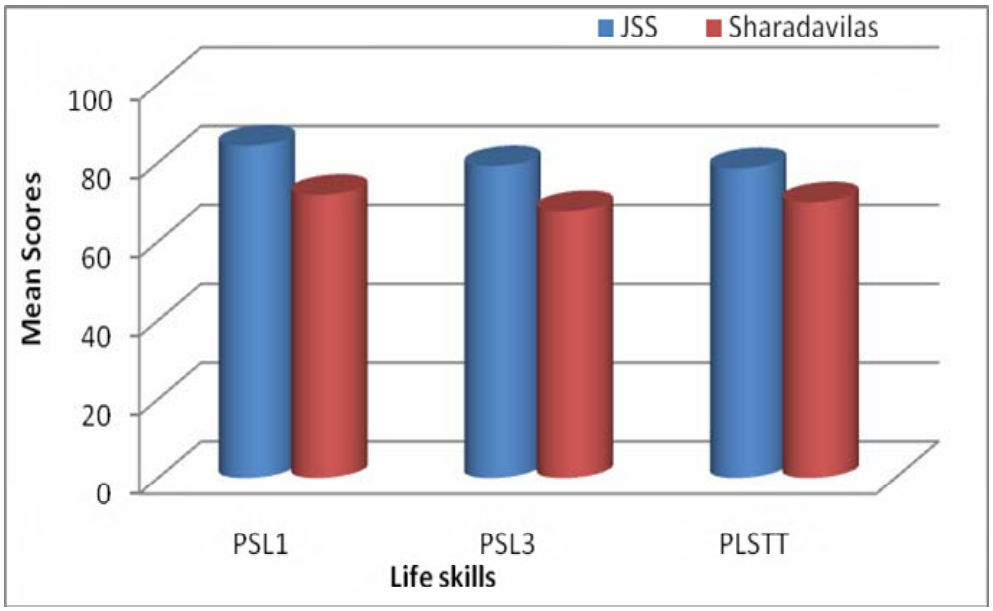
Table 2: Group statistics for JSSI-Sharada Vilas (PUCIQI)

	School	Mean	S.D	Std. Error Mean	T value	P value
PLS1	JSS	84.30	19.27	4.11	2.725	**.009**
	Sharada Vilas	71.82	13.79	2.52		
PLS2	JSS	79.71	18.55	3.96	1.963	.055
	Sharada Vilas	71.43	11.83	2.16		
PLS3	JSS	79.09	22.45	4.79	2.226	**.031**
	Sharada Vilas	67.67	14.55	2.66		
PLS4	JSS	68.18	20.18	4.30	.724	.473
	Sharada Vilas	64.85	13.02	2.38		
PLS5	JSS	76.14	29.36	6.26	1.728	.090
	Sharada Vilas	65.00	16.87	3.08		
PLS6	JSS	85.23	22.70	4.84	1.633	.109
	Sharada Vilas	75.00	22.02	4.02		
PLS7	JSS	72.73	29.95	6.39	.570	.571
	Sharada Vilas	68.67	21.45	3.92		
PLSTT	JSS	78.57	18.77	4.00	2.050	**.046**
	Sharada Vilas	69.91	11.63	2.12		

N (JSS & Sharada Vilas) = 22 and 30 respectively

Graph 3

Mean Scores of PLS1, PLS3 and PLSTT of JSS and Sharada Vilas



Hypothesis: There is no difference between JSS and SV in the percentage attainment of life skills.

In PLSI i.e. critical thinking and decision-making, attainment of JSS had a mean of 84.30 which is higher than that of SV with a mean of 71.82. This was significant. (t=2.725; p=.009)

In PLS2, i.e. critical thinking, students of JSS had an attainment mean of 79.71 which was definitely higher than that of SV but was not significant (t=1.963; p=0.055).

In PLS3, i.e. effective communication, students of JSS had an attainment mean of 79.09 and this was higher than that of SV with an attainment mean of 67.67. This was significant (t=2.22; p=.031).

In PLS4, i.e. creative thinking, students of JSS had an attainment mean of 68.18 which was higher than that of SV with a mean of 64.85 but was not significant (t=.724, p=.473).

In PLS5, i.e. effective communication and self awareness, students of JSS had an attainment mean of 76.14 which was higher than that of attainment of SV students with a mean of 65.0 but was not significant (t=1.728, p=.090).

In PLS6, i.e. decision-making, students of JSS had an attainment mean of 85.23 and this was definitely higher than that of SV students with a mean of 75 but was not significant (t=1.633, p=.109).

In PLS7 i.e. problem-solving and critical thinking students of JSS had an attainment mean of 72.73 which was definitely higher than that of SV students with an attainment mean of 68.67 but was not significant (t=.570, p=.571).

In PLSTT i.e. total of percent life skills of the two schools JSS had a higher mean of attainment of 78.57 than that of Sharada Vilas with a mean of 69.91. This was significant (t=2.050; p=.046). There are significant differences between JSS and SV in attainment of critical thinking and decision making, effective communication and total percent Life Skills. **Therefore hypothesis is rejected**.

Group statistics for gender-wise differences for boys and girls of JSS and SV

Percentage analysis was studied to assess total attainment of life skills in a gender (boys/girls) group. T-test was done to test for equality of means and their significance.

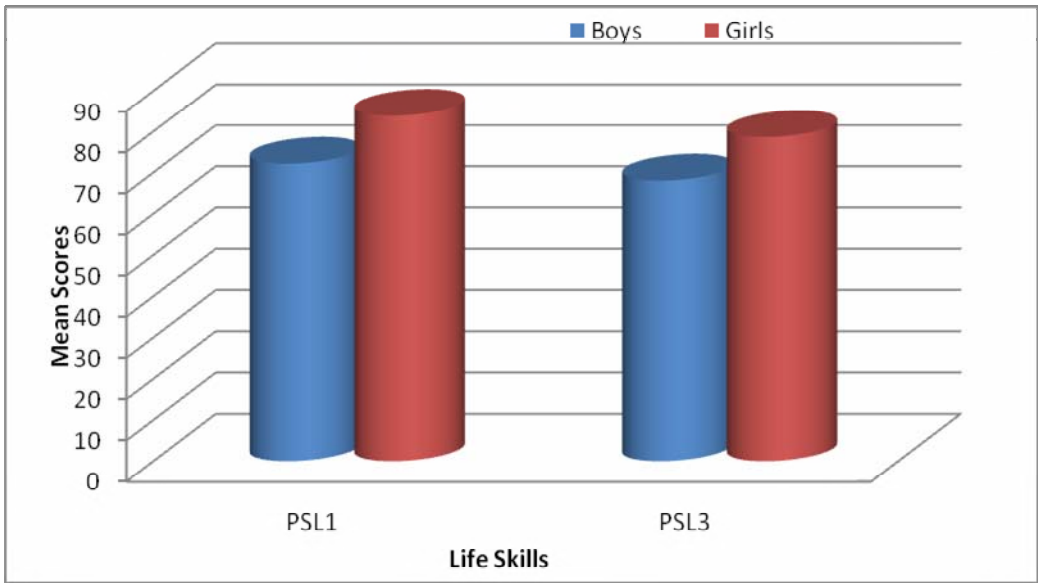
Table 3: Group statistics for gender differences in JSS1-Sharada Vilas (PUCIQI)

	Gender	Mean	S.D	Std. Error Mean	T value	P value
PLS1	B	72.12	13.70	2.50	-2.547	**.014**
	G	83.88	19.62	4.18		
PLS2	B	72.38	11.79	2.15	-1.404	.166
	G	78.41	19.11	4.07		
PLS3	B	68.00	14.24	2.60	-2.059	**.045**
	G	78.64	22.95	4.89		
PLS4	B	65.45	12.94	2.36	-.411	.683
	G	67.36	20.36	4.34		
PLS5	B	65.83	16.72	3.05	-1.409	.165
	G	75.00	29.88	6.37		
PLS6	B	75.83	22.49	4.11	-1.307	.197
	G	84.09	22.55	4.81		
PLS7	B	69.33	21.49	3.92	-.348	.729
	G	71.82	30.02	6.40		
PLSTT	B	70.61	11.54	2.11	-1.639	.108
	G	77.63	19.25	4.11		

N (Boys and girls 30 each)

Graph 4

Percent mean scores for gender-wise differences for JSS1-Sharada Vilas



Hypothesis: There is no difference between boys and girls in attainment of life skills.

In PLS1 i.e. percent life skills for critical thinking and decision making, boys of the two schools have a significantly lesser attainment mean of 72.12 than that of girls with a mean of 83.88. This was highly significant (t=-2.547, p=0.014).

In PLS2, i.e. percent life skills for critical thinking, girls have a higher attainment mean of 78.40 than boys with a mean of 72.38 and this is not significant (t=-1.404, p=0.166).

In PLS3, i.e. percent life skills for effective communication, girls have a higher attainment mean of 78.64 as against a lower attainment mean of 68.00 for boys and this is significant (t=-2.059, p=.045).

In PLS4, i.e. percent life skills for creative thinking, girls have a higher attainment mean of 67.36 than boys with a mean of 65.45 and this was not significant (t=-.411, p=.683).

In PLS5, i.e. percent life skills for effective communication and self-awareness, girls have a higher attainment mean of 75.00 than boys with a mean of 65.83 and this was not significant (t=-1.409, p=0.165).

In PLS6, i.e. percent life skills for decision-making, girls have a higher attainment mean of 84.09 than that of boys with a mean of 75.83 and this was not significant (t=-1.307, p=.197).

In PLS7, i.e. percent life skills for problem-solving and critical thinking also girls have a higher mean of attainment of 71.82 than boys with a mean of 69.33 but this was not significant (t=-.348, p=.729).

In PLSTT i.e. total percent of life skills, two girls showed higher mean of 77.63 of attainment than boys with a mean of 70.61 and this was not significant (t=-1.639, p=.108).

In brief, girls attain more life skills but this was not significant except in case of PLS1, i.e. critical thinking and decision-making skills. Therefore, the hypothesis is rejected.

Attainment of Minimum Levels of Learning (MLL) in the seven paired/ individual life skills of JSS and SV

The cut off point for attainment of minimum levels of learning (MLL) of the skills was fixed at 50% based on the scale as follows: *35-49% marks as minimum; 50-59% marks as good; 60-79% marks as excellent; 80-100% marks as mastery level* (Dave et al., 1991).

Hypothesis: There is no difference in the attainment of MLL in the 7 paired/ individual life skills of JSS and SV students.

1. Minimum Levels of Learning (MLL) in critical thinking and decision-making

Table 4: MLL in the life skill of critical thinking and decision-making of JSS1 and SV

ML1		School		Total	Test Statistics
		JSS	Sharada Vilas		
Not att	F	2	2	4	CC = .045; P=.746
	%	9.1%	6.7%	7.7%	
att	F	20	28	48	
	%	90.9%	93.3%	92.3%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 92.3% students have attained MLL (i.e. 50% attainment) in critical thinking and decision-making as against 7.7% who have not attained MLL (i.e. 50% attainment) in this skill and this was found to be true for both JSS and SV (CC=.045; .746). This difference was not significant.

2. Minimum Levels of Learning in Critical Thinking

Table 5: MLL in life skill of critical thinking of JSS1 and SV

ML2		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	1	1	2	CC = .031; P=.822
	%	4.5%	3.3%	3.8%	
att	F	21	29	50	
	%	95.5%	96.7%	96.2%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 96.2% of students have attained MLL (i.e. 50% attainment) in critical thinking as against 3.8% who have not attained MLL in this skill. And this was found to be true for both JSS and SV students (CC=0.031; .822). This difference was not significant.

3. Minimum Levels of Learning in Effective Communication

Table 6: MLL in life skill of Effective Communication of JSS1 and SV

ML3		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	4	4	8	CC = .066; P=.632
	%	18.2%	13.3%	15.4%	
att	F	18	26	44	
	%	81.8%	86.7%	84.6%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 84.6% of the students have attained MLL (i.e. 50% attainment) in critical thinking as against 15.4% who have not attained MLL in this skill. And this was found to be true for both JSS and SV students (CC=.066, .632). This difference was not significant.

4. Minimum Levels of Learning in Creative Thinking

Table 7: MLL in life skill of Creative Thinking of JSS1 and SV

ML4		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	3	3	6	CC = .056; P=.685
	%	13.6%	10.0%	11.5%	
att	F	19	27	46	
	%	86.4%	90.0%	88.5%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 88.5% students have attained MLL (i.e. 50% attainment) in creative thinking as against 11.5% who have not attained MLL in this skill. And this was found to be true of both JSS and SV students (CC=.056, .685). This difference was not significant.

5. Minimum Levels of Learning in Effective Communication and Self-awareness

Table 8: MLL in life skill of Effective Communication and Self-awareness of JSS1 and SV

ML5		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	6	11	17	CC = .098; P=.476
	%	27.3%	36.7%	32.7%	
att	F	16	19	35	
	%	72.7%	63.3%	67.3%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 67.3% have attained MLL (i.e. 50% attainment) in effective communication and self-awareness as against 32.7% who have not attained MLL in this skill. And this was found to be true of both JSS and SV students (CC=0.098; .476). This difference was not significant.

6. Minimum Levels of Learning in decision-making

Table 9: MLL in life skill of decision-making of JSS1 and SV

ML6		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	4	5	9	CC = .020; P=.887
	%	18.2%	16.7%	17.3%	
att	F	18	25	43	
	%	81.8%	83.3%	82.7%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 82.7% of the students have attained MLL (i.e. 50% attainment) in decision-making as against 17.3% who have not attained this skill. This was found to be true of both JSS and SV (CC=0.020; .887). The difference in attainment was not significant.

7. Minimum Levels of Learning in Problem Solving and Critical Thinking

Table 10: MLL in life skill of Problem-Solving and Critical Thinking of JSS1 and SV

ML7		School		Total	Test Statistics
		JSS	Sharada Vilas		
Not att	F	4	6	10	CC = .023; P=.869
	%	18.2%	20.0%	19.2%	
att	F	18	24	42	
	%	81.8%	80.0%	80.8%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 80.8% of the students have attained MLL (i.e. 50% attainment) in problem-solving and critical thinking as against 19.2% who have not attained this skill. This was found to be true of both JSS and SV (CC=0.023; .869). The difference was not significant.

8. Minimum Levels of Learning in Total Life Skills (7 paired/individual LS)

Table 11: MLL in Total Life Skills of JSS1 and SV

ML8		School		Total	Test Statistics
		JSS	Sharada Vilas		
not att	F	1	3	4	CC = .101; P=.466
	%	4.5%	10.0%	7.7%	
att	F	21	27	48	
	%	95.5%	90.0%	92.3%	
Total	F	22	30	52	
	%	100.0%	100.0%	100.0%	

On the whole 92.3% of the students have attained MLL (i.e. 50% attainment) in all the 7 paired LS/individual LS studied here as against 7.7% who have not attained MLL in these skills. This was found to be true of both JSS and SV students (CC=.101;.466). The difference was not significant.

As the pattern of attainment of MLL in both the schools is the same, and the differences in values are not significant, therefore, the hypothesis is accepted.

5.2 Comparison between JSS2 and Sadvidya in Life Skills

Descriptive Statistics for the Two Schools – JSS2 and Sadvidya (PUC II QI)

Mean and standard deviation were studied for assessing individual variation in life skills. (Table 12)

Table 12: Descriptive statistics for JSS and Sadvidya (PUC II – QI)

Descriptive Statistics

Life Skills	Minimum	Maximum	Mean	S.D
Critical thinking (LS1)	56.03	100.00	83.95	12.23
Effective communication (LS2)	51.22	100.00	84.92	13.65
Self-awareness and Effective communication (LS3)	9.09	100.00	77.92	18.81
Creative thinking and Self-awareness (LS4)	66.67	100.00	86.07	10.92
Creative thinking and and Critical thinking (LS5)	.00	100.00	59.52	30.92
Self-awareness (LS6)	50.00	100.00	85.37	13.83
Decision making (LS7)	51.52	100.00	82.43	13.76
Creative thinking (LS8)	50.00	100.00	85.74	13.68
Problem solving and Effective communication (LS9)	39.39	100.00	85.86	15.32
Creative thinking and Problem solving (LS10)	40.00	100.00	89.52	16.79
Decision making and Critical thinking (LS11)	50.00	100.00	92.06	18.42
Problem solving (LS12)	39.29	100.00	81.35	14.77
Critical thinking and Effective communication (LS13)	28.57	100.00	85.26	20.20
Self-awareness, Empathy and Coping with emotions (LS14)	50.00	100.00	89.68	15.96
Decision Making and Effective Communication (LS15)	33.33	100.00	88.89	18.93

N = 63

Hypothesis 1: There is no individual variation in the mean attainment of life skills.

The descriptive statistics for the above two schools for which the same content questionnaire (QI) was administered to the PUCII level shows that out of the 15 paired/ individual life skills studied for the two schools in the questionnaire, almost all of them viz., critical thinking, effective communication, self awareness & effective communication, creative thinking & self-awareness, creative thinking & critical thinking, self awareness, decision making, creative thinking, problem solving & effective communication, creative thinking & problem solving, decision making & critical thinking, problem solving, critical thinking & effective communication, self-awareness + empathy + coping with emotions and decision-making + effective communication all have standard deviation of the mean individual attainment of these life skills as more than 10, showing thereby that there is wide individual variation in the attainment of these skills. Wide individual variation with SD of the mean being more than 10, is also seen in the percent life skills values of the two schools.

Therefore, the hypothesis is proved wrong/rejected.

Group statistics for the two schools – JSS and Sadvidya (PUCIIQI)

Percentage analysis of life skills was studied to assess total attainment of life skills in a group. t-test was done to test for equality of means and their significance. (Table 13)

Table 13: Group statistics for JSS2 and Sadvidya (PUCII, QI)

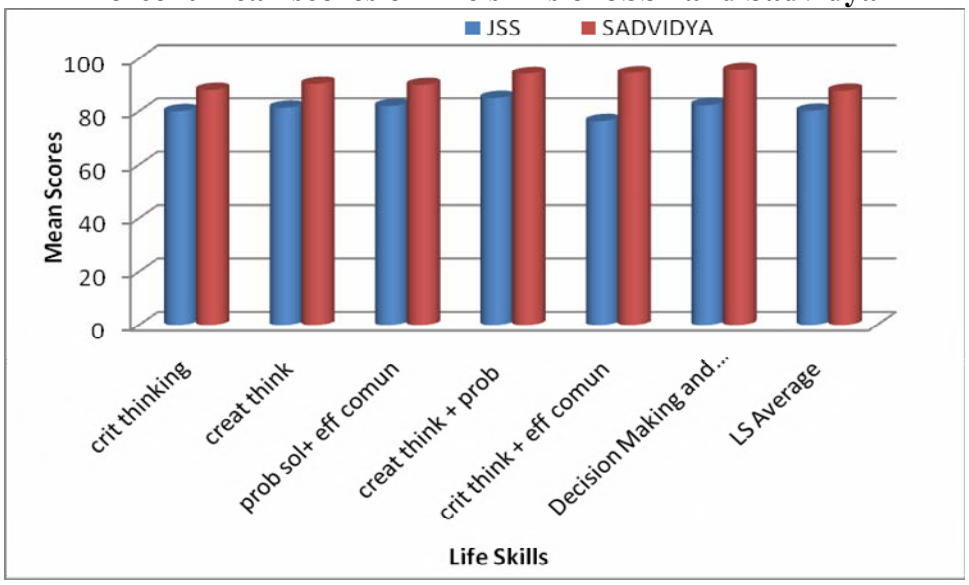
Group Statistics

Life Skills	School	Mean	S.D	Std. Error Mean	T value	P value
Critical thinking (LS1)	JSS	80.04	12.15	2.14860	-2.708	**.009**
	Sadvidya	87.99	11.10	1.99324		
Effective communication (LS2)	JSS	82.01	13.47	2.38054	-1.746	086
	Sadvidya	87.92	13.39	2.40559		
Self-awareness and Effective communication (LS3)	JSS	74.72	18.86	3.33458	-1.385	.171
	Sadvidya	81.23	18.47	3.31780		
Creative thinking and Self-awareness (LS4)	JSS	84.03	11.61	2.05325	-1.521	.133
	Sadvidya	88.17	9.91	1.78013		
Creative thinking and and Critical thinking (LS5)	JSS	59.38	39.02	6.89696	-.038	**.051**
	Sadvidya	59.68	20.08	3.60656		
Self-awareness (LS6)	JSS	82.03	13.00	2.29874	-1.993	.969
	Sadvidya	88.82	14.02	2.51779		
Decision making (LS7)	JSS	79.17	14.52	2.56636	-1.958	.055
	Sadvidya	85.81	12.26	2.20225		
Creative thinking (LS8)	JSS	81.37	14.24	2.51812	-2.706	**.009**
	Sadvidya	90.26	11.65	2.09325		
Problem solving and Effective communication (LS9)	JSS	82.01	15.98	2.82457	-2.081	**.042**
	Sadvidya	89.83	13.74	2.46843		
Creative thinking and Problem solving (LS10)	JSS	85.00	18.32	3.23788	-2.242	**.029**
	Sadvidya	94.19	13.85	2.48757		
Decision making and Critical thinking (LS11)	JSS	89.06	21.00	3.71243	-1.322	.191
	Sadvidya	95.16	15.03	2.69890		
Problem solving (LS12)	JSS	79.35	14.25	2.51893	-1.092	.279
	Sadvidya	83.41	15.25	2.73926		
Critical thinking and Effective communication (LS13)	JSS	76.34	22.84	4.03701	-3.962	**.000**
	Sadvidya	94.47	11.47	2.06089		
Self-awareness, Empathy and Coping with emotions (LS14)	JSS	85.94	16.73	2.95666	-1.934	.058
	Sadvidya	93.55	14.39	2.58400		
Decision Making and Effective Communication (LS15)	JSS	82.29	20.71	3.66140	-2.984	**.004**
	Sadvidya	95.70	14.25	2.55965		
LS Average	JSS	80.20	13.40	2.36873	-2.548	**.013**
	Sadvidya	87.70	9.80	1.76509		

N (JSS & Sadvidya) = 32 & 31 respectively

Graph 5

Percent mean scores of Life skills of JSS2 and Sadvidya



Hypothesis 2: There is no difference between JSS and Sadvidya in the percent attainment of life skills.

In PLS1 i.e. critical thinking students of Sadvidya had a higher attainment mean of 87.99 than that of JSS 2 with an attainment mean of 80.04. This difference was found to be highly significant (t=-2.708 and p=.009).

In PLS2 i.e. effective communication, students of Sadvidya had a higher attainment mean of 87.92 than that of JSS school students who had a mean of 82.01. This difference was not significant (t=-1.746 and p=.086).

In PLS3 i.e. self-awareness and effective communication, students of Sadvidya had achieved attainment mean of 81.23 which was higher than that of JSS students with an attainment mean of 74.72. This difference was not significant (t=-1.385; p=.171).

In PLS4 i.e. creative thinking and self-awareness, students of Sadvidya had a higher attainment mean of 88.17 than students of JSS with an attainment mean of 84.03. This difference was not found to be significant. (t=-1.521; p=.133)

In PLS 5 i.e. creative thinking and critical thinking, students of JSS 2 and Sadvidya had more or less similar (59.38 and 59.68) attainment of scores and this was not significant (t= -.038 and p=0.051).

In PLS 6, i.e. self-awareness, students of Sadvidya had a higher attainment mean of 88.82 than that of JSS with a mean of 82.03. This difference was not significant (t=-1.993, p=.969).

In PLS 7 i.e. decision-making, students of Sadvidya had a higher attainment mean of 85.81 as against, JSS students with a mean of 79.17. This difference was higher than 0.05 and therefore not significant (t=-1.958, p=0.055).

In PLS 8, i.e. creative thinking, students of Sadvidya had a higher attainment mean of 90.26 as against JSS students with a mean of 81.37. This difference was found to be highly significant (t=-2.706, p=.009).

In PLS 9, i.e. problem solving and effective communication, students of Sadvidya had a higher attainment mean of 89.83 as against the students of JSS 2 with a mean of 82.0. This difference was found to be significant (t=-2.081, p=.042).

In PLS 10, i.e. creative thinking and problem-solving, students of Sadvidya had a higher attainment mean of 94.19 as against the students of JSS with a mean of 85.0. This difference was found to be significant (t=-2.242, p=.029).

In PLS 11, i.e. decision-making and critical thinking, students of Sadvidya had a higher attainment of 95.16 as against the students of JSS with a mean of 89.06. This difference was not significant (t=-1.322, p=.191).

In PLS 12, i.e. problem-solving, students of Sadvidya had a higher attainment mean of 83.41 as against JSS students with a mean of 79.35. This difference was found to be not significant (t=-1.092, p=.279).

In PLS 13, i.e. critical thinking and effective communication, students of Sadvidya had a higher attainment mean of 94.47 as against that of JSS 2 students with a mean of 76.34. This difference was found to be highly significant (t=-3.962, p=.000).

In PLS 14, i.e. self-awareness + empathy + coping with emotions, students of Sadvidya had a higher attainment mean of 93.55 as against that of JSS 2 students with a mean of 85.94. This difference was not significant (t=-1.934; p=.058).

In PLS 15, i.e. decision making + effective communication, students of Sadvidya had a higher attainment mean of 95.70 as against JSS students with a mean of 82.29. This difference was significant (t=-2.984; p=.004).

In PLSAV or Total i.e. total of percent life skills of the two schools, Sadvidya had higher mean of attainment of 87.70 than that of JSS with mean of 80.20. This was significant (t=-2.548;p=.013). There are significant differences between JSS and SV in attainment of critical thinking, creative thinking,problem-solving & effective communication, creative thinking and problem-solving, critical thinking and effective communication, decision-making and effective communication and total percent life skills.

Therefore the hypothesis is rejected.

Group statistics for gender wise differences between boys and girls of JSS 2 and Sadvidya schools

Percentage analysis was studied to assess total attainment of life skills in a gender (boys/girls) group. t-test was done to test for equality of means and their significance. (Table 14)

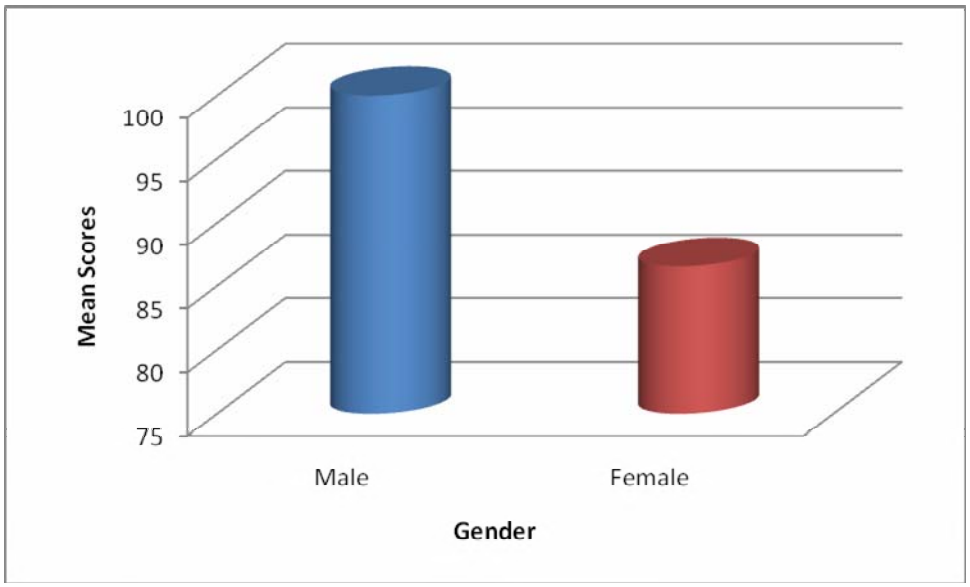
Table 14: Group statistics for gender differences in JSS2 and Sadvidya (PUC II, QI)

	Gender	Mean	S.D	Std. Error Mean	T value	P Value
Critical thinking (LS1)	Male	88.17	11.71	3.53169	1.265	.211
	Female	83.06	12.26	1.69956		
Effective communication (LS2)	Male	86.36	15.94	4.80493	.383	.703
	Female	84.62	13.27	1.84078		
Self-awareness and Effective communication (LS3)	Male	87.60	17.38	5.23996	1.919	.060
	Female	75.87	18.61	2.58103		
Creative thinking and Self-awareness (LS4)	Male	87.88	5.99	1.80692	.602	.549
	Female	85.68	11.71	1.62427		
Creative thinking and and Critical thinking (LS5)	Male	45.45	15.08	4.54545	-1.685	.097
	Female	62.50	32.65	4.52807		
Self-awareness (LS6)	Male	88.76	15.70	4.73290	.892	.376
	Female	84.65	13.46	1.86718		
Decision making (LS7)	Male	87.41	10.58	3.19010	1.328	.189
	Female	81.38	14.20	1.96966		
Creative thinking (LS8)	Male	88.99	15.46	4.66098	.863	.392
	Female	85.06	13.34	1.85036		
Problem solving and Effective communication (LS9)	Male	89.81	17.21	5.18902	.940	.351
	Female	85.02	14.94	2.07112		
Creative thinking and Problem solving (LS10)	Male	94.55	9.34	2.81672	1.093	.279
	Female	88.46	17.86	2.47742		
Decision making and Critical thinking (LS11)	Male	100.00	0.00	.00000	1.592	.116
	Female	90.38	19.90	2.75935		
Problem solving (LS12)	Male	82.79	18.34	5.52902	.354	.725
	Female	81.04	14.10	1.95551		
Critical thinking and Effective communication (LS13)	Male	92.21	13.35	4.02388	1.262	.212
	Female	83.79	21.18	2.93654		
Self-awareness, Empathy and Coping with emotions (LS14)	Male	93.18	11.68	3.52089	.798	.428
	Female	88.94	16.73	2.31941		
Decision Making and Effective Communication (LS15)	Male	100.00	0.00	.00000	2.208	**.031**
	Female	86.54	20.09	2.78550		
LS average	Male	87.54	9.51	2.86722	1.082	.283
	Female	83.13	12.74	1.76734		

N(Male & Female) = 11 & 52 respectively

Graph 6

Percent mean scores for gender-wise differences in decision making and effective communication skill of JSS2 and Sadvidya (PUCII, QI)



Hypothesis: There is no difference between boys and girls in the attainment of various life skills.

In PLS 1 i.e. critical thinking, girls had a lower mean of attainment (83.06) than boys with a mean of 88.17 and this was not significant (t=1.265, p=.211).

In PLS 2, i.e. effective communication, girls had a lower mean of attainment (84.62) than boys (86.36) and this was not significant (t=.383; p=.703).

In PLS 3, i.e. self-awareness + effective communication, girls had a lower mean of attainment (75.87) than boys (87.60) and this was not significant (t=1.919; p=.060).

In PLS 4, i.e. creative thinking + self awareness, girls had a lower mean of attainment (85.68) than boys (87.88) and this was not significant (t=.602, p=.549).

In PLS 5, i.e. creative thinking + critical thinking, girls have a higher mean of attainment (62.5) than boys (45.45) and this was not significant (t=-1.685, p=.097).

In PLS 6, i.e. self-awareness, girls have a lower mean of attainment (84.65) than boys (88.76) and this was not significant (t=.892; p=.376).

In PLS 7, i.e. decision-making, girls have a lower mean of attainment (81.38) than boys (87.41) and this was not significant (t=1.328; p=.189).

In PLS 8, i.e. creative-thinking, girls have a lower mean of attainment (85.06) than boys (88.99) and this was not significant (t=.863; p=.392).

In PLS 9, i.e. problem-solving + effective communication, girls have a lower mean of attainment (85.02) than boys (89.81) and this was not significant (t=.940; p=.351).

In PLS 10, i.e. creative thinking + problem solving, girls have a lower mean (88.46) than boys (94.55) and this was not significant (t=1.093, p=.279).

In PLS 11, i.e. decision-making and critical thinking, girls have a lower mean of attainment (90.38) than boys (100.00). Infact the boys have cent percent attainment in this skill. The gender difference was not significant (t=1.592; p=.116).

In PLS 12, i.e. problem-solving, girls have a slightly lower mean of attainment (81.04) than boys (82.79) and this was not significant (t=.354; p=.725).

In PLS 13, i.e. critical thinking + effective communication, girls have a lower mean of attainment (83.79) than boys (92.21) and this was not significant (t=1.262; p=.212).

In PLS 14, i.e. self-awareness + empathy + coping with emotions, girls had a lower mean of attainment (88.94) than boys (93.18) and this was not significant (t=.798; p=.428).

In PLS 15, i.e. decision-making + effective communication, boys showed cent percent attainment as against girls with a mean attainment of 86.54 and this difference was found to be significant (t=2.208; p=.031).

In PLS average, i.e. average attainment of all the skills together (LS1-LS15), girls had a lesser mean of attainment (83.13) as against boys (87.54) and this difference was not significant (t=1.082; p=.283).

Therefore the hypothesis is accepted.

A significant difference is seen between boys and girls only in Life Skills 15 of decision-making and effective communication.

Attainment of Minimum Levels of Learning in the 15 paired/individual life skills of JSS 2 and Sadvidya

Hypothesis 1: There is no difference in the attainment of MLL in the 15 paired/ individual life skills of JSS 2 and Sadvidya.

1. MLL in LS of critical thinking

Table 15: MLL in life skill of critical thinking of JSS 2 and Sadvidya
Crosstab

ML1		School		Total
		JSS	Sadvidya	
Attained	F	32	31	63
	%	100.0%	100.0%	100.0%
Total	F	32	31	63
	%	100.0%	100.0%	100.0%

There was cent percent attainment of this life skill in JSS2 and Sadvidya. Therefore CC was not calculated.

2. MLL in LS of Effective Communication

Table 16: MLL in life skill of effective communication of JSS2 and Sadvidya

ML2		School		Total
		JSS	Sadvidya	
Attained	F	32	31	63
	%	100.0%	100.0%	100.0%
Total	F	32	31	63
	%	100.0%	100.0%	100.0%

There was cent percent attainment of this life skill in JSS2 and Sadvidya. Therefore CC was not calculated.

3. Minimum levels of learning in self-awareness and effective communication

Table 17: MLL in life skill of self awareness and effective communication of JSS2 and Sadvidya

Crosstab

ML3		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	3	1	4	CC=.125; P=.317
	%	9.4%	3.2%	6.3%	
Attained	F	29	30	59	
	%	90.6%	96.8%	93.7%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 93.7% students have attained MLL (i.e. 50% attainment) in skills of self-awareness and effective communication as against 6.3% who have not attained these skills and this was found to be true for both JSS and Sadvidya (CC=0.125, .317). This difference was not significant.

4. Minimum levels of learning in creative thinking and self-awareness

Table 18: MLL in life skills of creative thinking and self-awareness of JSS2 and Sadvidya

ML4		School		Total
		JSS	Sadvidya	
Attained	F	32	31	63
	%	100.0%	100.0%	100.0%
Total	F	32	31	63
	%	100.0%	100.0%	100.0%

On the whole cent percent students have attained MLL (i.e. 50% attainment) in both of JSS and Sadvidya in creative thinking and self-awareness. Therefore, CC was not calculated.

5. Minimum levels of learning in creative thinking and critical thinking

Table 19: MLL in life skills of creative thinking and critical thinking of JSS2 and Sadvidya

ML5		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	19	25	44	CC=.226; P=.066
	%	59.4%	80.6%	69.8%	
Attained	F	13	6	19	
	%	40.6%	19.4%	30.2%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, only 30.2% students have attained MLL (i.e. 50% attainment) in creative thinking and critical thinking as against 69.8% who have not attained MLL. But this was not true of both JSS and Sadvidya. The pattern of attainment is different for both the schools (CC=.226; p=.066). The differences were not found to be significant.

6. Minimum levels of learning in self-awareness

Table 20: MLL in life skill of self-awareness of JSS2 and Sadvidya

ML6		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	0	1	1	CC=.128; P=.306
	%	.0%	3.2%	1.6%	
Attained	F	32	30	62	
	%	100.0%	96.8%	98.4%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 98.4% students have attained MLL (i.e. 50% attainment) in self-awareness as against 1.6% who have not attained MLL in this skill. This was found to be true of both JSS 2 and Sadvidya students (CC=.128; .306). The difference was not significant.

7. Minimum levels of learning in decision-making

Table 21: MLL in life skill of decision-making of JSS2 and Sadvidya

ML7		School		Total
		JSS	Sadvidya	
Attained	F	32	31	63
	%	100.0%	100.0%	100.0%
Total	F	32	31	63
	%	100.0%	100.0%	100.0%

On the whole, all the students have attained MLL (i.e. 50% attainment) in decision-making in both JSS 2 and Sadvidya. Therefore, CC was not calculated.

8. Minimum levels of learning in creative thinking

Table 22: MLL in life skill of creative thinking of JSS2 and Sadvidya

ML8		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	0	1	1	CC=.128; P=.306
	%	.0%	3.2%	1.6%	
Attained	F	32	30	62	
	%	100.0%	96.8%	98.4%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 98.4% students have attained MLL (i.e. 50% attainment) in creative thinking as against 1.6% who have not attained MLL in this skill. This was found to be true of both JSS and Sadvidya students (CC=.128; .306). The difference was not significant.

9. Minimum levels of learning in problem-solving and effective communication

Table 23: MLL in life skills of problem-solving and effective communication of JSS2 and Sadvidya

ML9		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	0	1	1	CC=.128; P=.306
	%	.0%	3.2%	1.6%	
Attained	F	32	30	62	
	%	100.0%	96.8%	98.4%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 98.4% students have attained MLL (i.e. 50% attainment) in problem-solving and effective communication as against 1.6% who have not attained MLL in these skills. In JSS, all the students have attained MLL whereas in Sadvidya 96.8% have attained MLL. However, this difference was not significant (CC=.128; .306).

10. Minimum levels of learning in creative thinking and problem-solving

Table 24: MLL in life skill of creative thinking and problem-solving of JSS2 and Sadvidya

ML10		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	1	1	2	CC=.003; P=.982
	%	3.1%	3.2%	3.2%	
Attained	F	31	30	61	
	%	96.9%	96.8%	96.8%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 96.8% students have attained MLL (i.e. 50% attainment) in creative thinking and problem-solving as against 3.2% who have not attained MLL in these skills. This was found to be true for both JSS and Sadvidya and the difference between the two schools was not significant (CC=.003; .982).

11. Minimum levels of learning in decision-making and critical thinking

Table 25: MLL in life skill of decision-making and critical thinking of JSS2 and Sadvidya

ML11		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	7	3	10	CC=.165; P=.185
	%	21.9%	9.7%	15.9%	
Attained	F	25	28	53	
	%	78.1%	90.3%	84.1%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 84.1% students have attained MLL (i.e. 50% attainment) in decision-making and critical-thinking as against 15.9% who have not attained MLL in this skill. This was found to be true of both JSS and Sadvidya students (CC=.165; .185) and the difference was not significant.

12. Minimum levels of learning in problem-solving

Table 26: MLL in life skill of problem-solving of JSS2 and Sadvidya

ML12		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	0	2	2	CC=.181; P=.144
	%	.0%	6.5%	3.2%	
Attained	F	32	29	61	
	%	100.0%	93.5%	96.8%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 96.8% students have attained MLL (i.e. 50% attainment) in problem-solving as against 3.2% who have not attained MLL in this skill. Students of JSS have cent percent attainment of MLL as against Sadvidya with 93.5% attainment of MLL. The difference was however not significant (CC=.181; .144).

13. Minimum levels of learning in critical thinking and effective communication

Table 27: MLL in life skill of critical thinking and effective communication of JSS2 and Sadvidya

ML13		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	5	1	6	CC=.207; P=.094
	%	15.6%	3.2%	9.5%	
Attained	F	27	30	57	
	%	84.4%	96.8%	90.5%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 90.5% students have attained MLL (i.e. 50% attainment) in critical thinking and effective communication as against 9.5% who have not attained MLL in these skills. This was found to be true of both JSS and Sadvidya students (CC=.207; .094). The difference was not significant.

14. Minimum levels of learning in self-awareness, empathy and coping with emotions

Table 28: MLL in life skill of self-awareness and empathy and coping with emotions of JSS2 and Sadvidya

ML14		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	3	2	5	CC=.054; P=.668
	%	9.4%	6.5%	7.9%	
Attained	F	29	29	58	
	%	90.6%	93.5%	92.1%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 92.1% students have attained MLL (i.e. 50% attainment) in self-awareness, empathy and coping with emotions as against 7.9% who have not attained MLL in these skills. This was found to be true of both JSS and Sadvidya students (CC=.054; .668). The difference was not significant.

15. Minimum levels of learning in Decision-making and Effective Communication

Table 29: MLL in life skill of decision-making and effective communication of JSS2 and Sadvidya

ML15		School		Total	Test Statistics
		JSS	Sadvidya		
Not attained	F	2	1	3	CC=.071; P=.573
	%	6.3%	3.2%	4.8%	
Attained	F	30	30	60	
	%	93.8%	96.8%	95.2%	
Total	F	32	31	63	
	%	100.0%	100.0%	100.0%	

On the whole, 95.2% students have attained MLL (i.e. 50% attainment) in decision-making and effective communication as against 4.8% who have not attained MLL in this skill. This was found to be true of both JSS and Sadvidya students (CC=.071; .573). The difference was not significant.

Whatever differences are seen in the attainment of MLL (i.e. 50% attainment) are not significant between JSS2 and Sadvidya. Therefore the hypothesis is accepted.

5.3 Comparison between Demonstration Multipurpose and Kendriya Vidyalaya Schools in Life Skills

Descriptive Statistics for the two Schools of DM School and Kendriya Vidyalaya (XI Std QI)

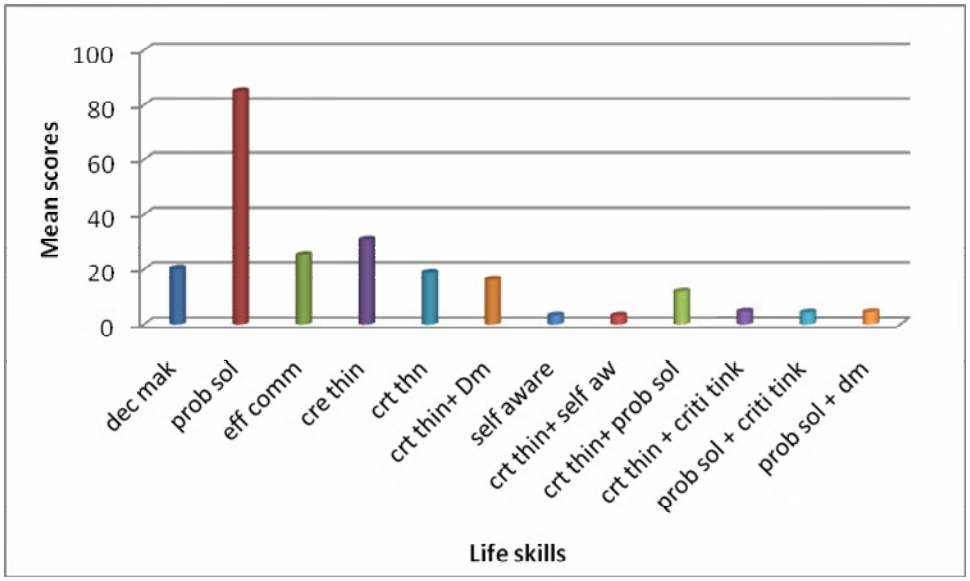
Mean and standard deviation were studied for assessing individual variation in the attainment of life skills. (Table 30)

Table 30: Descriptive statistics for DMS and KV (XI standard QI)

Life skills	Minimum	Maximum	Mean	S.D
Decision making (LS1)	12	24.00	20.38	3.95
Problem solving (LS2)	43.00	94.00	85.07	12.69
Effective communication (LS3)	12.00	28.00	25.21	3.69
Creative thinking (LS4)	14.00	45.00	30.93	12.06
Critical thinking (LS5)	6.00	24.00	18.74	4.79
Critical thinking and Decision-making (LS6)	5.00	21.00	16.14	4.19
Self-awareness (LS7)	2.00	4.00	3.29	0.64
Critical thinking and Self-awareness (LS8)	.00	4.00	3.26	1.13
Critical thinking and Problem solving (LS9)	5.00	13.00	11.81	1.88
Creative thinking and Critical thinking (LS10)	.00	6.00	4.69	1.83
Problem solving and Critical thinking (LS11)	.00	6.00	4.38	2.51
Problem solving and Decision making (LS12)	.00	10.00	4.50	4.87
TOTAL	110.00	274.00	224.29	42.21
TOTALP	40.15	100.00	81.86	15.40
LS1PER	57.14	100.00	86.73	10.53
LS2PER	45.74	100.00	90.50	13.50
LS3PER	42.86	100.00	90.05	13.19
LS4PER	31.11	100.00	68.73	26.80
LS5PER	25.00	100.00	78.08	19.97
LS6PER	23.81	100.00	76.87	19.94
LS7PER	50.00	100.00	82.14	15.89
LS8PER	.00	100.00	81.55	28.19
LS9PER	38.46	100.00	90.84	14.44
LS10PER	.00	46.15	36.08	14.06
LS11PER	.00	100.00	73.02	41.80
LS12PER	.00	100.00	45.00	48.65
LS12PER	.00	100.00	73.02	41.80
LS13PER	.00	100.00	45.00	48.65

N= 42

Graph 7
Mean scores on life skills attainment for DMS and KV



Hypothesis: There is no individual variation in the mean attainment of life skills in the two schools.

The descriptive statistics for the above two schools for which the same content questionnaire (QI) was administered to the XI standard students shows that out of the 12 paired/individual life skills studied for the two schools in the administered questionnaire, majority of the skills studied here viz., decision-making, problem solving, effective communication, creative thinking, critical thinking, critical thinking and decision-making, self-awareness, critical thinking and self-awareness, critical thinking and problem-solving, creative thinking and critical thinking, decision-making, problem solving & critical thinking, problem solving & decision making, a majority of them had standard deviation of the mean below 10, showing thereby less individual variation in the attainment of the above skills. Individual variation in the attainment of problem-solving and creative thinking was however widely significant as the standard deviation of the mean was above 10 in these two skills.

The descriptive statistics for the percent life skill attainment, for these two schools shows that the standard deviation of the mean is more than 10 and therefore **there is wide individual variation in the attainment of paired/individual/life skills in these schools. Therefore, the hypothesis is rejected**.

Group Statistics for the two schools of DM school and Kendriya Vidyalaya

Percentage analysis of life skills was studied to assess total attainment of life skills in a group. t-test was done to test for equality of means and their significance.

Table 31: Group statistics for DMS-KV (XI standard QI)

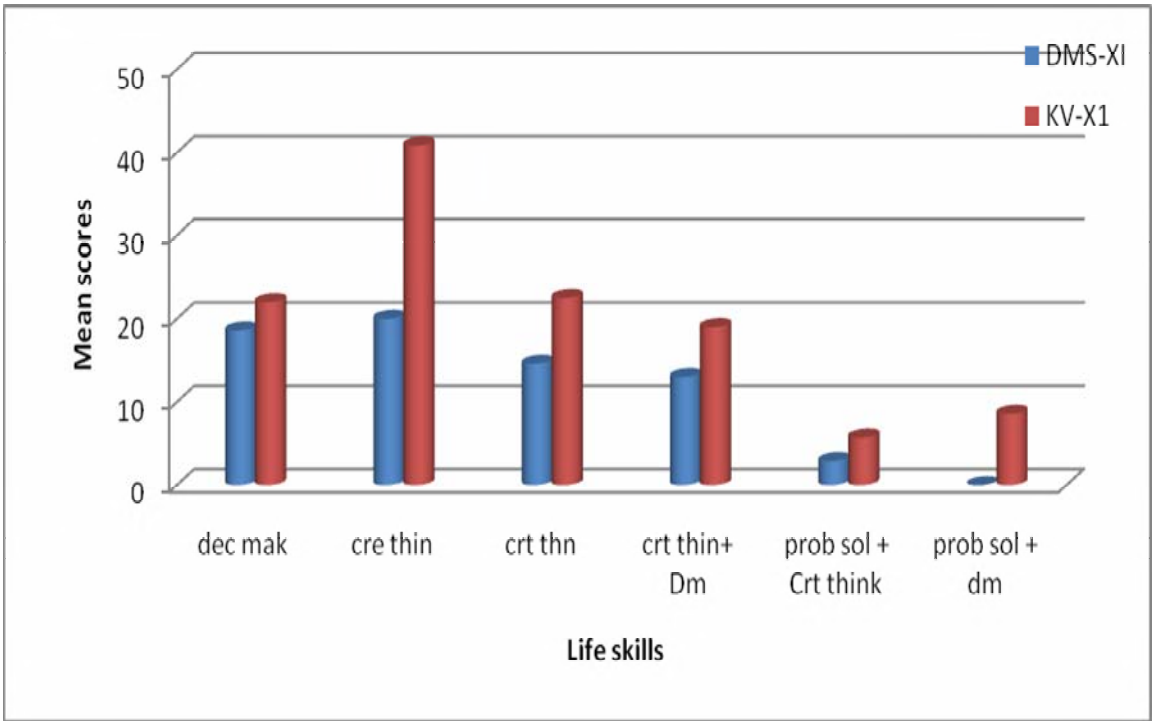
Group Statistics

Life Skills	School	Mean	S.D	Std. Error Mean	T value	P value
Decision making (LS1)	DMS-XI	18.60	4.739	.35615	3.308	**.004**
	KV-XI	22.00	2.000	.26910		
Problem solving (LS2)	DMS-XI	83.30	12.87	2.87832	-.860	.395
	KV-XI	86.68	12.60	2.68585		
Effective communication (LS3)	DMS-XI	24.35	4.49	1.00335	-1.466	.150
	KV-XI	26.00	2.65	.56599		
Creative thinking (LS4)	DMS-XI	20.00	2.75	.61559	-11.396	**.000**
	KV-XI	40.86	7.75	1.65183		
Critical thinking (LS5)	DMS-XI	14.60	2.26	.50471	-9.524	**.000**
	KV-XI	22.50	3.02	.64382		
Critical thinking and Decision-making (LS6)	DMS-XI	13.00	2.47	.55251	-6.642	**.000**
	KV-XI	19.00	3.28	.69941		
Self-awareness (LS7)	DMS-XI	3.20	0.77	.17168	-.830	.412
	KV-XI	3.36	0.49	.10497		
Critical thinking and Self-awareness (LS8)	DMS-XI	3.25	1.29	.28905	-.064	.949
	KV-XI	3.27	0.98	.20995		
Critical thinking and Problem solving (LS9)	DMS-XI	11.80	1.77	.39470	-.031	.975
	KV-XI	11.82	2.02	.42962		
Creative thinking and Critical thinking (LS10)	DMS-XI	4.50	1.76	.39403	-.639	.526
	KV-XI	4.86	1.91	.40716		
Problem solving and Critical thinking (LS11)	DMS-XI	2.90	2.92	.65253	-4.386	**.000**
	KV-XI	5.73	0.77	.16359		
Problem solving and Decision making (LS12)	DMS-XI	0.00	0.00	.00000	-12.520	**.000**
	KV-XI	8.59	3.07	.65353		

Life Skills	School	Mean	S.D	Std. Error Mean	T value	P value
TOTAL	DMS-XI	196.05	28.25	6.31601	5.346	**.000**
	KV-XI	249.95	36.15	7.70660		
TOTALP	DMS-XI	71.55	10.31	2.30511	-5.346	.063
	KV-XI	91.22	13.19	2.81263		
LS1PER	DMS-XI	76.29	22.51	2.54392	-3.055	.004
	KV-XI	92.08	8.64	1.92211		
LS2PER	DMS-XI	88.62	13.69	3.06204	-.860	.150
	KV-XI	92.21	13.40	2.85729		
LS3PER	DMS-XI	86.96	16.03	3.58339	-1.466	.000
	KV-XI	92.86	9.48	2.02140		
LS4PER	DMS-XI	44.44	6.12	1.36797	-11.396	.000
	KV-XI	90.81	17.22	3.67074		
LS5PER	DMS-XI	60.83	9.40	2.10298	-9.524	.000
	KV-XI	93.75	12.58	2.68258		
LS6PER	DMS-XI	61.90	11.77	2.63098	-6.642	.412
	KV-XI	90.48	15.62	3.33053		
LS7PER	DMS-XI	80.00	19.19	4.29198	-.830	.412
	KV-XI	84.09	12.31	2.62432		
LS8PER	DMS-XI	81.25	32.32	7.22637	-.064	.949
	KV-XI	81.82	24.62	5.24864		
LS9PER	DMS-XI	90.77	13.58	3.03617	-.031	.975
	KV-XI	90.91	15.50	3.30477		
LS10PER	DMS-XI	34.62	13.56	3.03103	-.639	.526
	KV-XI	37.41	14.69	3.13202		
LS11PER	DMS-XI	48.33	48.64	10.87542	-4.386	.000
	KV-XI	95.45	12.79	2.72647		
LS12PER	DMS-XI	0.00	0.00	.00000	-12.520	.000
	KV-XI	85.91	30.65	6.53526		

N(DMS-XI and KV-XI) = 20 and 22 respectively

Graph 8
Mean scores of DMS and KV on different life skills



Hypothesis: There is no difference between DMS and Kendriya Vidyalaya in the percentage attainment of life skills.

In PLS 1, i.e. decision-making, attainment values of DMS and KV were considerably low with mean values of 18.60 and 22.00 respectively. The difference between the two schools in attainment was however very significant (t=3.308; p=.004).

In PLS 2, i.e. problem solving, attainment of KV had a mean value of 86.68 which was higher than that of DMS standard but was not significant (t=.860;p=.395).

In PLS 3, i.e. effective communication, mean attainment values of both the schools were considerably low. KV had a mean of 26.0 which was higher than that of DMS with a mean of 24.35 but was not significant (t=-1.466;p=.150).

In PLS 4, i.e. creative thinking, mean attainment values of both the schools were considerably low. KV had a mean of 40.86 which was higher than that of DMS with an attainment mean of 20.00. KV had a significantly higher attainment. This was found to be highly significant (t=-11.396;p=.000).

In PLS 5, i.e. critical thinking, the mean attainment values were lesser than 50; and KV had a significantly higher mean of attainment (22.50) than that of DMS (14.60) and this was found to be highly significant (t=-9.524;p=.000).

In PLS 6, i.e. critical thinking and decision-making, mean attainment values of both the school students were very low with KV having a significantly higher mean of 19.00 than that of DMS XI standard with a mean of 13.00. This was found to be highly significant (t=-6.642; p=.000).

In PLS 7, i.e. self-awareness, mean attainment values of this skill in both the schools was very low and almost the same with KV having a mean attainment value of 3.36 and DMS a mean value of 3.2 and this was not significant (t=-.830;p=.412).

In PLS 8, i.e. critical thinking and self-awareness, mean attainment values of this skill in both the schools was very low and almost the same with KV having mean attainment value of 3.27 as against 3.25 of DMS students and this was not significant (t=.064; p=.949).

In PLS 9, i.e. critical thinking and problem-solving, mean attainment values of this life skill in both the schools was very low and almost the same with KV having mean attainment value of 11.81 and DMS having a mean value of 11.80 but this was not significant (t=-0.031;p=0.975).

In PLS 10, i.e. creative thinking and critical thinking, mean attainment values of this life skill in both the schools was very low and almost the same with KV having a mean attainment value of 4.86 and DMS having a mean value of 4.5 and this was not significant (t=-.639;p=.526).

In PLS 11, i.e. problem solving and critical thinking, mean attainment values of this life skill in both the schools was very low and almost the same with KV having a mean attainment value of 5.73 as against 2.90 for DMS students and this difference was found to be highly significant (t=-4.386;p=.000).

In PLS 12, i.e. problem-solving and decision-making, mean attainment values of these life skills was very low, with KV showing a higher mean of 8.59 as against 0.00 attainment of DMS students and this was found to be highly significant (t=-12.520;p=.000).

In PLS total, i.e. total of all the above 12 skills, it was found that KV had a higher attainment of 249.59 as against 196.05 of DMS standard students and this difference in attainment was found to be highly significant (t=-5.346;p=.000).

Variations in the attainment of life skills in the two schools is highly significant in creative thinking, critical thinking, critical thinking and decision-making, problem-solving and critical thinking, problem solving and decision-making and total of all the 12 skills studied here. It is significant in decision making as well. Therefore the hypothesis is rejected.

Group Statistics for gender-wise differences for boys and girls of DMS and KV

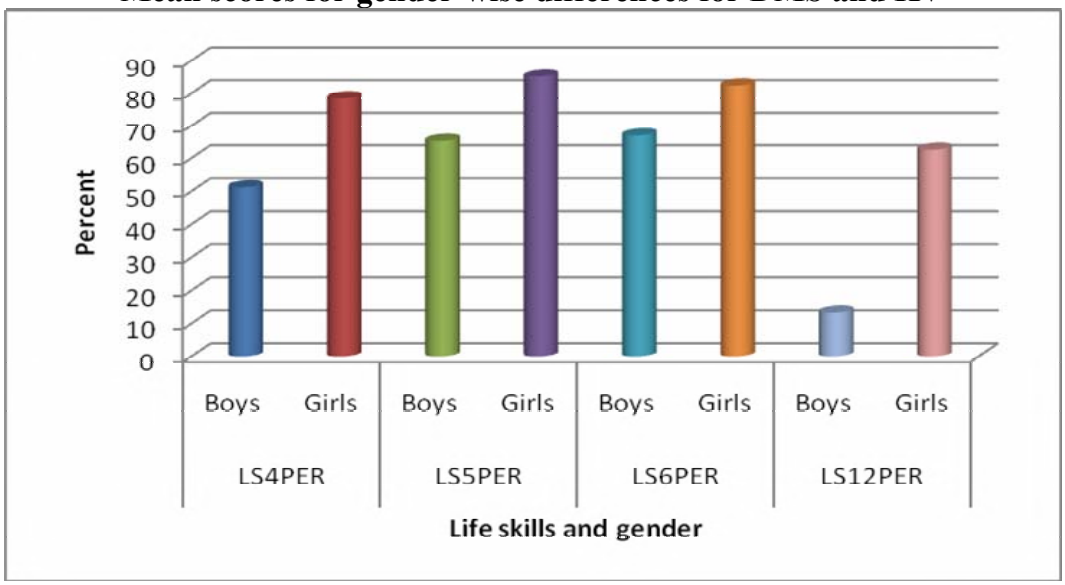
Percentage analysis was studied to assess total attainment of life skills in a gender (boys and girls) group. T-test was done to test for equality of means and their significance. (Table 32)

Table 32: Group statistics for gender differences in DMS-KV (XI standard QI)

	Gender	Mean	S.D	Std. Error Mean	T value	P value
LS1PER	Boys	80.81	21.31	3.20956	-0.986	.330
	Girls	86.64	16.56	1.78826		
LS2PER	Boys	88.94	14.42	3.72420	-.555	.582
	Girls	91.37	13.16	2.53200		
LS3PER	Boys	85.95	17.26	4.45617	-1.525	.135
	Girls	92.33	9.94	1.91298		
LS4PER	Boys	51.26	20.77	5.36265	-3.572	.001
	Girls	78.44	25.03	4.81783		
LS5PER	Boys	65.28	17.65	4.55831	-3.492	.001
	Girls	85.19	17.73	3.41175		
LS6PER	Boys	66.98	17.31	4.46867	-2.550	.015
	Girls	82.36	19.45	3.74258		
LS7PER	Boys	81.67	19.97	5.15629	-.143	.887
	Girls	82.41	13.54	2.60629		
LS8PER	Boys	86.67	24.76	6.39320	.875	.387
	Girls	78.70	29.99	5.77099		
LS9PER	Boys	91.79	11.80	3.04625	.315	.754
	Girls	90.31	15.91	3.06134		
LS10PER	Boys	35.90	12.22	3.15529	-.062	.951
	Girls	36.18	15.21	2.92684		
LS11PER	Boys	63.33	47.22	12.19333	-1.122	.268
	Girls	78.40	38.35	7.37966		
LS12PER	Boys	13.33	35.19	9.08514	-3.565	.001
	Girls	62.59	46.54	8.95689		
TOTALP	Boys	74.67	14.70	3.79462	-2.377	.022
	Girls	85.85	14.54	2.79916		

N (Boys and Girls) = 15 and 27 respectively

Graph 9
Mean scores for gender-wise differences for DMS and KV



Hypothesis: There is no difference between boys and girls in the attainment of life skills.

In PLS1, i.e. decision-making, girls have a higher mean of attainment of 86.64 than boys with a mean of 84.28; and this was not significant (t=-0.986;p=.330).

In PLS2, i.e. problem-solving, girls have a higher mean of attainment of 91.37 than boys with a mean of 88.93 and difference was not significant (t=-.555;p=.582).

In PLS3, i.e. effective communication, girls have a higher mean of 92.32 of attainment than boys with a mean of 85.95 and this difference was not significant (t=-1.525;p=.135).

In PLS4, i.e. creative thinking, girls have a higher mean of attainment of 78.44 than boys with a mean of 51.26 and this difference was significant (t=-3.572;p=.001).

In PLS5, i.e. critical thinking, girls had a higher mean of attainment of 85.19 than that of boys with a mean of 65.28. The difference was significant (t=-3.492;p=.001).

In PLS6, i.e. critical thinking and decision making, girls had a higher attainment mean of 82.36 than that of boys with a mean of 66.98. The difference was found to be significant (t=-2.550; p=.015).

In PLS7, i.e. self-awareness, girls had only a slightly higher mean of attainment of 82.41 than boys with a mean of 81.67 and this difference was not significant (t=-.143;p=.887).

In PLS8, i.e. critical thinking and self-awareness, boys have a higher mean of attainment of 86.67 than girls with a mean of 78.07 and the difference was not significant (t=.875; p=.387).

In PLS9, i.e. critical thinking and problem solving boys have a slightly higher mean of attainment of 91.79 than girls with a mean of 90.31 and this difference was not significant (t=.315; p=.754).

In PLS10, i.e. creative thinking and critical thinking, girls have a slightly higher attainment mean of 36.18 than boys with a mean of 35.90 and this difference was not significant (t=-.062; p=.951).

In PLS11, i.e. problem solving and critical thinking, girls have a higher mean of attainment of 78.40 than boys with a mean of 63.33 and this difference was not significant (t=-1.122; p=.268).

In PLS12, i.e. problem-solving and decision-making, girls have a much higher mean of attainment of 62.59 than boys with a mean of 13.33 and this difference was found to be significant (t=-3.565; p=.001).

In Total percent Life Skill attainment of all the 12 life skills measured over here, girls had a higher mean of attainment of 85.85 than boys with a mean of 74.67 and this difference was found to be significant (t=-2.377; p=.022).

There were significant differences in percent attainment of creative thinking (LS4), critical thinking (LS5), critical thinking and decision-making (LS6) and problem solving and decision-making (LS12) and total attainment between the boys and girls of the 2 schools of DMS and KV.

Attainment of Minimum Levels of Learning in the 12 paired/individual Life Skills of DMS and KV

Hypothesis: There is no difference in attainment of MLL in various life skills between DMS and KV students.

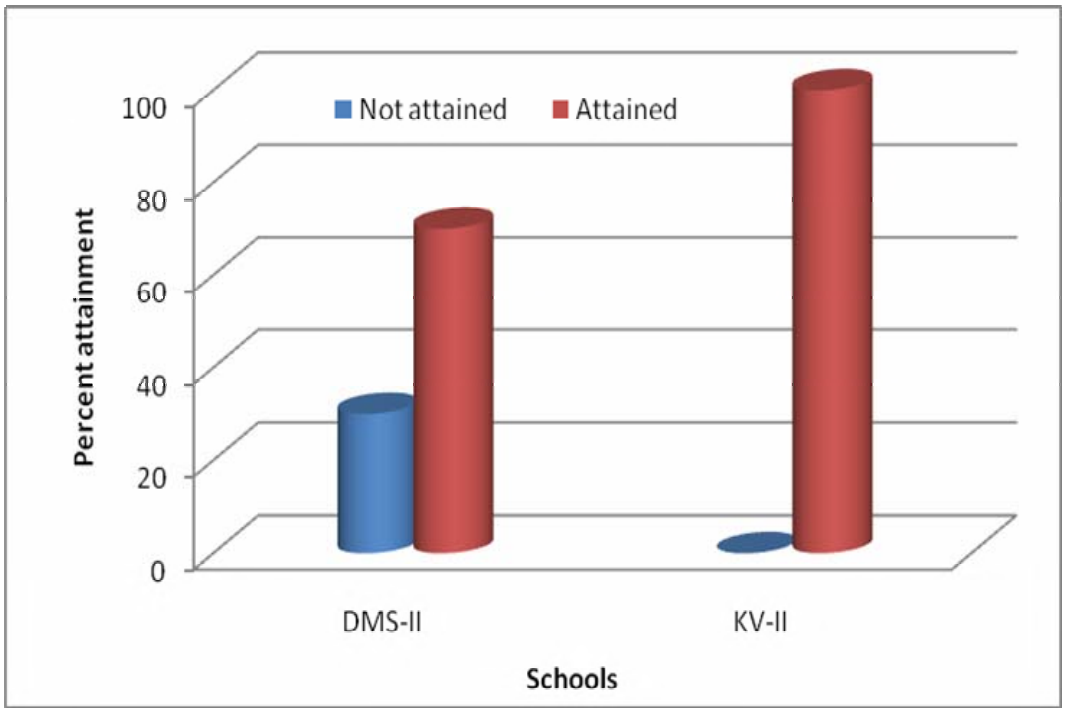
1. Minimum Levels of Learning in Decision-making

Table 33: MLL in the life skill of decision-making of DMS and KV

ML1		School		Total	Test Statistics
		DMS-XI	KV-XI		
Not attained	F	6	0	6	CC = .394; P=.004
	%	30.0%	0%	14.3%	
Attained	F	14	22	36	
	%	70.0%	100.0%	85.7%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 85.7% of the sample had minimum attainment of decision making skill as against only 14.3% of them who did not attain the skill. Schoolwise comparison revealed that students of KV-XI attained 100% decision making skill, where only 70% of the DMS-II students attained the skill, which was found to be significant (CC=.394; P=.004).

Graph 10
MLL in life skill of decision making of DMS and KV



2. Minimum Levels of Learning in Problem-Solving

Table 34: MLL in the life skill of problem-solving of DMS and KV

ML2		School		Total	Test Statistics
		DMS-XI	KV-XI		
Not attained	F	1	1	2	CC = .011; P=.945
	%	5.0%	4.5%	4.8%	
Attained	F	19	21	40	
	%	95.0%	95.5%	95.2%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 95.2% have attained MLL (i.e. 50% attainment) in problem-solving as against 4.8% who have not attained this skill. The pattern was found to be the same for both the schools. This was not significant (CC=.011; .945).

3. Minimum Levels of Learning in Effective Communication

Table 35: MLL in the life skill of effective communication of DMS and KV

ML3		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	1	0	1	CC = .162; P=.288
	%	5.0%	.0%	2.4%	
Attained	F	19	22	41	
	%	95.0%	100.0%	97.6%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

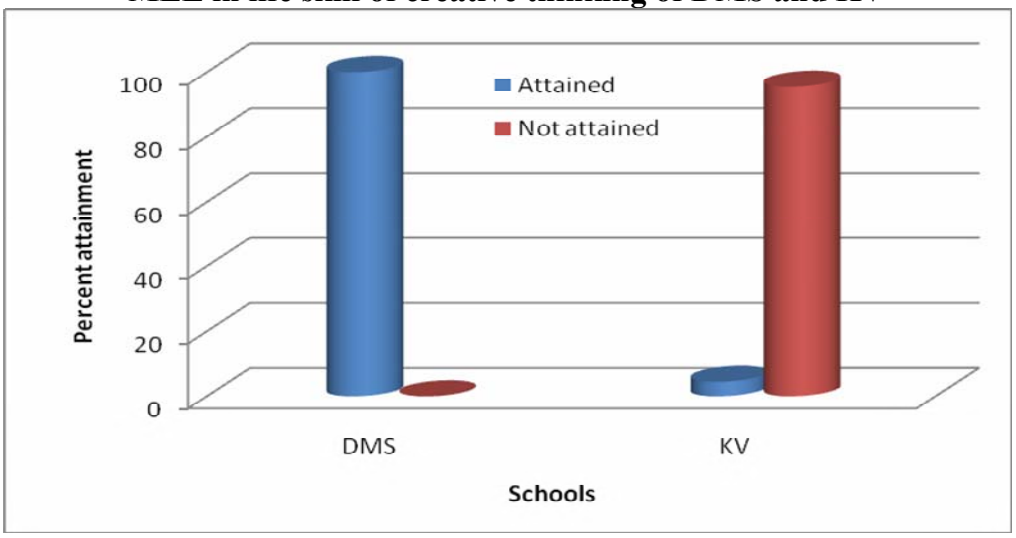
On the whole, 97.6% students have attained MLL (i.e. 50% attainment) in effective communication as against 2.4% who have not attained this skill. However in KV all the students have attained this skill as against 95.0% students in DMS. This was not significant (CC=1.62; .288).

4. Minimum Levels of Learning in Creative Thinking

Table 36: MLL in the life skill of creative thinking of DMS and KV

ML4		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	20	1	21	CC = .690; P=.000
	%	100.0%	4.5%	50.0%	
Attained	F	0	21	21	
	%	.0%	95.5%	50.0%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

Graph 11
MLL in life skill of creative thinking of DMS and KV



On the whole, 50% students have attained MLL (i.e. 50% attainment) in creative thinking as against 50% who have not attained this skill. This was not true for both the schools. Among KV students, 95.5% have attained this skill and 4.5% have not attained this skill as against 0% attainment amongst DMS students. This was found to be highly significant (CC=.690; .000).

5. Minimum Levels of Learning in Critical Thinking

Table 37: MLL in the life skill of critical thinking of DMS and KV

ML5		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	1	1	2	CC = .011; P=.945
	%	5.0%	4.5%	4.8%	
Attained	F	19	21	40	
	%	95.0%	95.5%	95.2%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 95.2% of the students have attained MLL (i.e. 50% attainment) in critical thinking as against 4.8% who have not attained this skill. This pattern was found to be the same for both the schools and was not significant (CC=.011; .945).

6. Minimum Levels of Learning in Critical Thinking and Decision-making

Table 38: MLL in the life skill of critical thinking and decision-making of DMS and KV

ML6		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	2	1	3	CC = .105; P=.493
	%	10.0%	4.5%	7.1%	
Attained	F	18	21	39	
	%	90.0%	95.5%	92.9%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 92.9% of the students have attained MLL (i.e. 50% attainment) in critical thinking and decision-making as against 7.1% who have not attained this skill. This pattern was found to be the same for both the schools and was not significant (CC=.105; .493).

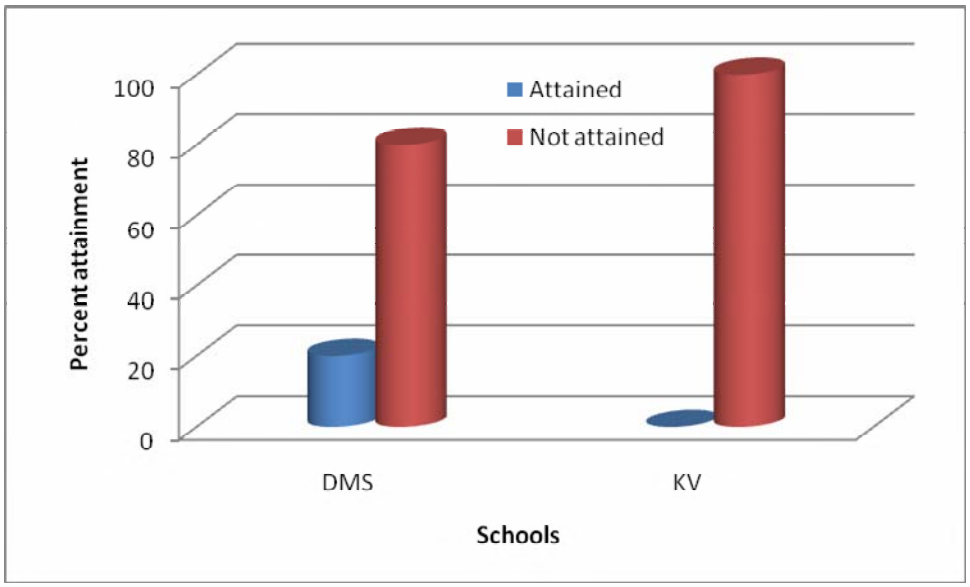
7. Minimum Levels of Learning in Self-awareness

Table 39: MLL in the life skill of self-awareness of DMS and KV

ML7		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	4	0	4	CC = .322; P=.027
	%	20.0%	.0%	9.5%	
Attained	F	16	22	38	
	%	80.0%	100.0%	90.5%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

Graph 12

MLL in life skill of Self awareness of DMS and KV



On the whole, 90.5% students have attained MLL (i.e. 50% attainment) in self-awareness as against 9.5% who have not attained this skill. This was however not true of both schools. KV students showed cent percent attainment as against DMS students with 80% attainment and 20% non-attainment. This was found to be significant (CC=.322; .027).

8. Minimum Levels of Learning in Critical Thinking and Self-awareness

Table 40: MLL in the life skill of critical thinking and self-awareness of DMS and KV

ML8		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	5	4	9	CC = .083; P=..591
	%	25.0%	18.2%	21.4%	
Attained	F	15	18	33	
	%	75.0%	81.8%	78.6%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 78.6% have attained MLL (i.e. 50% attainment) in critical thinking and self-awareness as against 21.4% who have not attained this skill. This was found to be true of both the schools and was not significant (CC=.083; .591).

9. Minimum Levels of Learning in Critical Thinking and Problem-Solving

Table 41: MLL in the life skill of critical thinking and problem-solving of DMS and KV

ML9		School		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	0	1	1	CC = .147; P=.335
	%	.0%	4.5%	2.4%	
Attained	F	20	21	41	
	%	100.0%	95.5%	97.6%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 97.6% have attained MLL (i.e. 50% attainment) in critical thinking and problem-solving as against 2.4% who have not attained this skill. This was not true for both the schools. DMS showed cent percent attainment as against 95.5% attainment by KV students. These differences were however not significant (CC=.147; .335).

10. Minimum Levels of Learning in Creative Thinking and Critical Thinking

Table 42: MLL in the life skill of creative thinking and critical thinking of DMS and KV

Crosstab

ML10		School		Total
		DMS-XI	KV- XI	
not attained	F	20	22	42
	%	100.0%	100.0%	100.0%
Total	F	20	22	42
	%	100.0%	100.0%	100.0%

All students (100%) of both the schools have attained MLL (i.e. 50% attainment) in the skills of creative thinking and critical thinking.

11. Minimum Levels of Learning in Problem-Solving and Critical thinking

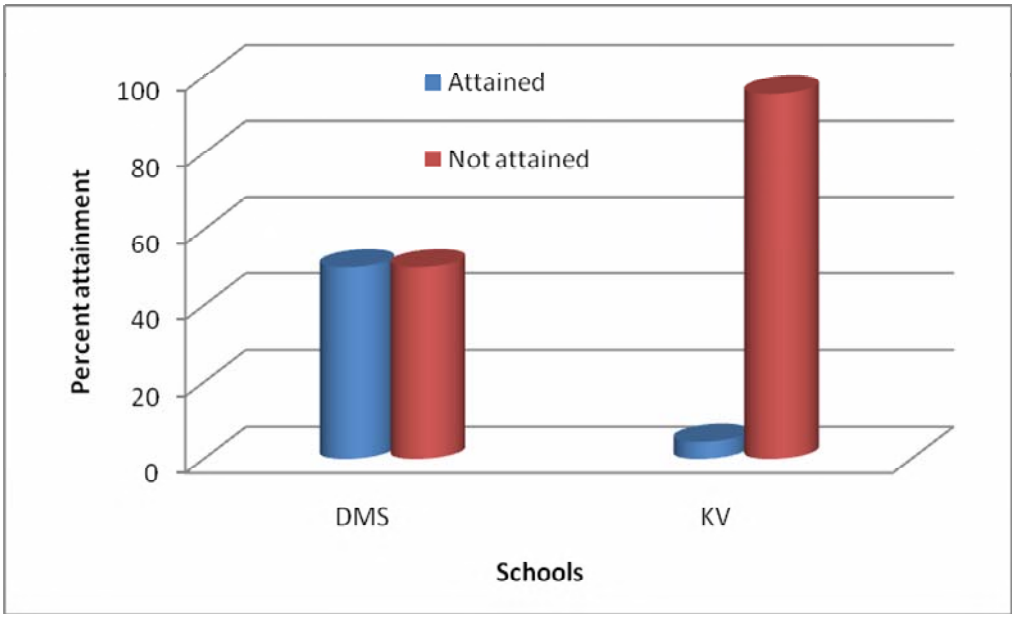
Table 43: MLL in the life skill of problem-solving and critical thinking of DMS and KV

ML12		SCHOOL		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	10	1	11	CC = .459; P=.001
	%	50.0%	4.5%	26.2%	
Attained	F	10	21	31	
	%	50.0%	95.5%	73.8%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

On the whole, 73.8% students have attained MLL (i.e. 50% attainment) in problem-solving and critical thinking as against 26.2% who have not attained this skill. This was not true for both the schools. KV showed 95.5% attainment and 4.5% non-attainment as against DMS students who showed 50% attainment and 50% non-attainment. This was found to be significant (CC=.459; .001).

Graph 13

MLL in life skill of Problem solving and critical thinking of DMS and KV



13. Minimum Levels of Learning in Problem-Solving and Decision-making

Table 44: MLL in the life skill of problem-solving and decision-making of DMS and KV

ML13		SCHOOL		Total	Test Statistics
		DMS-XI	KV- XI		
Not attained	F	20	3	23	CC = .655; P=.000
	%	100.0%	13.6%	54.8%	
Attained	F	0	19	19	
	%	.0%	86.4%	45.2%	
Total	F	20	22	42	
	%	100.0%	100.0%	100.0%	

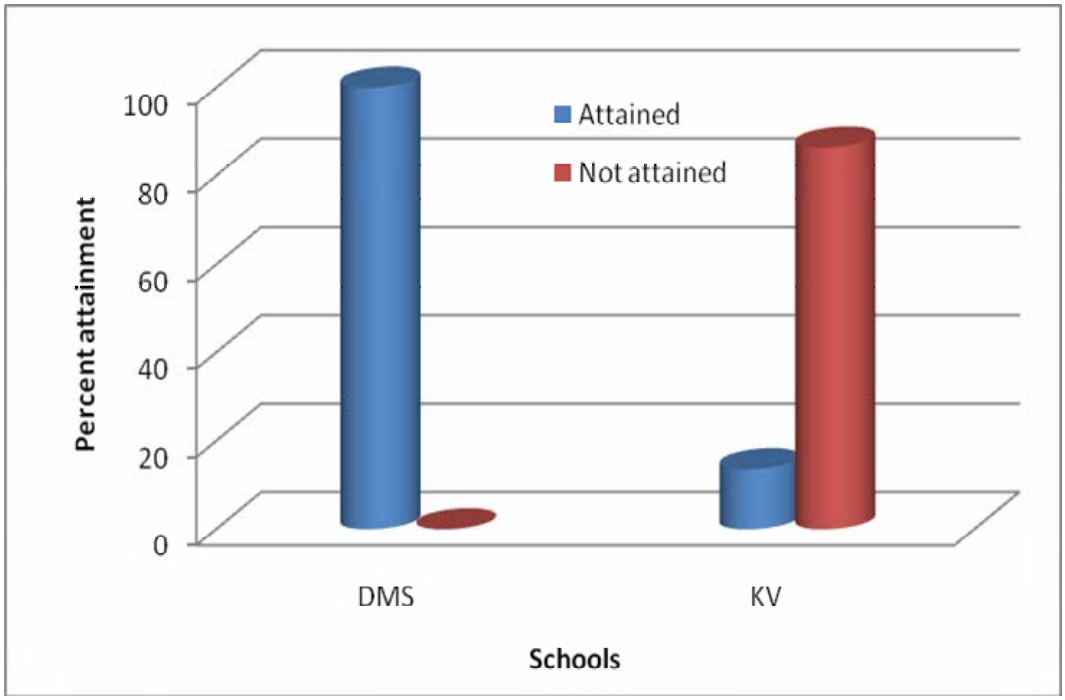
On the whole, 45.2% students have attained MLL (i.e. 50% attainment) in problem-solving and decision-making as against 54.8% who have not attained this skill. This was not true for both the schools. DMS showed cent percent attainment as against KV with 86.4% attainment and 13.6% non-attainment. This was highly significant (CC=.655; .000).

Variations in the attainment of life skills in the two schools are highly significant in creative thinking (LS4) and problem-solving and decision-making (LS12). It was significant in the life skills of self-awareness (LS7), decision making (LS1), problem-solving and critical thinking (LS11). Therefore the hypothesis is rejected.

There are significant variations in LS attainments of individuals, groups, and genders (boys and girls) and in MLL attainment. This is with particular reference to the thinking and solving skills and to a certain extent with respect to the understanding skill of self-awareness.

Graph 14

MLL in life skill of Problem solving and decision making of DMS and KV



5.4 Comparison amongst Six Schools in Life Skills

Descriptive Statistics for the 6 schools/colleges – Sadvidya, JSS2, KV, DMS, JSS1 and Sharada Vilas (Standard XII, PUC II, QII)

No.	WHO Life Skills	Skill Pairs
LS1	Decision-making	Solving
LS2	Problem-Solving	
LS3	Creative-thinking	Thinking
LS4	Critical-thinking	
LS5	Effective communication	Relationship
LS6	Interpersonal relationship	
LS7	Self-awareness	Understanding
LS8	Empathy	
LS9	Coping with emotions	Coping
LS10	Coping with stress	

These are the 10 life skills/skill pairs as recognised by the World Health Organisation. Mean and standard deviation were studied for assessing individual variation in the attainment of these life skills. (Table 45)

Table 45: Descriptive statistics for all six schools (JSS1, JSS2, KV, DMS, Sharada Vilas and Sadvidya)

Descriptive Statistics

Life Skills	Minimum	Maximum	Mean	S.D
LS1	2	22	9.41	2.534
LS2	1	18	7.64	2.221
LS3	0	18	7.58	2.249
LS4	0	10	4.33	1.213
LS5	1	20	8.55	2.422
LS6	0	4	1.76	.569
LS7	1	8	3.41	.978
LS8	2	10	4.44	1.062
LS9	0	4	1.77	.610
LS10	1	18	7.72	2.297

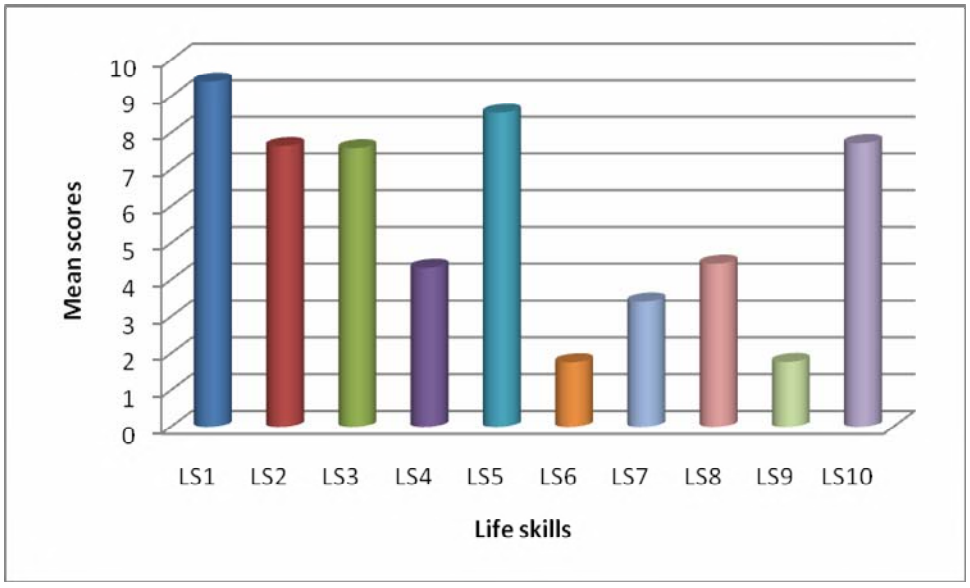
N=158

Hypothesis: There is no individual variation in the mean attainment of the above 10 life skills in the six schools studied here.

The descriptive statistics for the above two schools for which the same Self-Assessment Questionnaire/Interview Schedule on Life Skills was administered to the PU II and XII standard level showed that all the above 10 life skills (WHO) studied here have a standard deviation of the mean less than 10, indicating thereby that there is less individual variation in the attainment of these skills. Therefore, the hypothesis is rejected.

Graph 15

Mean scores of attainment of WHO life skills for 6 schools of Mysore



Group Statistics for the 6 schools (JSS1, JSS2, Sadvidya, SV, DMS and KV)

Percentage analysis of life skills was studied to assess total attainment of life skills in a group. t-test (F-value) was done to test for equality of means and their significance. One-way ANOVA Test was carried out to study differences between groups and within groups and results are in Table 46.

Table 46: One-way Group Statistics for all six schools

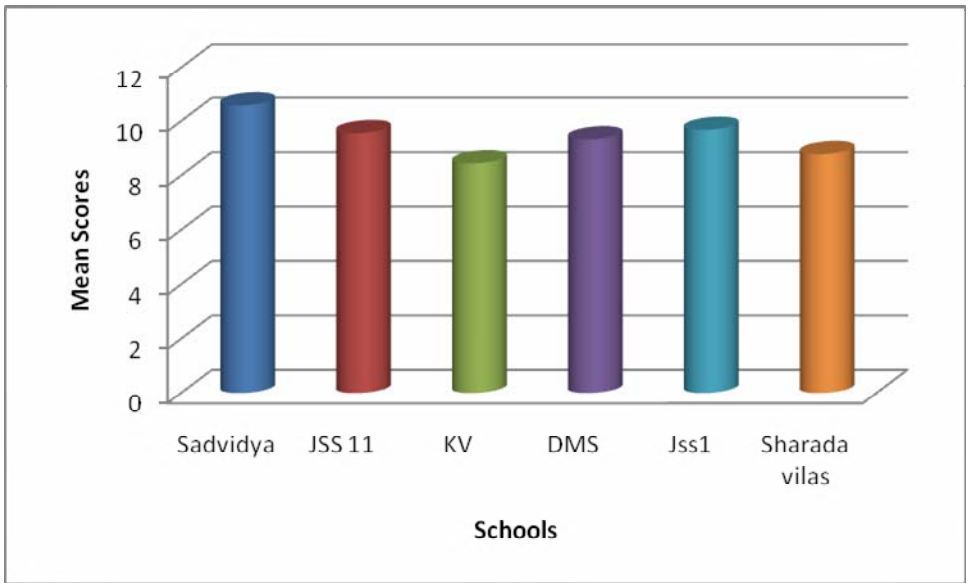
Descriptives

		N	Mean	S.D	Std. Error	F Value	P value
LS1	Sadvidya	31	10.58	.886	.159	2.714	**.022**
	JSS 11	32	9.56	2.564	.453		
	KV	29	8.45	2.515	.467		
	DMS	18	9.33	2.910	.686		
	JSS 1	19	9.68	2.056	.472		
	Sharada vilas	29	8.79	3.277	.609		
	Total	158	9.41	2.534	.202		
LS2	Sadvidya	31	8.35	1.450	.260	3.463	**.005**
	JSS 11	32	8.00	1.545	.273		
	KV	29	6.24	2.400	.446		
	DMS	18	7.67	1.940	.457		
	JSS 1	19	8.00	1.599	.367		
	Sharada vilas	29	7.62	3.201	.594		
	Total	158	7.64	2.221	.177		
LS3	Sadvidya	31	8.35	1.018	.183	2.140	.064
	JSS 11	32	7.69	1.615	.286		
	KV	29	6.83	2.361	.439		
	DMS	18	6.78	2.625	.619		
	JSS 1	19	8.11	1.410	.323		
	Sharada vilas	29	7.55	3.387	.629		
	Total	158	7.58	2.249	.179		
LS4	Sadvidya	31	4.55	1.091	.196	1.719	.134
	JSS 11	32	4.44	.982	.174		
	KV	29	3.97	1.451	.269		
	DMS	18	3.89	1.491	.351		
	JSS 1	19	4.74	.562	.129		
	Sharada vilas	29	4.34	1.344	.250		
	Total	158	4.33	1.213	.096		
LS5	Sadvidya	31	9.35	1.723	.310	2.511	**.032**
	JSS 11	32	9.13	2.282	.403		
	KV	29	7.97	2.471	.459		
	DMS	18	7.78	2.102	.495		
	JSS 1	19	9.00	1.856	.426		
	Sharada vilas	29	7.83	3.230	.600		
	Total	158	8.55	2.422	.193		

		N	Mean	S.D	Std. Error	F Value	P value
LS6	Sadvidya	31	1.84	.374	.067	1.870	.103
	JSS 11	32	1.81	.397	.070		
	KV	29	1.72	.528	.098		
	DMS	18	1.50	.857	.202		
	JSS 1	19	2.00	.333	.076		
	Sharada vilas	29	1.66	.769	.143		
	Total	158	1.76	.569	.045		
LS7	Sadvidya	31	3.84	.638	.115	3.728	**.003**
	JSS 11	32	3.47	.718	.127		
	KV	29	3.24	1.023	.190		
	DMS	18	3.33	.907	.214		
	JSS 1	19	3.74	.653	.150		
	Sharada vilas	29	2.90	1.398	.260		
	Total	158	3.41	.978	.078		
LS8	Sadvidya	31	4.71	.643	.115	.818	.539
	JSS 11	32	4.53	1.135	.201		
	KV	29	4.34	1.010	.188		
	DMS	18	4.17	1.098	.259		
	JSS 1	19	4.47	.905	.208		
	Sharada vilas	29	4.31	1.417	.263		
	Total	158	4.44	1.062	.084		
LS9	Sadvidya	31	1.94	.250	.045	.960	.444
	JSS 11	32	1.81	.780	.138		
	KV	29	1.62	.561	.104		
	DMS	18	1.72	.575	.135		
	JSS 1	19	1.79	.535	.123		
	Sharada vilas	29	1.69	.761	.141		
	Total	158	1.77	.610	.048		
LS10	Sadvidya	31	8.68	.791	.142	4.730	**.000**
	JSS 11	32	8.41	2.734	.483		
	KV	29	7.17	1.671	.310		
	DMS	18	6.06	2.879	.679		
	JSS 1	19	8.11	1.629	.374		
	Sharada vilas	29	7.24	2.668	.495		
	Total	158	7.72	2.297	.183		

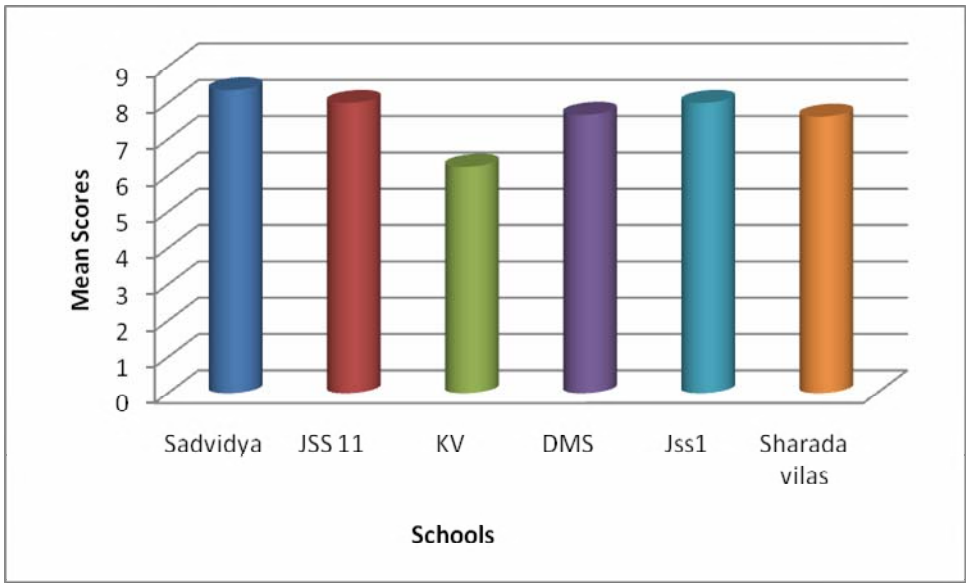
Graph 16

Mean scores of attainment of LS1 (Decision making) of WHO life skills for 6 schools of Mysore



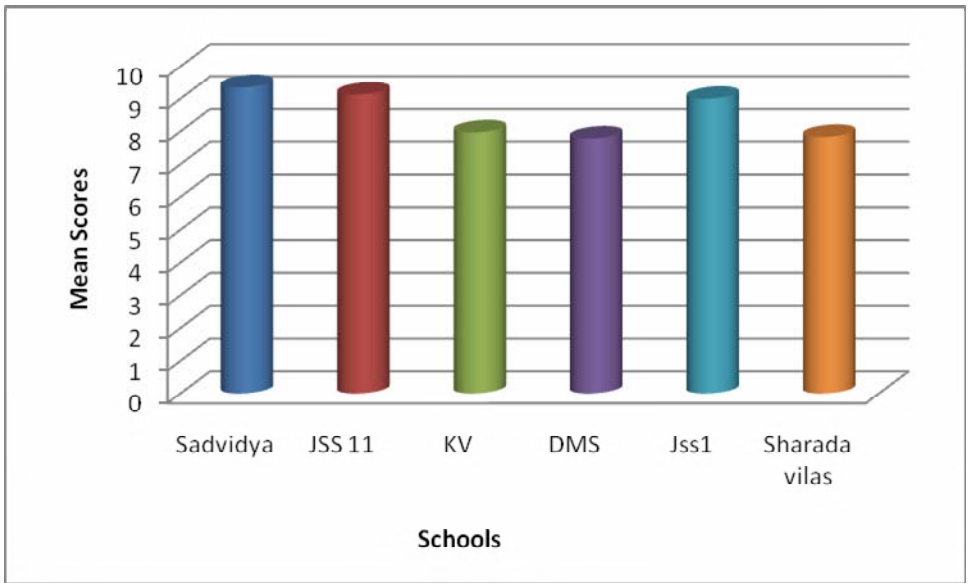
Graph 17

Mean scores of attainment of LS2 (Problem solving) of WHO life skills for 6 schools of Mysore



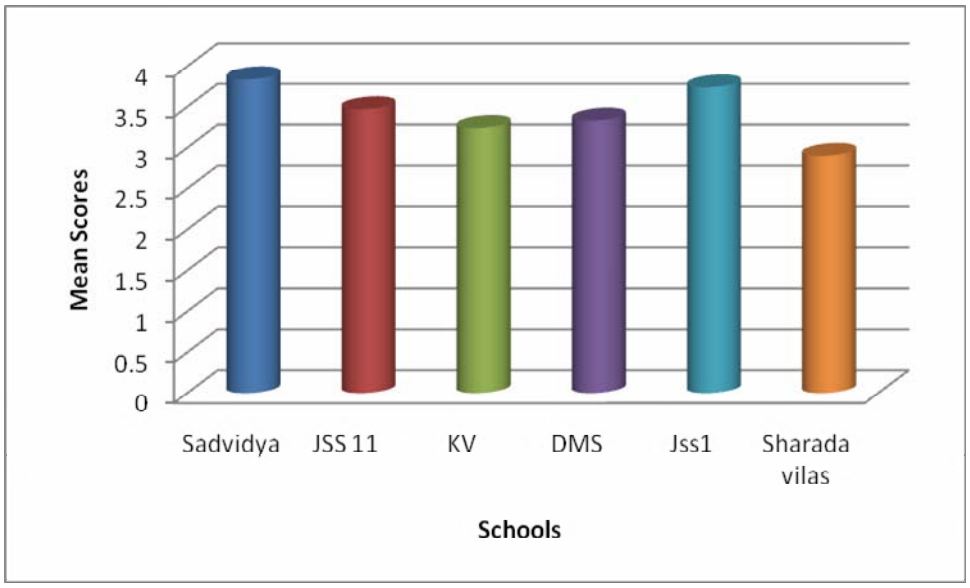
Graph 18

Mean scores of attainment of LS5 (Effective communication) of WHO life skills for 6 schools of Mysore



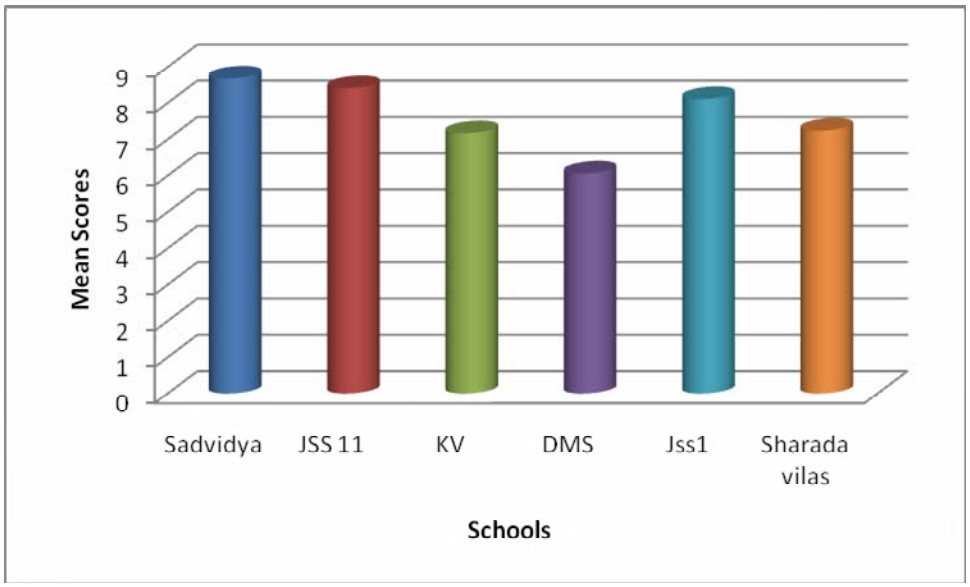
Graph 19

Mean scores of attainment of LS7 (Self awareness) of WHO life skills for 6 schools of Mysore



Graph 20

Mean scores of attainment of LS10 (Coping with stress) of WHO life skills for 6 schools of Mysore



Hypothesis: There is no difference between the six schools viz., JSS1, JSS2, Sadvidya, Sarada Vilas, DMS and KV in the percentage attainment of life skills.

In LS 1, i.e. decision-making, students of Sadvidya had the highest attainment mean of 10.58, followed by students of JSS 1 (9.68), JSS 2 (9.56), DMS (9.33), Sharada Vilas (8.79) and KV (8.45). The total mean attainment of the six schools in decision-making was 9.4 and this was found to be significant (F=2.714; p=.022).

In LS 2, i.e. problem-solving, students of Sadvidya had the highest attainment mean of 8.35, followed by students of JSS 1 and JSS 2 (8.00), DMS (7.67), Sharada Vilas (7.62) and KV (6.24) in order. The total mean attainment of the six schools in problem-solving was 7.64 and this was found to be significant (F=3.463; p=.005).

In LS 3, i.e. creative thinking, students of Sadvidya had the highest attainment mean of 8.35, followed by students of JSS 1 (8.11), JSS 2 (7.69), Sharada Vilas (7.55), DMS (6.78) and KV (6.83) in order. The total mean attainment of the six schools was 7.58 and this was not significant (F=2.140; p=.064).

In LS 4, i.e. critical thinking, students of JSS 1 had the highest attainment mean of 4.74, followed by students of Sadvidya (4.55), JSS II (4.44), Sharada Vilas (4.34), KV (3.97) and DMS (3.89). The total mean attainment of the six schools was 4.33 and this was not significant (F=1.719; p=.134).

In LS 5, i.e. effective communication, students of Sadvidya had the highest attainment mean of 9.35, followed by JSS 2 (9.13), JSS 1 (9.00), KV (7.97), Sharada Vilas (7.83) and DMS (7.78). The total mean attainment of the six schools was 8.55 and this was found to be highly significant (F=2.511; p=.032).

In LS 6, i.e. interpersonal relationships, students of JSS 1 had the highest attainment mean of 2.00, followed by Sadvidya (1.84), JSS 2 (1.81), KV (1.72), Sharada Vilas (1.66) and DMS (1.50). The total mean attainment of the six schools was 1.76 and this was not significant (F=1.870;p=.103).

In LS 7, i.e. self-awareness, students of Sadvidya had the highest attainment mean of 3.84, followed by JSS1 (3.74), JSS2 (3.47), DMS (3.33), KV (3.24) and Sharada Vilas (2.90) in order. The total mean attainment of the six schools in self-awareness was 3.41 and this was found to be very significant (F=3.728; p=.003).

In LS 8, i.e. empathy, students of Sadvidya had the highest attainment mean of 4.71, followed by JSS 2 (4.53), JSS 1 (4.47), KV (4.34), Sharada Vilas (4.31) and

DMS (4.17) in order. The total mean attainment of the six schools in empathy was 4.44 and this was not significant (F=.818; p=.539).

In LS 9, i.e. coping with emotions, students of Sadvidya had the highest attainment mean of 1.94, followed by JSS 2 (1.81), JSS 1 (1.79), DMS (1.72), Sharada Vilas (1.69) and KV (1.62) in order. The total mean attainment of the six schools in this life skill was 1.77 and this was not significant (F=.960; p=.444).

In LS 10, i.e. coping with stress, students of Sadvidya had the highest attainment mean of 8.68, followed by JSS 2 (8.41), JSS 1 (8.11), Sharada Vilas (7.24), KV (7.17) and DMS (6.06) in order. The total mean attainment of the six schools in this life skill was 7.72 and this was found to be highly significant (F=4.730; p=.000).

There was a maximum of only approximately 11% (10.58%) attainment in life skills and a minimum of 2% (1.66%). The mean attainment of life skills in six schools is very low. The difference in mean attainment of life skills was however significant in decision-making (LS1), problem solving (LS2), effective communication (LS3), self-awareness (LS7) and coping with stress (LS10). Therefore the hypothesis is rejected.

Percentage analysis was studied to assess total attainment of life skills in a gender (boys and girls group). t-test was done to test for equality of means and their significance. (Table 47)

Table 47: Group statistics for gender differences in all six schools (Standard XII/ PUC II QII)

	Gender	N	Mean	Std. Deviation	t value	P value
LS1	Male	55	9.35	2.80	.215	.830
	Female	103	9.44	2.40		
LS2	Male	55	7.76	2.64	.513	.608
	Female	103	7.57	1.97		
LS3	Male	55	7.73	2.75	.591	.555
	Female	103	7.50	1.39		
LS4	Male	55	4.40	1.31	.536	.593
	Female	103	4.29	1.16		
LS5	Male	55	8.15	2.86	1.543	.125
	Female	103	8.77	2.14		
LS6	Male	55	1.73	0.65	.519	.605
	Female	103	1.78	0.52		
LS7	Male	55	3.22	1.18	1.828	.070
	Female	103	3.51	0.84		
LS8	Male	55	4.35	1.24	.843	.400
	Female	103	4.50	0.96		
LS9	Male	55	1.75	0.64	.306	.760
	Female	103	1.78	0.59		
LS10	Male	55	7.40	2.47	1.263	.209
	Female	103	7.88	2.19		
TOTAL	Male	55	55.82	15.63	.553	.581
	Female	103	57.02	11.39		

Hypothesis: There is no difference between boys and girls in the attainment of the 10 major life skills studied.

In LS1, i.e. decision-making both boys and girls have almost equal means of attainment of 9.35 and 9.44 respectively (boys having lesser attainment of the two) and this was not significant (t=-.215; p=.830).

In LS2, i.e. problem-solving, girls have a slightly lesser mean of attainment (7.57) than boys with a mean of 7.76 and this difference was not significant (t=.513; p=.608).

In LS3, i.e. creative-thinking, girls have a slightly lesser mean of attainment (7.5) than boys with a mean of 7.73 and this difference was not significant (t=.591; p=.555).

In LS4, i.e. critical-thinking, girls have a slightly lesser mean of attainment (4.29) than boys with a mean of 4.4 and this difference was not significant (t=.536; p=.593).

In LS5, i.e. effective communication, girls have a higher mean of attainment (8.77) than boys (8.15) and this difference was not significant (t=1.543; p=.125).

In LS6, i.e. interpersonal relationship, girls have a higher mean of attainment (1.78) than boys (1.73) and this difference was not significant (t=.519; p=.605).

In LS7, i.e. self-awareness, girls have a higher mean of attainment (3.51) than boys (3.22) and this difference was not significant (t=1.828; p=.070).

In LS8, i.e. empathy, girls have a higher mean of attainment (4.50) than boys (4.35) and this difference was not significant (t=.843; p=.400).

In LS9, i.e. coping with emotions, girls have a higher mean of attainment (1.78) than boys (1.75) and this difference was not significant (t=.306, p=.760).

In LS10, i.e. coping with stress, girls have a higher mean of attainment (7.88) than boys (7.4) and this difference was not significant (t=1.263; p=.209).

In LS Total i.e. total mean of all the 10 life skills studied here, girls on the whole have a higher mean of attainment (57.02) than boys with a mean of 55.82, and this difference was not significant (t=1.263; p=.209).

On the whole, in the 10 life skills advocated by WHO, girls have a higher mean of attainment than boys except for the life skill of inter-personal relationships, coping with emotions and decision-making where both the genders are at par with each other – however, the differences are not statistically significant in Life Skills 1-10. Therefore, the hypothesis is accepted.

Attainment of MLL (Minimum Levels of Learning) in WHO Life Skills (1-10) in Six Schools of Mysore

Hypothesis: There is no difference in attainment of MLL in WHO Life Skills (1-10) amongst students of six schools of Mysore.

The cut-off point for attainment of minimum levels of learning of life skills was fixed at 50%. Each life skill had several sub-skills and the questionnaires reflected these sub-skills. The responses were based on the responses to each of the sub-skills of the major 10 life skills.

1. Minimum Levels of Learning in Decision-making

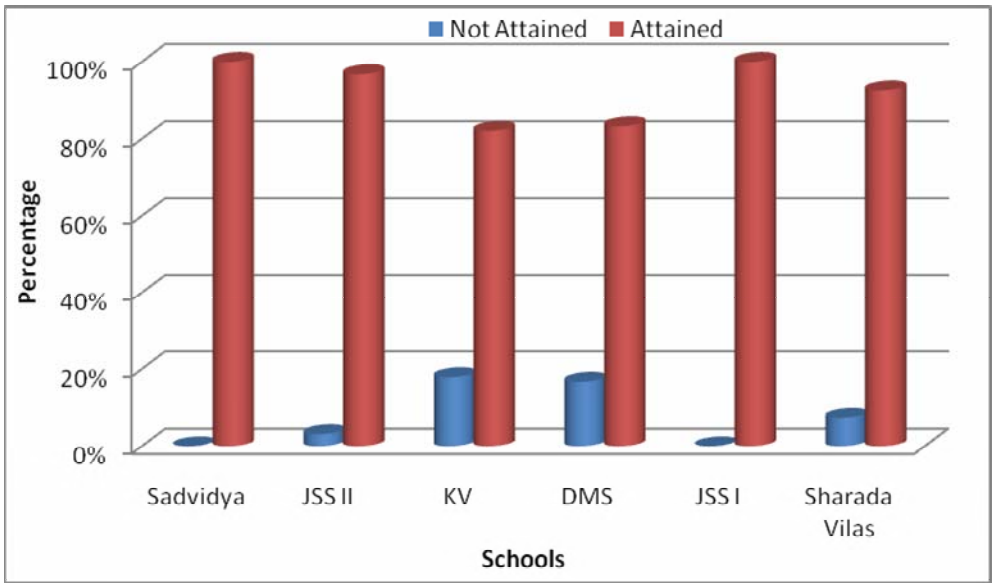
Table 48: MLL in life skill of decision-making across all six schools of Mysore

Crosstab

Schools		ML1		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	0	31	31	CC = .268; P=.037
	%	.0%	100.0%	100.0%	
JSS II	F	1	30	31	
	%	3.2%	96.8%	100.0%	
KV	F	5	23	28	
	%	17.9%	82.1%	100.0%	
DMS	F	3	15	18	
	%	16.7%	83.3%	100.0%	
JSS I	F	0	19	19	
	%	.0%	100.0%	100.0%	
Sharada Vilas	F	2	25	27	
	%	7.4%	92.6%	100.0%	
Total	F	11	143	154	
	%	7.1%	92.9%	100.0%	

Graph 21

MLL in WHO LS1 (Decision making) across 6 schools of Mysore



On the whole, 92.9% of the students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in decision-making as against 7.1% who have not attained MLL in this skill and this was not found to be true for all the schools studied here. All the students of Sadvidya (100%) have attained MLL and so have all the students of JSS (i.e. 100% students). The differences were found to be significant (CC=.268; p=.037).

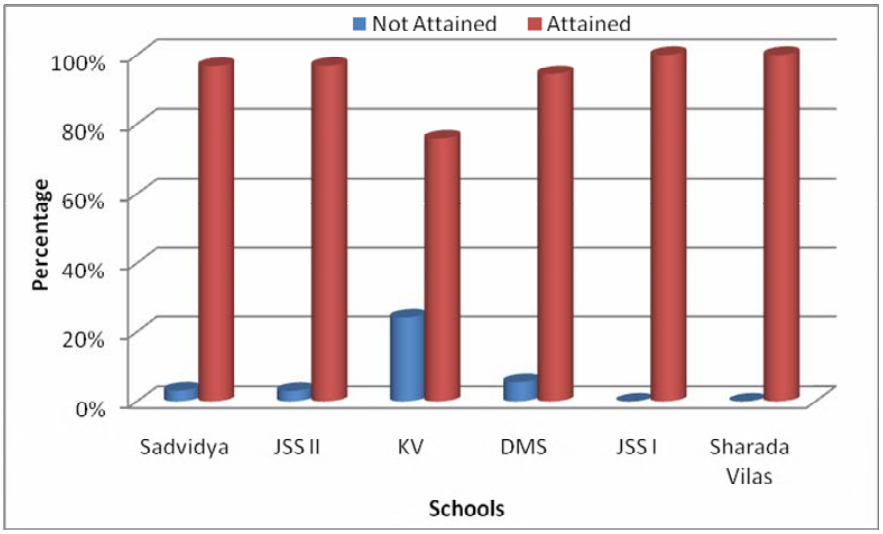
2. Minimum Levels of Learning in Problem-solving

Table 49: MLL in life skill of problem-solving across all the six schools of Mysore

Schools		ML2		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	1	30	31	CC = .334; P=.001
	%	3.2%	96.8%	100.0%	
JSS II	F	1	31	32	
	%	3.1%	96.9%	100.0%	
KV	F	7	22	29	
	%	24.1%	75.9%	100.0%	
DMS	F	1	17	18	
	%	5.6%	94.4%	100.0%	
JSS I	F	0	19	19	
	%	.0%	100.0%	100.0%	
Sharada Vilas	F	0	29	29	
	%	.0%	100.0%	100.0%	
Total	F	10	148	158	
	%	6.3%	93.7%	100.0%	

Graph 22

MLL in WHO LS2 (Problem solving) across 6 schools of Mysore



On the whole, 93.7% of the students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in problem-solving as against 6.3% who have not attained MLL in this skill and this was not found to be true for all the schools studied here. All the students (100%) of JSS and Sharada Vilas have attained MLL as against the other schools with lesser percentage of attainment. The differences were found to be significant (CC=.334; .001).

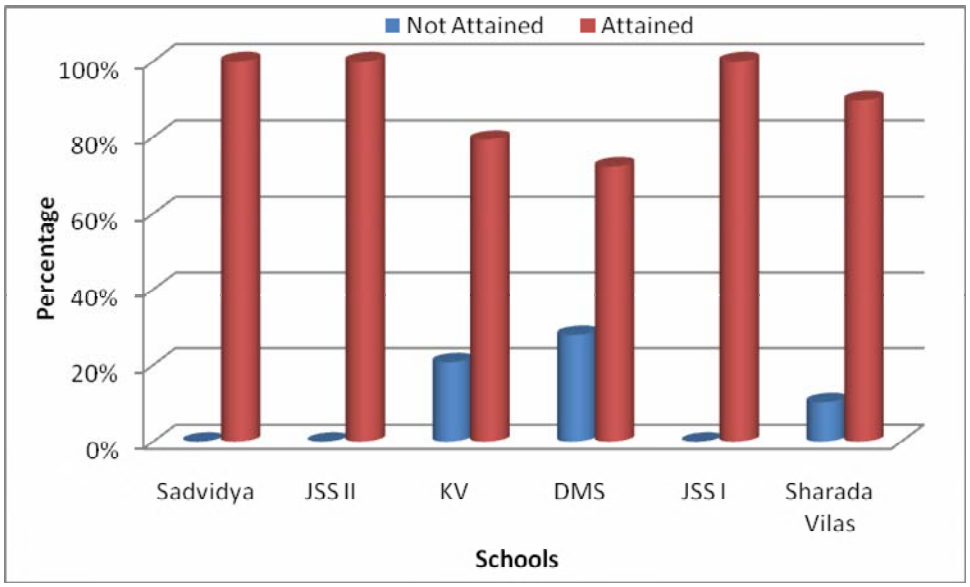
3. Minimum Levels of Learning in Creative Thinking

Table 50: MLL in life skill of creative thinking across all six schools of Mysore

Schools		ML3		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	0	31	31	CC = .343; P=.001
	%	.0%	100.0%	100.0%	
JSS II	F	0	32	32	
	%	.0%	100.0%	100.0%	
KV	F	6	23	29	
	%	20.7%	79.3%	100.0%	
DMS	F	5	13	18	
	%	27.8%	72.2%	100.0%	
JSS I	F	0	19	19	
	%	.0%	100.0%	100.0%	
Sharada Vilas	F	3	26	29	
	%	10.3%	89.7%	100.0%	
Total	F	14	144	158	
	%	8.9%	91.1%	100.0%	

Graph 23

MLL in WHO LS3 (Creative thinking) across 6 schools of Mysore



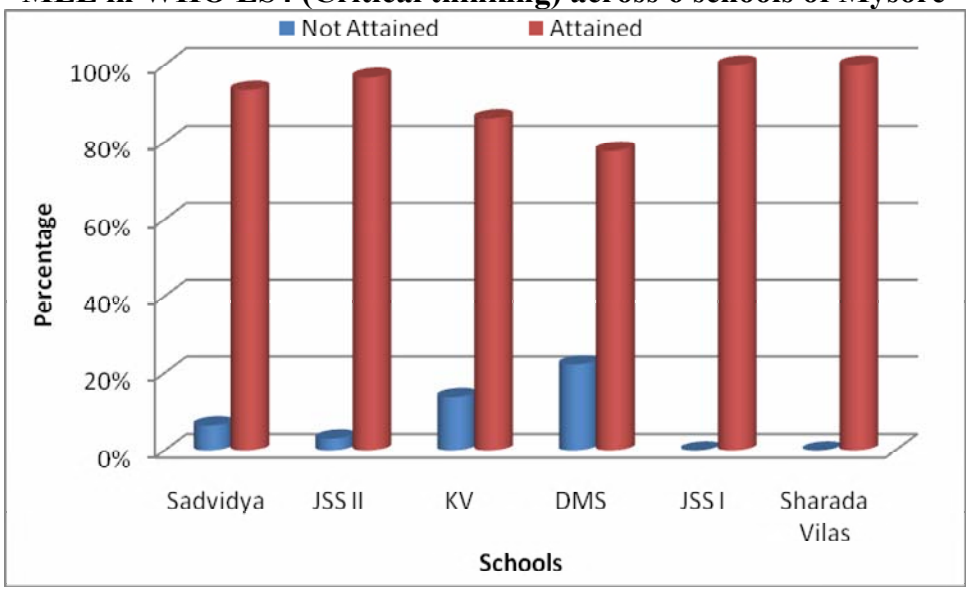
On the whole, 91.1% of the students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in creative thinking as against 8.9% who have not attained MLL in this skill and this was not found to be true for all the schools studied here. All the students of Sadvidya, JSS 2 and JSS 1 have attained MLL as against lesser percentage of students attaining the skill in the rest of the schools. The differences were found to be significant (CC=.343; .001).

4. Minimum Levels of Learning in Critical Thinking

Table 51: MLL in life skill of critical thinking across all six schools of Mysore

Schools		ML4		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	2	29	31	CC = .275; P=.024
	%	6.5%	93.5%	100.0%	
JSS II	F	1	31	32	
	%	3.1%	96.9%	100.0%	
KV	F	4	25	29	
	%	13.8%	86.2%	100.0%	
DMS	F	4	14	18	
	%	22.2%	77.8%	100.0%	
JSS I	F	0	19	19	
	%	.0%	100.0%	100.0%	
Sharada Vilas	F	0	29	29	
	%	.0%	100.0%	100.0%	
Total	F	11	147	158	
	%	7.0%	93.0%	100.0%	

Graph 24
MLL in WHO LS4 (Critical thinking) across 6 schools of Mysore



On the whole, 93.0% students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in critical thinking as against 7% who have not attained MLL in this skill and this was not found to be true for all the schools studied here. All the

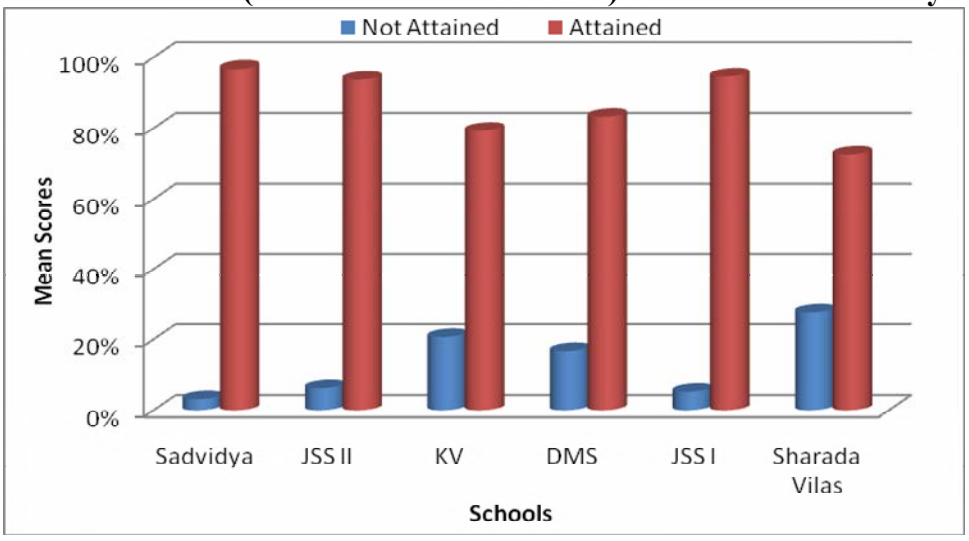
students of JSS 1 and Sharada Vilas have attained MLL as against lesser percentage of students attaining the skill in the rest of the schools. The differences were found to be significant (CC=.275; .024).

5. Minimum Levels of Learning in Effective Communication

Table 52: MLL in life skill of effective communication across all six schools of Mysore

Schools		ML5		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	1	30	31	CC = .264; P=.037
	%	3.2%	96.8%	100.0%	
JSS II	F	2	30	32	
	%	6.3%	93.8%	100.0%	
KV	F	6	23	29	
	%	20.7%	79.3%	100.0%	
DMS	F	3	15	18	
	%	16.7%	83.3%	100.0%	
JSS I	F	1	18	19	
	%	5.3%	94.7%	100.0%	
Sharada Vilas	F	8	21	29	
	%	27.6%	72.4%	100.0%	
Total	F	21	137	158	
	%	13.3%	86.7%	100.0%	

Graph 25
MLL in WHO LS5 (Effective communication) across 6 schools of Mysore



On the whole, 86.7% students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in effective communication as against 13.3% who have not attained MLL in this skill and this was found to be true for all the schools studied here. The differences were found to be significant (CC=.264; .037).

6. Minimum Levels of Learning in Interpersonal relationship

Table 53: MLL in life skill of interpersonal relationship across all six schools of Mysore

Schools		ML6		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	5	26	31	CC = .207; P=.215
	%	16.1%	83.9%	100.0%	
JSS II	F	6	26	32	
	%	18.8%	81.3%	100.0%	
KV	F	7	22	29	
	%	24.1%	75.9%	100.0%	
DMS	F	5	13	18	
	%	27.8%	72.2%	100.0%	
JSS I	F	1	18	19	
	%	5.3%	94.7%	100.0%	
Sharada vilas	F	10	19	29	
	%	34.5%	65.5%	100.0%	
Total	F	34	124	158	
	%	21.5%	78.5%	100.0%	

On the whole, 78.5% students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in inter-personal relationships as against 21.5% who have not attained MLL in this life skill and this was found to be true for all the schools studied here. The differences were not significant (CC=.207; .215).

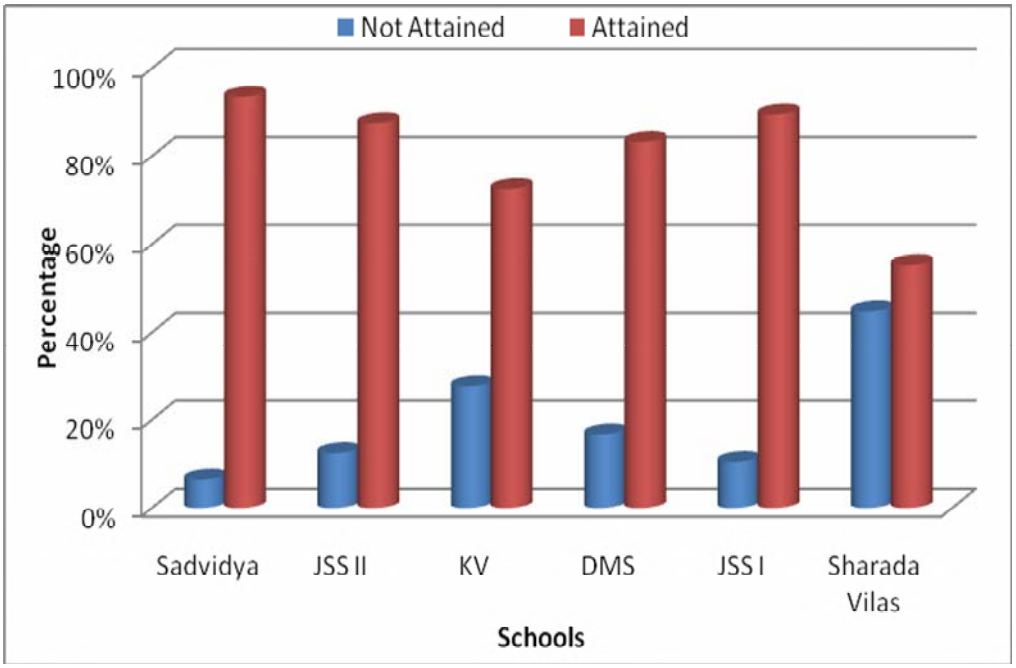
7. Minimum Levels of Learning in Self-awareness

Table 54: MLL in life skill of self-awareness across all six schools of Mysore

Schools		ML7		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	2	29	31	CC = .319; P=.003
	%	6.5%	93.5%	100.0%	
JSS II	F	4	28	32	
	%	12.5%	87.5%	100.0%	
KV	F	8	21	29	
	%	27.6%	72.4%	100.0%	
DMS	F	3	15	18	
	%	16.7%	83.3%	100.0%	
JSS I	F	2	17	19	
	%	10.5%	89.5%	100.0%	
Sharada Vilas	F	13	16	29	
	%	44.8%	55.2%	100.0%	
Total	F	32	126	158	
	%	20.3%	79.7%	100.0%	

Graph 26

MLL in WHO LS7 (Self awareness) across 6 schools of Mysore



On the whole, 79.7% students of six schools of Mysore have attained MLL (i.e. 50% attainment) in self-awareness as against 20.3% who have not attained MLL in this life skill and this was found to be true for all the schools studied here. The differences were found to be significant (CC=.319; .003).

8. Minimum Levels of Learning in Empathy

Table 55: MLL in life skill of empathy across all six schools of Mysore

Schools		ML8		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	0	31	31	CC = .177; P=.402
	%	.0%	100.0%	100.0%	
JSS II	F	1	31	32	
	%	3.1%	96.9%	100.0%	
KV	F	3	26	29	
	%	10.3%	89.7%	100.0%	
DMS	F	2	16	18	
	%	11.1%	88.9%	100.0%	
JSS I	F	1	18	19	
	%	5.3%	94.7%	100.0%	
Sharada Vilas	F	1	28	29	
	%	3.4%	96.6%	100.0%	
Total	F	8	150	158	
	%	5.1%	94.9%	100.0%	

On the whole, 94.9% students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in empathy as against 5.1% who have not attained MLL in this life skill and this was not found to be true for all the schools studied here. The variations/differences were not significant (CC=.177; .402.).

9. Minimum Levels of Learning in Coping with Emotions

Table 56: MLL in life skill of Coping with emotions across all six schools of Mysore

Schools		ML9		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	2	29	31	CC = .231; P=.112
	%	6.5%	93.5%	100.0%	
JSS II	F	9	23	32	
	%	28.1%	71.9%	100.0%	
KV	F	10	19	29	
	%	34.5%	65.5%	100.0%	
DMS	F	4	14	18	
	%	22.2%	77.8%	100.0%	
JSS I	F	3	16	19	
	%	15.8%	84.2%	100.0%	
Sharada Vilas	F	9	20	29	
	%	31.0%	69.0%	100.0%	
Total	F	37	121	158	
	%	23.4%	76.6%	100.0%	

On the whole, 76.6% of the students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in coping with emotions as against 23.4% who have not attained MLL in this skill and this was found to be true for all the schools studied here. The differences were not significant (CC=.231; .112).

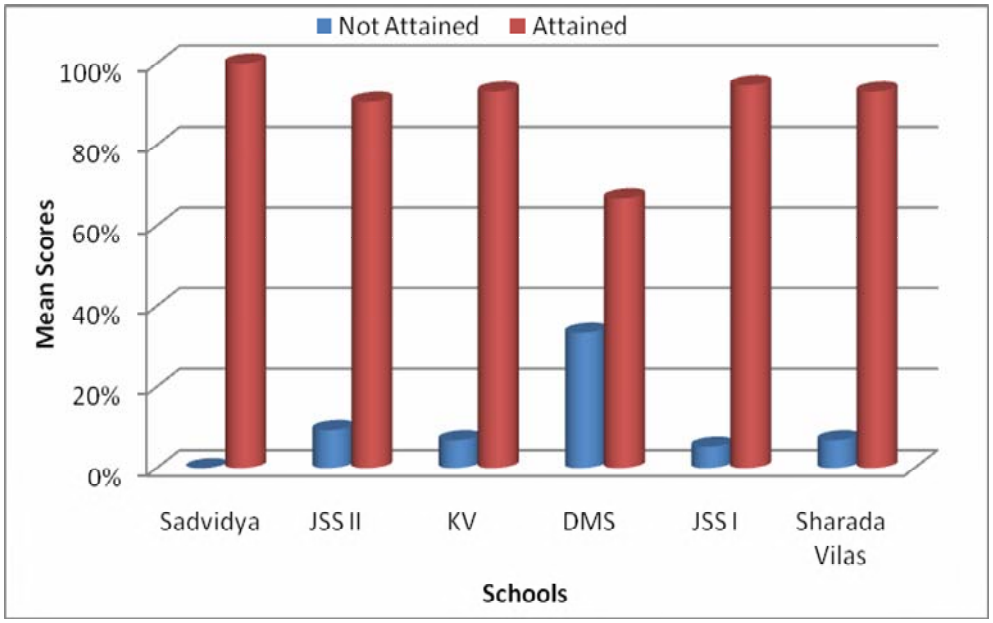
10. Minimum Levels of Learning in Coping with Stress

Table 57: MLL in life skill of coping with stress across all six schools of Mysore

Schools		ML10		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	0	31	31	CC = .311; P=.005
	%	.0%	100.0%	100.0%	
JSS II	F	3	29	32	
	%	9.4%	90.6%	100.0%	
KV	F	2	27	29	
	%	6.9%	93.1%	100.0%	
DMS	F	6	12	18	
	%	33.3%	66.7%	100.0%	
JSS I	F	1	18	19	
	%	5.3%	94.7%	100.0%	
Sharada Vilas	F	2	27	29	
	%	6.9%	93.1%	100.0%	
Total	F	14	144	158	
	%	8.9%	91.1%	100.0%	

Graph 27

MLL in WHO LS10 (Coping with stress) across 6 schools of Mysore



On the whole, 91.1% of the students of the six schools of Mysore have attained MLL (i.e. 50% attainment) in coping with stress as against 8.9% who have not attained MLL in this skill. This was not found to be true for all the schools studied here. All students have attained this skill as against lesser percentage of students in the rest of the schools. The differences were found to be significant (C=.311; .005).

To sum up, MLL (i.e. 50% attainment of Life Skills) has been attained by 75-95% students across the 6 schools of Mysore.

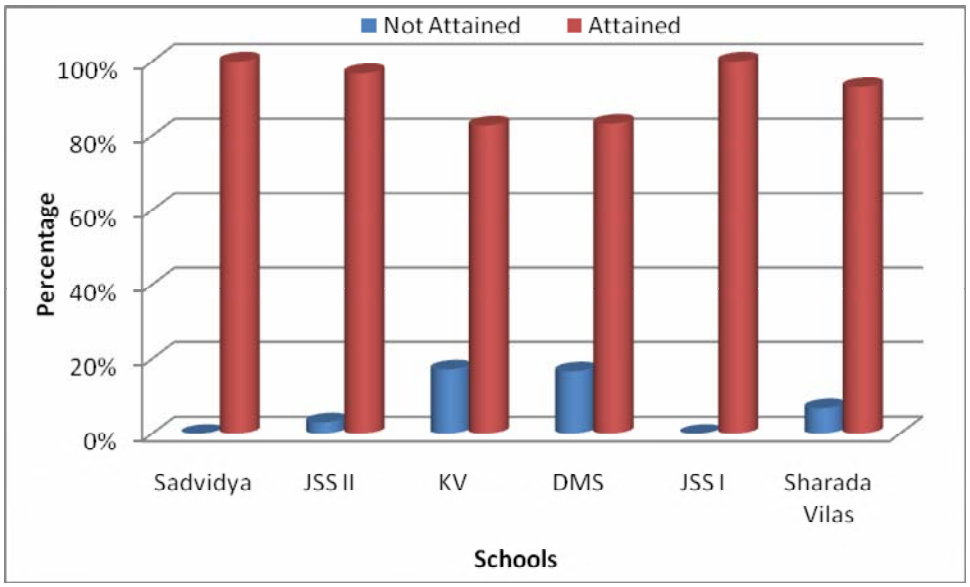
11. Minimum Levels of Learning in all WHO Life Skills Across Six Schools

Table 58: MLL in WHO Life Skills Total across six schools of Mysore

Schools		MLTT		Total	Test Statistics
		Not Attained	Attained		
Sadvidya	F	0	31	31	CC = .264; P=.037
	%	.0%	100.0%	100.0%	
JSS II	F	1	31	32	
	%	3.1%	96.9%	100.0%	
KV	F	5	24	29	
	%	17.2%	82.8%	100.0%	
DMS	F	3	15	18	
	%	16.7%	83.3%	100.0%	
JSS I	F	0	19	19	
	%	.0%	100.0%	100.0%	
Sharada Vilas	F	2	27	29	
	%	6.9%	93.1%	100.0%	
Total	F	11	147	158	
	%	7.0%	93.0%	100.0%	

Graph 28

MLL in WHO total life skills across 6 schools of Mysore



On the whole 93% of the students of all six schools of Mysore have attained MLL (i.e. 50% attainment) in all the 10 Life Skills of WHO studied here as against 7% who have not attained MLL in total WHO (10 skills) Life Skills. All students have attained WHO skills in Sadvidya and JSS1 as against lesser percentage of students in rest of the schools. The differences were found to be significant (CC=.264; .037).

MLL attainment across the six schools of Mysore in the 10 WHO life skills varied from 75% to 95%. However there were significant differences in MLL attainment across the six schools in problem-solving, creative thinking, critical thinking, effective communication, self-awareness and coping with stress. Therefore, the hypothesis is rejected.

5.5 Conclusions

I. JSS and Sharada Vilas

1. Wide individual variation seen in attainment of percent of individual and total life skills.
2. Significant differences seen between the two schools in the attainment of critical thinking, decision making, effective communication and total percent life skills.
3. Girls attain more life skills than boys and this was significant in critical thinking and decision making and effective communication life skills.
4. The pattern of attainment of MLL in seven individual/paired life skills and total life skills between the two schools was similar.

II. JSS2 and Sadvidya

1. Wide individual variation seen in attainment of percent life skills.
2. Significant differences seen between the two schools in attainment of critical thinking; creative thinking; problem solving and effective communication; creative thinking and problem solving; critical thinking and effective communication; decision making and effective communication and total percent life skills.
3. Girls attain lesser than boys in total life skills and this was significant in case of decision-making and effective communication life skills.
4. No significant differences seen between the two schools in attainment of MLL in Life Skills.

III. DMS and KV

1. Less individual variation seen in the scores of life skills except in case of problem solving and creative thinking where there is wide individual variation in attainment. However there is wide individual variation in percent life skills attainment.
2. KV had a significantly higher attainment of total life skills as against DMS. Variations in the attainment of life skills is significant in decision making and highly significant in creative thinking, critical thinking, critical thinking and decision making, problem solving and critical thinking and problem solving and decision making.
3. Girls attained more than boys in total life skills and this was significant. Differences in percent attainment of creative thinking; critical thinking; critical thinking and decision making; and problem solving and decision making were significant.
4. Significant differences are seen in the attainment of MLL in Life skills of creative thinking and problem solving &decision making.

IV. All six schools of Mysore

1. Less individual variation seen in the attainment of life skills.
2. Maximum mean attainment of life skills was very low in the six schools studied. Differences in mean attainment were significant in decision making, problem solving, effective communication, self-awareness and coping with stress.
3. Girls attaining more than boys in 8 out of 10 WHO life skills was however statistically not significant.

4. Attainment of MLL in life skills across six schools of Mysore varied from 75% to 95%. Significant differences in MLL attainment across the six schools of Mysore were seen in life skills of problem solving, creative thinking, critical thinking, effective communication, self-awareness and coping with stress.

Learning is the treasure within.

— Jacques Delors

CHAPTER – VI

IMPLICATIONS OF THE STUDY FOR SCHOOL AND TEACHER EDUCATION

We have to change. Why ? This is because technological development is pressurising our paradigm for teaching and learning. We face a world on the move and education needs to change or evolve and commit to changes at the classroom level. To be competent in the 21st century – we need new skills viz., the 21st century fluencies (Jukes, McCain and Crochett, 2010).

The future is in the hands of the students whose education has stagnated in the digital world. In future, mostly the skills required will be those of manipulation of placeable information into real problem solutions. The tools on this path will be programming skills along with multi-media talents. Words – the way they are presented to others is real communication. And this skill should be emphasised in schools of the future.

The world is changing rapidly, and it is difficult to qualify and qualify the scope and scale of the changes. Also it calls for our forgotten personal coping strategies. We have to continuously change in our life, be aware of changes around and blend with the environment. And for this the key view is our mind set or paradigm. We need new skills and strategies for surviving in the 21st century. The changes which led to the infotech and digital world of today are as follows.

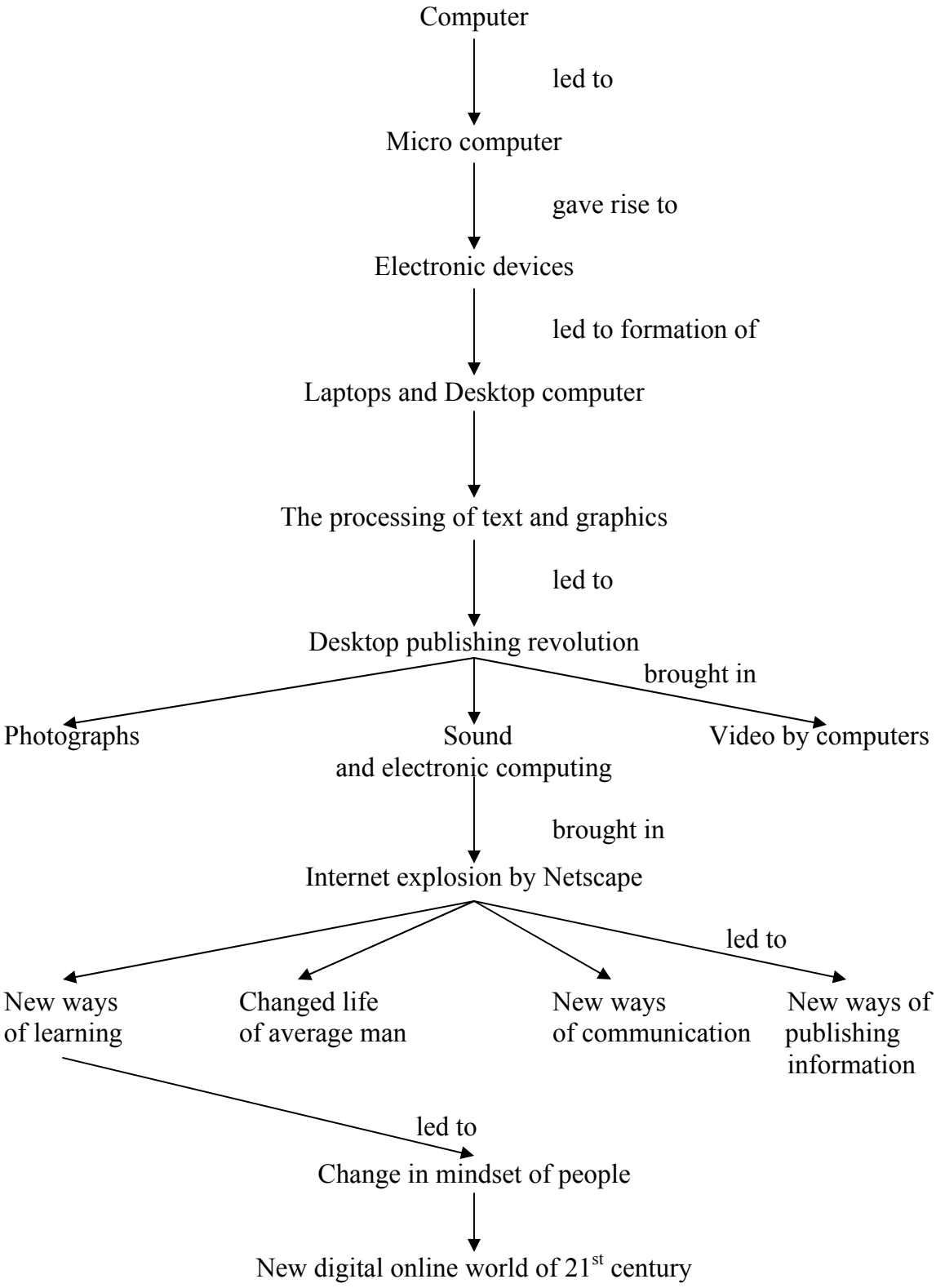


Figure 5: Changes leading to world of today

The question that arises is as to where are we headed to in future ? And what skills are necessary ?

The changes have brought paradigm paralysis i.e. pressure in existing mindset to adapt with less time to new ways of doing things. This paralysis necessitates changes in thinking, in ways of doing things and in viewing the world; necessitates having critical knowledge of the past and linking it to future; necessitates anticipation of consequences of what exponential growth can do; and, lastly, requires new perspectives and divergent thinking for visualising emerging trends in technology.

6.1 Technological Trends

In a moving and shifting world, one has to live life like a quarter back – meeting the demands of moving targets to make the future a success. There is no way we can survive if we deal only with the present. You must split the screen in your mind and devote half of your attention to the future. There are 6 major technological trends in the future that cannot be ignored – (1) Moore's Law, (2) Photonics, (3) The Internet, (4) Info Whelm, (5) Nano technology, (6) Biotechnology. One has to view the world differently and in a completely new perspective.

Moore's Law

Gordon Moore, Chief of Intel, proposed Moore's Law according to which the processing power and speed of any electronic computational device would double every 24 months while at the same time the price to produce it would decline by 50 percent, i.e. every 24 months we had technology that was twice as powerful at half the price (exponential growth). These are exponential times and we are now going faster than human beings can endure. Time is compressing and the life span of new

technologies is becoming shorter. By 2022, the power of an off the shelf computer will exceed the intelligence of a human being. By 2030, children will carry devices in their backpacks or their pockets containing the sum total of all human intelligence with any single piece of information accessible in a fraction of a second.

One has to be aware of these mind-blowing changes of the future and prepare for it creatively and solve in advance, one generation in advance only the problems of technology in future for succeeding generations and this calls for higher order thinking skills, creativity and problem-solving skills.

Nano and Bio Technology

1 Nano meter – 1 billionth of a meter (atomic/molecular scale)

If a structure/material/device is developed with one of its dimensions smaller than 100 nm then it is nano technology.

It is used for making stain and wrinkle resistant clothes, self-cleaning windows, sports socks and shirts that won't stink, cosmetics with particles that refract light and hide wrinkles, kitchen boards that kill bacteria, cooking oil that transports vitamins and minerals, microscopic computers, machines and robots of the size of a virus (which can be swallowed/injected). With microscopic technology, arterial clogs can be removed bloodlessly (non-invasive surgeries of arterial and neurological systems). Also viruses and bacteria can be reprogrammed and designed to deliver molecular doses of chemotherapy to target specific cells. This will also lead to implantable diagnostic and treatment devices and biosensors. Also it will lead to the creation of self-replicating machines that will reverse engineer human processes gone badly. Micro machines will course through our bodies to impact, repair and rebuild

dysfunctional parts of the nervous system. e.g. brain pacemakers to silence neurons that malfunction in neurological disorders like epilepsy. It also means bio materials laced with protein-based agents. It means genes or stem cell therapies used to stimulate or out perform the body's natural ability to heal memory tissues which were beyond repair.

All this involves a lot of creative thinking and problem-solving tasks in Biology and Science for the future generations keeping bioethics in mind, and therefore calls for proper decision-making abilities.

Photonics

The chip technology driving Moore's law has led to a second global exponential trend – photonics i.e. generation, transmission, modulation, signal processing, switching, amplification, detection and sensing of light (i.e. tele-communication and information processing). Here we deal with fiber optic cable and the transmission of laser light of different colours and frequencies through that cable. We have made bandwidth speeds of 10 gigabytes/second increasingly possible. Data is transmitted at light speed. This is fiber optics. What about wireless and co-axial cables ? These are the concrete and steel of the information highway and will affect greatly the future of global economy.

The way we work, we live and communicate and learn are going to change exponentially.

By spending a few minutes on desk one can hire millions of professionals in every conceivable industry. This new economy is based on new (not reconstituted) skills and knowledge.

Crowdsourcing has been made possible through wikipedia with accuracy greater than of Encyclopedia Britannica. Thousands of contributors edit and maintain this resource in real time. As news happens, as new scientific breakthroughs alter facts, wikipedia is kept current by its army of volunteer contributors. Through crowdsourcing we can get expertise of the entire planet. This is today. What will happen in the future ?

Continuous voice recognition technology has become possible along with automated speech, translation technology and automated interpreting telephoning. This changes the way we communicate in future.

Life skills will help in developing social and intellectual capital which are the new economic values in world economy. The great challenge for education is to prepare students to capitalise on these opportunities and prepare for solving problems that we have not begun to think about; and to train them to the technologies that have not yet been invented !! Students need creative training to succeed in an exponential environment. Thinking today is probably based on linear common sense and what students need in future is exponential thinking.

The Internet Boom: – UN considers Internet as human right. Face book is a socialised networking for children below 10. Children are taught to become good digital citizens. Twitter enables text-based posts of upto 140 characters known as tweets by the author, used for finding assistance, political campaigning, legal proceedings and public relations all of which involve life skills (video). Youtube (Video), ipods (for music and movies), skype (for voice calls) and e-bay (for shopping). These are resources increasingly available online.

The world is experiencing a massive shift from text-based learning resources to online interactive multimedia.

Internet has started overwhelming us, stretching our capacities to cope and make us sit for longer periods in front of a glowing screen. Very soon we will walk and talk our way through the web, searching for information and interacting with digital devices and this calls for coping skills.

Infowhelm

The intersection of the above global trends has created information age or infowhelm where access to the total of all human knowledge will be right in the palm of your hand anywhere, anytime and within seconds (or as an implant in your nose). This once again calls for coping and thinking skills and for investment in life-long learning as knowledge gained today becomes obsolete incredibly fast. What matters then in future is ability of students to place information in a context and use it effectively. New gadgets have brought in disruptive changes and these are globalising our economy. Education in future will be on: (a) **Customised learning** for the learner (as age and grade will not matter and mastery of content and skills become important); (b) **Non-linear learning** (with formation of cognitive links); (c) **Physical and virtual learning** (school will be a place where learners will have to work on interpersonal skills and social skills become important in virtual world as well); (d) **Learning assisted by machines** (robots and androids as well, besides computers) – these will assist in skill development in maths and reading; (e) **Learning will focus on** processing multimedia, information and skills thereof, receiving and decoding messages in different media formats and communication of messages; (f) **Learning**

will be collaborative – say through networked games and team work will be a must, with collaboration becoming an essential life skill. Even teachers will need collaborative life skills. (g) **Learning will be wholistic** i.e. whole mind: The left brain is used for learning the 3R's (i.e. reading, writing and arithmetic), and for literacy, logic and reason. These are taught in a traditional school. In contrast, the right brain handles emotions, creativity, synthesis and analysis leading to the development of new age higher skills; (h) **Learning will be based on discovery**: Students get realistic virtual experiences of world around and learn from them; (i) **Teaching will be about crafting problems**: Learning activities and projects will be made to foster to higher level thinking skills. (j) **Holistic evaluation**: Evaluation will be done using software and not manually.

New digital technology calls for routine cognitive work that can be done anywhere and *non-routine cognitive work is the stuff we refer to as 21st century skills* and these include critical thinking, problem-solving, innovativeness, creativity, being complex communicators, team-work and team-learning – a work or skill that cannot be replaced by unskilled labour; replaced by technology or software or outsourced to overseas workers.

These 21st century skills are referred to as 21st century fluencies. *Fluency here demonstrates a level of proficiency far beyond literacy*. The 21st century fluencies are solution fluency, information fluency, collaboration fluency and creativity fluency and media fluency (not about technology but what we do with it). *These are mostly process skills and critical thinking skills indicative of the kind of skills everyone will need in digital age.*

6.2 Life-long learning

The aim of education is synonymous with the aim of life and taken in a separate perspective life skills comprise learning of skills for life long Education. Life long Education has been gaining increased acceptance every day. Various philosophies of education of this century have accepted the principles of life long education. Integral education is one such modern philosophy which has accepted the principles of life long education. Integral education is a theory developed by Sri Aurobindo. The Philosophy of Integral Education is based on Hindu philosophy of life (the psychological principles are not western) and has five aspects.

(a) Physical education:– the goal is to make the body (with soul and consciousness) immortal.

(b) Vital education:– the goal is to help in effective use and development of sense organs and the development of desirable habits, behaviours and attitudes – especially the following four:

mental vital – emotions, desires, passions, sensations

emotional vital – love, joy, sorrow, hatred

central vital – ambition, pride, fear, attractions, repulsions

lower vital – food desires, sexual desire, small likings, dislikings, vanity, praise, anger at blame, etc.

Life skills education performs these through coping and understanding skills.

(c) Mental education – mind here has layers and is concerned with development of citta (active and passive memory), manas, (6^{th} organ), budhi (will power/intellect)

and intuition. Passive memory is of thoughts and sensations, and is not under our control and active memory can be under our control through ideas, facts, etc.

The buddhi or intellect is the seat of will power and has left hand (analytical, critical) and right hand (comprehension, judgement, imagination, memories, observation and manipulation i.e. creative and synthetic) faculties. Life skills education develops these faculties through solving and thinking skills.

(d) Psychic education – goal is discovery of one's own psychic being and making it take charge of physical, vital and mental education.

(e) Spiritual education – goal is abolishing 'ego'.

Though life skills are not concerned with the Indian concept of the Human mind, it partly fulfills these for the teacher and taught and all age levels through the solving, thinking, coping and understanding skills (Rao, 2007).

6.3 Biofeedback

Biofeedback is getting information about ourselves through specialised instrumentation that monitors various physiological processes in real time like brain-wave activity, muscle activity, temperature, sweating and activity, heart rate and respiration rate, etc. studied through moving graphs on a computer screen, and thereby enabling the individual to see, hear and optimise mind/body functioning. Through biofeedback an individual learns his own unique psychophysiological patterns and responses to stress and success and learns to control them than having them to control us. Biofeedback can correct behavioural problems at school and free-up energy and creativity for greater gains. Stress leads to attention problems, depression, anxiety, violence and biofeedback can give practical skills for coping with

stress. It is a cost-effective means of addressing and preventing psychophysiological disorders, and mind/body training for facing life situations.

It would help teachers promote learning – they can send disruptive children to a biofeedback lab where they learn to become more cooperative, and develop relaxation and alertness skills through feedback games. When children adjust psychophysiological responses to life events it fosters subtler human capacities like intuition and creativity.

Adolescence would be more comfortable and productive with biofeedback training where students become aware of mind/body phenomena and adjust psychophysiological arousal to meet the needs of the situation through decision-making. Biofeedback should be included in curricula of schools today to face the challenges of tomorrow (Wall, 2001).

WHAT DO LIFE SKILLS DO FOR US?

- Through life skills one learns to integrate not only scholastic subjects but also different skills in order to become competent to face life (WHO, 1994; Murthy and Rao, 2005).
- Teaching of life skills is effective in programmes for the prevention of substance abuse.
- Life skills are effective in prevention of adolescent pregnancy.
- Life skills are effective in the promotion of intelligence.
- Life skills are effective in prevention of bullying.
- Life skills are effective in prevention of AIDS.
- Life skills are effective in peace education.

- Life skills promote citizenship and inclusive education.
- Life skills are effective in the promotion of self-confidence, self-esteem and self-efficacy.
- Life skills promote health education. They help in prevention of mental disorders like anxiety disorders, mood disorders, psychotic disorders, eating disorders, addiction disorders and personality disorders, and in general prevents related health and behaviour problems (Gopal and Charles, 2011).
- Life skills promote psycho-social competence and promotes health in its broader sense, i.e. in terms of social well-being.
- Life skills education programme in schools promote pupil-teacher relationships.
- Life skills education programme in schools promote academic performance through Biofeedback.
- Life skills promote vocational education and facilitate development of skilled and technically trained people which are the capital of a developing society (Rashtriya, 2008).
- Life skills promote life-long education (Rao, 2007).
- Life skills are relevant for the development of higher order skills of the digital age, viz. the 21st century fluencies.

We are going to enter very soon the Innovation age, a transition from the already picturised and described information age or knowledge age, where inventions and innovations are going to play an important role in making our lives successful and for this both the skills of creativity and problem solving are very very important. Students in this age should be able to solve real world problems through challenging projects. And along with the above two skills critical thinking, collaboration skills and modern effective ways of communication become more and more important in the coming ages. The rapid pace of technological changes calls for flexibility and adaptability these being two very important skills with which we prepare ourselves for the future and also look at problems in a different perspective and adapt the strategies to new circumstances. The 21st century calls for educationists to be leaders with authority and decision-making skills and would require teachers to be 21st century learners themselves learning from inquiry, design and collaborative approaches that build a strong community of professional educators.School systems are already overhauling their educational systems for the 21st century with the Partnership for the 21st century skills i.e. P21 framework where the interlinked support systems of standards, assessments, curriculum and instruction, professional development and learning environments shift to support 21st century learning, understanding and skills performance (Trilling and Fadel, 2009). Along with United Kingdom's "harnessing technology:next generation learning 2008-14" and the Singapore "teach less-learn more" initiatives, the P21 framework brings forth six emerging principles for retooling schooling in the 21st century viz., vision, co-ordination, official policy, leadership, learning technology and teacher learning.

Though the first four principles have been there with us all along the last two are innovative. Schools will grow only when they incorporate health, child-care, family, social, cultural, gardening, hobby and recreational services on the same campus and develop into community learning and service centers or community schools.

An academy programme which gives competence in 21st century technical and business skills to its students is that of The Cisco Networking Academy (www.cisco.com/web/learning/netacad/index.html); an international organization that is pioneering large scale assessments of some of the 21st century life skills is the Organisation for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA) (www.pisa.oecd.org/pages/); and the vision of whole learning for the whole child has been well-developed by the ASCD organization (www.ascd.org/programs/The _Whole _Child/The_Whole_Child.aspx/.).

Education is now seen as the golden ticket to a brighter economic future. The recent global recession has left so many without work and with much less to live on and warns us of what it would be like to have 20th century educated citizens in the 21st century .Even in difficult economic times,the guarantee for a brighter future lies in continuing to invest in 21st century education for all our children .

6.4 Action points for improving school education

Many of the emerging trends and needs have already been dealt with at length hitherto under the 21st century fluency discussions. Keeping these in mind the schools need to execute the following agenda to improve school education in future:

a) incorporate Life Skills Education and Assessment as a part of the Biology Curricula as has already been done by the CBSE from the 1st to 8th standards so far.

b) make Life Skills Programs a part of various social activities in the school like Science Clubs, National Cadet Corps, and Summer Science Camps and other cultural programs and developmental activities.

c) introduce a minimum programme of life skills in the form of a Life Skills Curriculum for Adolescents of XI and XII Standards conducted either during summer and winter vacations.

d) identify and train teachers/staff members of the school/college /health clinic for conduction of an intense crash course in Life Skills Education.

e) develop a 5-point or 10-point Life Skills Curriculum based on the 5 paired thinking, solving, coping ,understanding and relationship skills given by WHO (1994) OR based on the 10 Life Skills mentioned by WHO(1994).

f) interpolate and extrapolate Life Skills into Science Curricula as units/ subunits and Science into Life Skills Curricula.

g) initiate and conduct training programmes for school teachers as a PAC programme in NCERT.

h) develop materials for Life Skills Training based on local and national needs and the curricula followed at these levels (be it the Sciences,Arts, Engineering or Humanities)/or alternatively develop materials based on WHO (1994) Life Skills alone.

i) make Life Skills Training Materials and Trainers/Providers available to schools. A guidance counselor could easily take on the role of a Life Skills Trainer in schools.

j) invite Health Professionals and Doctors for interactions with school students on a regular basis in the schools.

k) train rural and urban school teachers for disseminaton of knowledge and materials on life skills.

l) introduce Psychology as a part of the Biology/Science Curricula at various levels of teaching as Life Skills are mostly Psycho- social skills.

m) introduce a paper on Life Skills Eucation into the NCERT'S ongoing International Diploma in Guidance and Counselling Programs to turn out individuals with Life Skills Training for Schools.

n) maintain biofeedback labs and introduce biofeedback programmes through consultations with Doctors in schools to improve the overall performance of school students depending on individual drawbacks and limitations.

o) introduce evaluation through computers/indirectly/incognito in order to ascertain and assess individual capabilities without affecting performance – besides continuous and comprehensive evaluation(CCE).

p) bring environmental education and its wider implications into focus in the Science Curriculum at the secondary stage as this helps in building harmony with nature through awareness and understanding of relationships of man and nature. As of today, we have EVS till the V Standard and it is Science in the higher classes.

q) bring environmental engineering(a part of B.E. course at present) to enable students to meet the problems of future head on.

r) introduce bio-ethics and bio-piracy apart from bio-diversity as a part of XI AND XII standard syllabi.

s) introduce Mindlab and mindlab games in schools.

No problem of human destiny is beyond human beings.

— John F. Kennedy

CHAPTER – VII

MODULES IN BIOLOGY AND LIFE SKILLS

The modules in Biology incorporating life skills were prepared by a resource team of Biology teachers and education faculty pooled from the Institute. The format of the modules was constructed through detailed discussions about the requirements of the teacher and the taught at the XI standard level. Only 7 life skills have been incorporated in the Biology here, these being the ones where differences in MLL attainment were significant. Topics were selected from NCERT Textbooks using the Check-list Tool based on these 7 significant life skills arrived at during the course of this study. The idea has been to project and bring out step by step development of a life skill during the teaching-learning process.

REGIONAL INSTITUTE OF EDUCATION, MYSORE 6
Six day workshop on Life Skills and XI Std Bio-curriculum
06/04/2011 to 12/04/2011

(ERIC RESEARCH PROJECT)

Date / Day / Time	9.30 a.m – 11.15 a.m		11.30 a.m -1.00 p.m	1.00-2.00 p.m	2.00 – 3.15 p.m.		3.30 – 5.00 p.m.
06/04/2011 Wednesday	Registration Inauguration by *Principal* Approach Paper – Dr. GGN Life Skills Curriculum Dr. CSN	T E	Life Skills and Psychology Dr. L'D	L U N	Module Preparation in Life Skills Dr. CGVM	T E	Module I on Creative Thinking (B/Z)
07/04/2011 Thursday	Module I on Creative Thinking (B/Z) Contd..	A	Module II on Critical Thinking (B/Z)	C	Module II on Critical Thinking (B/Z) Contd…	A	Presentations Modules I & II
08/04/2011 Friday	----------		----------	H	----------		----------
09/04/2011 Saturday	Module III on Problem Solving (B/Z)	B R	Module III on Problem Solving (B/Z) contd…	B	Module IV on Self awareness (B/Z)	B R	Module IV on Self awareness (B/Z) Contd... Presentations Modules III and IV
10/04/2011 Sunday	Module V on Decision making (B/Z)	E A K	Module V on Decision making (B/Z) Contd…	R E A	Module VI on Effective Communication (B/Z)	E A K	Module VI on Effective Communication (B/Z) Contd…. Presentations Modules V & VI
11/04/2011 Monday	Module VII on Coping with Emotions (B/Z)		Module VII on Coping with Emotions (B/Z) Contd…	K	Presentation of Module VII (B/Z)		Discussion and Finalization of Modules I & II (B/Z)
12/04/2011 Tuesday	Discussion and finalization of Modules III and IV (B/Z)		Discussion and finalization of Modules V and VI (B/Z)		Discussion and Finalization of Module VII Stage specificity of modules		Valediction

B – Botany Z- Zoology
Dr. CSN – Dr. C S Nagaraju, Dr. GGN – Dr. Geetha G Nair, Dr. L'D – Dr. Lancy D'Souza , Dr. CGVM – Dr. C G Venkatesha Murthy

Prof. K Dorasami
Principal, RIE &
Principal Administrator ERIC

Dr. (Ms.) Geetha G Nair
Principal Investigator, ERIC
Associate Professor and Programme Co-ordinator

RESOURCE TEAM

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2. Ms. Pradeep, DMS, RIEM

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4. Ms. Mangala, DMS, RIEM

5. Dr. Gireesh, Assistant Professor of Microbiology, Maharani's College, Mysore

6. Ms. Sameera, Guest Faculty, Yuvaraja's College, Mysore

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10. Dr. L. Srikantappa, Retired Professor of Zoology, RIEM

11. Ms. Jubilee Padmanabhan, Research Scholar, RIEM

12. Dr. (Ms.) Geetha G. Nair, Associate Professor of Botany, RIEM

Approach Paper

Dr. Geetha G Nair

Life Skills and XI Standard Bio Curriculum

Need for the study:

Rapid technological advance has left a lacuna in the development of co-scholastic area of life skills that support the cohesive functionality of body, mind and spirit. 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, 1997).

Literature reveals that curricular information / ideas/ concepts are redundant, non-contextual and least relevant in the present scenario and may very soon be forgotten. The survey also shows that passing out of school or test score achievements in school does not always indicate learner's ability to use the knowledge and skills in similar and new life situations. How to ensure reinforced learning of these skills? According to NPE (1986), Science education will be strengthened so as to develop in the child will defined abilities and values such as the spirit of thinking, inquiry, creativity, objectivity , the courage to question and an aesthetic sensibility. There should be extrapolation as well as interpolation of Science into Life Skills and vice versa. What is the relationship of Science with health, agriculture, industry and other aspects of daily life? Concern of Science education the world over has been to make it relevant, vibrant, addressing the real-life situations.

Skills have been mentioned at every step of the elementary and secondary stages of education in NCF 2005. Science and Technology section of NCF emphasizes development of manipulative skills to be acquired in day-to-day life situations. It has been stressed time and again by NCERT that curriculum review should take note of needs of the community. This workshop is the final stage of a research study to find out how the Bio-curriculum can meet the needs of the community through the development of life skills.

Life Skills:

WHO has advocated the development of life skills in order to promote psychosocial competence – this being the ability to deal effectively with the demands and challenges of every day life. Enhancement of psycho-social competence could make an important contribution to well-being of individuals especially, where health problems are related to behavior and where the behavior is related to an inability to deal effectively with stresses and pressures of life.

Life Skills are already being taught in many schools around the world with initiatives being taken by Non-Governmental organizations, education authorities and religious groups. Teaching life skills as generic skills in relation to everyday life forms the foundation of life skills education for the promotion of mental well being and healthy interaction and behavior in society.

Educational programmes teaching life skills have been developed for substance abuse, adolescent education, peace education, promotion of self-confidence and self-esteem and promotion of intelligence.

A core set of life skills are at the heart of skill-based initiatives (as advocated by WHO) and these are

Decision-making
Problem-solving
Creative thinking
Critical thinking
Effective Communication
Interpersonal Relationship
Self-awareness
Empathy
Coping with emotions
Coping with stress

These skills are to be developed during schooling process. Development of these skills may be accomplished with designing and implementing different interventions (Short-term, medium-term and long-term). Life skills can be developed based on brainstorming technique, role-play technique and follow up group discussions.

Sample Module (NIMHANS, 2002)

Theme: SOCIAL RESPONSIBILITY - KEEPING THE ENVIRONMENT CLEAN

FACT SHEET:

The health of an individual, a community or a country is determined by the integration of two ecological universes i.e., the internal environment of man himself and the external environment, which surrounds him/her. These two internal and external environments comprise the total environment. Industrial growth, advances in nuclear technology, and urbanization have given rise to the problem of environment pollution like air pollution, water pollution. Various diseases are often a result of disturbance in the delicate balance between man and his environment. Therefore, the attainment of healthy environment is very important for a Healthy Person. Towards this it is the duty and responsibility of the every individual in the society to keep the environment clean and prevent pollution.

Environment pollution refers to the process in which contaminants and foreign matter are added to the environmental resources. It can be classified into air pollution, water pollution, soil pollution and noise pollution.

How to Prevent the Environment Pollution:

The following are some of the strategies that can be adopted by the students to prevent environment pollution and conservation of natural resources,

- Keeping the garbage in proper containers at home and in the school.
- Avoiding disposal of waste on the road and public places.
- Always carrying a cloth bag; this prevents accumulation of plastic bags.
- Developing the habit of turning the lights off when not necessary. This will save electricity costs and energy.
- Turning the tap off while brushing teeth and turning it on again while rinsing.
- Carrying necessary repairs wherever possible to prevent wastage - leaking taps.
- Recycling as much as possible from used materials.

The benefits of environment pollution prevention are,

- Conservation of natural resources and energy.
- Proper utilization of resources - energy, material and resources.
- Minimizes or avoids the creation of pollutants.
- Prevents the transfer of pollutants from one medium to another.
- Minimizes health risks.

Name of the Activity:

Keeping the Environment Clean - Do I Care ?!!!!

Objective of the activity:

- *To make students aware that the responsibility of maintaining a clean environment is in their hands too.*

Expected Outcome:

- *Increased awareness of immediate problems in the environment around them and steps taken by them to contribute to a cleaner environment.*

Time: 60 Minutes

Life Skills Promoted:

Critical Thinking, Creative Thinking and Decision Making.

Techniques Used:

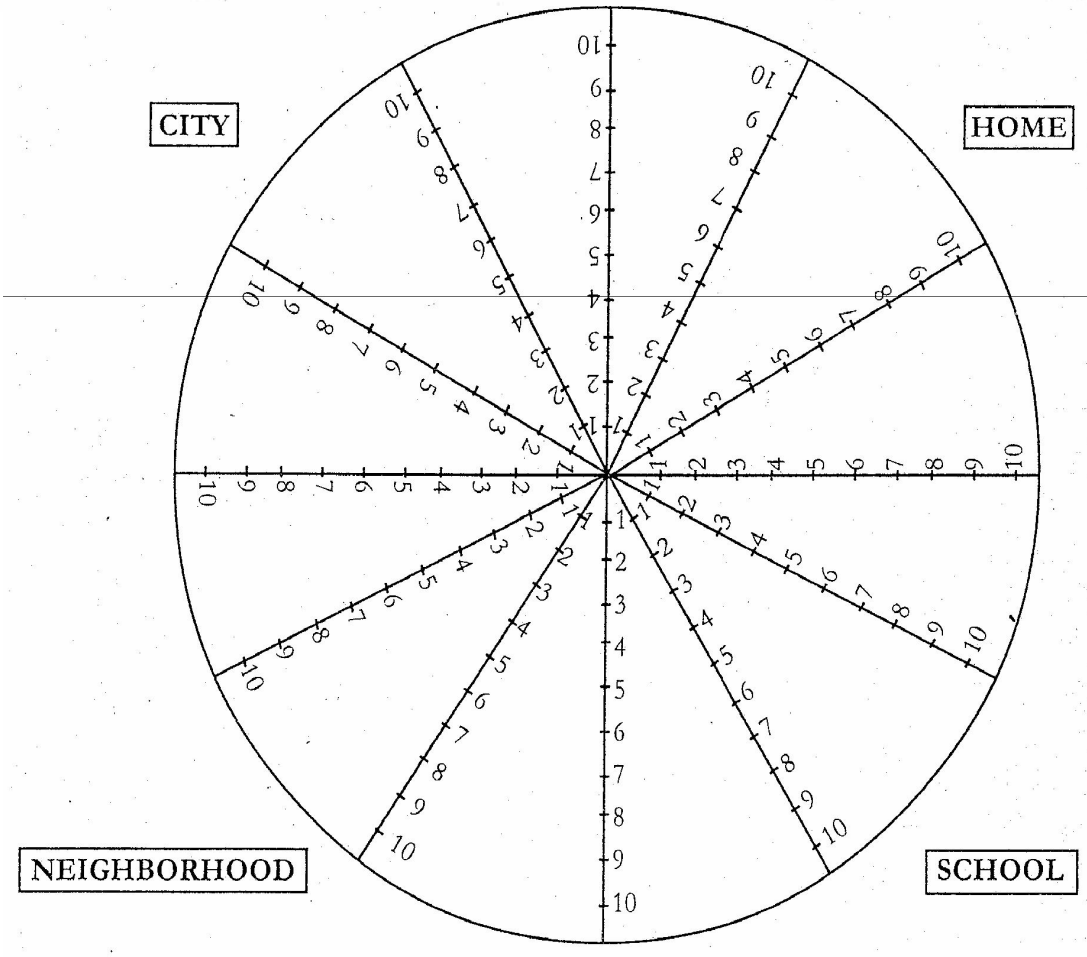
Directed Work - Sheet Completion, Introspection and Planning.

Materials Needed:

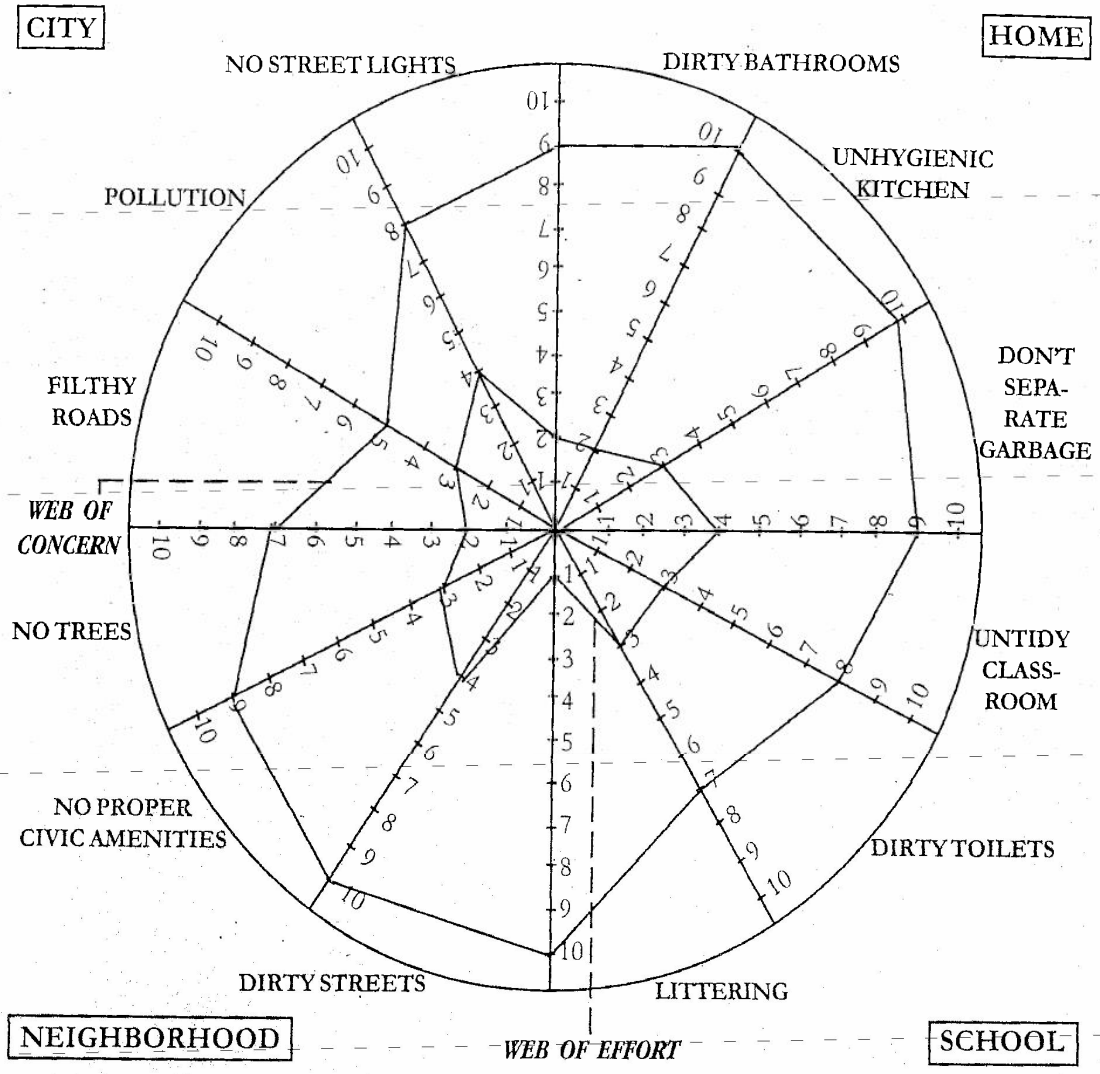
The worksheet below, black and green color pencils (See Activity Material - 2.13).

WORK SHEET:

WEBS OF CONCERN AND EFFORT



WEBS OF CONCERN AND EFFORT



Note to the Teacher:

Tell the students that each student will be doing this activity alone. If desired a student need not even share her/his work with neighbors. Each student should rate each concern sincerely and also see how much she/he is doing to solve the issues

Procedure:

Step 1:

Provide all the students of the class a photocopy of the above worksheet with 4 areas of concern mainly, home, school neighborhood and city. Each area has 4 sections with demarcations from 1-10. Tell students first to think of cleanliness issues that deeply concern each one of them personally at home, school, in their locality and city; write the concerns down next to the segments in that area. Students should come up with not less than 2 concerns. Maximum of 4 concerns in each area could be written. Reassure students that the concerns need not be very major - could be very small issues.

For e.g. a student's concern at home could be leaking tap, unwashed clothes, rat infestation etc

For school it could be litter, toilets without latches on the doors, lack of water etc.

For the city it could be dug up pavements, no streetlights etc.

Once 2 - 4 concerns have been written for each area, ask the students to rate each of their concern on a rating between 1 - 10. For e.g. my concern for dirty bathrooms at home could be 9, absence of streetlights could be 6 and untidy classromm is 8 etc (See Picture - Pg. No. 108).

After the students rate their concerns in each area, demonstrate with a pencil how they mark their each concern in each area and the corresponding rating on the graph. (0 towards the center of the grid and 10 towards the periphery) Show them how to join up all the ratings to form a circular web using a black color pencil (20 minutes).

Step 2:

Ask students to compare their neighbour's issues of concern and the web size (5 minutes).

Step 3:

Instruct each student (since he/she is so concerned about these issues), to rate themselves on a scale of 1 - 10 the effort that they are currently making to better/address/solve the issue. For e.g., a student who has marked 9 on his graph for leaking taps of his house as a concern may rate his effort as 2 taps if the attempt is low.

Ask the students like the previous time to mark their efforts for each issue in each area on the same grid with green pencil. Later ask them to join all the effort marking with a green pencil. Ask students to compare their neighbor's green web (20 minutes).

Step 4:

Point out that the gap between the black web and the green web is the extent of each student's responsibility. If the green web is outside the black web, it means the social efforts are better than the issues and he/she is a very socially responsible person. On the other hand, the green web is within the black web, he/she is not taking responsibility to solve issues in all areas including home (10 minutes).

Step 5:

Summarize... (5 minutes).

Summarize....

- It is usually the practice of everybody to complain about the deficits in the home and in the society. Society is made up of individuals like us who need to take small steps to address and solve them.
- Social responsibility is the duty of one and all. Students need to think and act (skills) towards this.
- The web is a clear indication of our complaints and efforts. We can change it and hence the society.

Reflection at Home by the Student:

- What are my concerns at Home?
- What is the rating of the concerns?
- What is my rating of the effort to rectify it?
- Can I change it by my skills within a week?
- Can I ask my family members for help and ideas?

Life Skills where differences in MLL attainment were significant (Ref. Chapter V on Statistical Analysis of Data)

DMS-KV

- Creative Thinking
- Self-awareness
- Decision-making
- Problem-solving and Critical thinking
- Problem-solving and Decision-making

All 6 schools/colleges of Mysore

- Decision-making
- Problem solving
- Creative thinking
- Critical thinking
- Effective communication
- Self-awareness
- Coping with stress
- Total Life Skills

The Process

1. Select a topic from Bio-Text Book of XI standard
   - Write an overview
2. Identify the Life Skills involved
3. Identify all the components of the Life Skills
4. Develop interventions

   Debate
   Brain Storming
   Group Discussion
   Anecdotes
   Activities
   Experiments
   Concept maps
   Venn Diagrams
   Flow-charts
   Cross word
   Model (Active/static & working models)
   Analogies
   Exemplars
   Mnemonics
   Quizzes
   Puzzles

5. Prepare Bio(Botany/Zoology) modules on

   Decision making (2)
   Problem solving (2)
   Critical Thinking (2)
   Creative Thinking (2)
   Effective Communication (2)
   Self-awareness (2)
   Coping with stress and emotions (2)

Format of Module

Unit No.

Chapter No.

Topic

Objectives

Overview

Associate Issues

Pedagogic Concern

Expected Outcomes

Life Skills

Component of Life Skills

Interventions

Assessments

Modules in Biology incorporating Life Skills
prepared in
'Life Skills and Bio-Curriculum' workshop from 06/04/11 to 12/04/11
at RIE, Mysore

Dr. Geetha G Nair
Principal Investigator ERIC and
Associate Professor in Botany

MODULE I

The Digestive system and creative thinking

Unit II

Chapter No. VII

Topic : Digestive System

Objectives: To bring out expressive skills in drawing, elaboration and analytical ability with respect to organs and their functions.

To foster the development of divergent thinking, elaboration ability in the students through the diagram of digestive system of frog which will facilitate development of creative thinking as life skill.

Overview:

Digestive system involves alimentary canal and digestive glands. Bilobed tongue helps in capturing the food. Digestion of food takes place with the action of various digestive

Juices: Digestive food is absorbed by villi and microvilli of the intestine and undigested solid waste gets egested.

Flow chart

Mouth(bilobed tongue)---buccal cavity-----oesophagus-----stomach----intestine----rectum----cloaca

Digestive glands---Liver(bile); wall of stomach(gastric juice);pancreas(pancreatic juice)

Frog alimentary canal is short as it is carnivorous.

Associate issues: Jaundice, Vomiting, Diarrhoea, Indigestion, Endoscopy in Human Digestive System.

Pedagogic concern:

Draw neat diagram of digestive system of frog.

Expected outcomes:

While drawing the digestive system of frog, the student's ability to think about the digestive system of other amphibians, man, reptile etc. develops (divergent thinking develops).

Student also becomes capable of expanding different issues like enzymes, functions of each part of alimentary canal, food habit, habitat of frog, presence of short alimentary canal etc. and tries to connect them to the diagram of the digestive system of frog.

Life Skills:

Creative thinking

Component Life Skills:

Divergent thinking

Elaboration

Interventions:

a) Model preparation using balloons and plastic tubes

The students inflate different coloured balloons representing different parts of the frog digestive system like the liver, gall bladder, stomach and cloaca. These are then interconnected using white transparent plastic tubes as shown in the diagram using fevicol and then fixed on to a thermocol sheet (1'x2') with the help of threads

or celotape. A small rubber pump is fixed to the mouth and coloured water is pumped into the model tracing the path of food through the digestive system.

b) Concept mapping

Students recall sequence of events in digestive system in the process of digestion.

1. Students explain the process of digestion.
2. Students specify the different parts in the process of digestion and their specific functions like churning, absorption and egestion.
3. Students draw different parts of digestive system based on previous knowledge.
4. Students sequence the flow of food in different parts of the digestive system in order and with respect to their functions.
5. Students can understand the functions of digestive enzymes in the process of digestion.
6. Students can relate the structure of villi to the process of absorption in the intestine.
7. Students can identify the function of bilobed tongue.

Using the above sequence of events, the students are asked to relate the parts of the digestive system to their functions and draw the digestive system using an arrow network or flow chart.

Bilobed tongue (to capture insects)
/
Gall bladder (stores bile juice)
/
Oesophagus(short)
/
Liver (gland secreting bile juice)
/
Stomach (wall cells secret gastric juice)
/
Intestines(with reduced length due to carnivorous habit)
/
Intestinal villi(promote absorption of food materials)
/
Cloaca(undigested solid waste moves out)

While drawing the students compare the digestive systems of man, reptile birds etc; this activity thereby facilitates divergent thinking and elaboration which are the two components of creative thinking.

Assessments:

1. Name the organs which are involved in the following activities:

a) ingestion b) digestion c) absorption d) egestion

2. Write the functions of each part.

3. Name the digestive glands and their functions.

4. How does the human digestive systenm differ from that of the frog and why?

5. Are there organisms which do not have a digestive system?

6. What is the need for an organized digestive system?

MODULE I

Plant growth regulators and creative thinking

Unit No IV

Chapter No. 15

Topic: Physiological effects of plant growth regulators

Objectives: To anticipate the importance of auxins and to impose creative thinking on its application to various plants.

Overview:

Auxins were first isolated from human urine.

Auxins are applied to Indole 3Acetic Acid (IAA) and other natural and synthetic compounds.

Auxins are produced by growing apices of stem and roots.

Auxins like IAA and IBA (Indole butyric acid) are isolated from plants and NAA (Naphthalene Acetic Acid) and 2,4-D(2,4-Dichlorophenoxyacetic) are synthetic auxins.

They help in initiating rootings in stem cuttings

It promotes flowering

It helps in preventing fruit and leaf drop at early stages, but promotes the abscission of older and mature leaves and fruits.

Auxins induce parthenocarpy.

2,4-D is used to kill dicot weeds without affecting mature monocot plants .

Auxins control xylem differentiation and helps in cell division.

Associate issues: Parthenocarpy and Auxins, Senescence and Gibberellins, Cell division and Zeatin in Coconut milk, Leaf fall and Abscissic Acid, Ripening of fruits and Ethylene.

Pedagogic concerns:

How would you induce rooting in a twig?

How can we induce growth in axillary buds?

Which hormone helps in delaying leaf senescence?

Expected outcomes:

Pupil develops creative thinking in identifying plants for inducing rooting in stem, delaying leaf senescence and inducing growth in axillary buds.

Life Skills:

Creative thinking

Component Life Skills:

Innovativeness

Flexibility

Interventions:

Experiment and Brainstorming

The students are made into groups of five and each group is asked to select a plant in the garden/bring a potted plant (dicot) to the classroom.

The students are asked to start the experiment one week before spraying PGR.

Each group is given 2,4-D and they are asked to spray it on the axillary bud of leaf and find out their observations.

Pupil is also asked to bring another plant which can propagate through stem.

Each group is asked to spray 2,4-D for one week in the same manner mentioned above.. The groups come out with their observations.

The observations of the groups are as follows

2,4-D initiates rooting in stems.

2,4D promotes flowering and also prevents leaf senescence.

It can induce the growth in axillary bud.

The teacher explains that these compounds are auxins and these are natural ones that we get from plants(like IAA,IBA) and also synthetic ones(like 2,4-D, NAA).

The teacher conducts a brain-storming session on the various uses of auxins in Agriculture. The student gives varied responses which the teacher writes on the Blackboard. It is followed by the teacher gathering the opinion on each point, based on which some statements are discarded. Some of these observations are,

- it can be used in cabbage where the leaf dehiscence can be prevented.
- it can be used in easy stem propagation in plants like pepper, tapioca, rose etc.
- it can be used in easy germination of bud in bud grafting(as in rose)
- it can be used to remove apical dominance in some plants.

Hence the students use these innovative ideas.

Assessments:

1. Use auxins on any economically useful plant in your garden. Observe its growth and development for one month. Record your observations on the height of plant and flower growth.

MODULE II

Phytohormones and critical thinking

Unit 6

Chapter No.15

Topic- Phytohormones

Objectives: To anticipate consequences with respect to role of plant hormones in plant growth which facilitates critical thinking.

Overview:

Plant hormones called phytohormones influence growth and development in plants. GA3($C_{19}H_{22}O_6$) helps in internodal growth.

Gibberelic acid produces a wide range of physiological responses in plants.

They help in increase in length of axis, in elongation of stem, in anticipating shape of fruits and delaying senescence.

Gibberelins also promote bolting in beet, cabbage and many plants with rosette habit.

Associate issues: Stress hormones in plants, Senescence, Brewing Industry, Bolting

Pedagogic concern:

What would we expect to happen if GA3 is applied to rice seedling?

Expected outcome:

Students can develop life skill of critical thinking utilizing analyzing and synthetic ability and anticipating the consequences thereof.

Life Skills: Critical thinking

Component Life Skills:

Anticipation of consequences

Interventions:

Brain storming and probing the material that appears in print media regarding the topic.

Views expressed in brain-storming session:

1. Plant becomes very tall and thin

2. The plant could not bear the air pressure, so it bends in heavy breeze.

3. As nutrients are not sufficient, the stem becomes weak and slender.

4. There is increase in length of the stem.

5. There is loss of crop and economical loss to farmers.

Outcome of Brainstorming session: There is increase in length of the stem with the application of GA3.

Assessments:

1. What are the various types of phytohormones?

2. What is the fiunction of GA3

3. How was GA3 discovered?

4. Name the synthetic Gibberellins.

MODULE II

Osmoregulation and critical thinking

Unit No V

Chapter No. 19

Topic: Osmoregulation

Objectives:

To acquire the knowledge of the term osmoregulation and its physiological importance.

To understand the process of osmoregulation and its role in maintaining water level in the body.

Planning a dialysis model.

Demonstrate osmoregulation.

To observe the experiment and report them objectively.

To apply the knowledge of osmosis to new situations.

Overview:

Osmoregulation is the ionic and fluid volume regulation in animals.

Protonephridia are primarily concerned with ionic and fluid volume.

Nephridia help to remove nitrogenous wastes and maintain a fluid and ionic balance.

Nephrons help in removal of nitrogenous wastes and osmoregulation.

Osmoregulation in Protists and animals:

Amoeba make use of contractile vacuoles to collect excretory waste such as ammonia, from the intracellular fluid by both diffusion and active transport. As

osmotic acion pushes water from the environment into the cytoplasm, the vacuole moves to the surface and disposes the contents into the environment.

Kidneys play a very large role in human osmoregulation, regulating the osmosis of water in urine waste with the help of hormones such as anti-diuretic hormone, ardosterone and angiotensin. The human body can increase the permeability of the collecting ducts in the kidney to reabsorb water to prevent it from being excreted.

Associate issues: Renal failure, Uremia and hemodialysis, Kidney transplantation, Renal calculi, Kidney transplantation, Glomerulonephritis

Pedagogic concern:

What is meant by the term osmoregulation?

Expected outcomes:

It is a very interesting topic which could be explained with experiments and the students enjoy looking at these experiments and learn with joy and it is the truth which will be accepted by the peer group.

It could be explained with the osmosis experiment and thistle funnel experiment.

The students will appreciate the process of osmoregulation through critical observation . This is actually an ability to analyse information and experience in an objective manner. It will contribute to our quality of life.

The students draw urinary tubules and kidney.

Life Skills:

Critical thinking

Component Life Skills:

Intelligence and objectivity

Interventions:

Teacher demonstrates an experiment showing the process of osmoregulation (osmosis experiment using potato). The students relate the observation to the glomerular filtration in kidney to maintain water balance in body

- Thistle funnel experiment — An egg membrane is tied at the mouth of a thistle funnel. Add sucrose solution with the help of a pipette and mark the level of sucrose solution with the help of a thread. Dip the thistle funnel in a beaker filled with water. Observe the difference in sucrose solution in the thistle funnel after some time. The sucrose solution moves upwards showing osmosis.
- Keep fresh water fishes in different concentrations of salt water. Make keen observations.

Assessments:

1. What happens to the excess amount of water that you drink?
2. How do you correlate osmosis with glomerular filtration?
3. Plan a dialysis model.
4. Demonstrate osmoregulation.
5. Apply your knowledge of osmosis to different life situations.
6. What do you know about the Dead Sea and life therein?

MODULE III

Ploidy levels and problem solving

Unit I

Chapter No.3

Topic: Bryophytes and Pteridophytes

Objectives: To impart the message that self-knowledge of life cycle of Bryophytes (its gametophytic phase, sporophyte and protonemal phase) and pteridophytes (its gametophyte, reproduction and sporophytic phase) facilitate problem-solving in the concerned area like ploidy of protonemal cells of the zygote of a fern.

Overview:

Moss belongs to advanced bryophytes.

The plant body is distinguished into root-like, shoot-like and leaf-like structures. This structure constitutes gametophyte. They bear male and female reproductive organs. All the cells of gametophyte are haploid in nature.

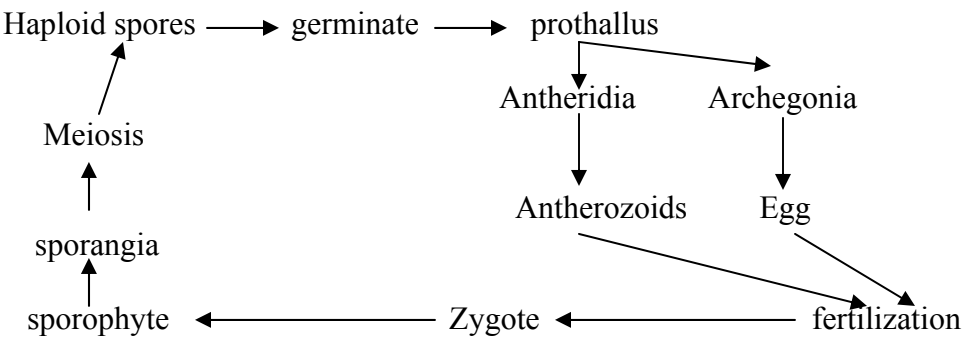
Sporophyte constitutes only foot, seta and capsule which encloses spores of diploid nature.

Diploid spores undergo meiosis to form haploid spores which on germination produces protonema which is haploid in nature.

Fern belongs to pteridophytes.

Plant body is a sporophyte with true root, stem and leaf. The cells of sporophyte are diploid.

The sporangia undergo meiosis to form haploid spores.



Protonema is the moss equivalent of a seedling.

Associate issues: Horticultural varieties of fruits and flowers, Peat, Trans-shipment of living material.

Pedagogic concern:

Mention the ploidy of a protonemal cell of a moss and zygote of a fern

Expected outcomes:

Students acquire and assess their self-knowledge by reading, recalling the various topics related to protonema and zygote of fern.

With self-knowledge they are able to develop problem-solving in the concerned area i.e. to find the ploidy of protonema and fern zygote.

Life Skills:

Problem solving

Component Life Skills:

Self-knowledge

Interventions:

Quiz, discussion, brain-storming, questions and answers, and reading books, will help the children to recall the knowledge.

1. Which phase of bryophytes is dominating?

a) gametophyte

b) sporophyte

c) protonema

d) prothallus

2. Which of the parts constitute the gametophyte?

a) root-like, stem-like and leaf-like structures

b) foot, seta and capsule

c) antheridia and archegonia

d) true root, true stem and true leaf.

3. Gametophyte bears antheridia and archegonia

a) No b) Yes

4. Which structure produces protonema?

a) haploid spore b)diploid spore c) cells of gametophytic plants d) sporangia

5. Branched,cylindrical, green, photosynthetic structure in bryophytes are

a) gametophyte plant b) sporophyte plant c)protonema d)prothallus

6. What is the ploidy of gametophyte?

a)haploid b) diploid

7. What is the ploidy of sporophyte?

a)haploid b)diploid

8. What is the ploidy of protonema?

a)haploid b) diploid

9.Where is a zygote formed in a fern?

a)prothallus b)protonema c)sporophyte of plant d)None of these.

10. Zygote is formed by the fusion of

a)two cells of gametophyte b) from spores c)egg and antherozoids

11. Zygote of fern has ploidy that is

a)haploid b) diploid

12.The reason for zygote of fern being diploid

a)fusion of antherozoid and egg both of which are haploid

b) meiosis of a diploid spore mother cell

13. The reason for protonema of moss being haploid is

a) meiosis of a diploid spore

b)developed from haploid cell of the gametophytic plant.

Assessments:

1. Prepare a whole mount of a bryophyte moss and identify the various parts.

2. Pick up a garden fern and observe its various parts.

MODULE III

Epithelial tissue and problem solving

Unit No. II

Chapter 7

Topic: Epithelial tissue

Objectives:

1. To understand the location of epithelial tissue and its significance
2. To analyse the structure and functions of simple epithelium and compound epithelium with examples.
3. To enable the students to develop problem-solving abilities.

Overview:

Epithelial tissue

Simple epithelium	Compound epithelium
-made of a single layer of cells	-- made of more than one layer of cells and thus has a limited role in secretion and absorption.

1) Squamous epithelium—it is made of single thin layer of flattened cells with irregular boundaries. For eg., wall of epithelium, air sacs of lungs.
2) Cuboidal epithelium—it is made of a single layer of cube like cells.For eg., ducts of glands, tubular parts of nephrons in the kidney.
3) Columnar epithelium—it is made up of a single layer of tall and slender cells. Their nuclei are located in the base. Free surface may have microvilli. If they bear cilia they are called ciliated epithelium. For eg., lining of stomach, and the intestine which help in secretion and absorption.

4) Glandular epithelium—Some of the columnar and cuboidal cells get specialized for secretion. They are of two kinds:

   a) exocrine—secretion of saliva, ear wax, milk, digestive enzymes
   b) endocrine—secretion of hormones of endocrine glands.

5) Compound epithelium – It is made of more than one layer –thus they have a limited role in secretion and absorption. They cover dry surfaces of skin, moist surface of buccal cavity, pharynx and inner lining of ducts, of salivary glands and of pancreatic ducts.

All the epithelial cells are held together with the intracellular materials. Specialised junctions provide both structural and functional links between its individual cells.

Three types of junctions

Tight junctions	Adhering junctions	Gap junctions
Helps to stop substances from leaking across a tissue	Perform cementing to keep neighbouring cells together	Facilitate cells to communicate with each other

Associate issues: Salivary glands, Mammary glands, Earwax

Pedagogic concern:

Distinguish between simple and compound epithelium

Expected outcomes:

1. The students are able to locate the epithelial tissue.

2. The students are able to analyse and learn the structure and functions of simple and compound epithelium.

Life Skill:

Problem solving
Component Life Skill
Analytical thinking

Interventions:

Experiment 1

1. The students observe two slides A and B (Simple and compound epithelium) under microscope.

   What are the distinguishing features of those two epithelial tissues?

   Draw diagrams from A and B slides showing structural differences between the two epithelial tissues.

   How glandular cells are different from ciliated epithelial cells?

2. The students note down the similarities between A and B.
3. The students identify the structural and functional differences between A and B.
4. The students are able to distinguish ciliated epithelial tissues from glandular tissues.

Experiment 2

The teacher demonstrates another experiment to show epithelial tissues:

With the help of tooth-pick scrape the inner surface of the tooth and make a thin smear on the slide. Dry the slide and stain with safranin and methylene blue. Focus the slide under microscope and observe cheek cells. Draw the diagram and comment.

Assessments:

1. Through permanent slides identify the simple and compound epithelium

2. Distinguish between simple and compound epithelium

MODULE IV

Lung capacity and self-awareness

Unit No.5

Chapter No.17

Topic: Respiratory volumes and capacities of lungs.

Objectives:

Students will be able to understand the concept of residual volume and tidal volume.

Overview:

The volume of air remaining in the lungs even after a forcible expiration is called residual volume

Residual volume averages from 1100 ml to 1200 ml.(RV= 25% of TLC i.e. total lung capacity)

Tidal volume is the volume of air inspired or expired during a normal respiration.

Tidal volume is 500 ml i.e. a healthy man can inspire or expire approximately 6000-8000 ml of air per minute.

Residual volume increases with age.

In healthy adults, the residual volume increases with age.

In children and adolescents residual volume grows slightly faster than the total lung capacity.

In adults, the tidal volume is equal to .5 litres.

Vital capacity is the maximum volume of air a person can breathe out after a forced inspiration.

Associate issues: Spirometer, Hypoxia, Asthma, Emphysema, Respiratory rhythm centre.

Pedagogic concerns:

What is the volume of air remaining in the lungs after normal breathing ?

Expected outcome:

Develop self-awareness on one's residual volume and tidal volume.

Life Skills:

Self-awareness

Component Life Skills:

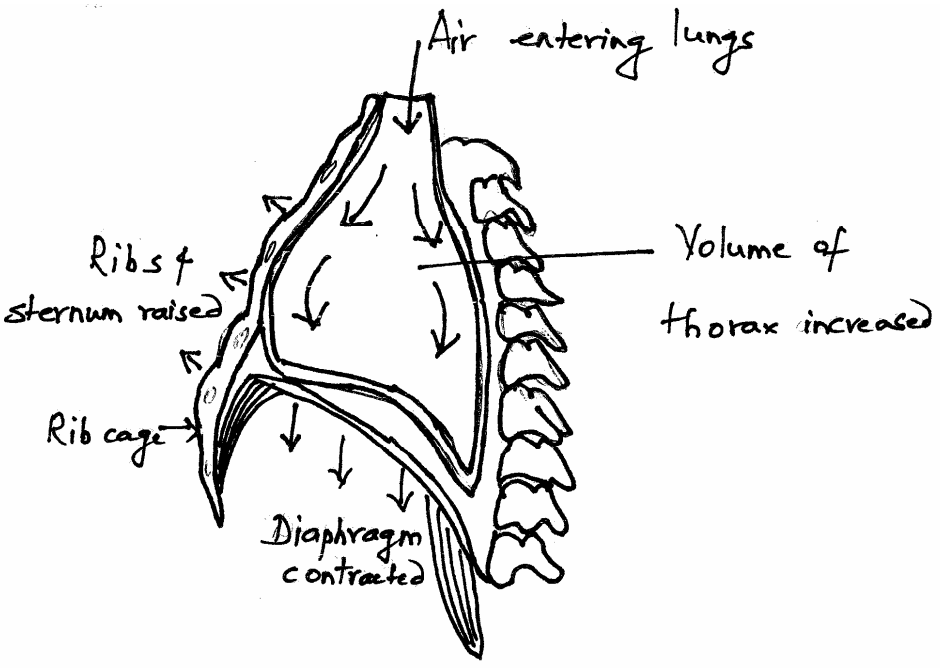
- objectivity

- introspectionability

Interventions:

Experiment to measure vital capacity

Diagram showing inspiration



The experiment is as shown in figure above. The students are asked to come forward and each one is asked to breath air in and find out the vital capacity of lungs of each student in terms of the volume of a balloon when air is expired.

Experiment to measure Tidal volume (Balloon Experiment).

Students are given a balloon. They are asked to blow it. The students are asked to measure the blown up balloon which will help in finding out the tidal volume.

Assessments:

1. Determine tidal volume of your lungs and also their vital capacity.

2. Introspect and infer the VC and TV of old people, athletics and smokers, etc.

MODULE IV

Growth and self-awareness

Unit : IV

Chapter No.:15

Topic: Growth parameters in flowering plants.

Objectives:

1. To impart the message that objectivity and reflectivity are prerequisites for development of realistic self-awareness while carrying out a task related to a parameter of growth in flowering plants.

Overview:

Growth is irreversible increase in number of cells and enlargement of cells due to increase in amount of protoplasm and other cellular material.

Growth is measured by parameters like

a) increase in fresh weight of entire plant

b) increase in dry weight

c) length of pollen tube

d) area of leaf

Associate issues: Plant tumours, Galls and Dendrochronology.

Pedagogic concern:

Why is one parameter not good enough to demonstrate growth through the life of a flowering plant?

Expected outcomes:

Students are given the opportunity to develop objectivity (the ability to understand one's own strengths, weaknesses, emotions and feelings) and reflectivity which are important for self- awareness.

Life Skills:

Self-awareness

Component Life Skills:

Reflectivity

Objectivity

Interventions:

Team work and group discussions

Scene 1: The teacher informs the students to carry out various investigatory projects to investigate the process of growth of a flowering plant at various stages. He informs that marks will be awarded for their project and they have to finish within a month.

Scene 2: After 15 days, the teacher reviews the project status with every student. Only very few students had started the project. And others had no idea of the project. The teacher encourages the students who have not done any work to see and understand from others who have started the work and to shed their weakness and gather strength to start the task.

Scene 3: At the end of the month every student had completed the project and submitted the project. The teachers award them marks.

In the first scene children good in objectivity and reflectivity start the project but some of them who lack the skill cannot finalise the project.

It took them some time to understand themselves. They start the project after the teacher asks them and encourages them to focus on self-awareness.

Assessments:

1. Reflect on your knowledge of growth.
2. What is intercalary growth and growth by intususception?
3. Plan a project on growth in plants.

MODULE V

Human eye and decision-making

Unit No: V

Chapter No. 21:

Topic: Human eye

Objectives:

1. To impress upon the students that synthetic ability is important to develop decision-making.
2. To develop logical thinking for decision-making
3. To impress upon the students to use synthetic ability, logical thinking and anticipate the consequences of a situation.

Overview:

Wall of the eye ball is composed of three layers.

External layer is composed of a dense connective tissue and is called sclera.

The anterior portion of sclera is cornea.

The middle layer of eyeball is called choroid.

The choroid layer in the anterior region forms ciliary body. The ciliary body encloses a pigmented and opaque structure called iris which encloses an aperture called pupil.

Through pupil light is regulated. Iris muscles contract and relax to make pupil large and small.

Behind the pupil a transparent crystalline lens is held in place by ligaments attached to ciliary body.

The inner layer is retina and it contains 3 layers of cells (from inside to outside) viz., ganglion cells, bipolar cells and photoreceptor cells (rods and cones).

Light passes from cornea to lens. Refraction of light occurs. An inverted half-image is formed on retina. Rods and cones are activated, and the impulse generates potential difference. Action potential generated in bipolar cells is passed to optic nerve and visual cortex of brain and the image formed on retina is recognized.

Image formed at fovea is sharpest and no image is formed on blind spot.

Accomodation is a property of the eye whereby in bright light the pupil is constricted and in dim light it is dilated and the focal length of the lens can be changed.

In bright light radial muscle relaxes, circular muscle of eye contracts, the pupil becomes smaller and less light enters the eye, preventing damage to the retina. In dim light opposite of the above occurs. The pupil may become 16 times bigger, leading to increase in depth of the image/focus of the eye.

Associate issues: Cataract, Myopia, Hypermyopia, Astigmatism, Working of a camera.

Pedagogic concern:

Demonstrate how eye regulates the amount of light that falls on the retina.

Expected outcomes:

The students learn to perform experiments using synthetic ability, logical ability and anticipate consequences of the actions performed during the course of the experiment. These components help in development of decision-making.

Life Skills:

Decision-making

Component Life Skills:

- synthetic ability

- logical thinking

- anticipation of consequences

Interventions:

Experiment

Aim—To demonstrate working of eye by regulating the amount of light that falls on the retina.

Materials required—a box with hole on one side, a candle and a paper.

Procedure—Take a box with a hole on one side.

Light is passed through the hole and allowed to strike a surface inside where it is reproduced, upside down with color.

The image is projected on the paper.

Change the position of the picture and observe the image formed.

Observation – As the aperture is made smaller, the image gets sharper. With too small a pinhole, the sharpness again becomes worse due to diffraction.

Results — The aperture and its regulation in the camera and the structure and function of the lens are exactly like that of the human eye. The pupil is like the aperture with the ciliary muscles regulating its size and the lens helps in focusing on the retina.

Assessments:

1. Make the model of a camera

2. Explain the working principle of the camera

3. Correlate working of the camera with the human eye.

MODULE V

Anatomy of the stem and decision-making

Unit No II

Chapter No.4

Topic: Anatomy of monocot and dicot stem

Objectives

Students are able to identify monocot and dicot stem.

Students are able to impart the knowledge of dicot and monocot stem through decision-making ability.

Overview

The dicot stem has an epidermis, a hypodermis made of collenchyma, and ground tissue consisting of cortex, endodermis, pericycle and pith. The vascular bundles are arranged in a ring of similar size around the pith and have medullary rays inbetween them. The vascular bundles are open due to the presence of cambium between phloem and xylem. Stem shows secondary growth due to the formation of secondary vascular tissues and periderm.

Monocot stem has an epidermis,a hypodermis which is non-green and sclerenchyma fibres.The ground tissue is a mass of similar cells where the vascular bundles are scattered. The vascular bundles are numerous and of different sizes with smaller ones towards outside and the larger ones towards the centre. A sclerenchymatous bundle sheath is generally on the outside of each vascular bundle. The vascular bundles are closed. Secondary growth is usually absent.

Associate issues: Histological stains safranin, fast green etc., Latex and rubber Raphides, Tannins and Leather manufacture, Resins and Turpentine.

Pedagogic concerns:

Cut a T.S. of a young plant from your school garden and observe it under the microscope. Reason out /ascertain whether it is monocot or dicot stem.

Expected outcomes:

Students develop decision-making skill with the sub-component of analytical thinking.

Life Skills: Decision-making

Component Life Skills: Analytical thinking

Interventions: Group Discussion

The students are made into two groups. Group A is given a dicot stem (eg., sunflower stem) and they are asked to take a T.S. of it and observe. Each group discusses their observations and the leader consolidates their findings. The teacher also gives a model/chart showing the T.S. of Dicot and Monocot stem and their observations are as follows.

Group A

1. Dicot stem consists of epidermis, cortex and stele.
2. Epidermis consists of thin, flattened, compactly arranged cells which has multicellular hairs and few stomata.
3. There is a thin cuticle.
4. Cortex comprises the layers below epidermis and extends till endodermis.
5. Cortex consists of hypodermis, general cortex and endodermis.

6. Hypodermis has collenchymatous cells.
7. General cortex has parenchymatous cells with large intercellular spaces.
8. Endodermis is single layered with barrel-shaped cells.
9. Stele is differentiated into pericycle, medullary rays,pith and vascular bundles.
10. Vascular bundles are arranged in ring form and are conjoint, collateral and open.

Group B

1. It has scattered vascular bundles.
2. Stem is differentiated into epidermis, hypodermis and ground tissue and vascular bundles.
3. Epidermis is the outermostlayer having stomata and a thick cuticle.
4. Hypodermis is 2-3 layers thick and is lignified.
5. Ground tissues are of large thinwalled parenchymatous cells.
6. Ground tissue is differentiated into cortex, endodermis and pith.
7. Vascular bundles are collateral and closed.

This is followed by another activity where teacher gives young stem of plants like Banyan, Bamboo, Eupatorium, Grass, Hibiscus, Sugarcane etc. and the groups are asked to identify them as Dicot/Monocot by taking TS This enables the pupil to decide upon type of stem from the characteristic features by using their analytical ability.

Assessments:

1. Take the section of the given material.
2. Identify the material by giving diagnostic points.
3. Draw a labeled diagram
4. Using diagrams and observations differentiate between monocot and dicot stems.

MODULE VI

The nature of viruses and effective communication

Unit: I

Chapter: 2

Topic: Viruses

Objective:

To impart the knowledge of viruses through effective communication

Overview:

Viruses are sub-microscopic and highly infectious entities that multiply only within the cells and are potentially pathogenic under appropriate conditions.

Viruses are of great biological significance as they possess only a few and not all the characteristics of life.

They behave as non-living particles outside the host cell and inside a host cell they behave as intra-molecular parasites.

Till today, the virologists have not been able to ascertain whether the viruses are living or non-living.

Associate issues: AIDS, Mumps, Small pox, Influenza, Herpes, Viroids, Dwarfing of plants, Mosaic formation in plants, Leaf rolling and leaf curling in plants.

Pedagogic concern:

Discuss whether viruses are living or non-living.

Expected outcomes:

Students develop effective communication skill along with synthetic thinking abilities.

Life Skills:

Effective Communication

Component Life Skills:

Synthetic ability

Interventions:

Group Discussions and Debate

The students are made into two groups A and B

Group A – discusses all the living characteristics of viruses with suitable examples.

Viruses are living organisms.

- They possess genetic material(DNA or RNA) which determine their structure and multiplication for eg., the entire TMV particle enters into the host cell and causes infection. The viral RNA replicates and some of them behave as messenger RNA and direct the synthesis of proteins. The RNA and protein molecules assemble together to form new virus particles.
- They have definite shape and morphology like other living organisms eg., Reo virus is polyhedral in shape, TMV is rod-shaped, Herpes and HIV viruses are round. Foot and mouth virus causes foot and mouth disease in cattle.
- All viruses are intracellular obligate parasites and attack specific hosts. They produce characteristic symptoms on their particular host. For eg., Tobacco Mosaic Virus shows yellow green mosaic pattern on the leaves along with other symptoms, such as stunted growth, chlorosis etc.
- Potato Mottle Virus PMV causes mosaic and mottle symptoms in potato along with yellow spotting, necrosis etc.

- Foot and mouth viruses cause foot and mouth disease in cattle. The infected animals develop wound in the mouth and foot.
- They show property of mutation

  They are sensitive to environmental conditions such as heat, ultraviolet rays, humidity, drought, alcohol etc. for eg., most of the vaccines are prepared by heat or chemical treatment of specific virus particles. When the viruses are subjected to low temperatures or low doses of chemicals, they lose their virulence.
- Most importantly viruses grow inside the specific host and multiply enormously.
- They inherit all the characteristics in the genome.

Group B: Should discuss all the non-living characteristics of viruses with suitable examples.

- They are non-cellular i.e. they do not have complete cellular structure and they are not surrounded by cell membrane or cell-wall. Cell organelles are absent.
- They do not show cellular metabolism and lack respiration as they lack enzymes.
- The viruses can be precipitated just like chemical substances for eg., W.M.Stanley crystallized Tobacco Mosaic Virus. These crystallized particles retain their capacity for infection.
- They possess high specific gravity.
- They do not respond to external stimuli(as they are non-living outside the host).
- They do not exhibit motility.

After discussion, both the groups come to a final conclusion based on maximum number of points given as to whether viruses are living or non-living.

Assesments:

1. Write the living characteristics of the viruses.
2. Write the non-living characteristics of viruses.
3. How do viruses infect a host ?

MODULE VI

The electrocardiograph (ECG) and effective communication

Unit No: V

Chapter No. 18

Topic: Electrocardiograph (ECG)

Objectives:

To sensitise the students to the importance of expressive skills in effective communication through the activities concerned with ECG.

Overview:

ECG is a graphical representation of the electrical activity of heart during a cardiac cycle.

The patient is connected to the machine with 3 electric leads (one to each wrist and the left ankle) in the standard ECG.

For a specialised evaluation, multiple leads are attached to the chest.

The P wave represents excitations of the atria(contraction of atria).

QRS Complex represents excitations of the ventricle(contractions of ventricle).

T –wave represents normal state of the ventricles(end of systole).

By counting the number of QRS complexes in a given time period one can determine the heart beat rate of an individual.

Any deviation from this shape indicates a possible abnormality or disease. Hence it is of great clinical significance.

Associate issues: Angiogram, Pacemaker, Cardiac cycle, Stroke volume.

Pedagogic concern:

Draw a standard ECG and explain different segments in it.

Expected outcome:

The student is able to understand and communicate various components of ECG and is able to communicate any abnormality seen in the ECG.

Life Skills:

Effective Communication

Component Life Skill:

Expressive Skills

Intervention:

Activity followed by Discussion.

Take the students to the hospital and show them how an ECG is taken. They are made to observe the ECG of a heart patient and a normal person and asked to express differences between these.

Assessment:

1. How will you differentiate between the hearts of a normal individual and a heart patient?

MODULE VII

Heart failure and coping with emotions and stess

Unit No.: V

Chapter No.: 18

Topic: Heart failure

Objectives:

To enable the students to practice healthy habits and overcome emotional stress and to enable them to assist people suffering from related problems.

Overview:

Heart failure occurs when enough blood is not pumped to meet the needs of the body.

Heart failure is also termed as congestive heart failure because congestion is one of the main symptoms of this disease.

Proper pumping of blood is a critical requirement as it supplies oxygen as well as nutrients to all the cells of the body.

Heart failure results in inhibition of O_2 supply and can be fatal.

Heart failure can be dependent on food habits and hormonal imbalance.

Heart failure is different from cardiac arrest where the heart stops beating.

Heart attack is when the heart muscle is suddenly damaged by inadequate blood supply.

Stress, anxiety, frustration, fear, depression, insecurity etc. are some of the causes of heart failure.

Only a healthy way of living which is stress free can prevent heart failure.

One should avoid all the emotional imbalances in order to avoid the stress leading to heart failure. One should practise ways of being cheerful, healthy habits like proper diet, exercise and sleep to keep stress at bay.

Heart is enclosed by a membraneous bag called pericardium which encloses pericardial fluid.

Heart has four chambers--2 small upper chambers called atria and 2 large ventral chambers called ventricles. These chambers are separated by a septum.

There is an aperture between right atrium and right ventricle.

Ventricle is guarded by a valve called tricuspid valve whereas bicuspid valve is present between left ventricle and left auricle.

Pulmonary artery and aorta are guarded by semilunar valves.

Associate issues:Angina, Artherosclerosis, Hypertension

Pedagogic concern:

How does heart failure occur in an individual?

Expected outcomes:

The student understands the causes and prevention of heart failure and develops resilience which is necessary to cope with emotions.

Life Skills:

Coping with emotions and stress

Component Life Skills:

Resilience

Emotional intelligence

Objectivity

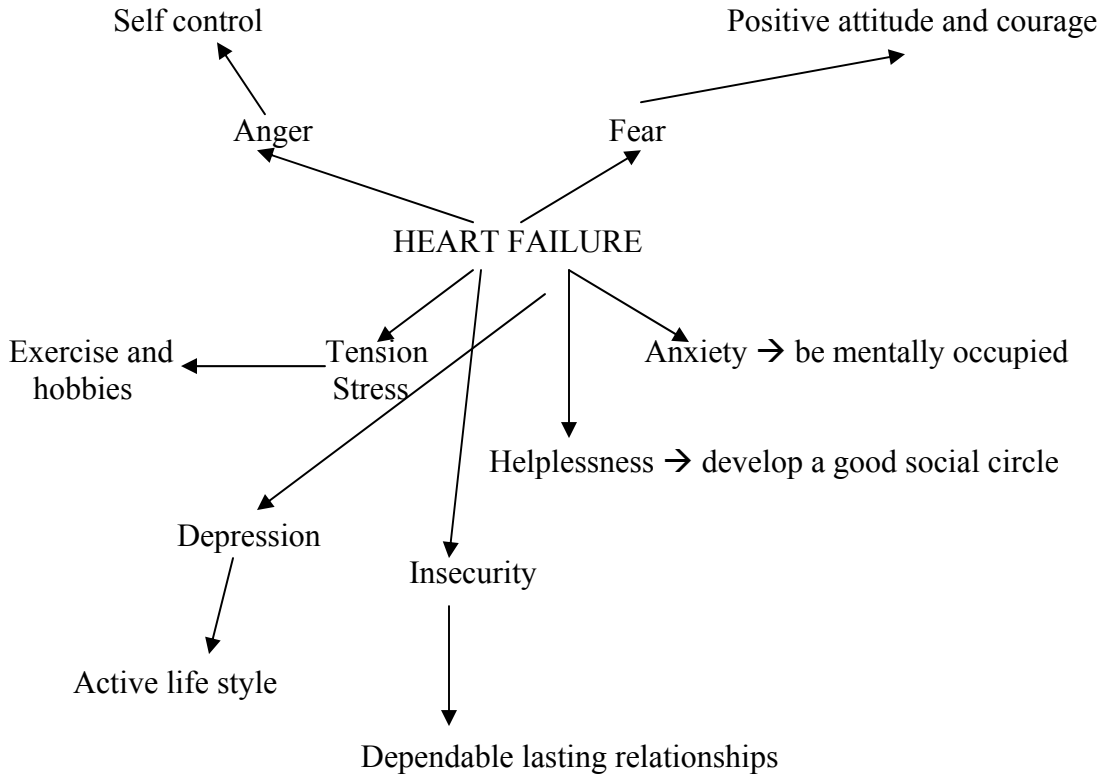
Interventions:

Group Discussion

The teacher narrates how a heart failure occurs followed by group discussion.

The students form two groups and discuss life-styles adopted by people in their locality who had heart failures. The discussion focuses on the stress related problems these people had and the different ways of coping with such conditions.

The findings of each group are consolidated on the blackboard. The discussion should focus on the symptoms and ways to overcome the stress



Points raised

People who had heart failures were under stress. They should overcome emotional imbalance and stress through cheerfulness. Walking exercises the whole body and is a good way of exercise for heart patients.

Cholesterol leads to blocking of arteries and congestion and one should have cholesterol free diet.

Threat to life, insecurity, anxiety, fear, anger and depression were discussed as the prominent feelings among heart patients. These could be overcome through a well ordered daily routine, proper exercise, diet and sleep, maintenance of good relations with family and friends and by having proper financial resources to fall back on.

Assessments:

1. How can you change the habits of a family member to prevent heart failure?
2. How can building social relationships helping avoiding stress?
3. What will you do if there is an emergency case of heart failure amongst your friends?
4. Prescribe a diet for a heart patient.

MODULE VII

Arthritis and coping with emotions and stress

Unit No V

Chapter 20

Topic: Arthritis

1. To make students aware of causes and symptoms of arthritis.
2. To make students understand how to prevent arthritis.
3. To make them aware about their behaviour towards arthritic patients.

Overview:

Arthritis is inflammation of joints which results in pain, swelling,fatigue, stiffness, limited movement and permanent crippling.

Arthritis involves the breakdown of cartilage which absorbs shock when pressure is placed on the joints while walking.

Arthritis can occur in men and women of all ages .

There are two important types of prevalent arthritis viz., osteoarthritis and rheumatoid arthritis. The first is due to wear and tear of cartilage and the second is due to inflammation of an overactive immune system.

Associate issues: Myasthemia gravis, Muscular dystrophy, Tetany, Osteoporosis, Gout

Pedagogic concern:

Is arthritis a physiological disease or stress and emotions related phenomenon in the body?

Expected outcomes:

Students will become aware of the causes and symptoms of arthritis.

Arthritis is stress and emotion related as well as physiological and can be prevented.

Life Skills:

Coping with emotions and coping with Stress

Component Life Skills:

Resilience, relaxationability,sympathy, self-awareness, objectivity.

Interventions:

Debates, Group discussions, Role-play and flow -chart

Debate

Arthritis is caused due to stress and emotions

FOR	AGAINST
Being overweight can cause arthritis.	The deposition of lactic acid crystals in the joint fluid (synovial fluid) causes arthritis.
Using affected joints in a repetitive way puts stress on the joint.	Misdirected immune system causes arthritis i.e. the blood produces abnormal antibodies that target tissues of their own body rather than foreign infectious agents
Without the usual amount of cartilage the bones rub together causing pain, swelling and stiffness.	Pain and swelling are an indirect or direct effect of bacterial or viral infection

This debate develops mental cheerfulness (resilience), objectivity, sympathy and self-awareness.

Group discussion:

Students are made to form two groups with one group discussing the causes and symptoms of arthritis and the second group discussing ways of preventing arthritis.

Group A: Causes and symptoms

Being overweight causes joint pain in the limbs

Using the affected joint in a repetitive action puts stress on the joint.

Increased stress brings about stiffness and immobility in the limbs.

Increased stress generates the emotions of excruciating pain and fatigue in the body along with loss of weight and appetite.

Metabolic abnormalities can cause arthritis.

Misdirected immune system along with autoimmunity causes arthritis.

The symptoms of arthritis are joint pain, swelling, immobility or reduced mobility with crippling in severe cases, redness of the skin around joints, weight loss, fatigue, feeling unwell and damage to connective tissues and vital organs.

Group B: Prevention

Exercise is a must for maintaining muscle and bone strength, to maintain healthy joints, prevent stiffness and to fight the emotions of pain and fatigue.

Rest is as important as exercise. 8-10 hours of sleep in the night and naps in the afternoon help reduce the effects of arthritis.

Avoidance of foods that cause flare-ups of arthritis is preventive.

Losing weight and maintenance of an optimum weight reduces wear and tear of tissues.

One should avoid positions or movements that place extra stress on affected joints.

One should avoid working a damaged or sore joint.

One should avoid excessive repetitive motions.

This group discussion also develops objectivity, resilience and self-awareness and in turn nurtures relaxationability.

Role-play:

Scene 1

Two boys play on the road side when one sees an old man walking by with a lot of difficulty

Boy 1: Hey, look at that old man . He cannot walk.

Boy 2: Don't make fun of him. He is an arthritic patient.

Boy 1: What is this arthritis?

Boy 2: Arthritis is inflammation of the joints resulting in pain, swelling, stiffness and limited movement and that is why he finds difficulty in walking.

Boy 1: How do you know about arthritis?

Boy 2: My grandfather had arthritis.

Boy 1: It is their fault. They should take care of themselves.

Boy 2: No, it is not their fault. Come, let us go to a doctor and find out more about this.

Scene 2

The boys go to a doctor and initiate a discussion.

Boy 1: Good morning Sir, we would like to know about the causes of arthritis.

Doctor: Increased stress, overweight, metabolic abnormalities and misdirected immune system are some of the prime causes of arthritis.

Boy 2: And the symptoms, what are they?

Doctor: Joint pain, swelling, redness of the skin, weight loss and fatigue are associated symptoms

Boy 1: Is there any treatment for this?

Doctor: Some arthritis related disorders can be completely cured with treatment.

Boy 2: What about some others which cannot be cured with treatment?

Doctor: Some other types of arthritis can be prevented through exercise, rest, sleep, adopting a balanced and healthy diet ., losing weight etc.

Boy 1: Thank you Sir for enlightening us.

Doctor: Fine.

Boy 1: I feel sorry about making fun of that person.

Boy 2: It is okay now. We should show concern for such people.

The above role-play develops sympathy, self-awareness, and objectivity.

Flow chart

Emotions

Discrimination

Helplessness

Pain

Fatigue

Maimed feeling

Insecurity

Fear

//
cause stress-----secretion of stress hormones-----inflammation----arthritis
//
Joint pain

Swelling

Reduced mobility of joints

Crippling

Assessments:

1. What treatment would you prescribe for an arthritic patient?

2. How does allopathic treatment differ from ayurvedic treatment of arthritis?

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PROF. & HEAD, DEE

No. F.1-24/ERIC/RIEM/2010-11
April 12, 2011

CERTIFICATE

A six-day Workshop on ***Life Skills and XI Standard Bio-Curriculum*** *was organized on 6th and 7th April 2011 and from 9th to 12th April 2011at the Regional Institute of Education (NCERT), Mysore. Dr. (Ms.) Geetha G Nair, Associate Professor in Botany, Principal Investigator (ERIC) is the Coordinator of this Programme.*

Dr./Sri./Smt./_____ attended the programme as a Resource Person on 6th and 7th April 2011 and from 9th to 12th April 2011.

He/She is relieved in the afternoon of 12th April 2011

(B S UPADHYAYA)

Table 1: Sub-skills and their distribution under The Ten WHO (1994) Skills

	Decision making	Problem solving	Creative thinking	Critical thinking	Effective communication	Interpret relation	Self-awareness	Empathy	Coping with emotions	Coping with stress
Emotional stability	✓									
Objectivity	✓	✓		✓			✓	✓	✓	✓
Self-knowledge	✓	✓								
Knowledge of the situation	✓									
Analytical ability	✓	✓		✓	✓				✓	
Divergent thinking	✓	✓	✓							
Synthetic ability	✓	✓		✓	✓				✓	
Anticipating consequences	✓	✓		✓						
Logical thinking	✓	✓		✓						
Rationality	✓	✓								
General intelligence	✓			✓						
Positive attitude		✓				✓				
Innovativeness			✓		✓					
Novelty			✓		✓					
Fluency			✓		✓					
Flexibility			✓		✓					
Originality			✓		✓					
Elaboration			✓		✓					
Unconventionality			✓							
Independence			✓							

	Decision making	Problem solving	Creative thinking	Critical thinking	Effective communication	Interpret relation	Self-awareness	Empathy	Coping with emotions	Coping with stress
Expressive skills					✓					
Non-verbal skills					✓					
Posture					✓					
Gesture					✓					
Presentation					✓					
Assertiveness					✓					
Sensitivity					✓	✓				
Patient listening					✓					
Imaginability					✓					
Reacting on the spur of moment					✓					
Empathy						✓			✓	✓
Sympathy						✓			✓	
Tolerance						✓				
Accepting others as they are						✓				
Reciprocality						✓				
Etiquette						✓				
Healthy distance						✓				
Lack of prejudices and stereotypes						✓				
Effective communication						✓				
Idnetify strengths and weaknesses							✓			
Introspectionability							✓			

	Decision making	Problem solving	Creative thinking	Critical thinking	Effective communication	Interpret relation	Self-awareness	Empathy	Coping with emotions	Coping with stress
Accepting self as it is							✓			
Openness							✓			
Reflectivity							✓			
Sensitivity								✓		
Social inclination								✓		
Social responsibility										
Social obligation										
Emotional intelligence									✓	
Self-awareness									✓	✓
Sense of proportion									✓	
Emotional shock absorber									✓	
Resilience									✓	
Recognisability									✓	
Planning ability									✓	
Reality orientation									✓	
Relaxationability									✓	
Entertainability									✓	
Stability									✓	

An analysis of the sub-skills of Core Life skills was carried out and it was found that a sub-skill could be a component of several life skills. For e.g., objectivity as a sub-skill is a component of problem-solving, critical thinking, self-awareness, empathy, coping with emotions and coping with stress indicating thereby the importance of this sub-skill in a Life Skill Curriculum.

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APPENDIX – I

TOOLS 1-8

Tool 1

Evaluation Tool for Analyzing the Syllabi or Textbooks

Ch.No.and P.No.	Unit No.	Type of Generic Skills Included										
		1	2	3	4	5	6	7	8	9	10	11
		Critical Thinking	Creative Thinking	Decision Making	Problem Solving	Interpersonal relationship	Effective Communication	Coping with emotions	Coping with stress	Self-awareness	Empathy	Comments
1												
2												
3												
4												
5												

Tool 2

Checklist Tool for Preparing an Achievement Test – I PUC (State) (Sarada Vilas and JSS PUC I) (Rao, S.M., 2006)

Unit No.	Syllabus/ Ch. No.	Q. No.	Activity/ Projects	Experiments	Problems	Life Skills	Sub Skills	Learning Process/ NW
Botany	B 2.1/3	1	-	-	What is the physical basis of the cell?	Effective communication and self-awareness	Analytical ability Objectivity	
	B 2.2/4	2	-	-	Reason out why chromosomes are vehicles of heredity?	Decision making and critical thinking	Analytical ability Objectivity	
	B 2.3/5	3	-	-	Why meiosis is called reduction division?	Critical thinking	Logical thinking and objectivity	
	B 2.1/3	4	-	-	What is cell theory?	Decision making Critical thinking	Self-knowledge Analytic and synthetic ability	
	B 3.1.2/7	5	-	-	Explain the lytic cycle of T_4 phage	Critical thinking	Logical thinking	
	B 3.1.3.1/ 8	6	-	-	Write the role of bacteria in fermentation and maintenance of ecological balance	Critical thinking	Analytic and synthetic ability	
	B 3.2.3/9	7	Draw a neatly labelled sketch of Closterium	-	-	Creative thinking	Innovativeness Elaboration	
	B 5/20	8	-	-	What is pathology?	Effective communication	Presentation Objectivity	
	B 3.1/ 1&2	9	-	-	What is bio-diversity?	Effective communication	Presentation Objectivity	

Unit No.	Syllabus/ Ch. No.	Q. No.	Activity/ Projects	Experiments	Problems	Life Skill	Sub Skill	Learning Process/ NW
Zoology	Z 1.4/21	1	-	-	What are myths? Write a note on any two myths.	Effective communication	Analytical ability Presentation	
	Z 2.1/22	2	-	-	Which polysaccharide is called queen of gelling agent?	Decision making	Self knowledge	
	Z 2.2/22	3	-	-	How will you differentiate simple proteins from conjugated proteins?	Critical thinking	Intelligence Logical thinking	
	Z 2.4/22	4	-	-	Explain mode of enzyme action with induced fit theory	Critical thinking	Analytical and synthetic ability	
	Z 3.2.4/ 24	5	-	-	Explain genetic drift	Problem solving and critical thinking	Divergent thinking Logical thinking	
	Z 4.3.1/ 26	6	Write a labelled diagram of Ascaris	-	-	Creative thinking	Originality Elaboration	
	Z 4.3.2/ 27	7	-	-	Why is the skin of amphibians smooth, moist and richly vascularised?	Critical thinking	Objectivity	
	Z 5/28	8	-	-	Reason out why cockroaches are omnivorous?	Critical thinking and decision making	Logical thinking Rationality	
	Z 6.5/25	9	-	-	Why is earthworm called a Farmer's friend?	Decision making	Synthetic ability	

Tool 3
Checklist Tool for Preparing an Achievement Test (Life Skills – State II PUC) (Rao, S.M., 2006)
BOTANY

Sec. No.	Ch. No.	Q. No.	Activity	Project	Experiment	Problem	Life skills (WHO)	Sub-skill	Learning Process – Numerical Weightage
I	1	1.				Name the places where DNA occurs in Eukaryotic cell.	Effective communication	Imaginability	
		2.				Distinguish a purine from a pyrimidine.	Critical thinking	Analytical and synthetic ability	
		3.				What is Chargaff's Rule?	Self-awareness	Reflectivity	
		4.				Name the functions of t-RNA.	Self awareness	Objectivity	
		5.				Distinguish between genetic and non-genetic RNA.	Critical thinking	Logical thinking	
		6.				What is linear DNA?	Effective communication	Analytic and synthetic ability Objectivity	
		7.				How stable is DNA?	Decision making	Divergent thinking ability	
		8.	Draw a double helix and label the parts.				Creative thinking	Innovativeness	
		9.				Compare any four features of DNA and RNA.	Critical thinking	Analytic and synthetic ability	

		10.	Draw a labelled diagram representing DNA replication.				Creative thinking	Elaboration	
		11.				Write any two reasons for considering DNA as the genetic material.	Problem solving	Rationality	
		12.				State and explain functions of DNA.	Effective communication	Expressive skills Presentation	
		13.	Draw a double helix and explain any four of its features.				Creative thinking	Originality Independence	
		14.				Describe the steps in transcription. What is Reverse transcription?	Effective communication	Presentation	
		15.				Reason out how if in a sample of DNA, A = 15%, the percentage of rest of the bases can be determined.	Problem solving	Divergent thinking Anticipation of consequences	
		16.				Who proposed the Gene concept?	Self-awareness	Openness	
		17.				What is a gene chemically ?	Critical thinking	Objectivity Logical thinking	
		18.				Who proposed the one-Gene, one-polypeptide hypothesis?	Self-awareness	Openness	
		19.				What is polycystronic m-RNA ?	Critical thinking	Logical thinking Objectivity	
		20.				Define Genetic Code.	Decision making	Self-knowledge Synthetic ability	

		21.				What are the 2-well studied bacterial spp. ?	Decision making	Self-knowledge General intelligence	
		22.				Differentiate codon from anticodon.	Critical thinking	Logical thinking	
		23.				Why is genetic code expressed in terms of m-RNA codons?	Problem solving	Rationality Analytical ability	
	II	24.	List any two aspects of Gene concept.				Decision making	Knowledge of the situation	
		25.				Explain any two features of genetic code.	Effective communication	Analytical ability	
		26.				Mention parts of an operon.	Effective communication	Objectivity	
		27.	Make a checker board to represent the 64 codons.				Creative thinking	Novelty Unconventionality	
		28.				Briefly explain the first two steps of protein biosynthesis.	Effective communication	Presentation	
		29.				Explain how Jacob and Monod's work established the role of genetic control in protein biosynthesis.	Effective communication	Analytical and synthetic ability	
		30.				Name two microbial metabolites.	Decision making	Self-knowledge	
		31.				What are steroids used for?	Critical thinking	Objectivity	

		32.				Name two vitamins produced by fermentation technology ?	Decision making	Self-knowledge	
		33.				What is bio-reactor?	Decision making	General intelligence	
		34.				Name two diseases where gene therapy has been successfully attempted.	Decision making	Knowledge of situation	
		35.				Name scientists responsible for development of first hybridoma.	Self-awareness	Reflectivity	
	III	36.				Mention two advantages of genetic engineering in health products.	Decision making	Self-knowledge	
		37.				How was first hybridoma produced?	Problem solving	Logical thinking	
		38.				Who are the pioneers in tissue culture?	Self-awareness	Introspectionability	
		39.	Draw a labelled diagram of PUC 18 plasmid.				Creative thinking	Fluency Novelty	
		40.	Draw a bioreactor and label.				Creative thinking	Independence Innovativeness	
		41.	Write a note on cloning.				Critical thinking	Intelligence	
		42.				How are embryonic stem cells cultured?	Problem solving	Divergent thinking	

		43.				Describe the synthesis of insulin by GE.	Critical thinking	Analytical and synthetic ability	
		44.				With reference to stem cells explain a) Totipotency b) Embryonic stem cells	Effective communication	Non-verbal skills Expressive skills	
		45.				Write a note on human genome project.	Creative thinking	Divergent thinking Elaboration	
		46.	List applications of DNA finger printing.				Critical thinking	Objectivity Anticipation of consequences	
		47.				Reason out why tissue culture can contribute to horticulture.	Problem solving	Rationality	
		48.				Reason out why a restriction endonuclease cuts DNA only at a specific site.	Problem solving	Rationality	
		49.				Reason out why plasmids can be used in gene cloning.	Problem solving	Rationality	
	IV	50.				Name the pioneers in the study of plant tissue culture.	Self-awareness	Openness	
		51.				Name the secondary meristems.	Decision Making	Self-knowledge	
		52.				Who first used the term phloem?	Self-awareness	Knowledge	
		53.				What is primary Xylem ?	Critical thinking	Objectivity	

		54.				Name living elements of phloem.	Decision making	Logical thinking	
		55.				Name the dead elements of Xylem.	Decision making	Self-knowledge	
		56.				Give a definition of tissue. Who were the pioneers in the study of tissues?	Critical thinking	Objectivity	
		57.				How do you distinguish a lateral meristem from an intercalary meristem.	Critical thinking and effective communication	Logical thinking Analytical ability	
		58.	Draw a labelled diagram of parenchyma tissue.				Creative thinking	Novelty Innovativeness	
		59.				Which types of wall thickenings are found in Xylem vessels?	Critical thinking	Objectivity	
		60.				In which parts of plants are phloem fibres absent?	Decision making	Self-knowledge	
		61.				What are meristems? Classify them based on origin and give examples.	Critical thinking	Objectivity Logical thinking	
		62.				Describe the structure and function of parenchyma.	Creative thinking	Elaboration	

		63.				Explain the distribution of the vascular tissues in (i) collateral, (ii) bicollateral and (iii) radial bundles.	Effective communication	Expressive skills	
		64.				Reason out why meristematic cells are totipotent.	Problem solving	Rationality	
		65.				Reason out why the pulp of many fruits is gritty.	Problem solving	Rationality	
		66.				What is sclerenchyma composed of? What are its functions?	Critical thinking	Objectivity	
		67.				Give the characteristics of meristems as based on position.	Decision making	Analytical ability	
	V	68.				Name the outermost part of Stele.	Decision making	Self-knowledge	
		69.				What is Casparian band?	Critical thinking	Logical thinking	
		70.				What tissue composes hypodermis in *Eupatorium* stem?	Decision making and critical thinking	Logical thinking	
		71.				What difference is there between the epidermal layers of root and stem?	Critical thinking	Logical thinking	

		72.				Why is the Endodermis in *Eupatorium* stem called starch sheath?	Critical thinking	Analytic and synthetic abilities	
		73.				Name two regions of Mesophyll.	Decision making	Objectivity Self- knowledge	
		74.	Draw the vascular bundle of *Eupatorium* stem.				Creative thinking	Unconventionality Elaboration	
		75.	Draw a vascular bundle of maize stem.				Creative thinking	Elaboration	
		76.				Distinguish between vascular cylinders of dicot and Monocot roots.	Critical thinking	Logical thinking Intelligence	
		77.				Describe the endodermis of roots.	Effective communication	Expressive skills Objectivity	
		78.				Distinguish between exarch and endarch xylem.	Critical thinking	Analytic and synthetic abilities	
		79.				Describe the anatomy of *Helianthus* leaf.	Creative thinking and Effective communication	Independence Expressive skills	
		80.	Draw the TS of a dicot root and label.				Creative thinking	Unconventionality Originality	
		81.				Point out differences in anatomy of a dicot root with that of a dicot stem.	Decision making	Divergent thinking	

	VI	82.				Name the components of periderm.	Decision making	Analytic ability	
		83.				What is Dendrochronology?	Critical thinking	Objectivity	
		84.				Differentiate spring wood and Autumn wood?	Critical thinking	Logical thinking	
		85.				What are tyloses?	Critical thinking	Analytic and synthetic ability	
		86.				Distinguish between phellem and phellogen.	Critical thinking	Intelligence Logical thinking	
		87.				What is the function of a lenticel?	Critical thinking	Objectivity	
		88.				What is heart wood composed of?	Critical thinking	Analytic and synthetic ability	
		89.				Explain the formation of a lenticel.	Effective communication	Expressive skills Analytic ability	
		90.	Draw and label a lenticel.				Creative thinking	Originality Independence	
		91.	Represent diagrammatically the formation of vascular cambium.				Creative thinking	Innovativeness Elaboration	
		92.	Write notes on (a) Spring and autumn wood (b) Tyloses (c) Commercial cork (d) Heart wood				Effective communication	Expressive skills	

		93.				Describe the activity of phellogen.	Critical thinking	Logical thinking	
		94.				Describe the periderm.	Critical thinking	Logical thinking	
		95.				Reason out why heart wood appears darker in colour?	Problem solving	Rationality	
		96.				Reason out why Periderm is protective.	Problem solving	Objectivity Rationality	
		97.				Reason out why grafting is not possible in monocots.	Problem solving	Divergent thinking Rationality	
		98.				Ring porous wood is seen in temperate trees.	Problem solving	Divergent thinking	
	VII	99.				State the two factors that control the rate of diffusion.	Decision making	Objectivity	
		100.				Give a definition of Osmosis.	Decision making	Self-knowledge	
		101.				Differentiate exosmosis from endosmosis.	Critical thinking	Logical thinking	
		102.				Define water potential.	Decision making	Divergent thinking	
		103.				Why is salt often used as a preservative?	Problem solving	Rationality	
		104.				State the relationship between water potential, solute potential and pressure potential.	Decision making Critical thinking	Divergent thinking	

		105.				Which is the most hypotonic solution?	Decision making	Anticipation of consequences.	
		106.				Name the types of soil water.	Decision making	Self-knowledge	
		107.				How is water passively absorbed by root hairs?	Effective communication	Objectivity Analytic ability	
		108.	Draw different stages of plasmolysis of a plant cell.				Creative thinking	Originality	
		109.				Explain Radial Movement.	Effective communication	Analytic ability	
		110.				Why is water a good solvent?	Problem solving	Objectivity	
		111.				What are ψ_S and ψ_P?	Critical thinking	Intelligence Logical thinking	
		112.				Explain properties of water which are important in plant life.	Effective communication	Presentation	
		113.				Explain the process of Osmosis by using a potato Osmoscope.	Creative thinking	Innovativeness Independence	
		114.				Reason out why Endosmosis occurs when cells are immersed in hypotonic solution.	Problem solving	Rationality	
		115.				Ascent of sap depends on properties of water.	Problem solving	Logical thinking	
	VIII	116.				Name the process of transport occurring in xylem.	Decision making	General intelligence	

		117.				Mention one merit of Dixon's theory.	Decision making	Objectivity	
		118.				On what principles is the theory of Dixon's and Joly based?	Critical thinking	Analytic and synthetic ability	
		119.			What apparatus is used in demonstrating transpiration pull?		Critical thinking	Originality Objectivity	
		120.				Name the theory proposed by J.C.Bose.	Self-awareness	Reflectivity	
		121.				Is guttation water pure?	Decision making	Objectivity	
		122.				What is Darwin's potometer used for?	Decision making	Self-knowledge Logical thinking	
		123.				Who proposed the K^+ transport theory?	Self-awareness	Assertiveness	
		124.				Name the reasons for the necessity of the transport system for a plant.	Decision making	Objectivity	
		125.				On what does the opening and closing of a stoma depend?	Problem solving	Logical thinking	
		126.	Draw a Munch model to demonstrate pressure flow hypothesis.				Creative thinking	Originality Independence	

		127.	Draw a labelled figure of a hydathode.				Creative thinking	Elaboration Innovativeness	
		128.			Describe the balsam plant experiment to demonstrate ascent of sap.		Critical thinking Effective communication	Objectivity Anticipation of consequences	
		129.			Describe the theory of starch hydrolysis to explain stomatal mechanism.		Critical thinking Effective communication	Presentation Analytic and synthetic abilities	
		130.			Describe the active K^+ mechanism of stomatal functioning.		Critical thinking Effective communication	Presentation Analytic and synthetic abilities	
		131.	"Transpiration is a necessary evil". Discuss.				Effective communication	Analytic ability and synthetic ability	
		132.			Demonstrate unequal transpiration on either side of a leaf with an experiment.		Creative thinking	Originality Flexibility	

		133.				Explain Munch theory.	Effective communication	Presentation	
		134.				Compare the structure and distribution of stomata.	Critical thinking	Logical thinking	
		135.	Discuss the environmental factors that affect transpiration.				Effective communication	Objectivity	
	IX	136.				Who discovered ATP?	Self-awareness	Introspectionability	
		137.				Name different types of redox reactions.	Decision making	Self-knowledge	
		138.				What is meant by coupling?	Critical thinking	Analytic and synthetic abilities	
		139.				Give the equation that symbolizes energy relationship.	Critical thinking	Objectivity	
		140.				What is a squiggle bond?	Decision making	Knowledge of the situation	
		141.				Which is the energy currency in a cell?	Critical thinking	Logical thinking	
		142.				What is the function of ATP synthase?	Decision making	Logical thinking	
		143.				How is the free energy change represented?	Critical thinking	Logical thinking	
		144.				Explain the structure of ATP.	Creative thinking	Elaboration	
		145.				Differentiate oxidative and photosynthetic phosphorylations.	Critical thinking	Analytic and synthetic abilities	

		146.				For what work was the 1997 Nobel Prize awarded?	Self-awareness	Reflectivity	
		147.				Explain the concept of chemi-osmosis.	Critical thinking	Analytic and synthetic abilities	
		148.				Explain different types of redox reactions.	Effective communication Critical thinking	Objectivity	
		149.				Explain the concept of free energy. How is it made to do work in cells?	Effective communication Critical thinking	Logical thinking Imaginability	
		150.				Explain why ATP is an energy-rich model.	Critical thinking Effective communication	Logical thinking	
	X	151.				Give the definition of photosynthesis.	Decision making	Synthetic ability	
		152.				Whose radio isotope experiments proved that O_2 comes from H_2O?	Self-awareness	Identifying strengths and weaknesses	
		153.				Who established the first action spectrum?	Self-awareness	Identifying strengths and weaknesses.	
		154.				Plants cannot prepare food in darkness. Why ?	Problem solving	Logical thinking	
		155.				In which light does photosynthesis occur best?	Critical thinking	Anticipation of consequences	

		156.				What is red drop effect?	Decision making	Anticipation of consequences	
		157.				What is Warburg Effect ?	Decision making	Anticipation of consequences	
		158.				State the law of limiting factors.	Decision making	Rationality	
		159.				Which three important properties of light affect photosynthesis?	Critical thinking	Analytic and synthetic abilities	
		160.				Explain the term photosynthesis by defining it.	Critical thinking Effective communication	Presentation	
		161.	Draw a section of the chloroplast and label.				Creative thinking	Originality	
		162.				What was the work of van Niel?	Self-awareness	Reflectivity	
		163.				The carbon of the carbon dioxide is reduced in photosynthesis. What does this mean?	Problem solving	Divergent thinking	
		164.	Give a schematic presentation of cyclic photophosphorylation.				Creative thinking	Flexibility Originality	
		165.				How many turns of Calvin- Benson cycle are necessary to produce one molecule of Glucose? Why?	Problem solving	Divergent thinking Logical thinking	

		166.				What are the products of non-cyclic photophosphorylation?	Critical thinking	Objectivity	
		167.				Name the steps in the Calvin-Benson cycle.	Decision making	Knowledge of the situation	
		168.				Explain components of photosystem.	Critical thinking Effective communication	Logical thinking	
		169.				Write and explain the formulae of raw materials and products in photosynthesis, pointing out the origin.	Effective communication	Non-verbal skills Expressive skills	
		170.	With a schematic representation, explain non-cyclic photophosphorylation.				Creative thinking Effective communication	Originality	
		171.				State and explain the law of limiting factors.	Effective communication	Analytic and synthetic abilities	
		172.				Give reasons to show that light reactions are dependent on light.	Problem solving	Divergent thinking	
		173.				Describe an experiment to show the evolution of oxygen during photosynthesis.	Effective communication	Analytic and synthetic ability	
		174.				With reference to light reactions, explain : a) Photo excitation and b) Photo reduction	Effective communication	Analytic and synthetic ability	

		175.				Reason out why cyclic photophosphorylation does not split water.	Problem solving	Synthetic ability	
		176.				Reason out why photosynthesis and respiration are interdependent.	Problem solving	Synthetic ability	
	XI	177.				Name the cell organelle in which Racker's particles are found.	Decision making	Knowledge of the situation	
		178.				Write an equation for aerobic respiration.	Creative thinking	Divergent thinking	
		179.				List the four major steps in Aerobic respiration.	Critical thinking	Objectivity	
		180.				What does the mitochondrial matrix contain?	Decision making	Self-knowledge	
		181.				How do you calculate the total energy yield in terms of K cal aerobic respiration?	Problem solving	Divergent thinking	
		182.				How many molecules of reduced compounds are produced in Krebs cycle?	Problem solving	Analytic and synthetic ability	
		183.				What is the ATP yield in Kreb's cycle?	Problem solving	Self-knowledge	
		184.				What is the yield of ATP in Electron Transport Cycle?	Problem solving	Analytic ability	

		185.				Who discovered fermentation ?	Self-awareness	Reflectivity	
		186.				What is Kuhne's vessel used for ?	Self-awareness	Reflectivity	
		187.	Draw a sectional view of Mitochondria.				Creative thinking	Novelty	
		188.				Explain the term Glycolysis.	Effective communication	Expressive skills	
		189.				Give a break up of ATPs produced and consumed during Glycolysis.	Problem solving	Analytic ability Anticipation of consequences	
		190.				State where each type of fermentation occurs.	Decision making	Anticipation of consequences	
		191.	Give a schematic representation of Electron Transport System.				Creative thinking	Divergent thinking	
		192.				Explain Glycolysis.	Effective communication	Synthetic ability	
		193.				Explain the term Pasteur effect.	Effective communication	Synthetic ability	
		194.				Describe Kuhne's vessel and its use.	Decision making	Self-knowledge Analytic ability	
		195.				Explain RQ for different substrates.	Critical thinking Effective communication	Analytic and synthetic abilities	
		196.				Chemiosmosis is not the only way of ATP synthesis.	Problem solving	Divergent thinking	

	XII	197.				What are determinate and indeterminate growth?	Critical thinking	Analytic and synthetic abilities	
		198.				Define photoperiodism.	Critical thinking	Analytic and synthetic abilities	
		199.				What is Richmond-Lang effect ?	Self-awareness	Reflectivity	
		200.				What does the log phase of sigmoid curve represent ?	Critical thinking	Anticipation of consequences	
		201.				Name two horticultural uses of Gibberellins.	Decision making	Objectivity	
		202.				Name a gaseous hormone.	Decision making	Logical thinking	
		203.	Draw a growth curve and label.				Creative thinking	Originality	
		204.				How does growth differ from development?	Critical thinking	Logical thinking	
		205.				Name the phases of Growth and describe any one.	Decision making	Objectivity	
		206.				Explain effect of photoperiodism.	Effective communication	Objectivity	
		207.				Describe two physiological effects of auxins.	Critical thinking	Objectivity	
		208.	Draw V.S. through root apex and explain the regions of growth.				Creative thinking	Elaboration	

		209.				Explain the sigmoid growth curve.	Effective communication	Creativity	
		210.				How do you discover the region of greatest growth in a root?	Problem solving	Logical thinking	
		211.				Briefly mention what are i) Triple response ii) Bolting iii) Abscission	Critical thinking	Logical thinking	
		212.				Reason out why sugar yield can be increased by using gibberellins.	Critical thinking	Analytic and synthetic abilities	
		213.				Reason out why one rotten apple will spoil all others in a basket.	Critical thinking	Logical thinking	

Tool 3 (Continued)
Checklist Tool for Preparing an Achievement Test (Life Skills State II PUC)
ZOOLOGY

Sec. No.	Ch. No.	Q. No.	Activity	Project	Experiment	Problem	Life skills (WHO)	Sub-skill	Learning Process – Numerical Weightage
II	13	214.				Define heredity.	Decision making	Knowledge of situation, Self-knowledge Objectivity	
		215.				Who is the Father of Genetics?	Self-awareness	Accepting self	
		216.				State Mendel's second law	Self-awareness	Reflectivity	
		217.				On which plant did Mendel carry out his experiments?	Self-awareness	Reflectivity	
		218.				What is the first filial generation?	Decision making	Objectivity Self-knowledge	
		219.				Name persons responsible for rediscovery of Mendelism.	Effective communication	Objectivity Expressive skills	

		220.				What is the progeny obtained in the F_2 generation in a cross involving round, yellow and wrinkled green seeded plants?	Problem solving	Objectivity divergent thinking	
		221.				In which cross do you get 9:3:3:1 ratio?	Decision making	Analytic ability Divergent thinking ability Anticipation of consequences Logical thinking	
		222.				What are the expected children in a marriage between a carrier woman and a colour blind man?	Problem solving	Rationality Analytic ability Anticipation of consequences Divergent thinking	
		223.				What will be the possible blood groups of children in a mating between parents of A and B blood groups?	Problem solving	Divergent thinking Analytic ability Anticipation of consequences	

		224.				Who discovered the RH factor?	Self awareness Effective communication	Objectivity Reflectivity Expressive skills Objectivity	
		225.				Who discovered sex linkage?	Effective communication	Analytical ability Synthetic ability Expressive skills	
		226.				Which disease is named Royal disease?	Self-awareness	Reflectivity Introspectionability	
		227.				Which condition is produced by partial monosomy of chromosome 5?	Critical thinking	Analytic and synthetic abilities Anticipation of consequences	
		228.				What do the terms Genotype and Phenotype mean?	Critical thinking	Objectivity Intelligence	
		229.	Make a punnet square to represent a cross between TT and Tt.				Creative thinking	Novelty Independence	
		230.				Explain what alleles are.	Effective communication	Expressive skill Presentation Analytic and synthetic ability	

		231.	Represent the possible results of a marriage between a carrier colour blind woman and a normal visioned man.				Critical thinking	Analytic ability Synthetic ability Objectivity Intelligence	
		232.				Name the blood group Genotypes and Phenotypes.	Effective communication	Objectivity Expressive skills	
		233.				Explain two features of Turner's syndrome.	Effective communication	Analytic and synthetic ability Presentation skills	
		234.	Represent a mating between a carrier woman and a colour blind man.				Critical thinking	Analytic and synthetic abilities Objectivity Anticipation of consequences Intelligence	
		235.				Explain the law of Dominance with an example.	Effective communication	Expressive skills Objectivity	

		236.	Make a tabular column to indicate possible combinations of blood groups in children from parents of different blood groups.				Creative thinking	Divergent thinking Independence	
		237.	Show the inheritance of colour blindness in man by a schematic representation.				Creative thinking	Innovativeness Originality Unconventionality	
		238.				Describe the laboratory technique of blood typing.	Effective communication	Analytical ability Expression skills	
		239.	If 800 plants are obtained from a dihybrid cross, 600 will show the dominant trait				Problem solving	Self-knowledge Divergent thinking Logical thinking Anticipation of consequences	
		240.				Only one of a pairs of contrasting characters is expressed in a hybrid.	Problems solving	Logical thinking Divergent thinking	
II	14	241.				Define Endemism.	Effective communication	Effective communication	

		242.				Mention two animals endemic to Karnataka.	Effective communication	Expressive skills Assertiveness	
		243.				What is spp. Biodiversity?:	Effective communication	Expressive skills	
		244.				Mention two disadvantages of patenting.	Decision making		
		245.				What is bio-piracy?	Critical thinking	Objectivity Intelligence	
		246.				What is a sacred Grove?	Effective communication	Expressive skills	
		247.				Mention two consequences of expansion of agriculture.	Decision making	Anticipation of consequences General intelligence	
		248.				List different types of soil erosion caused by water.	Critical thinking	Logical thinking Objectivity	
		249.				Why is India a victim of bio-piracy ?	Effective communication	Analytic ability Synthetic ability Assertiveness Presentation skill	
		250.				Briefly explain mining activities and their effects on bio-diversity.	Effective communication	Objectivity Expressive skills	

		251.				Write a note on intellectual property rights.	Critical thinking	Objectivity Intelligence	
		252.				Explain genetic diversity	Critical thinking Effective communication	Objectivity Logical thinking	
		253.				Write a note on urbanization and its effects.	Critical thinking	Analytical and synthetic abilities. Intelligence Anticipation of consequences.	
		254.				What is patent? Who is patenting and what is being patented?	Self-awareness	Reflectivity	
		255.				List major benefits of bio-diversity and explain any one of them.	Decision making Effective communication	Self-knowledge Objectivity Expressive skills	
		256.				What are the effects produced on biodiversity by a) expansion of agriculture, b) Deforestation	Critical thinking	Objectivity Anticipation of consequences Intelligence	
II	15	257.				Mention two types of natural resources.	Decision making	Objectivity Self-knowledge	
		258.				What is Ethnobiology ?	Critical thinking	Elaboration	

		259.				What is the need for conservation of water?	Critical thinking	Objectivity Anticipation of consequences.	
		260.				List two major methods of maintaining soil fertility.	Decision making	Objectivity Self-knowledge	
		261.				Name the biosphere reserves in Karnataka.	Self-awareness	Reflectivity	
		262.				Give any two names of National Parks of Karnataka.	Self-awareness	Openness	
		263.				Define global warming.	Effective communication	Expressive skills	
		264.				Mention any two methods of in-situ conservation.	Decision making Effective communication	Self-knowledge Objectivity Expressive skills	
		265.				Explain briefly methods of harvesting rain water.	Effective communication Critical thinking	Expressive skills Presentation skills Logical thinking	

		266.				List consequences of Global Warming	Decision making	Anticipation of consequences	
		267.				Mention two objectives of setting up biosphere reserves.	Decision making	Knowledge of situation	
		268.				Write a note on Nuclear Winter	Critical thinking	Synthetic ability	
		269.				Explain any two methods of soil conservation.	Effective communication Critical thinking	Expressive skills	
		270.				Mention two aims of water shed management.	Decision making	Objectivity	
		271.				List steps by which Global warming can be prevented.	Decision making	Analytic ability	
		272.				What is habitat improvement? Discuss techniques of such an improvement.	Critical thinking	Analytic and synthetic ability	
		273.				Explain briefly the Green House effect and Global Warming.	Effective communication	Expressive skills	

II	16	274.				Name the persons whose contributions helped in understanding Homeostasis.	Self-awareness	Reflectivity	
		275.				State normal values of Fosting and Post prandial levels of Glucose.	Effective communication	Analytic ability Assertiveness	
		276.				What is Gluoneogenesis?	Critical thinking	Objectivity Intelligence	
		277.				Give a definition of Diabetes Milletus.	Effective communication	Expressive skills	
		278.				List any two symptoms of Diabetes.	Decision making	Self- knowledge General intelligence	
		279.				Mention sources of blood glucose.	Effective communication	Analytic ability Synthetic ability	
		280.				Which organ serves as the Glucostat.	Decision making	Objectivity Self-knowledge Knowledge of situation	
		281.				Explain terms a) Hyperglycemia, b) Glycosuria.	Effective communication	Expressive skills Creativity Objectivity	

		282.				List any four symptoms of Diabetes mellitus.	Decision making	Divergent thinking ability. Synthetic ability	
		283.				What is the role of Insulin in glucose Homeostasis?	Critical thinking	Objectivity Anticipation of consequences.	
		284.				What is Homeostasis? Which factors are to be kept constant?	Critical thinking	Analytical and synthetic ability	
		285.				Explain the terms: I) Internal Environment and ii) Role of Insulin and glucagons in homeostasis.	Critical thinking Effective communication	Intelligence	
		286.				Post-Prandial glucose levels are higher than fasting levels.	Problem solving	Self-knowledge Divergent thinking Rationality	
		287.				Long standing diabetes can lead to permanent and irreversible changes in many systems.	Problem solving	Objectivity Logical thinking Anticipation of consequences	

II	17.	288.				Name the two types of defence systems of the human body.	Effective communication	Assertiveness	
		289.				Mention any two protective functions of the skin.	Decision making Effective communication	Assertiveness Objectivity	
		290.				Name steps in Phagocytosis.	Critical thinking	Analytic and synthetic ability	
		291.				State what is an antigen.	Effective communication	Presentation	
		292.				List the major classes of Immunoglobulin.	Critical thinking	Analytic and synthetic abilities Intelligence	
		293.				What is the contribution of Edward Jenner?	Self-awareness	Identifying Strengths and weaknesses Reflectivity	
		294.				What does the prefix T- in T-Lymphocyte mean?	Critical thinking	Intelligence	
		295.				What are T4 cells?	Critical thinking	Intelligence	
		296.				Name different types of vaccines.	Self-awareness	Reflectivity	
		297.				Which features are absent in artificial passive immunity ?	Decision making	Objectivity Analytic ability	

		298.				Distinguish between humoral and cell mediated immunity.	Critical thinking Decision making	Divergent thinking ability	
		299.				Explain Phagocytosis.	Effective communication Critical thinking	Synthetic abilility	
		300.				Write a note on vaccination.	Creative thinking	Elaboration	
		301.				Explain non-specific defence mechanism of human body.	Effective communication	Expressive skills	
		302.				Briefly explain the role of T-cells in immunity.	Effective communication	Objectivity	
		303.				With reference to the defence system, what are the following: a) Neutrophiles b) NK cells c) Memory cells d) Gamma-globulin	Critical thinking	Analytic and synthetic ability	
		304.				Reason out why cells involved in immunity bear surface markers.	Problem solving	Self-knowledge Rationality	

		305.				Reason out why any non-self molecule can act as an antigen.	Problem solving	Self-knowledge	
		306.				Reason out why Interferons alert uninfected cells.	Problem solving	Rationality	
II.	18	307.				What is Ebner's gland?	Self-awareness	Self-knowledge	
		308.				What is uvula?	Decision making	Self-knowledge Knowledge of situations	
		309.				List the exocrine glands associated with the gastro-intestinal tract.	Decision making	Synthetic ability	
		310.				Which enzyme is non-digestive but functions as an activator ?	Critical thinking	Analytic and synthetic ability	
		311.				Why is the fibre content of the food important?	Critical thinking	Objectivity	
		312.				What is emulsification?	Critical thinking	Anticipation of consequences	
		313.				Write a note on hyperacidity.	Decision making	Knowledge of the situation	

		314.				What is the function of the large intestine?	Decision making	Logical thinking	
		315.				Mention the composition of saliva.	Decision making	Self-knowledge	
		316.				Explain what a balanced diet is.	Effective communication	Presentation	
		317.				Describe digestion of food in the mouth.	Effective communication	Expressive skills	
		318.				List fat soluble vitamins, their functions and mention the deficiency diseases.	Effective communication	Presentation	
		319.				Draw a labelled diagram of digestive system of man.	Creative thinking	Independence Innovativeness	
		320.				Mention the causes, symptoms and prevention of peptic ulcers.	Critical thinking	Analytic and synthetic abilities	
		321.				Make a list of juices and enzymes participating in intestinal digestion.	Critical thinking	Analytic and synthetic ability	

		322.				Reason out why twelve teeth develop only once in human dentition.	Problem solving	Logical thinking Rationality	
		323.				Reason out why HCl of stomach is necessary for many reasons.	Problem solving	Analytic ability Rationality	
		324.				Reason out why humans cannot digest cellulose.	Problem solving	Rationality	
II.	19	325.				What is a closed circulatory system?	Effective communication	Objectivity	
		326.				Who discovered blood circulation?	Self awareness	Objectivity	
		327.				What is the importance of capillaries?	Critical thinking	Objectivity	
		328.				State the position of heart in the human body.	Decision making	Self-knowledge	
		329.				Differentiate systole from diastole.	Critical thinking	Objectivity	
		330.				What is pacemaker?	Decision making	Self-knowledge	

		331.				What is the demerit of Best and Taylor's theory of blood clotting?	Critical thinking	Analytic and synthetic abilities	
		332.				What is a blue baby?	Effective communication	Expressive skills	
		333.				Draw a labelled diagram of the conducting system of the heart.	Creative thinking	Novelty Fluency	
		334.				Write a note on hypertension and hypotension.	Decision making	Divergent thinking	
		335.				Briefly refer to the events occurring in blood clotting.	Critical thinking	Anticipation of consequences	
		336.				Explain Stroke volume and Cardiac output.	Effective communication	Postures Gestures Presentation	
		337.				What are the roles played by the following in the human circulatory system?	Critical thinking	Analytic ability	

						a) Thrombo-plastin and Fibrinogen b) Arterial valves c) Pericardium			
		338.				Explain the causes, effects and risk factors in myocardial infarction.	Effective communication	Objectivity	
		339.				Reason out why large animals require a transport system.	Problem solving	Rationality	
		340.				Reason out why the heart rate and pulse rate are the same.	Problem solving	Divergent thinking	
		341.				Reason out why a blue baby is cyanotic.	Problem solving	Rationality	
II	20	342.				What is Adam's apple?	Self-awareness	Identification of strengths and weaknesses.	
		343.				Why is inspiration considered active and expiration passive?	Critical thinking	Objectivity	

		344.				Define Bohr effect.	Decision making	Logical thinking General intelligence	
		345.				Name the principle of inspiratory muscles.	Decision making	Knowledge of the situation.	
		346.				Which pressure is always sub-atmospheric?	Decision making	Logical thinking	
		347.				Define Haldane effect.	Decision making	Knowledge of the situation	
		348.				Draw a labelled diagram of lungs.	Creative thinking	Novelty	
		349.				Differentiate left lung from right lung.	Critical thinking	Intelligence	
		350.				How are partial pressures of Gases important in diffusion?	Decision making	Synthetic ability	
		351.				What are the symptoms of Rhinitis?	Critical thinking	Intelligence	
		352.				Explain the parts of the respiratory system of man briefly.	Effective communication	Presentation	
		353.				Explain how carbon-dioxide is transported in blood.	Effective communication	Imaginability	

		354.				Reason out why larynx has two functions.	Critical thinking	Logical thinking	
		355.				Reason out why tobacco smoke is harmful.	Decision making Coping with stress	Recognisability Reality orientation	
		356.				Reason out why artificial respiration is a life saving method.	Decision making	Objectivity	
		357.				Reason out why exchange of gases depends on partial pressures.	Critical thinking	Objectivity	
II.	21	358.				Define excretion.	Decision making	Logical thinking	
		359.				Mention two functions of kidneys.	Critical thinking	Logical thinking	
		360.				Name parts of a Nephron.	Decision making	General intelligence	
		361.				Name pressures relevant to ultra filtration.	Critical thinking	Analytic and synthetic ability	
		362.				What is Micturition?	Critical thinking	Objectivity	
		363.				What are renal calculi?	Critical thinking	Objectivity	

		364.				What is dialysate?	Critical thinking	Anticipation of consequences	
		365.				Describe the parts of a renal corpuscle.	Critical thinking Effective communication	Presentation	
		366.				Write a note on re-absorption.	Decision making	Self-knowledge	
		367.				Name the components which a normal healthy urine does not contain.	Decision making	Knowledge of the situation	
		368.				Explain the term Glomerulo-nephritis.	Critical thinking Effective communication	Analytic ability	
		369.	Draw a labelled diagram of a nephron.				Creative thinking	Originality	
		370.				Mother of all pains is associated with a kidney disease.	Problem solving	Synthetic ability	
		371.				The major function of the kidney is homeostasis.	Decision making	Synthetic ability	
		372.				Urea is produced in the liver.	Critical thinking	Intelligence Objectivity	

		373.				Wastes are produced by metabolic reactions.	Decision making	Divergent thinking	
II.	22	374.				Name the main divisions of human nervous system.	Critical thinking	Intelligence	
		375.				What are the components of CNS?	Decision making	Synthetic ability	
		376.				List the divisions of the brain.	Critical thinking	Analytic ability	
		377.				What is Huntington's disease?	Self-awareness	Reflectivity	
		378.				Expand ACTH.	Problem	Self-knowledge	
		379.				What is acromegaly?	Critical thinking	Logical thinking	
		380.				Mention two differences between diabetes mellitus and insipidus.	Decision making	Analytic ability	
		381.				What could happen if cerebellum is damaged?	Critical thinking	Analytic and synthetic ability	

		382.				What is Simmonds disease?	Self-awareness Empathy	Sensitivity	
		383.	Draw and label a reflex arc.				Creative thinking	Innovativeness	
		384.				Differentiae between grey and white matters.	Critical thinking	Analytic and synthetic ability	
		385.				List the functions of cerebellum.	Decision making	Divergent thinking	
		386.				Give examples of Reflex actions.	Decision making	General intelligence	
		387.				Describe the spinal cord.	Effective communication	Postures presentation	
		388.	Draw labelled diagram of the T.S. of spinal cord.				Creative thinking	Elaboration	
		389.				What are drugs? What is drug abuse?	Critical thinking	Anticipation of consequences	
		390.				List Narcotic drugs with one example for each.	Decision making	General intelligence	
		391.				Mention Gonadotropins and one function of each.	Decision making	Self-knowledge	

		392.				Describe the cerebrum and its functions.	Critical thinking	Objectivity	
		393.	Draw a sagittal section of the human brain and label.				Creative thinking	Originality	
		394.	Make a list of parts of the human brain and mention.				Decision making Critical thinking	Objectivity Knowledge of the situation	
		395.	With the aid of the sketch, mention how a reflex arc works. Give example for reflex actions.				Creative thinking Critical thinking	Divergent thinking	
		396.	List any four hormones of anterior pituitary and mention one function of each.				Decision making Critical thinking	Synthetic ability	
		397.	List efforts that can be made to control drug menace.				Critical thinking	Analytic and synthetic ability Anticipation of consequences	
		398.				Why is Arbor Vitae a part of the cerebellum?	Decision making	Rationality	
		399.				If cerebellum is damaged, why are posture and balancing affected?	Decision making	Knowledge of situation Objectivity Logical thinking	

		400.				Pituitary is the master gland. Why?	Decision making	Objectivity	
		401.				Growth hormone abnormalities can take different forms. How?	Critical thinking	Anticipation of consequences	
		402.				Polyuria and Polydypsia are symptoms of two unrelated types of diabetes. Why?	Decision making	Rationality	
		403.				Some reflexes can occur even when brain is destroyed. Why?	Critical thinking	Objectivity	
II.	23	404.				Which reproduction is uniparental?	Critical thinking	Logical thinking	
		405.				How is secondary spermatocyte different from a primary spermatocyte?	Critical thinking	Objectivity	
		406.				What is spermatogenesis?	Decision making	Analytic ability	
		407.				What is acrosome?	Decision making	Analytic ability	

		408.				Which part of the sperm is “engine room”?	Critical thinking	Rationality	
		409.				Point out one difference between the principal piece and middle piece of a sperm.	Decision making	Synthetic ability	
		410.				Name the major steps in fertilization.	Decision making	Anticipation of consequences	
		411.				What is approximation of gametes?	Decision making	Logical thinking	
		412.				Differentiate monospermy and polyspermy.	Critical thinking	Analytic and synthetic ability	
		413.	Give a diagrammatic representation of spermatogenesis.				Creative thinking	Flexibility Novelty	
		414.	Draw and label A.V.S. of blastula of frog.				Creative thinking	Unconventionality	
		415.				Explain grey crescent.	Effective communication.	Objectivity	
		416.	Write any four differences between spermatogenesis and oogenesis.				Decision making	Synthetic ability Expressive skills	

		417.				Explain the process of spermatogenesis.	Effective communication	Expressive skills	
		418.				Describe the structure of a human sperm.	Effective communication.	Presentation skills	
		419.	Draw a V.S. of Gastrula and label.				Creative thinking	Innovativeness	
		420.				Describe the gastrula of frog.	Effective communication	Elaboration	
		421.				Meiosis and fertilization are important in sexual reproduction.	Decision making	Synthetic ability	
		422.				Middle piece of the sperm is named engine room.	Decision making	Objectivity Logical thinking	
II.	24	423.				What is puberty?	Decision making	Emotional stability Knowledge of the situation	
		424.				Mention any one function of seminal fluid.	Critical thinking	Objectivity	
		425.				When is conception most likely to occur?	Decision making	Emotional stability Knowledge of situation	

		426.				Why is the human ovum termed a lecithal?	Critical thinking	Analytic and synthetic ability	
		427.				Mention any two functions of placenta.	Decision making	Self-knowledge	
		428.	Draw and label the human ovum.				Creative thinking	Flexibility and novelty	
		429.				Explain any four methods of transmission of AIDS.	Effective communication	Sensitivity	
		430.				Briefly describe causes of male and female infertility.	Effective communication	Sensitivity Imaginability Objectivity	
		431.				With reference to AIDS, describe (i) symptoms, (ii) diagnostic tests.	Critical thinking Effective communication	Presentation Sensitivity	

Tool 4

***Checklist Tool for preparing an Achievement Test (NCERT, 2006)**

Unit No.	Ch. No.	Q.No.	Activity/ Projects	Experiments	Problems	Life skills	Sub-skill	Learning Process – Numerical Weightage
I	I	1	Collection of all currently accepted meanings for the word 'species'			Decision making	Self-knowledge	
		2	To identify the correctly written scientific name of Mango. *Mangifera Indica* *Mangifera indica*			Decision making	Analytical ability	
		3			Why are living organisms classified?	Problem solving	Analytical Ability	
I	II	4.	Organise a discussion in your class on the topic – Are viruses living or non-living?			Effective communication	Synthetic ability	

* Gives an idea of no. of life skills which are included

		5.	Discuss how classification systems have undergone several changes over a period of time.			Critical thinking	Analytic and synthetic ability	
I	III	6.			Mention the ploidy of following: - protonemal cell of a moss - zygote of a fern	Problem solving	Self-knowledge	
		7.			Both gymnosperms and angiosperms bear seeds, then why are they classified separately?	Critical thinking	Intelligence	
		8.	Match Col. I and II Chlamydomonas Moss Cycas Pteridophyte Selaginella Algae Sphagum Gymnosperm			Problem solving	Synthetic ability	
I	IV	9.	Prepare a list of animals that are found parasitic on human beings.			Effective communication	Expressive skills	

		10.			Reason out why arthropods constitute the largest group of the animal kingdom.	Effective communication	Analytical ability	
II	V	11.		Take one flower of family Fabaceae and write its semi-technical description.		Decision making	Objectivity	
II	VI	12.		Cut a TS of young plant from your school garden and observe it under the microscope. Reason out/ ascertain whether it is monocot or dicot stem.		Decision making	Divergent thinking	
II	VII	13.			Distinguish between simple and compound epithelium.	Problem solving	Analytical ability	
		14	Mark the odd one in the series : Alveolar tissue; blood; neuron/ tendon.					

		15	Draw a neat diagram of digestive system of frog.			Creative thinking	Divegent thinking, Elaboration	
III	VIII	16			Match the following. Cristae – Flat membranous sacs in stoma Cisternae – infoldings in mitochondrion Thylakoids – Disc shaped sacs in Golgi apparatus.	Self-awareness	Objectivity Reflectivity	
III	IX	17	Find and write down structures of ten small molecules. Find out if there is any industry which manufactures the compounds by isolation.			Empathy	Social inclination	
		18			Illustrate a glycoside, peptide and phosphodiester bond.	Creative thinking	Novelty Elaboration Independence	

III	IX	19	Attempt building models of bio-molecules using commercially available atomic models (Ball and stick models)			Critical thinking	Intelligence Logical thinking	
		20	Draw the structure of amino acid alanine.			Coping with stress. Creative thinking.	Planning ability.	
		21			What are gums made of? Is fevicol different?	Problem solving	Rationality	
		22			Explain the composition of triglycerides.	Decision making	Knowledge	
III	X	23			What is the significance of meiosis?	Problem solving	Rationality	
		24		Name the stage of cell cycle at which chromosomes go to the spindle.		Problem solving	Logical thinking	
		25			Can there be mitosis without DNA replication in S Phase?	Decision making Problem solving	Self-knowledge Rationality Analytical ability	
IV	XI	26			Explain why pure water has the maximum water potential.	Problem solving	Analytical ability	

IV	XII	27		Why is purification of water and nutrient salts in studies involving mineral nutrition using hydroponics necessary?		Critical thinking	Analytical and synthetic abilities. Anticipation of the consequences.	
IV	XIII	28		Suppose there were plants that had a high concentration of chlorophyll B, but lack chlorophyll A, would it carry out photosynthesis? Then why do plants have chlorophyll B and accessory pigments?		Decision making	Synthetic ability Self-knowledge Knowledge	
IV	XIV	29	Give the schematic representation of glycolysis.			Creative thinking	Novelty Fluency Unconventionality	
		30	Give the schematic representation of an overall view of Krebs' cycle.			Creative thinking	Novelty Independence	

		31			What are the assumptions made during the calculation of net gain of ATP?	Problem solving	Self-knowledge Analytical ability Synthetic ability	
IV	XV	32	How would you -induce rooting in a twig? - Quickly ripen a fruit? - delay leaf senescence -induce growth in axillary buds - bolt a rosette plant - induce immediate stomatal closure in leaves.			Creative thinking	Innovativeness Flexibility Independence	
		33		What would we expect to happen if GA_3 is applied to rice seedlings? - Ripened fruit gets mixed with unripe fruits. - you forget to add cytokinin to the culture medium. What would happen if dividing cells stop differentiating?		Critical thinking	Analytic and synthetic ability Anticipation of consequences.	

		34			Why is one parameter not good enough to demonstrate growth throughout the life of a flowering plant?	Self-awareness	Reflectivity Objectivity	
V	XVI	35	Write the dental formula for human beings.			Decision making	Synthetic ability Self-knowledge	
		36			Choose the correct answer among the following : Gastric juice contains ….. 1. Pepsin, lipase, Rennin 2. Trypsine, Lipase and Rennin 3. Trypsine, Pepsin and Lipase. 4. Trypsine, Pepside and Rennin	Decision making	Logical thinking.	

V	XVII	37	Have you heard about hypoxia? Try to gather information about it and discuss with your friends.			Decision making Problem solving	Synthetic ability Positive attitude	
		38			State the volume of air remaining in the lungs after normal breathing.	Self-awareness	Objectivity Introspectionability	
V	XVIII	39	Draw a standard ECG and explain the different segments in it.			Effective communication Coping with stress	Expressive skills Non-verbal skills Planning ability	
V	XIX	40			What is meant by the term osmoregulation?	Critical thinking	Objectivity Intelligence	
V	XX	41	Draw the diagram of a sarcomere skeletal muscle showing different regions.			Creative thinking	Divergent thinking	
		42			Name the type of joint between atlas/ axis.	Creative thinking	Divergent thinking	
V	XXI	43	Draw the structure of brain/ eye/ ear.			Creative thinking	Independence	
V	XX	-	-	-	Why is arthritis is a rich man's disease?	Coping with stress	Resilience Relaationability	

		44		Demonstrate how eye regulates the amount of light that falls on the retina.		Decision making	Synthetic ability Logical thinking Anticipation of consequences	
V	XXII	45			Fill in the blanks : Hormone Thyrotrophin (TSH) Target gland …? …	Critical thinking	Intelligence	
V	XXII	46		How estrogen causes emotional imbalance and stress		Coping with emotions	Resilience	
V	XVIII	47		Heart failure		Coping with emotions		
V	XVII	48	Asthma	Asthma is the disorder of the respiratory system/Have you heard about asthma, is it a respiratory disorder or allergic disorder?		Empathy	Sensitivity	

Tool 5

Preliminary Test Questionnaire for Validation

Biology teachers may please answer the following :

Are the questions/ learning levels mentioned simple?	Yes / No
Are the questions/ learning levels mentioned moderate ?	Yes / No
Are the questions/ learning levels mentioned tough/ difficult to attempt?	Yes / No
Are the questions/ learning levels adequate for XI Std ?	Yes / No
Are the questions/ learning levels clear and lucid?	Yes / No
Do the questions reflect a particular life skill ?	Yes / No

viz., Life Skills of

Decision-making

Problem-solving

Creative thinking

Critical thinking

Effective communication

Interpersonal relationships

Self-awareness

Empathy

Coping with emotions

Coping with stress

QUESTIONNAIRE

QUESITONNAIRE FOR ASSESSING ACHIEVEMENT OF LIFE SKILLS IN BIOLOGY TEXTBOOKS OF I PUC

Name of student: Name of teacher:
Class: I PUC Time: 1 hour

BOTANY

Chapter B2.1
Problem Decision-making and Critical thinking
Q.1. What is cell theory?

		Answer	Weigh-tage
LL1	Cell is a structural and functional unit in all living organisms	Yes/ No	1
LL2	It was formulated by 2 German scientists after studying different plants and animals in the year 1838.	Yes/ No	2
LL3	The first assumption of Cell Theory is that all plants and animals are composed of cells.	Yes/ No	3
LL4	The second assumption of this theory states that new cells come into existence by the division of pre-existing cells.	Yes/ No	4

Chapter B2.3
Problem Critical thinking
Q.2. Why meiosis is called reductional division?

		Answer	Weigh-tage
LL1	Meiosis is a divison which occurs in a diploid cell.	Yes/ No	1
LL2	In meiosis a diploid cell gives rise to 4 haploid cells.	Yes/ No	2
LL3	Each haploid cell contains half the number of chromosomes as compared to the parent cell.	Yes/ No	3
LL4	Because of the reduction in number of chromosomes, meiosis is called reductional division.	Yes/ No	4

Chapter B3.1
Problem — Effective communication
Q.3. What is bio-diversity?

		Answer	Weigh-tage
LL1	There are various and innumerable forms of life on earth.	Yes/ No	1
LL2	The earth forms a large biosphere and is the largest ecosystem.	Yes/ No	2
LL3	Bio-diversity is the variety and variability in flora, fauna and microbes in an ecosystem.	Yes/ No	3

Chapter B3.1.2
Problem — Critical thinking
Q.4. Explain the lytic cycle of T4 phage.

		Answer	Weigh-tage
LL1	The term bacteriophage refers to a virus that infects bacteria.	Yes/ No	1
LL2	The most widely known phage is the T4 bacteriophage	Yes/ No	2
LL3	The bacteirophage first undergoes adsorption i.e. it gets attached to the bacterial cell.	Yes/ No	3
LL4	Later the bacteriophage penetrates the bacterial cell by the activity of the enzyme lysozyme.	Yes/ No	4
LL5	The bacterial DNA is then broken down by endonuclease enzyme.	Yes/ No	5
LL6	The phage DNA then synthesizes proteins and is transcribed to mRNA	Yes/ No	6
LL7	These proteins help in the formation of components of new phage.	Yes/ No	7
LL8	The phage DNA undergoes DNA replication next.	Yes/ No	8
LL9	Then the pool of phage DNA and protein components form a new phage virus.	Yes/ No	9
LL10	The new phage viruses are released by the lysis of the bacterial or host cell.	Yes/ No	10

Chapter B3.1.3
Problem communication — Critical thinking

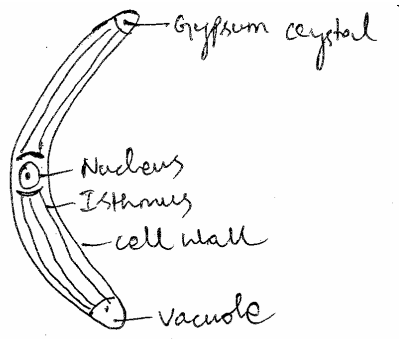
Q.5. Write the role of bacteria in fermentation and maintenance of ecological balance.

		Answer	Weigh-tage
LL1	*Azatobacter* is the vinegar bacterium.	Yes/ No	1
LL2	Vinegar is acetic acid produced through the process of fermentation.	Yes/ No	2
LL3	*Rhizobium* is another bacterium found in the root nodules of leguminous plants.	Yes/ No	3
LL4	*Rhizobium* fixes atmospheric nitrogen into nitrogenous salts and supplies it to the plants.	Yes/ No	4
LL5	When the leguminous plants die and decay, the fixed nitrogen in the root nodules enriches the soil and increase soil fertility – this helps in maintaining ecological balance.	Yes/ No	5

Chapter B3.2.3
Activity — Creative thinking

Q.6. Draw a neat labeled sketch of *Closterium*.

		Answer	Weigh-tage
LL1	*Closterium* is a spindle shaped unicellular microscopic alga.	Yes/ No	1
LL2	Each cell has 2 semi-cells joined at a common point called 'Isthmus'.	Yes/ No	2
LL3	The cell-walls are cellulosic and possess pores which secrete mucilage.	Yes/ No	3
LL4	The chloroplast is elongated and the nucleus embedded within as given below.	Yes/ No	4



CLOSTERIUM

Chapter B5
Problem Effective communication
Q.7. What is pathology?

		Answer	Weigh-tage
LL1	Pathogenic organisms transmit various diseases to man.	Yes/ No	1
LL2	The science which deals with the study of diseases is called pathology.	Yes/ No	2
LL3	The branch which deals with the study of pathogenic diseases of plants is called phytopathology.	Yes/ No	3

Chapter B2.1
Problem Effective communication and Self-awareness
Q.8. Which is the physical basis of the cell?

		Answer	Weigh-tage
LL1	The cell consists of cell wall and protoplast.	Yes/ No	1
LL2	Protoplast consists of cytoplasm and nucleus.	Yes/ No	2
LL3	Protoplasm refers to the entire living matter in the body.	Yes/ No	3
LL4	Huxley called protoplasm as the physical basis of life.	Yes/ No	4

Chapter B2.2
Problem Decision-making and Critical thinking
Q.9. Reason out why chromosomes are vehicles of heredity.

		Answer	Weigh-tage
LL1	Chromosomes are made up of DNA.	Yes/ No	1
LL2	DNA provides genetic information for growth, development and reproduction of organisms.	Yes/ No	2
LL3	Due to the property of DNA there is a precise distribution of DNA to the daughter cells during cell division.	Yes/ No	3
LL4	This DNA or gene transmits characteristics from parents to offspring and therefore chromosomes are vehicles of heredity.	Yes/ No	4

ZOOLOGY

Chapter Z1.4
Problem — Effective communication
Q.1. What are myths? Write a note on any 2 myths.

		Answer	Weigh-tage
LL1	Myths are held as false notions or created mis-conceptions.	Yes/ No	1
LL2	Myths arise from misunderstanding or even imagination.	Yes/ No	2
LL3	A misconception about Malaria was that it is acquired by means of bad air.	Yes/ No	3
LL4	Advances in Biology have however proved now that Malaria is caused by a protozoan which is transmitted by Anopheles mosquito.	Yes/ No	4

Chapter Z2.1
Problem — Decision-making
Q.2. Which polysaccharide is called queen of gelling agent?

		Answer	Weigh-tage
LL1	Basically carbohydrates are naturally occurring organic substances which contain Carbon, Hydrogen and Oxygen	Yes/ No	1
LL2	They are classified into monosaccharides, oligosaccharides and polysaccharides.	Yes/ No	2
LL3	Polysaccharides are complex sugars with several monosaccharide units and they are classified into Homo and Heteropolysaccharides.	Yes/ No	3
LL4	Agar agar is a heteropolysaccharide and has high gelling properties. Therefore it is considered queen of gelling agents.	Yes/ No	4

Chapter Z2.4
Problem Critical thinking
Q.3. How will you differentiate simple proteins from conjugated proteins?

		Answer	Weigh-tage
LL1	Proteins are complex organic nitrogenous compounds with amino acids as their building blocks.	Yes/ No	1
LL2	Proteins are classified into simple and conjugated proteins.	Yes/ No	2
LL3	Simple proteins yield amino acids on hydrolysis e.g. globulins and keratins	Yes/ No	3
LL4	Conjugated proteins are those which yield amino acids and a non-protein group, e.g. glycoprotein and lipoprotein.	Yes/ No	4

Chapter Z4.3
Problem Critical thinking
Q.4. Why is the skin of amphibians smooth, moist and richly vascularised?

		Answer	Weigh-tage
LL1	Amphibians are cold-blooded tetrapods living partly in water and partly on land.	Yes/ No	1
LL2	The skin has no scales and is smooth.	Yes/ No	2
LL3	The skin is moist and richly vascularised as they have to respire through the skin in water.	Yes/ No	3

Chapter Z5.1
Problem Critical thinking and decision-making
Q.5. Reason out why cockroaches are omnivorous?

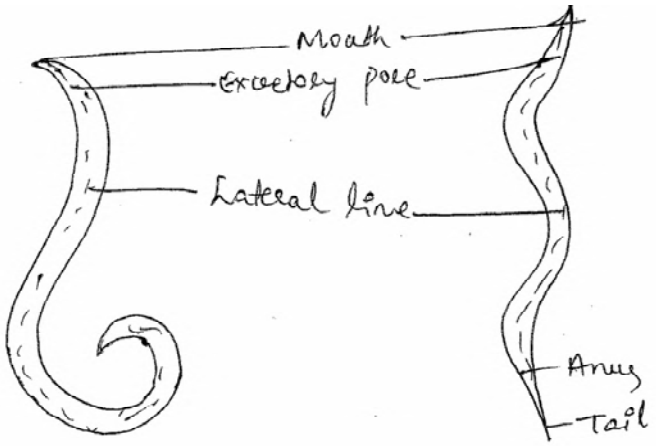
		Answer	Weigh-tage
LL1	Cockroaches are pests.	Yes/ No	1
LL2	Cockroaches are nocturnal animals.	Yes/ No	2
LL3	They feed on both plant and animal matter and are therefore omnivorous.	Yes/ No	3

Chapter Z2.4
Problem — Critical thinking
Q.6. Explain mode of enzyme action with Induced Fit Theory.

		Answer	Weigh-tage
LL1	Enzyme is a specialized protein capable of catalyzing specific chemical reactions.	Yes/ No	1
LL2	According to Induced Fit Theory the active site of the enzymes modify and mould themselves into a precise shape which enables the enzyme to perform its catalytic functions.	Yes/ No	2

Chapter Z4.3
Activity — Creative thinking
Q.7. Write a labeled diagram of Ascaris.

		Answer	Weigh-tage
LL1	Ascaris belongs to Class Nematoda and Pyylum Aschelminthes.	Yes/ No	1
LL2	There are fresh water, marine and parasitic forms.	Yes/ No	2
LL3	They are bilaterally symmetrical	Yes/ No	3
LL4	They are cylindrical, worm-like and taper at both ends.	Yes/ No	4
LL5	The digestive tract is complete.	Yes/ No	5
LL6	They exhibit sexual dimorphism.	Yes/ No	6



Ascaris male **Ascaris female**

Chapter Z6.2
Problem Decision-making
Q.8. Why is the earthworm called a farmer's friend?

		Answer	Weigh-tage
LL1	Earthworms burrow in the soil.	Yes/ No	1
LL2	They contribute thereby to soil fertility.	Yes/ No	2
LL3	They are exploited for organic waste management and for the production of organic fertilizers.	Yes/ No	3
LL4	They are a boon to the environment.	Yes/ No	4

Chapter Z3.2
Problem Problem-solving and Critical thinking
Q.9. Explain genetic drift?

		Answer	Weigh-tage
LL1	It is an evolutionary force observed in small populations.	Yes/ No	1
LL2	Gene frequency of the population changes purely by chance.	Yes/ No	2
LL3	During this process some genes are lost, some reduced and some increase in frequency.	Yes/ No	3
LL4	It eliminates any character by chance.	Yes/ No	4
LL5	It alters Hardy-Weinberg equilibrium and helps in the origin of new species.	Yes/ No	5

Tool 6

Preliminary Test Questionnaire for Validation

Biology teachers may please answer the following :

Are the questions/ learning levels mentioned simple?	Yes / No
Are the questions/ learning levels mentioned moderate ?	Yes / No
Are the questions/ learning levels mentioned tough/ difficult to attempt?	Yes / No
Are the questions/ learning levels adequate for XI Std ?	Yes / No
Are the questions/ learning levels clear and lucid?	Yes / No
Do the questions reflect a particular life skill ?	Yes / No

viz. Life Skills of

Decision-making

Problem-solving

Creative thinking

Critical thinking

Effective communication

Interpersonal relationships

Self-awareness

Empathy

Coping with emotions

Coping with stress

QUESTIONNAIRE

Learning levels for select problems/ activities/ experiments and projects given in II PUC State Textbooks. Please tick one of the options under Yes/ No.

Class : II PUC **Name of the Teacher :**

Time : 1 hour **Name of the Student :**

Unit 1 - Chapter 1

Problem

Critical thinking

Q.1	Distinguish a purine from a pyrimidine	Answer	Weigh-tage
LL1	Biochemical analysis of purified DNA revealed that it is composed of sugar, phosphoric acid and nitrogenous bases.	Yes/ No	1
LL2	Sugar is a monosaccharide composed of 5/6 carbon atoms. The 2^{nd} carbon carries a Hydrogen atom instead of an –OH group. Hence it is deoxyribose.	Yes/ No	2
LL3	Phosphoric acid is an orthophosphoric acid which is responsible for the acidity of nucleic acid.	Yes/ No	3
LL4	Nitrogenous bases are the nitrogen containing organic bases derived from aromatic benzene ring structures.	Yes/ No	4
LL5	There are two types of nitrogenous bases viz. purines and pyrimidines.	Yes/ No	5
LL6	Pyrimidines are “single ring” structures and hence are smaller molecules.	Yes/ No	6
LL7	Two pyrimidines associated with DNA are Cytosine (C) and Thymine (T).	Yes/ No	7
LL8	Purines are “double-ring” structures. Hence they are larger molecules.	Yes/ No	8
LL9	There are two purines associated with DNA.	Yes/ No	9
LL10	Two purines associated with DNA are Adenine and Guanine.	Yes/ No	10

Unit 1 : Chapter 1

Problem

Critical thinking

Q.2	**Distinguish genetic and non-genetic RNA.**	**Answer**	**Weigh-tage**
LL1	Ribonucleic acid (RNA) occurs in viruses and in prokaryotic and eukaryotic cells.	Yes/ No	1
LL2	Most of the RNAs are single stranded polynucleotide chains.	Yes/ No	2
LL3	Chemically it is composed of ribose sugar, which is a pentose, phosphoric acid.	Yes/ No	3
LL4	Four nitrogenous bases as in DNA, where the purines are adenine and guanine and the pyrimidines are cytosine and uracil.	Yes/ No	4
LL5	When RNA acts as a genetic material it is called genetic RNA eg. Riboviruses.	Yes/ No	5
LL6	When RNA do not carry out any genetic function, but are involved in transcription / translation, they are named non-genetic RNAs.	Yes/ No	6
LL7	There are 3-types of non-genetic RNA, m-RNA, t-RNA and r-RNA.	Yes/ No	7

Unit 1 : Chapter 1

Problem

Effective communication

Q.3	**What is Chargaff's rule?**	**Answer**	**Weigh-Tage**
LL1	Erwin Chargaff was the first to propose the Chargaff's rule of base equivalence.	Yes/ No	1
LL2	By chemical analysis of DNA he found that the four nucleotides were not present in equal proportions and the composition varied from one source to another.	Yes/ No	2
LL3	According to the rule the amount of adenine always equals the amount of thymine (A ≡ T).	Yes/ No	3
LL4	The amount of cytosine always equals the amount of Guanine (C ≡ G).	Yes/ No	4

LL5	To conclude Chargaff's rule, "there is always equal proportion of purines and pyrimidines (A = G) and (C – T)"	Yes/ No	5

Unit 1 : Chapter 2

Problem

Effective communication

Q.4	What is linear DNA ?	**Answer**	**Weigh-tage**
LL1	DNA molecule is said to be linear DNA if it has free ends.	Yes/ No	1
LL2	Linear DNAs are found in the nuclear chromosomes of all eukaryotes.	Yes/ No	2

Unit 1: Chapter 1

Problem

Critical thinking

Q.5	Write any two reasons for considering DNA as the genetic material.	**Answer**	**Weigh-tage**
LL1	Genetic material is that which composes Genes, stores information and controls the expression of characters in organisms.	Yes/ No	1
LL2	In 1928 Griffith was working on a bacterium called *Diplococcus pneumoniae* or *Streptococcus pneumoniae* and he found two strains of the bacterium S-Strain (virulent) and R-strain (Non-virulent).	Yes/ No	2
LL3	He injected S-strain and R-strain into the mice and he found that the S-strand injected mice developed pneumonia and died whereas the R-strain injected mice survived.	Yes/ No	3
LL4	Later on he injected the heat killed S-strain into the mice and he found the mice survived.	Yes/ No	4
LL5	Then he mixed live R-strain bacteria and heat killed S-strain bacteria and he injected them into mice and the mice died of pneumonia.	Yes/ No	5

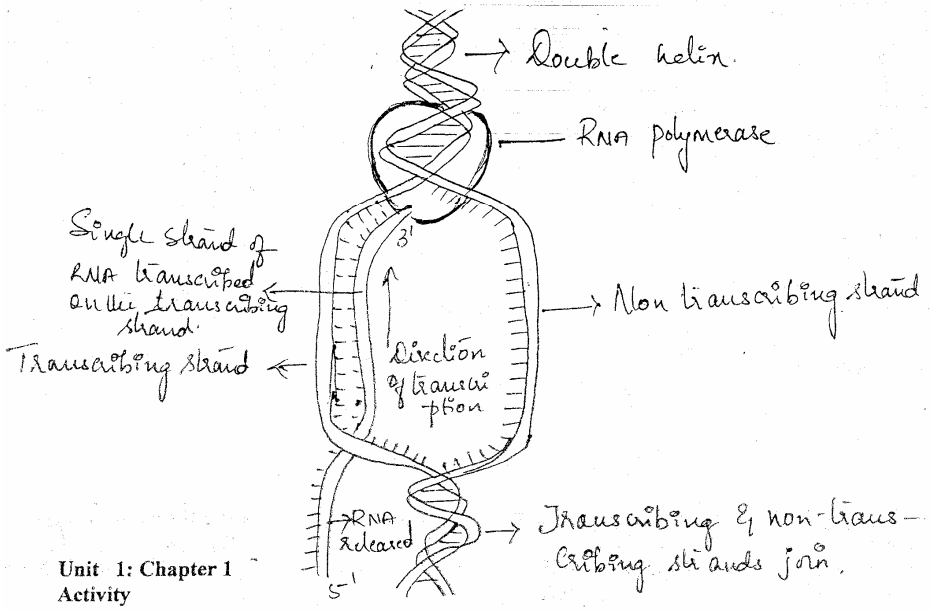
LL6	From this experiment he concluded that the virulent S-strain bacteria could have been produced only by transformation of non-virulent R-strain through a genetic material.	Yes/ No	6

Unit 1 : Chapter 1

Problem

Self-awareness and Effective communication

Q.6	**Describe the steps in transcription. What is reverse transcription?**	**Answer**	**Weigh-tage**
LL1	Transcription is a process of RNA synthesis in which one of the DNA strand is used as a template.	Yes/ No	1
LL2	RNA synthesis occurs at specific sites on DNA. The strand that is used for synthesis is called **sense-strand/ template strand or non-coding strand**	Yes/ No	2
LL3	The corresponding region of the ether strand which is not used is called **coding strand.**	Yes/ No	3
LL4	During transcription G of DNA pairs with C of the RNA and pairs with U of RNA. Note that thymine is replaced with uracil in RNA.	Yes/ No	4
LL5	Chief enzymes of transcription are the RNA polymerases which catalyse the addition of ribonucleotides.	Yes/ No	5
LL6	The region of DNA with which the RNA polymerase associates itself at the beginning of transcription is called the **promotor.**	Yes/ No	6
LL7	In prokaryotes the promotor has a sequence of bases which run from 5′ - 3′ in the sequence TATAAT. This is known as **pribnow box.**	Yes/ No	7
LL8	When RNA is used as the template for DNA synthesis, the process is called **reverse transcription.**	Yes/ No	8
LL9	The enzyme which catalyses the activity is called reverse transcriptase.	Yes/No	9



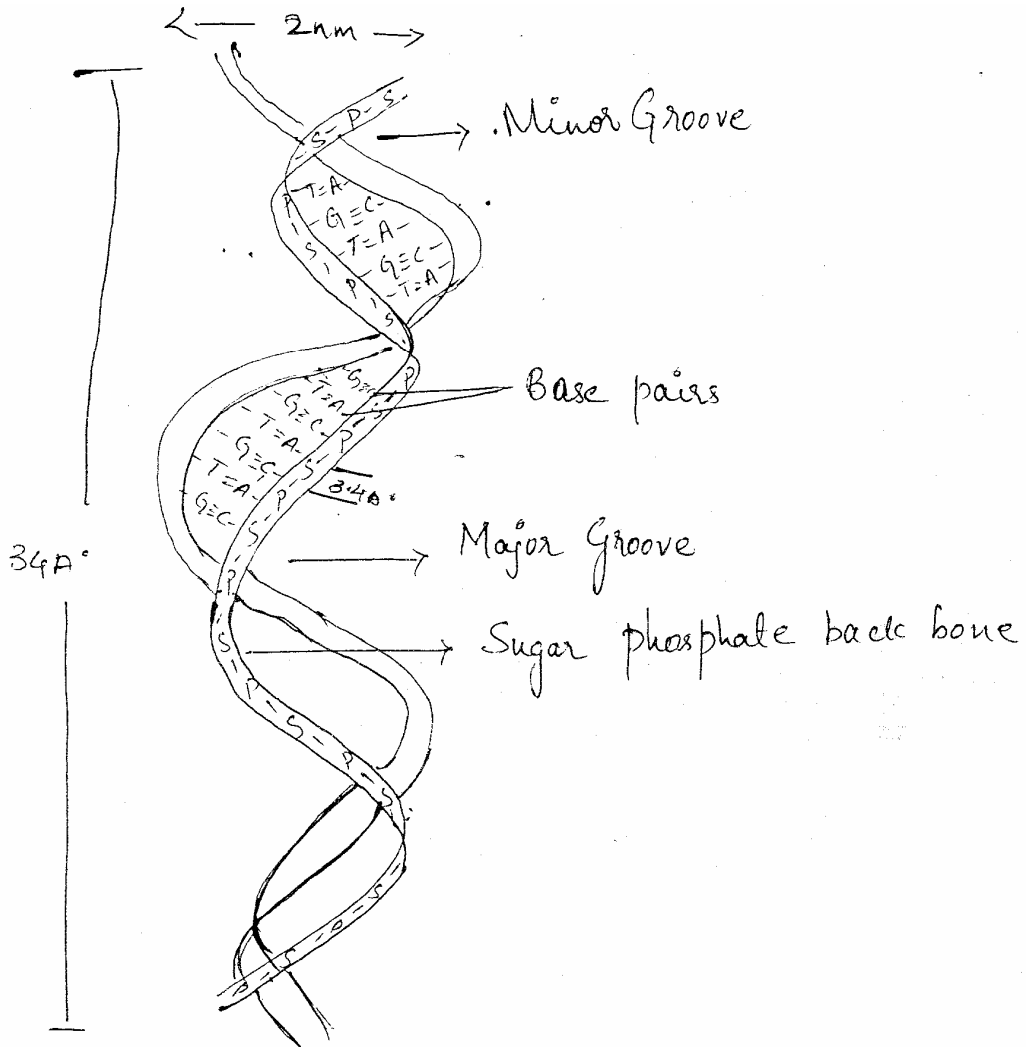
Unit 1: Chapter 1

Activity

Creative thinking and Self-awareness

Q.7	**Draw a double helix and label the parts.**	**Answer**	**Weigh-tage**
LL1	In 1953, James D.Watson and H.C.Crick proposed the double helix or duplex which consists of two polynucleotide chains coiled together. Hence double stranded and has a diameter of 2 nm.	Yes/ No	1
LL2	The backbone is composed of repeating units of sugar and phosphate.	Yes/ No	2
LL3	The lease on the one strand is always paired with the base of the other strand by hydrogen bonds and it is called **base pairing.**	Yes/ No	3
LL4	The base pairing is very specific i.e. A = T and G ≡ C. This is known as "Complementary base pairing".	Yes/ No	4
LL5	There are two hydrogen bonds between A and T and three hydrogen bonds between G and C.	Yes/ No	5
LL6	Successive base pairs are paired at a distance of 3.4 A^o. There are 10 base pairs per turn.	Yes/ No	6
LL7	Each base pair is rotated 36′ from its neighbour. Thus 10 base pairs would make a turn of 360^o.	Yes/ No	7
LL8	The two strands run in opposite direction and they are said to be antiparallel. One strand runs in 5′ → 3′ and the other from 3′ → 5′.	Yes/No	8

LL9	The amount of purines is equal to pyrimidines i.e. A+T = G+C.	Yes/No	9



Double Helix model of DNA

Unit 1 : Chapter 1

Problem

Creative thinking and Critical thinking

Q.8.	**Reason out how in a sample of DNA, if A = 15%, the % of rest of the bases can be determined?**	**Answer**	**Weigh-Tage**
LL1	According to Chargaff's rule, the amount of purines and pyrimidines are equal i.e. A + G = T + C.	Yes/ No	1
LL2	So if A = 15%, the % of remaining bases are also 15%.	Yes/ No	2

Unit 1 : Chapter 2

Problem

Self-awareness

Q.9	**Who proposed one gene one polypeptide hypothesis?**	**Answer**	**Weigh-tage**
LL1	The work of Charles Yanofsky and others in 1965 on the human colon bacterium, *E. coli* established a clear relationship between the Gene and Polypeptide.	Yes/ No	1
LL2	Based on experiments, the one gene one polypeptide hypothesis was proposed.	Yes/ No	2
LL3	It states that a single structural gene specifies the synthesis of a single polypeptide.	Yes/ No	3

Unit 1 : Chapter 2

Problem

Self-awareness

Q.10	**What is polycystronic m-RNA ?**	**Answer**	**Weigh-Tage**
LL1	In prokaryotes several genes coding for a set of proteins or enzymes occur together. Such genes are said to be clustered.	Yes/ No	1
LL2	The clustered genes together make a single "polycistronic m-RNA".	Yes/ No	2

Unit 1 : Chapter 2

Problem

Critical thinking

Q.11	**Define Genetic Code.**	**Answer**	**Weigh-tage**
LL1	The genetic code is the language of the gene or DNA.	Yes/ No	1
LL2	It is the collection of symbols meant to contain information in an abbreviated form.	Yes/ No	2
LL3	It consists of codon with a set of 3AA making a codon.	Yes/ No	3
LL4	A sequence of codons make the genetic code. The codons are of different types and have different functions.	Yes/ No	4

Unit 1 : Chapter 2

Problem

Critical thinking

	Q.12 Mention parts of an operon.	**Answer**	**Weigh-tage**
LL1	Operon concept proposes that cells do not produce all enzymes and other proteins at all times. It explains how genes regulate protein synthesis in molecular terms through structural operator, promotor and regulator genes.	Yes/ No	1
LL2	Structural genes : There are three adjacent structural genes named Lac Z, lac Y and lac A. Lac Z codes for β - galactosidase Lac Y codes for lactose permease. Lac A codes for β - galactoside transacetylase.	Yes/ No	2
LL3	A single polycistronic m-RNA is produced by 3 genes and contains coding sequences for proteins.	Yes/ No	3
LL4	Operator Gene: This is another segment of DNA close to the structural gene and named lac O.	Yes/ No	4
LL5	Operator activates the structural genes to transcribe, when the enzymes are needed.	Yes/ No	5
LL6	Promoter Gene : It is designated as lac P. This is the site at which RNA polymerase interacts with DNA to initiate transcription. This part of DNA has 6 bases. It is named "**pribnow box".**	Yes/ No	6
LL7	Regulator gene: It is another segment of DNA situated upstream and is designated as lac I. Which codes for protein are called lac repressor ?	Yes/ No	7
LL8	Its only function is to control transcription of lac ZYA gene cluster. When it binds to lac O, it prevents RNA polymerase from binding to the promoter lac P and initiating transcription.	Yes/No	8

Unit 1 : Chapter 3

Problem

Self-awareness

Q.13	**Name two microbial metabolites.**	**Answer**	**Weigh-tage**
LL1	Metabolites are substances that take part/ are found in the physiology of any living system.	Yes/ No	1
LL2	The microbial metabolites include ethyl alcohol, organic acids, enzymes, antibiotics, vitamins and steroids.	Yes/ No	2

Unit 1 : Chapter 3

Problem

Self-awareness

Q.14	**What is a Bio-reactor?**	**Answer**	**Weigh-Tage**
LL1	Bioreactors are called fermentor vessels or tanks where micro –organisms carry out fermentation process either in a liquid or solid medium either aerobically or anaerobically.	Yes/ No	1

Unit 1: Chapter 3

Problem

Self-awareness

Q.15	**Name the scientists responsible for development of first hybridoma.**	**Answer**	**Weigh-Tage**
LL1	A hybridoma is a hybrid of two cells.	Yes/ No	1
LL2	Hybridization is the process of fusion of two cells.	Yes/ No	2
LL3	Cesar Milstein and Georges Kohler, Nobel Laureates are the scientists who developed the first hybridoma.	Yes/ No	3

Unit 1: Chapter 3

Problem

Decision-making

Q.16	**How was the first hybridoma produced ?**	**Answer**	**Weigh-Tage**
LL1	A hybridoma is a hybrid of two cells. One is the normal antibody producing B - lymphocyte. Other is a myeloma cell, a cell isolated from a malignancy or tumour which can multiply in cultures and can remain immortal.	Yes/ No	1

LL2	The hybridoma combines the properties of these two cells in antibody producing capacity in response to antigen by B-lymphocyte and the ability of malignant cell to grow and divide rapidly and permanently in cell cultures.	Yes/ No	2
LL3	Milstein and Kohler noted that B cells divided in spleen after mouse was injected with an antigen. The spleen was removed and the B-lymphocytes were collected. They were fused with myeloma cells using Poly Ethylene Glycol (PEG). This process is termed "somatic cell fusion" / Somatic hybridisation.	Yes/ No	3
LL4	The hybridomas produced as a result are cultured to produce clones of cells and their produces.	Yes/ No	4

Unit 1: Chapter 3

Problem

Self-awareness

Q.17	**Who are the pioneers in tissue culture ?**	**Answer**	**Weigh-tage**
LL1	The first attempts to culture tissue came from Haberlandt.	Yes/ No	1
LL2	In 1902, a German botanist obtained the plant tissues from isolated mesophyll cells *invitro*.	Yes/ No	2
LL3	Frank Steward and his colleagues in 1953, successfully propagated carrot plants from the phloem of the roots.	Yes/ No	3
LL4	In India, it was P.Maheshwari who initiated *invitro* cultures of organs such as ovule and ovary.	Yes/ No	4

Unit 1: Chapter 3

Problem

Decision-making

Q.18	**How are embryonic stem cells cultured?**	**Answer**	**Weigh-tage**
LL1	Stem cells are multi potent or pluripotent cells that can differentiate into number of other cell types. There are two types of S.C. Embryonic and adult stem cells.	Yes/ No	5
LL2	Embryonic stem cells are derived from embryos developed out of invitro fertilization. They consist of blastocyst and an inner mass of about 30 cells.	Yes/ No	6

LL3	The culture dishes and nutrient solution are preparatory preparations for the culture of embryonic stem cells.	Yes/ No	7
LL4	The culture dishes are typically coated with mouse embryonic skin cells which have been treated so that they do not divide. This is known as feeder layer.	Yes/ No	4
LL5	The embryonic stem cells are isolated from the inner mass of the human embryo.	Yes/ No	10
LL7	After few days the cells in the culture dish proliferate and begin to crowd the dish. They are removed gently and passed onto several fresh dishes. This is sub-culturing.	Yes/ No	11
LL8	Within several months millions of cells are developed which are undifferentiated and genetically identical forming embryonic stem line.	Yes/ No	12

Unit 1: Chapter 3

Problem

Effective communication

Q.19	**With reference to stem cells explain a) Totipotency, b) Embryonic stem cells.**	**Answer**	**Weigh-tage**
LL1	Totipotency is the ability of a cell to produce a mass of tissue which on further morphogenesis forms an individual organism.	Yes/ No	1
LL2	Invitrofertilisation is an artificial process carried out in the lab.	Yes/ No	2
LL3	Embryonic stem cells are derived from embryos developed out of invitro fertilization.	Yes/ No	3

Unit 1: Chapter 3

Problem

Critical thinking

Q.20	**Reason out why plasmids can be used in Gene Cloning.**	**Answer**	**Weigh-tage**
LL1	Cloning is a process of obtaining identical copies by using cloning vector.	Yes/ No	1

LL2	The DNA of interest is first inserted into the cloning vector. The vector replicates along with the DNA it carries.	Yes/ No	2
LL3	Various types of vectors are used and a plasmid is one of them.	Yes/ No	3
LL4	Plasmids are small circular double stranded DNA molecules occurring naturally in some bacteria. They can replicate independently of host chromosome when inserted in a host organism.	Yes/ No	4
LL5	The two most popular plasmids developed are PUC^{18} and $P^{BR}322$.	Yes/ No	5

Unit 1: Chapter 4

Problem **Self-awareness**

Q.21	**Name the dead elements of Xylem.**	**Answer**	**Weigh-tage**
LL1	Basically the tissues in plants are of two types – simple permanent tissues and complex permanent tissues.	Yes/ No	1
LL2	Complex permanent tissues are of two types – xylem and phloem. Together they are described as conducting tissues.	Yes/ No	2
LL3	Xylem tracheid which is a long elongated single cell does not have protoplasts and has lignified walls.	Yes/ No	3
LL4	Xylem tracheae are multicellular structure, they form tube like structure from end to end fusion of individual cells. They do not have living protoplast and hence are dead.	Yes/ No	4
LL5	Xylem fibres are long elongated dead sclerenchymatous cells with lignified walls and small pits.	Yes/ No	5

Unit 1: Chapter 4

Problem **Effective communication**

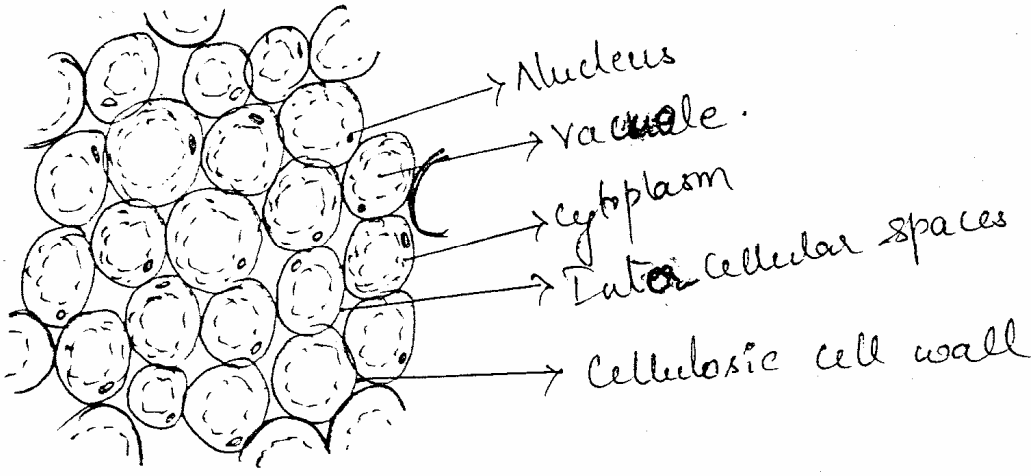
Q.22	**Give a definition of tissue. Who were the pioneers in the study of tissues?**	**Answer**	**Weigh-tage**
LL1	A tissue may be defined as an aggregation or grouping of cells specialized to perform a particular function.	Yes/ No	1

LL2	Marcello malpighi And Nehemiah Grew were the pioneers in the study of plant tissue.	Yes/ No	2
LL3	Nehemiah Grew was called Father of Plant Anatomy. It was he who coined the word 'tissue'.	Yes/ No	3

Unit 1: Chapter 4

Activity **Creative thinking**

Q.23	**Draw a labelled diagram of parenchyma tissue.**	**Answer**	**Weigh-Tage**
LL1	Parenchyma is one of the simple permanent tissues. It is most basic type and the least specialized tissue.	Yes/ No	1
LL2	They are living cells, isodiametric in shape and having many surfaces or facets which are in contact with neighbouring cells.	Yes/ No	2
LL3	Cell wall is thin, primary and is composed of cellulose. Pits which are present are simple type.	Yes/ No	4
LL4	Protoplast is metabolically active and have central vacuoles. Cytoplasm and the single nucleus occupy a peripheral position.	Yes/ No	5



Parnechyma Tisuse in section

Unit 1: Chapter 4

Problem **Self-awareness**

	Q.24 Which type of wall thickenings are found in xylem vessels ?	**Answer**	**Weigh-tage**
LL1	A vessel or tracheae is a multicellular structure formed by the end to end fusion of individual cylindrical cells called vessel members. Hence they are known as syncytes.	Yes/ No	1
LL2	During development, the end walls of vessel members become perforated i.e.. they break down completely and thus produce continuous vessels.	Yes/ No	2
LL3	The secondary wall of a mature vessel is lignified.	Yes/ No	3
LL4	The secondary wall material i.e. lignin is deposited producing annular, spiral, scalariform, reticulated and pitted vessels.	Yes/ No	4

Unit 1: Chapter 4

Problem **Critical thinking**

	Q.25 What are meristems? Classify them based on origin and give examples.	**Answer**	**Weigh-tage**
LL1	The term meristem is derived from Greek where meristos means divisible.	Yes/ No	1
LL2	Meristems are actively metabolizing cells which have retained the power of division.	Yes/ No	2
LL3	Based on origin, it is classified into two types. 1. Pro-meristem 2. Primary meristem 3. Secondary meristem	Yes/ No	3
LL4	The promeristems are the youngest or the earliest stage of growing. They are present in the tip of the stem and root. On division, primary meristem is produced.	Yes/ No	4
LL5	Primary meristems are directly derived from the promeristem. The cells produced by them differentiate into primary permanent tissues. They are present in the apical meristem of stem and root and in intercalary meristem.	Yes/ No	5

LL6	The secondary meristem arises primarily from permanent tissue by the process of de-differentiation. They are present in the lateral or peripheral position in the stem and root. They are also present in the cambium of root.	Yes/ No	6

Unit 1: Chapter 4

Problem **Effective communication**

Q.26	**Explain the distribution of vascular tissues.** **(i) Collateral** **(ii) Bicollateral** **(iii) Radial bundles**	**Answer**	**Weigh-tage**
LL1	In collateral bundle, the xylem and phloem are in the same radius with xylem facing the centre and phloem facing the periphery.	Yes/ No	1
LL2	In bi-collateral bundle the xylem is in the centre with a layer of cambium and phloem on each side of it.	Yes/ No	2
LL3	When xylem and phloem are present as separate strands along different radii and alternating with each other bundles, they are said to be radial.	Yes/ No	3

Unit 1: Chapter 4

Problem **Critical thinking**

Q.27	**Why is the Endodermis in <u>Eupatorium</u> stem called Starch sheath ?**	**Answer**	**Weigh-tage**
LL1	The transverse section of young <u>Eupatorium</u> stem shows Epidermis, cortex and stele from periphery to the centre.	Yes/ No	1
LL2	The endodermis is the innermost layer of cortex which forms the wavy layer.	Yes/ No	2
LL3	The cells are barrel shaped and arranged without intercellular spaces which contain abundant starch grain. Hence known as starch sheath.	Yes/ No	3

Unit 1 : Chapter 5

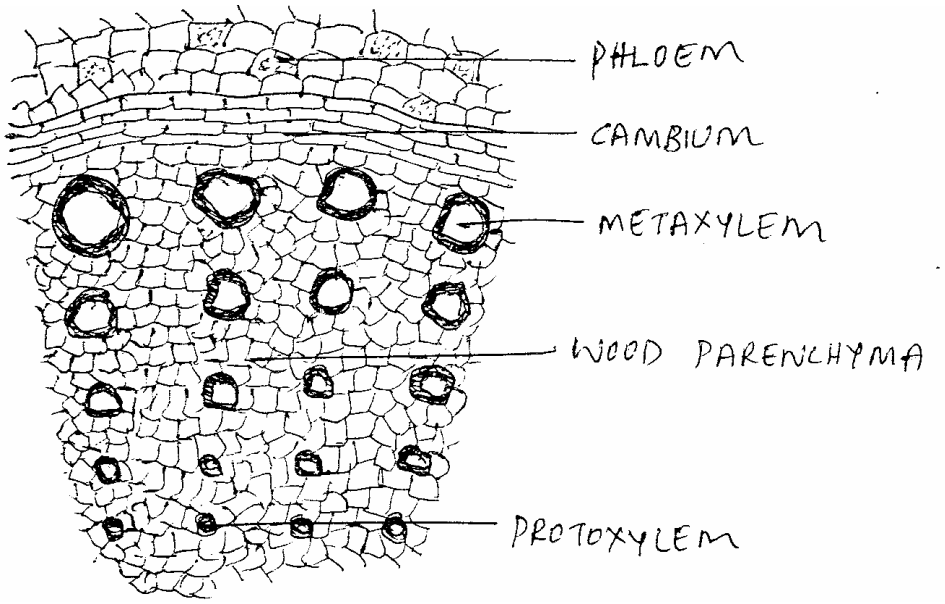
Problem **Self-awareness**

	Q.28 Name two regions of Mesophyll.	**Answer**	**Weigh-tage**
LL1	The tissue sandwiched between the epidermal layers is called mesophyll. It is differentiated into two regions.	Yes/ No	1
LL2	Palisade parenchyma and spongy parenchyma are the two regions of mesophyll.	Yes/ No	2

Unit 1 : Chapter 5

Problem **Creative thinking**

	Q.29 Draw the vascular bundle of <u>Eupatorium</u> stem.	**Answer**	**Weigh-tage**
LL1	The vascular bundles are contained in the stele.	Yes/ No	1
LL2	The numerous vascular bundles are arranged in the form of discontinuous ring. This arrangement is known as Eustele.	Yes/ No	2
LL3	Each bundle is collateral, conjoint and open.	Yes/ No	3
LL4	The xylem is differentiated into protoxylem and metaxylem.	Yes/ No	4
LL5	Since the protoxylem faces the pith and metaxylem faces the periphery, the xylem is said to be Endarch.	Yes/ No	5
LL6	The phloem is external and consists of sieve tubes, sieve elements, companion cells and phloem parenchyma.	Yes/ No	6
LL7	The cambium is fascicular or Interfascicular and it is held between xylem and phloem.	Yes/ No	7



Vascular Bundle of <u>Eupatorium</u> Stem

Unit 1 : Chapter 5

Problem **Critical thinking**

	Q.30 Distinguish between vascular cylinders of dicot and monocot root.	**Answer**	**Weigh-tage**
LL1	The stele is also called as vascular cylinder where it comprises of pericycle, vascular bundles, conjunctive tissue and pith.	Yes/ No	1
LL2	Vascular bundles are radial and xylem and phloem are arranged in separate groups. The bundles are closed as there is no cambium.	Yes/ No	2
LL3	Usually four patches of xylem and phloem are present alternatively in dicot root.	Yes/ No	3
LL4	The vascular bundles of the monocot root consists of several patches of xylem and phloem arranged along alternating radii.	Yes/ No	4
LL5	Since there are many patches of xylem, it is said to be polyarch. The vascular bundles are closed as in dicot root.	Yes/ No	5

Problem **Critical thinking**

	Q.31 Point out the differences in anatomy of a dicot root and that of a dicot stem.	**Answer**	**Weigh-tage**
LL1	The outermost layer in dicot root is called epiblema and is composed of thin walled cells, there is no cuticle and no stomata.	Yes/ No	1
LL2	Epidermal cells draw tubular extension of their outer walls called root hairs.	Yes/ No	2
LL3	Cortex includes general cortex and endodermis. General cortex consists of thin walled parenchyma cells and contain numerous leucoplasts and starch grains.	Yes/ No	3
LL4	Endodermis consists of closely arranged cells without intercellular spaces. Each endodermal cell has a peculiar thickening on its radial and transverse wall due to the deposition of secondary material "suberin". These thickenings are called "Casparian strips".	Yes/ No	4
LL5	Stele is also called vascular cylinder. It consists of pericycle, vascular bundles, conjunctive tissue and pith.	Yes/ No	5
LL6	Pericycle is inner to the endodermis and consists of single layer of parenchyma cells.	Yes/ No	6
LL7	Vascular bundles are radial as the xylem and phloem are arranged in separate groups. Bundles are closed. Usually four patches of xylem alternate with four of phloem.	Yes/ No	7
LL8	Xylem is exarch and is typical of roots. Xylem is said to be tetrarch as there are 4 wedges of xylem.	Yes/No	8
LL9	Phloem occurs in between the arms of the xylem. It consists of sieve tubes, companion cells and phloem parenchyma. Pith is generally absent in dicot root.	Yes/No	9
LL10	The epidermis of dicot stem consists of single layer of lining cells. At intervals, the epidermis is pierced by openings called stomatal pores, each bound by a pair of guard cells. Trichomes are present on epidermis.	Yes/No	10

LL11	Cortex occurs next to epidermis and is differentiated into three regions. The hypodermis lying just inner to the epidermis, consists of closely packed collenchyma cells.	Yes/No	11
LL12	Hypodermis is followed by loosely packed parenchyma cells. The cells contain chloroplasts and hence form chlorenchyma.	Yes/No	12
LL13	Endodermis is the inner most layer and the cells contain numerous starch grains and hence this layer is called the starch sheath.	Yes/No	13
LL14	The vascular bundles are numerous and they are arranged in the form of discontinuous ring. This is called Eustele. Each bundle is conjoint collateral and open.	Yes/No	14
LL15	Since the protoxylem faces the centre, and the metaxylem faces the periphery, the xylem is said to be endarch.	Yes/No	15
LL16	The phloem is external and consists of sieve tube, companion cells and phloem parenchyma.	Yes/No	16

Unit 1 : Chapter 6

Problem **Self-awareness**

Q.32	**Name the components of periderm.**	**Answer**	**Weigh-tage**
LL1	Cells in the outer cortical layer or even in the epidermis dedifferentiate become meristematic and develop into the cork cambium.	Yes/ No	1
LL2	Likewise the cells by actively dividing produce phellogen, phellem and phelloderm.	Yes/ No	2
LL3	Secondary growth in the cortex has now produced 3 additional tissues: Phellem, phellogen and phelloderm. These together constitute “periderm”.	Yes/ No	3

Unit 1: Chapter 6

Problem **Self-awareness**

Q.33	**What is Dendrochronology?**	**Answer**	**Weigh-tage**
LL1	The activity of the cambium is greatly influenced by seasons. Due to the activity of the cambium, the secondary xylem produced can be distinguishable.	Yes/ No	1
LL2	The spring wood and the autumn wood together make up one year's growth to constitute annual ring or growth ring. Such annual rings are concentrically arranged in an old stem.	Yes/ No	2
LL3	The age of a tree can be determined by counting the number of annual rings and this study is called Dendrochronology.	Yes/ No	3

Unit 1: Chapter 6

Problem **Critical thinking**

Q.34	**Differentiate spring wood and autumn wood.**	**Answer**	**Weigh-tage**
LL1	The spring wood possesses wider xylem elements.	Yes/ No	1
LL2	The trachea and tracheids have larger diameters and have thinner walls.	Yes/ No	2
LL3	Autumn wood consists of lesser number of vessels and having generally thicker walls.	Yes/ No	3

Unit 1: Chapter 6

Problem **Critical thinking**

Q.35	**Distinguish between phellem and phellogen.**	**Answer**	**Weigh-tage**
LL1	Cells in the outer cortical layer dedifferentiate become meristematic and develop into cork cambium.	Yes/ No	1
LL2	It consists of single layer of cells and can divide tangentially to produce cells both towards outer and inner side. This is phellogen.	Yes/ No	2

LL3	The cells produced on the outer side by the phellogen soon start depositing suberin. These suberised cells are compactly arranged without intercellular spaces. This tissue is known as phellem.	Yes/ No	3

Unit 1: Chapter 6

Problem **Problem solving and Effective communication**

Q.36	**Explain the formation of a lenticel.**	**Answer**	**Weigh-tage**
LL1	The lenticels are lens shaped raised spots developed on the stem.	Yes/ No	1
LL2	They are produced at the time of periderm formation.	Yes/ No	2
LL3	These cells are produced by the phellogen. Due to increase in number of cells, they protrude outwards exposing the outer layer cells.	Yes/ No	3

Unit 1: Chapter 7

Problem **Effective communication**

Q.37	**Give a definition of osmosis.**	**Answer**	**Weigh-tage**
LL1	Diffusion involves movement of particles from a region of higher concentration to the region of lower concentration, down a concentration gradient until they are distributed evenly in the available space.	Yes/ No	1
LL2	Osmosis is a special case of diffusion wherein a solvent moves from a region of higher concentration to a region of lower concentration across a differentially permeable membrane.	Yes/ No	2

Unit 1: Chapter 7

Problem **Effective communication**

Q.38	**Define water potential.**	**Answer**	**Weigh-tage**
LL1	The concept of water potential was introduced by Ralpho Seatyer and S.A. Taylor.	Yes/ No	1
LL2	Potential is a way of representing free energy and in predicting in which way water will move.	Yes/ No	2

LL3	Water potential is defined as the difference between the free energy of water in a system and free energy of pure water.	Yes/ No	3

Unit 1: Chapter 7

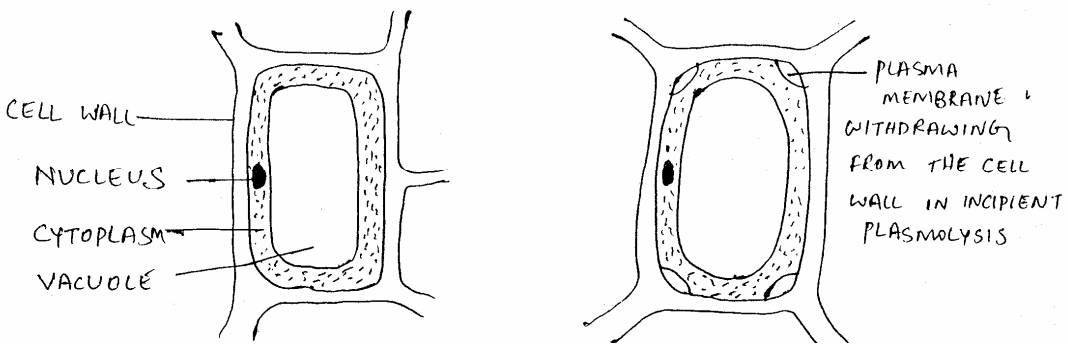
Problem **Decision-making**

Q.39	**Which is the most hypotonic solution?**	**Answer**	**Weigh-tage**
LL1	This term is used to refer to the osmotic conditions of fluids in relation to that of a cell.	Yes/ No	1
LL2	Hypotonic solution has a lower concentration of dissolved substances than the cell sap.	Yes/ No	2
LL3	It has higher water concentration.	Yes/ No	3

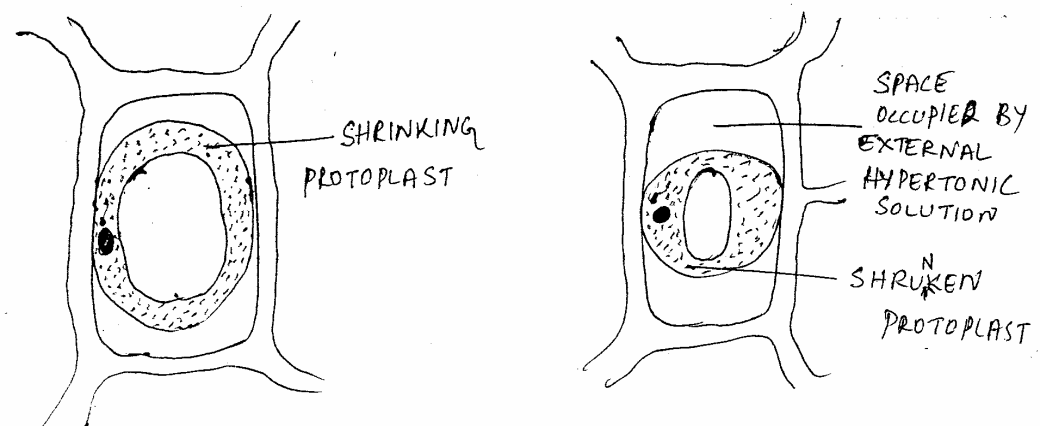
Unit 1: Chapter 7

Activity **Creative thinking and Problem-solving**

Q.40	**Draw different stages of plasmolysis of a plant cell.**	**Answer**	**Weigh-tage**
LL1	When plant cell s placed in a hypertonic solution, exosmosis occurs and water from the cell will pass into the solution.	Yes/ No	1
LL2	The turgor is lost and the cell will shrink along with the protoplast.	Yes/ No	2
LL3	The phenomenon of shrivelling up of the protoplast under the influence of hypertonic solution is called plasmolysis.	Yes/ No	3



Stages in Plasmolysis



Different Stages of Plasmolysis

Unit 1: Chapter 7

Problem **Decision-making**

	Q.41 What is ψ_s and ψ_p ?	**Answer**	**Weigh-tage**
LL1	ψ_s is called solute potential. It is produced as a result of solute in water.	Yes/ No	1
LL2	In pure water, there are no solutes and $\psi_s = 0$.	Yes/ No	2
LL3	ψ_p is called solute potential. It is the pressure exerted on the cellular contents by the elastic cell wall, when the cell is in turgor.	Yes/ No	3

Unit 1 : Chapter 7

Problem **Problem-solving and Effective communication**

	Q.42 Explain the process of osmosis by using potato osmoscope.	**Answer**	**Weigh-tage**
LL1	Osmosis is a special case of diffusion where solvent moves from a region of higher concentration to a region of lower concentration across a differential gradient.	Yes/ No	1
LL2	A peeled raw potato is taken and a cup shaped depression is cut out in the centre and it is filled with concentrated sugar solution partially.	Yes/ No	2
LL3	The whole potato is placed in water and is partially submerged. Initial level of solution in the tuber is marked by a pen.	Yes/ No	3

LL4	This set up is known as osmoscope and this is allowed to remain for a couple of hours.	Yes/ No	4
LL5	Water soon enters the tuber from the beaker and the level of the solution in the cavity rises. Final level is marked with a pin.	Yes/ No	5
LL6	This entry is by osmosis through the cell membranes of potato cells.	Yes/ No	6

Unit 1 : Chapter 8

Problem **Critical thinking**

Q.43	**Mention one merit of Dixon's theory.**	**Answer**	**Weigh-Tage**
LL1	H.H.Dixon and J.Joly proposed Transpiration Pull Theory.	Yes/ No	1
LL2	Dendrograph was used to measure daily changes in diameters of tree trunks.	Yes/ No	2
LL3	Minimum diameters are recorded during day time when the transpiration rate is highest indicating the xylem vessels are under tension and hence they shrink.	Yes/ No	3
LL4	Dixon's theory of Transpiration Pull can explain ascent of sap in very tall trees.	Yes/ No	4

Unit 1: Chapter 8

Problem **Effective communication**

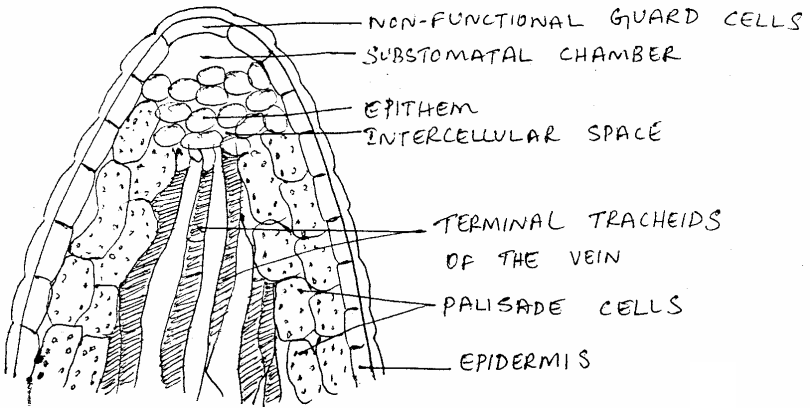
Q.44	**Who proposed the K^+ transport theory?**	**Answer**	**Weigh-tage**
LL1	The theory of Active Potassium Ion (K^+) and proton transport was first proposed by S.Imamura and later by M.Fugino and A.A.Fisched.	Yes/ No	1
LL2	This theory is based on potassium flux in and out of the guard cells from the surrounding epidermal cells.	Yes/ No	2
LL3	J.Levitt modified this theory to include H^+ transport linked to K^+ transport.	Yes/ No	3

Unit 1: Chapter 8

Problem	**Decision-making and Critical thinking**		
Q.45	**On what does the Opening and closing of a stoma depend?**	**Answer**	**Weigh-tage**
LL1	Stomata are open during the day and closed during night. This indicates that they are photoactive or photoreceptive.	Yes/ No	1
LL2	The opening and closing of a stoma is an osmotic phenomenon, controlled by changes in turgor and therefore, the shapes of guard cells.	Yes/ No	2

Unit 1: Chapter 8

Problem		**Creative thinking**	
Q.46.	**Draw a labelled figure of a hydathode.**	**Answer**	**Weigh-tage**
LL1	Loss of water in a liquid form, from uninjured parts during night and early mornings, along the margins of leaves of herbaceous plants through specialized structures called hydathodes is called Guttation.	Yes/ No	1
LL2	The hydathodes, through which guttation occurs are stomata like pores which are always open and are guarded by non-functional guard cells.	Yes/ No	2
LL3	There is an air cavity below the aperture containing loose, thin walled, colourless mesophyll cells, forming the Epithem.	Yes/ No	3
LL4	The intercellular spaces of the epithem are filled with water.	Yes/ No	4
LL5	Below the epithem are the terminal tracheids representing the ends of the conducting tissues.	Yes/ No	5



Vertical Section through the Hydathode

Unit 1: Chapter 8

Problem **Critical thinking**

Q.47	**"Transpiration is a necessary evil". Discuss.**	**Answer**	**Weigh-tage**
LL1	Curtis described transpiration as "a necessary evil".	Yes/ No	1
LL2	Transpiration increases the rate of water mineral transport within the plant.	Yes/ No	2
LL3	It increases the rate of water absorption by the roots by producing the transpiration pull which helps in the ascent of sap.	Yes/ No	3
LL4	It favours the development of mechanical tissues.	Yes/ No	4
LL5	It helps in the removal of excess of water since plants absorb more water than acquired. It also maintains "optimum turgidity".	Yes/ No	5
LL6	The anatomy of leaf is designed for gaseous exchange and transpiration is a natural consequence of leaf anatomy. Therefore, a necessary evil.	Yes/ No	6
LL7	Transpiration through loss of H_2O from stomata regulates temperature. Therefore, a necessary evil.	Yes/ No	7

Unit 1: Chapter 8

Problem **Self-awareness**

Q.48	**Who discovered ATP ?**	**Answer**	**Weigh-tage**
LL1	The German chemist Karl Lohmann discovered ATP.	Yes/ No	1
LL2	ATP is the universal carrier of chemical energy in the cell and 'energy rich phosphate bonds'.	Yes/ No	2

Unit 1: Chapter 9

Problem **Decision-making**

Q.49	**Name the different types of Redox reactions.**	**Answer**	**Weigh-tage**
LL1	There are the Reduction-Oxidation reactions.	Yes/ No	1
LL2	These reactions transfer one or more electrons or hydrogen atoms in which there is a donor and acceptor molecule.	Yes/ No	2

LL3	Four types of Redox reactions are : i) Direct electron transfer ii) Transfer of hydrogen atom iii) Transfer of hydride ion iv) Direct reaction of hydrogen and oxygen	Yes/ No	3

Unit 1: Chapter 9

Problem **Decision-making**

Q.50	**Which is the energy currency in the cell ?**	**Answer**	**Weigh-tage**
LL1	Adenosine triphsophate (ATP) is the energy currency in the cell.	Yes/ No	1
LL2	ATP can be broken down to release energy in the form of calories.	Yes/ No	2

Unit 1: Chapter 9

Problem **Decision-making**

Q.51	**What is the function of ATP synthase?**	**Answer**	**Weigh-Tage**
LL1	The synthesizing of ATP from ADP in organic phosphate is catalysed by the enzyme ATP synthase.	Yes/ No	1
LL2	They are named F_oF_1 particles in mitochondria and CF_oCF_1 particles in chloroplasts.	Yes/ No	2

Unit 1: Chapter 9

Problem **Effective communication**

Q.52	**Explain the concept of chemi-osmosis.**	**Answer**	**Weigh-tage**
LL1	Chemi osmotic hypothesis was proposed by Peter Mitchell.	Yes/ No	1
LL2	He proposed a mechanism by which ATP is formed in Mitochondria and Chloroplasts.	Yes/ No	2
LL3	There is establishment of a proton gradient across a membrane as a source of potential energy to form ATP from ADP and PI.	Yes/ No	3

LL4	Firstly, some of the energy released during electron transfer in redox reactions is used in pumping across a membrane into a lumen.	Yes/ No	4
LL5	This is followed by the accumulation of protons on one side of the membrane and a difference in H^+ concentration or a gradient develops. This represents a reservoir of potential energy called the proton motive force.	Yes/ No	5

Unit 1: Chapter 10

Problem **Self-awareness**

	Q.53 Whose radioisotopic experiments proved that oxygen comes from water?	**Answer**	**Weigh-tage**
LL1	C.B.Van Niel proposed that oxygen released in photosynthesis comes from water.	Yes/ No	1

Unit 1: Chapter 10

Problem **Self-awareness**

	Q.54 Who established the first action spectrum?	**Answer**	**Weigh-tage**
LL1	T.W.Englemann established the first action spectrum.	Yes/ No	1
LL2	He used the alga Spirogyra and aerobic bacteria were subject to different wavelengths of light and clearly demonstrated and the wavelength of light which is more effective in photosynthesis.	Yes/ No	2

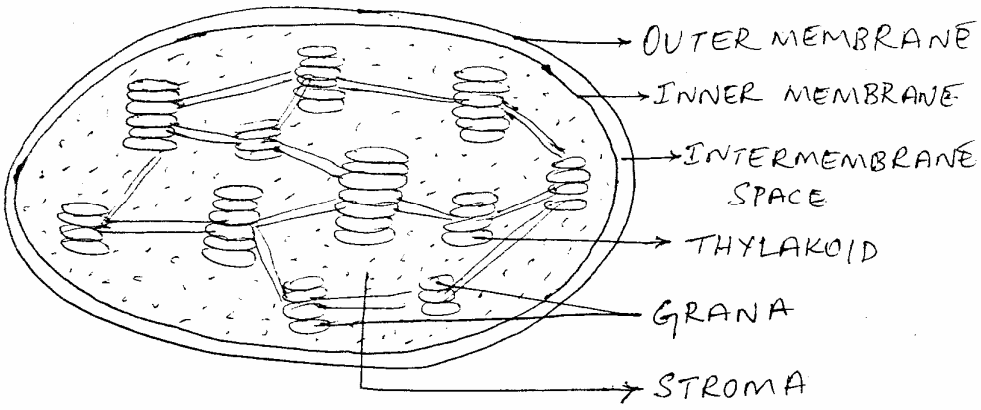
Unit 1: Chapter 10

Problem **Effective communication**

	Q.55 State the law of limiting factors.	**Answer**	**Weigh-tage**
LL1	F.F.Blackman proposed the law of limiting factors.	Yes/ No	1
LL2	Limiting factors states that "when a process is conditioned as to its rapidity by a number of separate factors, the rate of the process is limited by the pace of the slowest factor.	Yes/ No	2

Problem **Creative thinking**

	Q.56 Draw a section of the chloroplast and label.	**Answer**	**Weigh-tage**
LL1	Photosynthesis in eukaryotes is confined only to the organelles called chloroplasts.	Yes/ No	1
LL2	A chloroplast has 2 membranes outer and inner, composed of a lipid bilayer. The two membranes are separated by an intermembranal compartment.	Yes/ No	2
LL3	Chloroplast contains a fairly homogenous gel-fluid which is called stroma or matrix.	Yes/ No	3
LL4	The thylakoids are flattened sacs or vesicles constituting the third membrane system of a chloroplast. They are arranged in the form of stacks within the stroma.	Yes/ No	4
LL5	A stack of thylakoids is called a Granum. The stacked membranes are grana lamellae.	Yes/ No	5



Ultrastructure of a chloroplast

Unit 1: Chapter 10

Problem **Decision-making**

Q.57	**Name the steps in the Calvin- Benson cycle.**	**Answer**	**Weigh-Tage**
LL1	The stroma reactions occur in the stroma of a chloroplast and are independent of light.	Yes/ No	1
LL2	The steps of cycle are as follows : i) Fixation of CO_2 by Ru1, 5 BP. ii) Splitting iii) Second phosphorylation iv) Reduction v) Regeneration of Ru1, 5BP	Yes/ No	2

Unit 1: Chapter 11

Problem **Creative thinking**

Q.58	**Write an equation for aerobic respiration.**	**Answer**	**Weigh-Tage**
LL1	Aerobic respiration is defined as complete oxidation of fuel molecules to simpler molecules like CO_2 and H_2O in the presence of molecular O_2. $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 278$ K cal	Yes/ No	1
LL2	The process releases 278 k cal of energy.	Yes/ No	2

Unit 1: Chapter 11

Problem **Problem-solving**

Q.59	**List the four major steps in Aerobic Respiration.**	**Answer**	**Weigh-tage**
LL1	Aerobic respiration occurs in the presence of molecular oxygen.	Yes/ No	1
LL2	Four major steps include Glycolysis, preparatory reactions of Krebs cycle, Krebs cycle and electron transport and ATP synthesis.	Yes/ No	2

Unit 1: Chapter 11

Problem **Problem-solving**

Q.60	**What is the ATP yield in Kreb's cycle?**	**Answer**	**Weigh-tage**
LL1	ATP is produced only when succinyl COA in the Krebs cycle is converted to succinate.	Yes/ No	1
LL2	It is a high energy compound and energy is released when there is hydrolysis of its thioester bond is used in adding an inorganic phosphate group to GDP to produce GTP.	Yes/ No	2
LL3	In this reaction GTP transfers its phosphate group to ADP to form ATP.	Yes/ No	3
LL4	Hence only one ATP molecule is formed in Kreb's cycle.	Yes/ No	4

Unit 1: Chapter 11

Problem **Problem-solving**

Q.61	**What is the yield of ATP in Electron Transport Chain?**	**Answer**	**Weigh-tage**
LL1	ETC is Electron Transport Chain .	Yes/ No	1
LL2	2NADH from glycolysis = Total 6 ATPs 2 NADH from preparatory reactions = total 6 ATPs 6 NADH from Krebs cycle = Total 18 ATPs 2 $FADH_2$ from Krebs cycle = Total 4 ATPs	Yes/ No	2
LL3	The yield of ATP is 34 ATPs.	Yes/No	3

Unit 1: Chapter 11

Problem **Effective communication**

Q.62	**Explain the term Pasteur effect.**	**Answer**	**Weigh-tage**
LL1	Facultative anaerobes break down respiratory fuels either by aerobic respiration or by fermentation.	Yes/ No	1
LL2	When they are involved in fermentation, supply of O_2 will make yeast cells switch over to the aerobic process and utilize less respiratory substrate.	Yes/ No	2

LL3	Such a change from an anaerobic to an aerobic process with a reduction in the amount of respiratory substrate consumed due to availability of oxygen is called Pasteur effect.	Yes/ No	3

Unit 1: Chapter 12

Problem **Self-awareness**

Q.63	**Name two horticultural uses of Gibberellins.**	**Answer**	**Weigh-tage**
LL1	Gibberellins were first discovered by Japanese scientist Eiichi Kurosawa in 1926 while studying the foolish seedling disease in paddy plants.	Yes/ No	1
LL2	The Gibberellins are extracted from the fungi cultures.	Yes/ No	2
LL3	Many horticultural applications include growing of Thomson seedless grapes by parthenocarpy to increase their berry size.	Yes/ No	3
LL4	Increasing the height of the sugarcane plant by stimulating internodal elongation for better yield.	Yes/No	4

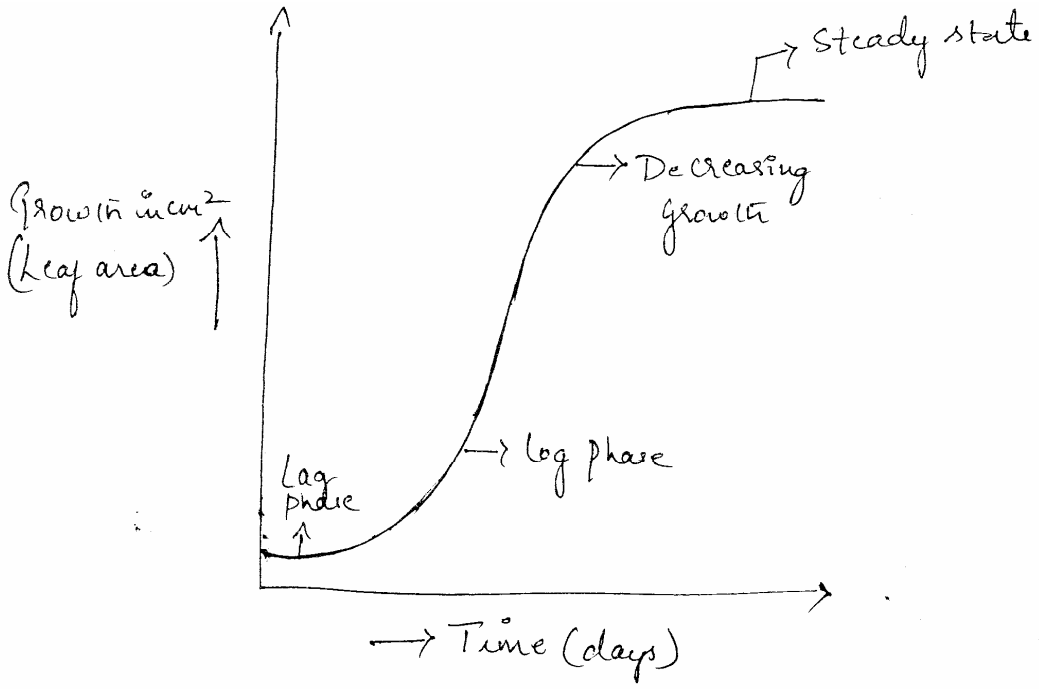
Unit 1: Chapter 12

Activity **Creative thinking**

Q.64	**Draw a growth curve and label.**	**Answer**	**Weigh-tage**
LL1	Growth is one of the most fundamental characteristics of living organisms. It is a vital process which brings about a permanent and irreversible change in the size or volume of the living material.	Yes/ No	1
LL2	Growth in the early stages is slow. Then it increases rapidly to the maximum and gradually decreases and ultimately stops altogether.	Yes/ No	2
LL3	When such a growth is measured in terms of height, weight or volume and plotted against time, a growth curve is obtained. This is known as “growth curve or sigmoid” curve. It is S-shaped in structure.	Yes/ No	3

LL4 Sigmoid curve has 4 different parts : They are Yes/No 4

- Lag phase
- Log phase
- Decelerating phase
- Stationary phase



Growth Curve

Unit 2: Chapter 13

Problem **Effective communication**

Q.65	**Define Heredity.**	**Answer**	**Weigh-tage**
LL1	All organisms have the ability to produce offspring like themselves.	Yes/ No	1
LL2	Every new generation of organisms resemble the older generation to a greater or lesser extent.	Yes/ No	2
LL3	Resemblances are due to transmission of characters from parents to offsprings.	Yes/ No	3
LL4	The transmission of characters from parents to offspring is called heredity.	Yes/ No	4

Unit 2: Chapter 13

Problem **Effective communication**

Q.66	**State Mendel's Second Law.**	**Answer**	**Weigh-tage**
LL1	Gregor John Mendel is referred to as 'Father of Genetics'.	Yes/ No	1
LL2	Mendel carried out 'breeding and crossing' experiments.	Yes/ No	2
LL3	Mendel said transmission of characters take place through factors.	Yes/ No	3
LL4	Whenever a pair of factors for a character is brought together in a hybrid the factors segregate or separate during the formation of gametes. This is Mendel's second law.	Yes/ No	4

Unit 2: Chapter 13

Problem **Critical thinking**

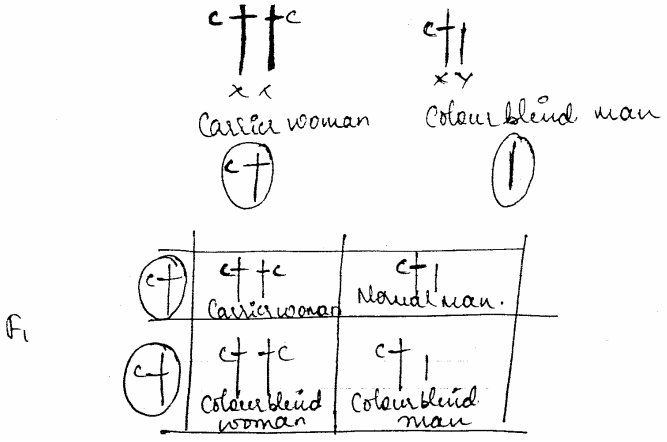
Q.67.	**In which cross do you get 9 : 3 : 3 : 1 ratio?**	**Answer**	**Weigh-tage**
LL1	The crossing of individuals differing in two pairs of alleles that determines two separate characters is known as dihybrid cross.	Yes/ No	1

LL2	Mendel selected two traits for his crosses. One is seed colour and the other seed shape.	Yes/ No	2
LL3	Individuals with round, yellow seeds is crossed with those having green and wrinkled seeds.	Yes/ No	3
LL4	The plants obtained produced only round and yellow seeds in the F_1 generation.	Yes/ No	4
LL5	In order to segregate the gametes the F_1 generation was selfed.	Yes/ No	5
LL6	Mendel noted 4 different types of plants in F_2 - Two parental types and two non-parental types.	Yes/ No	6
LL7	When the number of offsprings were counted, they were in the ratio of approximately 9 : 3 : 3 : 1.	Yes/ No	7

Unit 2: Chapter 13

Problem **Problem-solving**

	Q.68 What are the expected children in a marriage between a carrier woman and a colour blind man?	**Answer**	**Weigh-tage**
LL1	Colour blindness is a sex linked recessive condition in which an individual is insensitive to certain wavelengths of light.	Yes/ No	1
LL2	The gene responsible for producing the photosynthetic pigment in the cones is located on the X-chromosome. Hence it is sex-linked inheritance.	Yes/ No	2
LL3	A cross between carrier woman and colour blind man would be as follows :	Yes/ No	3



LL4	The expected children are 1 carrier woman, 1 colour blind woman, 1 normal man and 1 colour blind man.	Yes/No	4

Unit 2: Chapter 13

Problem **Self-awareness**

Q.69	**Who discovered the Rh factors?**	**Answer**	**Weigh-tage**
LL1	The ABO blood group system in man is further differentiated by '+' or '–'.	Yes/ No	1
LL2	It is presented by Rh. Rh stands for Rhesus factor. It is a protein associated with the RBC membrane.	Yes/ No	2
LL3	It was found in the rhesus monkey. (M*accaca mulatta)*	Yes/ No	3
LL4	It was noticed by Philip Lavine and R.E. Stenton in 1939 and later by Landsteines and A.S.Weiner in 1940.	Yes/ No	4

Unit 2: Chapter 13

Problem **Decision-making**

Q.70	**Which condition is produced by partial monosomy of chromosome-5 ?**	**Answer**	**Weigh-tage**
LL1	Partial monosomy is the deletion of a part of the short arm of chromosome-5.	Yes/ No	1
LL2	Cri-du-chat syndrome is produced by the monosomy of 5-P chromosome.	Yes/ No	2
LL3	The affected person has a small head widely parted eyes and developmental delay.	Yes/ No	3

Unit 2: Chapter 13

Activity **Creative thinking**

Q.71	**Make a punnet square to represent a cross between TT and tt.**	**Answer**	**Weigh-tage**
LL1	The punnet square is a chart or grid developed by the British Geneticist Reginald C.Punnet. It allows one to visualize the probable results of genetic crosses.	Yes/ No	1

LL2		Yes/ No	2

t

Gametes of dwarf plant (tt)

Gametes of tall plants (TT)		t	t
	T	Tt	Tt
T T	T	Tt	Tt

All are tall.

LL3	Results of the cross between pure tall and pure dwarf worked out using Punnet square. All are hybrid tall.	Yes/ No	3

Unit 2: Chapter 14

Problem **Effective communication**

Q.72	**Define Endemism.**	**Answer**	**Weigh-tage**
LL1	The word endemic is derived from Greek, where 'en' means within and 'demos' means population.	Yes/ No	1
LL2	The word is used in referring to any taxonomic unit or taxon which occurs in a restricted area, a mountain range or an island.	Yes/ No	2

Unit 2: Chapter 14

Problem **Effective communication**

Q.73	**What is bio-piracy?**	**Answer**	**Weigh-tage**
LL1	Biopiracy is a type of unethical practice of procuring biological wealth from other countries and patenting it subsequently for commercial purposes.	Yes/ No	1
LL2	India is a victim of biopiracy due to biodiversity.	Yes/ No	2
LL3	Biopirates obtain vast materials from less developed countries and claim it as their own.	Yes/ No	3
LL4	Eg. Basmati rice, pepper and turmeric are biopirated.	Yes/No	4

Unit 2: Chapter 14

Problem **Self-awareness**

	Q.74 Mention two animals endemic to Karnataka.	**Answer**	**Weigh-tage**
LL1	Endemism refers to the taxonomical spp. Or restricted to a particular habitat.	Yes/ No	1
LL2	Endemic area is defined as an area where species have a restricted distribution or habitat.	Yes/ No	2
LL3	Tiger, leopard cat are endemic to Karnataka.	Yes/No	3

Unit 2: Chapter 14

Problem **Self-awareness**

	Q.75 What is patent? What is patenting and what is being patented?	**Answer**	**Weigh-tage**
LL1	Patenting provides an individual or company absolute and complete monopoly to market a new variety of animal/ plant product, derived from the original, as if it is private property.	Yes/ No	1
LL2	The person who discovers the plant or animals for the first time patents it.	Yes/ No	2
LL3	Patents are given to several types of items. They are i) A new product, either unknown agricultural or medical, produced or invented, using new technology and useful to humans. This is a utility patent. (ii) Genetically modified plants or animals with a specific ability to produce substances of human importance. This is a genetic engineering or biotechnology patent.	Yes/No	3

Unit 2: Chapter 15

Problem **Effective communication**

	Q.76 What is Ethnobiology?	**Answer**	**Weigh-tage**
LL1	Variety of plants/ animals in the world is termed as biodiversity.	Yes/ No	1

LL2	The biodiversity remains conserved because of traditional ecological knowledge.	Yes/ No	2
LL3	The practising of traditional ecological knowledge is for the conservation of biodiversity.	Yes/No	3

Unit 2: Chapter 15

Problem **Self-awareness**

Q.72	**Give two names of National Parks of Karnataka.**	**Answer**	**Weigh-tage**
LL1	National Parks are large areas or land selected and developed by the government to preserve flora and fauna.	Yes/ No	1
LL2	Bandipur National Park and Bannerghatta National Park are the wild national parks of Karnataka.	Yes/ No	2

Unit 2: Chapter 15

Problem **Self-awareness and Effective communication**

Q.78	**Mention any two methods of in-situ conservation.**	**Answer**	**Weigh-tage**
LL1	Insitu conservation includes the establishment of national parks and biosphere resource in the wild for the protection of biological diversity.	Yes/ No	1
LL2	It includes – Species preservation and assemblage protection.	Yes/ No	2

Unit 2: Chapter 15

Problem **Effective communication**

Q.79	**Explain any two methods of soil conservation.**	**Answer**	**Weigh-tage**
LL1	Soil conservation is prevention of soil erosion and preservation of soil structure.	Yes/ No	1
LL2	It can be done by animal manuring. Animal manure is faecal material and urine of livestock.	Yes/ No	2
LL3	It can be done by Green manuring. Green manure includes the leafy shoots of several species of plants.	Yes/No	3

LL4	Both animal and green manure add organic matter to the soil and increase water retention thereby preserving soil.	Yes/No	4

Unit 2: Chapter 15

Problem **Critical thinking**

Q.80	**Mention two aims of watershed management.**	**Answer**	**Weigh-tage**
LL1	Watershed management is the handling of water resources by creating a common water course.	Yes/ No	1
LL2	It is done to break the force of moving water.	Yes/ No	2
LL3	It is done to allow standing water to percolate and recharge ground water.	Yes/No	3
LL4	It is done to prevent flooding.	Yes/No	4

Unit 2: Chapter 16

Problem **Critical thinking and Effective communication**

Q.81	**State normal values of Fasting and post prandial levels of glucose.**	**Answer**	**Weigh-tage**
LL1	Levels of glucose differ after fasting and after food.	Yes/ No	1
LL2	The fasting glucose level is estimated to be 80 – 100 mg/ dL of blood.	Yes/ No	2
LL3	The post prandial glucose is glucose level measured after meal and is 160 mg/dl.	Yes/No	3

Unit 2: Chapter 16

Problem **Critical thinking**

Q.82	**List any four symptoms of Diabetes mellitus.**	**Answer**	**Weigh-tage**
LL1	Diabetes mellitus is insulin dependent Diabetes.	Yes/ No	1
LL2	First symptom is excretion of glucose in urine.	Yes/ No	2

LL3	The second symptom is thirst and dry mouth due to dehydration.	Yes/No	3
LL4	Third symptom is increased excretion of water in urine or polyuria.	Yes/No	4
LL5	Tiredness or fatigue, loss of weight and wasting and other symptoms.	Yes/No	5

Unit 2: Chapter 16

Problem **Critical thinking**

	Q.83 Explain the terms (i) Internal environment, (ii) role of insulin and glucagon in homeostasis.	**Answer**	**Weigh-tage**
LL1	Internal environment : Claude Bernard who used the French expression 'millieu interieur' means internal environment.	Yes/ No	1
LL2	In the human body the internal environment is the extracellular fluid which includes all fluids occurring outside cells including plasma and lymph.	Yes/ No	2
LL3	(ii) Role of Insulin and Glucagon Insulin increases the number of glucose transporters in cell membranes, allowing movement of more glucose into cells from blood.	Yes/No	3
LL4	Insulin promotes increased glucose utilization by cell to derive energy.	Yes/No	4
LL5	Glucagons acts as a hyperglyaemic factor by mobilizing glucose from stored reserves.	Yes/No	5
LL6	Glucagons promotes gluconeogenesis in the liver helping to create a new source of glucose in blood.	Yes/No	6

Unit 2: Chapter 17

Problem **Effective communication**

	Q.84 Name the two types of defence systems of the human body.	**Answer**	**Weigh-tage**
LL1	The survival of the body itself will depend on the possession of an effective defence mechanism for its protection.	Yes/ No	1

LL2	Non-specific defence and specific defence are the two types of defence systems of the human body.	Yes/ No	2
LL3	Examples of non-specific defence system is the skin.	Yes/No	3
LL4	Example of specific defence and stem is WBC/ Lymphocytes.	Yes/No	4

Unit 2: Chapter 17

Problem **Self-awareness**

Q.85	**What is the contribution of Edward Jenner?**	**Answer**	**Weigh-tage**
LL1	Edward Jenner introduced the idea that immunity might be induced against a disease deliberately.	Yes/ No	1
LL2	A milkmaid stated that she could not be disfigured by small pox as she had already contracted a mild disease viz. cow pox.	Yes/ No	2
LL3	Jenner concluded that introducing cow pox might provide protection against small pox.	Yes/No	3
LL4	The cow pox immunized the milkmaid against small pox.	Yes/No	4

Unit 2: Chapter 17

Problem **Critical thinking**

Q.86	**What does the prefix T in T-lymphocyte mean?**	**Answer**	**Weigh-tage**
LL1	T-lymphocytes are involved in the cellular or cell-mediated immunity.	Yes/ No	1
LL2	T-cells though produced initially in the bone marrow become immuno competent.	Yes/ No	2
LL3	The prefix T indicates that it has passed through the thymus gland and they have become Thymocytes.	Yes/No	3

Unit 2: Chapter

Problem **Effective communication and Critical thinking**

Q.87	**Write a note on vaccination.**	**Answer**	**Weigh-tage**
LL1	The term vaccination was first named by Louis Pasteur, in honour of Jenner.	Yes/ No	1
LL2	Vaccination is the process of administering a vaccine. It is either injecting or giving drops orally. While in some cases a single vaccination is enough to provide life long immunity, in others two to three 'booster doses' are required.	Yes/ No	2
LL3	An ideal vaccine should a) promote effective immunity b) confer life long protection c) be safe d) be stable e) be cheap and effective f) be such that no disease must be caused.	Yes/No	3
LL4	The three types of vaccines are - toxoids - killed or inactivated vaccines - live attenuated vaccines	Yes/No	4

Unit 2: Chapter 18

Problem **Effective communication**

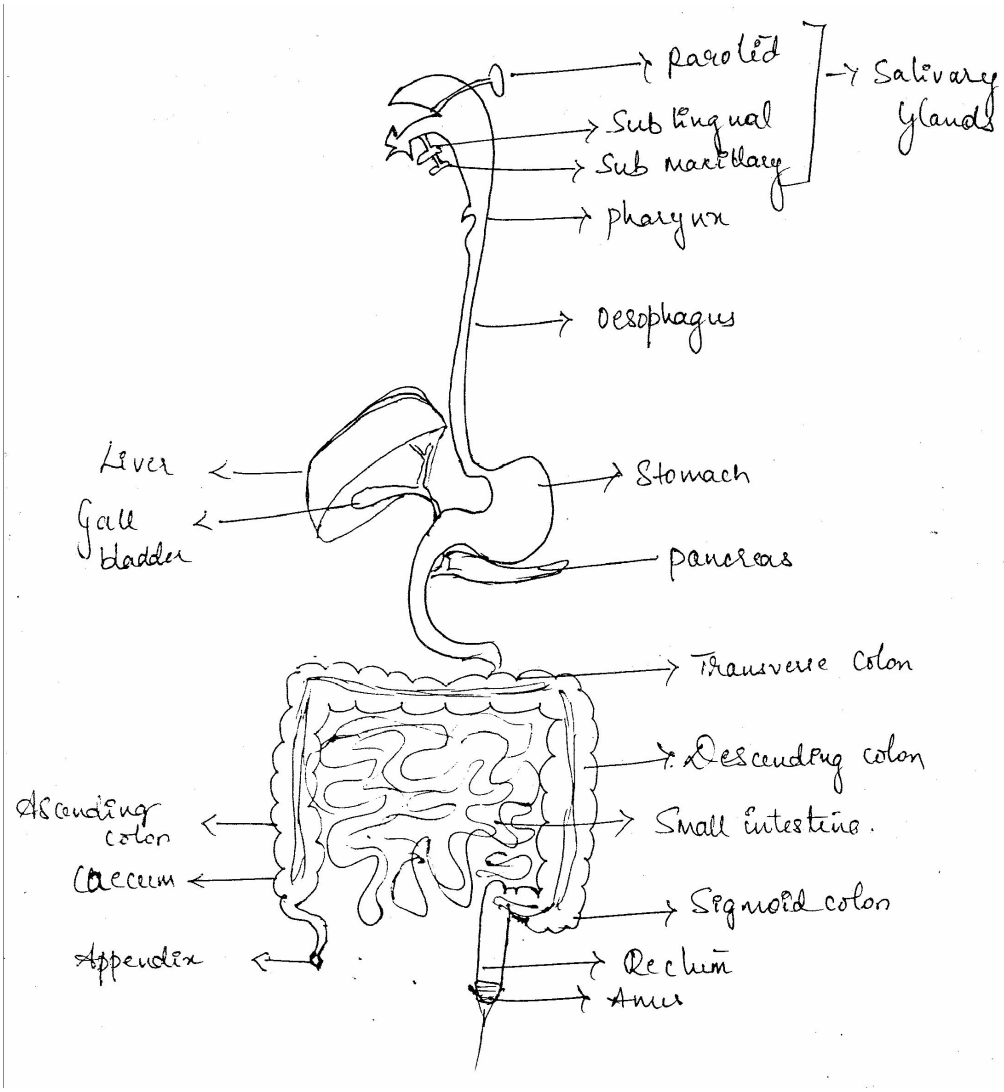
Q.88	**Write a note on hyperacidity.**	**Answer**	**Weigh-tage**
LL1	The increased secretion or abnormal secretion of hydrochloric acid by the parietal cells of the gastric glands of the stomach. This condition is also called hyperchlorhydria or hyperhydrochloria.	Yes/ No	1
LL2	Effect of hyperacidity is peptic ulcer formation.	Yes/ No	2

Unit 2: Chapter 18

Activity **Creative thinking**

Q.89	**Draw a labelled diagram of digestive system of man.**	**Answer**	**Weigh-Tage**
LL1	Digestive system starts from the oral cavity and ends with anus.	Yes/ No	1

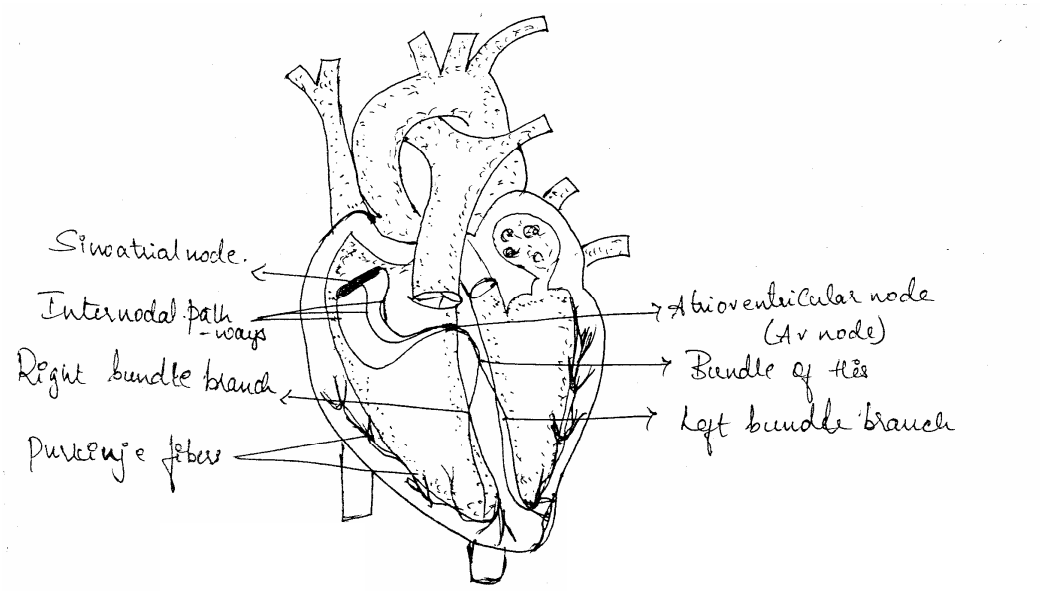
LL2	The oral cavity is bounded by upper and lower lips and palate at the roof and the tongue on its floor.	Yes/ No	2
LL3	The tongue lies on the floor of the mouth cavity and teeth are within the sockets of jaw bones.	Yes/No	3
LL4	Four types of teeth can be found i.e. 2 incisors, a single canine, 2 premolars and 3 molars.	Yes/No	4
LL5	The pharynx is situated at the back of the mouth cavity. It has 3 divisions – plaspharynx, oropharynx and laryngopharynx.	Yes/No	5
LL6	Oesophagus is a muscular tube which lies behind trachea and connects the pharynx with the stomach.	Yes/No	6
LL7	Oesophagus then enters the abdomen after passing through the diaphragm and joins stomach.	Yes/No	7
LL8	The stomach is large hollow muscular organ which lies under the diaphragm on the left side of the body in the abdominal cavity.	Yes/No	8
LL9	The small intestine extends between the stomach and large intestine. It has 3 regions – duodenum, Jejunum and Ileum.	Yes/No	9
LL10	The large intestine extends from iliocoecal valve to the anus. It is divisible into caecum, appendix, colon, rectum and anal canal.	Yes/No	10
LL11	The caecum is found attached with the vermiform appendix.	Yes/No	11
LL12	The colon ends in a terminal portion called anal canal.	Yes/No	12



Digestive System of Man

Activity **Creative thinking**

	Q.90 Draw a labelled diagram of the circulatory system of the heart.	**Answer**	**Weigh-Tage**
LL1	The part of the myocardium which generates the impulse for contraction and the parts which conduct the impulse together form the conducting system of the heart.	Yes/ No	1
LL2	Sinoatrial node is also called cardiac pacemaker. It is named pacemaker because it establishes the rate of beating of the heart.	Yes/ No	2
LL3	Internodal tracts are 3 bundles of specialized conducting cardiac muscle fibres that connect the SA node with the AV node.	Yes/ No	3
LL4	Atrioventricular node is another mass of nodal tissue situated above the tricuspid value.	Yes/ No	4
LL5	Bundle of this is the continuation of AV node and is located on the right side of the interventricular septum. It divides into right and left bundle branches.	Yes/ No	5
LL6	Right and left bundle branches proceed on each side of the inter ventricular septum. These distribute the impulses on the middle surface of the ventricles to the purkinje fibres and papillary muscles.	Yes/ No	6
LL7	Purkinje /conduction myofibres arise from the bundle branches and get connected to the cardiac muscle fibres.	Yes/ No	7
LL8	The system generates potentials at Sinoatrial node and conducts them throughout the myocardium.	Yes/No	8



Conducting System of Human Heart

Unit 2: Chapter 19

Problem **Problem-solving and Effective communication**

Q.91	**Write a note on hypertension and hypotension.**	**Answer**	**Weigh-tage**
LL1	The lateral pressure exerted by the column of blood on the wall of blood vessels is generally termed as blood pressure.	Yes/ No	1
LL2	Hypertension is a condition where the Diastolic blood pressure exceeds 90 mm Hg irrespective of systolic blood pressure.	Yes/ No	2
LL3	Hypotension is a condition when the systolic blood pressure and diastolic blood pressure fall below the normal values is 100 and 50 mm Hg respectively.	Yes/No	1

Unit 2: Chapter 19

Problem **Problem-solving and Effective communication**

Q.92	**Explain Stroke Volume and Cardiac output.**	**Answer**	**Weigh-tage**
LL1	Stroke volume is the amount of blood ejected by the ventricle per beat of the heart.	Yes/ No	1
LL2	Cardiac output is stroke volume multiplied by heart rate.	Yes/ No	2

Unit 2: Chapter 20

Problem **Problem solving**

Q.93	**What is Adam's apple?**	**Answer**	**Weigh-Tage**
LL1	Two major components of respiratory tract are (i) upper respiratory tract, (ii) lower respiratory tract.	Yes/ No	1
LL2	Upper respiratory tract consists of nostrils, nasal cavities, pharynx and larynx.	Yes/ No	2
LL3	Larynx is a chamber measuring about 5 cm in height.	Yes/No	3
LL4	The projecting front part of the larynx can be felt in front part of the neck; this is referred to as Adam's apple.	Yes/No	4
LL5	Adam's apple has no particular role in respiration.	Yes/No	5

Unit 2: Chapter 20

Problem **Problem solving**

Q.94	**Differentiate left lung from right lung.**	**Answer**	**Weigh-Tage**
LL1	Lungs are spongy pyramidal structures located in the chest cavity.	Yes/ No	1
LL2	Left lung is smaller weighing about 550 g.	Yes/ No	2
LL3	It is divided into 2 lobes : Superior, Inferior.	Yes/No	3
LL4	It has a cardiac notch to accommodate the tip of the heart.	Yes/No	4
LL5	It is larger and weighs 650 g.	Yes/No	5
LL6	The right lung is divided into 3 lobes : Superior, Middle, Inferior.	Yes/ No	6
LL7	Cardiac notch is absent here.	Yes/No	7

Unit 2: Chapter 20

Problem **Problem-solving and Effective communication**

Q.95	**Explain the parts of the respiratory system of man briefly.**	**Answer**	**Weigh-tage**
LL1	The organs involved in the respiration constitute the respiratory system.	Yes/ No	1
LL2	Respiratory system is composed of two major parts : Upper respiratory tract Lower respiratory tract	Yes/ No	2
LL3	Upper respiratory tract is composed of nostrils, oral cavities, pharynx and larynx whereas the lower consists of trachea, bronchi, their branches and alveoli.	Yes/No	3
LL4	Nostrils are the external openings situated at the projecting part of the face called nose. The nasal cavities open posteriorly into the nasal part of the pharynx by the way of internal nostrils.	Yes/No	4
LL5	Pharynx is commonly called throat. Pharynx is divided into 3 regions : Nasopharynx, oropharynx and laryngopharynx.	Yes/No	5
LL6	Larynx is a chamber formed by 9 cartilages and connected to each other by ligaments and skeletal muscles.	Yes/No	6
LL7	The projecting part of the larynx is called 'Adam's apple'. The larynx has vocal folds within it. Vibration of these vocal folds produces sound.	Yes/No	7
LL8	Lower respiratory tract is also called the tracheo bronchial tree. It is divisible into two components : Conducting zone, Respiratory zone	Yes/No	8
LL9	Trachea is the wind pipe which extends from larynx down through the neck into the thorax. It lies in front of oesophagus.	Yes/No	9
LL10	Respiratory bronchioles are the finest tubes and they represent the starting points of the respiratory zone.	Yes/No	10
LL11	The alveoli are the structural and functional units of the respiratory system and are the sites of actual exchange of gases.	Yes/No	11

LL12	In addition, there are roaming phagocytic cells named alveolar maesophages which are involved in defence.	Yes/No	12

Unit 2: Chapter 21

Problem **Problem solving and Effective communication**

Q.96	**Describe the parts of a renal corpuscle.**	**Answer**	**Weigh-tage**
LL1	Each kidney is made up of microscopic tubes called renal corpuscle/renal tubules. These are called the structural and functional units of a kidney.	Yes/ No	1
LL2	Renal corpuscle consists of two parts. It is in form of a double walled cup called Bowman's capsule.	Yes/ No	2
LL3	Within the Bowman's capsule a tuft of capillaries called Glomerulus are present. The renal corpuscle lies in the cortex of the kidney.	Yes/No	3
LL4	Proximal convoluted tubule starts from the base of the renal corpuscle.	Yes/No	4
LL5	Henle's loop is a U-shaped portion of the nephron. It helps in concentrating urine.	Yes/No	5
LL6	Distal convoluted tubule is the second coiled portion and represents thick segment of Henle's loop.	Yes/No	6
LL7	Collecting tubules form a branched system. They extend from cortex into the medulla and open into renal pelvis.	Yes/No	7

Unit 2: Chapter 22

Problem **Problem-solving and Creative thinking**

Q.97	**Expand ACTH.**	**Answer**	**Weigh-tage**
LL1	It is the hormone of the Anterior pituitary and is called Adenocorticotropic hormone.	Yes/ No	1
LL2	It stimulates the cortex of the adrenal gland to produce its secretions called Glucocorticoids.	Yes/ No	2

Unit 2: Chapter 22

Problem **Self-awareness**

Q.98	**Give examples of Reflex actions.**	**Answer**	**Weigh-tage**
LL1	Reflex action may be defined as an automatic, stereotyped, rapid predictable involuntary motor response to a stimulus.	Yes/ No	1
LL2	The knee-jerk action is a reflex action.	Yes/ No	2
LL3	Blinking of eye when an object is brought near the eye or conjuctiva is lightly touched.	Yes/No	3

Unit 2: Chapter 22

Problem **Effective communication**

Q.99	**Describe the spinal cord.**	**Answer**	**Weigh-tage**
LL1	Spinal cord is a glistening whitish tubular structure which extends from the base of the brain to the level of the second lumbar.	Yes/ No	1
LL2	Its upper and lower surfaces are marked by anterior tissue and posterior median sulcus respectively.	Yes/ No	2
LL3	The tapering cone-shaped end of the cord is called conus medullaris.	Yes/ No	3
LL4	It has grey and white matter.	Yes/ No	4
LL5	Grey matter is occupied in the centre composed of cell bodies of motor neurons and blood capillaries.	Yes/ No	5
LL6	The arms of the grey matter are called dorsal and neutral horns.	Yes/ No	6
LL7	White matter lies outside the grey matter. There are no cell bodies in it.	Yes/ No	7

Unit 2: Chapter 22

Problem **Self-awareness and Empathy and Coping with emotions**

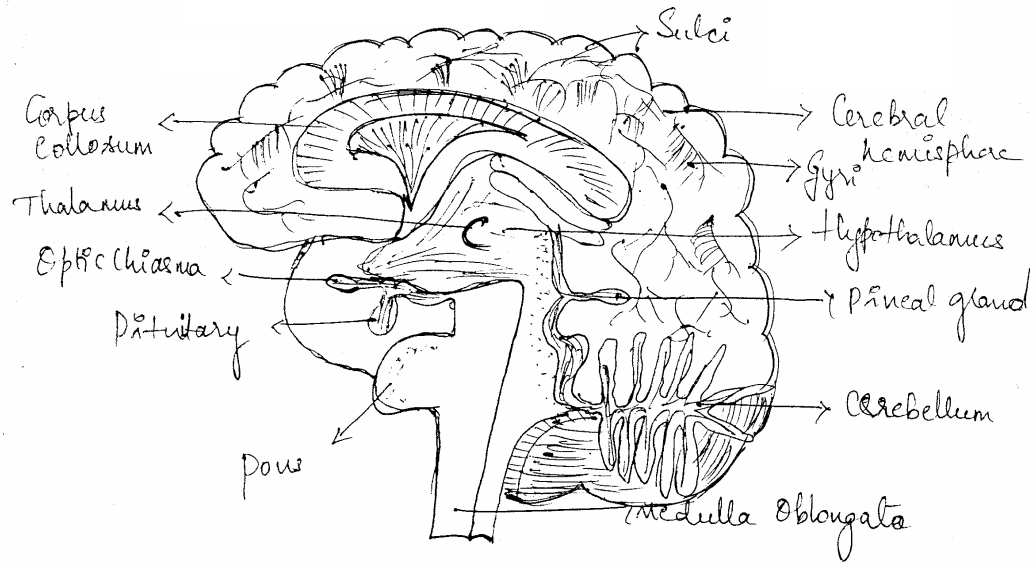
Q.100	**What are drugs? What is drug abuse?**	**Answer**	**Weigh-tage**
LL1	Drug is any substance which when taken into a living organism modifies one or more of its functions.	Yes/ No	1

LL2	Alcohol, tobacco, bhang, morphine, opium, cocaine are some of the narcotic drugs.	Yes/ No	2
LL3	When these drugs are taken in, they change the functioning of brain affecting the way of feeling, thinking, speaking and moving about.	Yes/ No	3
LL4	Excessive use of any narcotic drug or non-medical drug is called drug abuse.	Yes/ No	4

Unit 2: Chapter 22

Activity **Creative thinking**

Q.101	**Draw a sagittal section of human brain and label.**	**Answer**	**Weigh-tage**
LL1	Sagittal is a vertical C Section.	Yes/ No	1
LL2		Yes/ No	2



Sagittal Section of Human Brain

Unit 2: Chapter 22

Empathy **Effective communication**

Q.102	**Simmond's disease.**	**Answer**	**Weigh-tage**
LL1	It is one of the diseases caused by the lack of the anterior pituitary hormone.	Yes/ No	1
LL2	It is named after German physician Morris Simmonds.	Yes/ No	2
LL3	It is caused by the insufficiency of ant pit hormones when it becomes ischemic and its cells undergo degeneration or necrosis.	Yes/No	3
LL4	It is characterized by weight loss, weakness, loss of body hair, arterial low BP and insufficiency of hormones of thyroid gonads.	Yes/No	4

Unit 2: Chapter 23

Problem **Critical thinking**

Q.103	**Which part of the sperm is "engine room"?**	**Answer**	**Weigh-tage**
LL1	A sperm has nucleus forming head and containing nucleus and acrosome.	Yes/ No	1
LL2	Nucleus has chromatin.	Yes/ No	2
LL3	Acrosome contains hydrolytic enzymes and is a large lysosome.	Yes/No	3
LL4	Middle part has mitochondria and is engine room.	Yes/No	4

Unit 2: Chapter 23

Problem **Problem-solving**

Q.104	**Name the major steps in fertilization.**	**Answer**	**Weigh-tage**
LL1	Fertilisation or syngamy is a process of fusion of haploid male and female gametes and their nuclei to produce a diploid zygote/ oosperm.	Yes/ No	1
LL2	The diploid nucleus of the zygote formed as a result of fusion is called the synkaryon.	Yes/ No	2

LL3	Stages include approximation of gametes. • Acrosome reaction • Cortical changes • Amphimixis	Yes/No	3

Unit 2: Chapter 24

Problem **Effective communication**

Q.105	**What is puberty?**	**Answer**	**Weigh-tage**
LL1	Puberty is a transitional period in life.	Yes/ No	1
LL2	It is generally 12 to 15 years of age when sexually immature boys and girls attain sexual maturity and acquire the capacity to reproduce.	Yes/ No	2
LL3	Bodily changes occurring during puberty are called secondary sexual characteristics.	Yes/No	3

Unit 2: Chapter 24

Problem **Decision-making and Effective communication**

Q.106	**Mention any two functions of placenta.**	**Answer**	**Weigh-tage**
LL1	Placenta is an organic association of embryonic or foetal and maternal tissues for the purposes of attachment and physiological change.	Yes/ No	1
LL2	The functions of placenta forms the important part in that it acts as GI tract of the foetus when it allows transport of organic molecules from maternal to the foetus side.	Yes/ No	2
LL3	It also acts as foetal lung when respiratory gases are exchanged across it.	Yes/No	3

Unit 2: Chapter 24

Problem **Effective communication**

Q.107	**Explain any four methods of transmission of AIDS.**	**Answer**	**Weigh-tage**
LL1	AIDS is abbreviated as acquired immuno deficiency syndrome.	Yes/ No	1
LL2	The causal organism is a virus named Acquired Immuno Deficiency Syndrome.	Yes/ No	2
LL3	It is a sexually transmitted disease.	Yes/No	3
LL4	Intimate sexual contact in which HIV passes from an infected partner to non-infected partner.	Yes/No	4
LL5	It can be transmitted by blood transfusion where the blood from the infected person is transfused to the non-infected person.	Yes/No	5
LL6	HIV is transmitted from mother to child the i.e. in a pregnant woman the HIV passes from placenta to the foetus.	Yes/No	6
LL7	Contaminated syringes and needles which are previously used by an infected person, if used by a normal person can easily acquire the HIV virus.	Yes/No	7

***

Tool 7

Preliminary Test Questionnaire for Validation

Class XI

Biology teachers may please answer the following :

Are the questions/ learning levels mentioned simple?	Yes / No
Are the questions/ learning levels mentioned moderate ?	Yes / No
Are the questions/ learning levels mentioned tough/ difficult to attempt?	Yes / No
Are the questions/ learning levels adequate for XI Std ?	Yes / No
Are the questions/ learning levels clear and lucid?	Yes / No
Do the questions reflect a particular life skill ?	Yes / No

viz., Life Skills of

Decision-making

Problem-solving

Creative thinking

Critical thinking

Effective communication

Interpersonal relationships

Self-awareness

Empathy

Coping with emotions

Coping with stress

Questionnaire

LEARNING LEVELS (LL) FOR SELECT PROBLEMS/ACTIVITIES/EXPERIMENTS AND PROJECTS GIVEN IN XI STD. TEXTBOOK

Class IX Std. **Name of Teacher:**

Time : 45 Min. **Name of Student:**

Please tick (✓) one of the options under Yes / No. You are given 45 minutes to answer the questionnaire.

Unit I, Chapter I
Activity

Decision-making

Q.1 Collection of all currently accepted meanings for the word species.

			Ans	**W.**
LL1	:	Cellular organization of the body is the defining feature of life form.	Yes/No	1
LL2	:	Every life form is a species.	Yes/No	2
LL3	:	A life form (species) is a living organism that can sense its surroundings or environment or respond to these environmental stimuli (physical, chemical or biological).	Yes/No	3
LL4	:	Every living organism (species) is aware of its surroundings – i.e. have self-consciousness.	Yes/No	4
LL5	:	Living organisms (species) are self-replicating, evolving and self-regulative interactive systems.	Yes/No	5
LL6	:	All living organisms (species) past, present and future are linked to one another by the sharing of the common genetic material to varying degrees.	Yes/No	6
LL7	:	There are a range and variety of living organisms (species) around us.	Yes/No	7

* Each learning level is to be assessed using two options : Yes / No
* Each learning level is given numerical weightage according to the level eg. LL1 – Wtg – 1; LL9 – Wtg – 9
* The weightage of LL attained with Yes options to be scored to give achievement.

LL8	:	Each different kind of plant, animal or organism that one sees around represents a species.	Yes/No	8
LL9	:	Names of living organisms (species) are standardized through the process of Binomial nomenclature.	Yes/No	9
LL10	:	These standardized names have two components – generic name and the specific epithet.	Yes/No	10
LL11	:	For example, in the scientific name *Mangifera indica*, *Mangifera* represents the genus while *indica* is a particular species.	Yes/No	11
LL12	:	The specific epithet/species starts with a small letter, is underlined and printed in italics.	Yes/No	12
LL13	:	Species forms a unit of classification in taxonomy and forms the lowest category.	Yes/No	13
LL14	:	Taxonomic studies consider a group of individual organizations with fundamental similarities as a species.	Yes/No	14

Unit 1 : Chapter I
Problem **Problem-solving**
Q.2 : Identify the correctly written name of Mango : *Mangifera Indica, Mangifera indica*

			Ans	**W.**
LL1	:	One has to follow the rules of Binomial Nomenclature.	Yes/No	1
LL2	:	The name is in Latin and written in italics.	Yes/No	2
LL3	:	The names are latinised and derived from Latin irrespective of their origin.	Yes/No	3
LL4	:	The first word is genus and the second a specific epithet.	Yes/No	4
LL5	:	Both the words are separately underlined and printed in italics to indicate their Latin origin.	Yes/No	5
LL6	:	The first word denoting genus starts with a capital letter.	Yes/No	6

LL7	:	The specific epithet starts with a small letter.	Yes/No	7
LL8	:	Therefore, the correct name is *Mangifera indica*.	Yes/No	8

Unit I : Chapter I

Problem **Problem-solving**

Q.3 Why are living organisms classified?

			Ans.	**W.**
LL1	:	There is a range and variety of organisms around (Biodiversity).	Yes/No	1
LL2	:	New organisms are continuously being identified.	Yes/No	2
LL3	:	Local names of the same organism vary from place to place reating confusion.	Yes/No	3
LL4	:	Therefore, the need to describe the organism correctly and assign it to a group(identification).	Yes/No	4
LL5	:	The name of a particular organism is standardized the world over through nomenclature (binomial nomenclature).	Yes/No	5
LL6	:	These names ensure that each organism has only one name.	Yes/No	6
LL7	:	This ensures that description of any organism in any part of world should enable people to arrive at the same name.	Yes/No	7
LL8	:	This also ensures that a name has not been used for any other known organism.	Yes/No	8
LL9	:	Classification is the process by which anything is grouped into convenient categories based on some easily observable characters.	Yes/No	9
LL10	:	Taxon is a unit of classification and a convenient category at very different levels.	Yes/No	10
LL11	:	Classification into taxa is done based on characteristics.	Yes/No	11
LL12	:	Classification helps us in knowing more and more about various kinds of organisms.	Yes/No	12

LL13	:	Classification helps us in knowing relationships among various organisms (systematics).	Yes/No	13
LL14	:	Systematics takes into account evolutionary relationships between organisms and gives us an idea about the origin of different forms of life.	Yes/No	14

Unit I Chapter II

Activity **Effective communication**

Q.4 : Are viruses living or non-living? Organise a discussion in your class.

			Ans.	**W.**
LL1	:	Viruses are acellular and are not truly living.	Yes/No	1
LL2	:	Viruses have a unit crystalline structure outside the living cell and are not truly living.	Yes/No	2
LL3	:	Viruses can infect a cell and replicate inside the cell using the machinery of the host cell and therefore are living.	Yes/No	3
LL4	:	Viruses when crystallized give proteins and also contain RNA / DNA.	Yes/No	4
LL5	:	Virus is therefore a nucleoprotein and therefore infectious and are living.	Yes/No	5
LL6	:	Viruses cause diseases like mumps, cold, small pox, herpes and flu and AIDS.	Yes/No	6
LL7	:	Since viruses cause infection when inside a host cell, they are obligate parasites.	Yes/No	7

Unit I Chapter II

Project /Activity **Critical thinking**

Q. 5 : Discuss how classification systems have undergone several changes over a period of time.

			Ans	W.
LL1	:	Aristotle made the first attempt to classify plants scientifically using simple morphological characters.	Yes/No	1
LL2	:	Linnaeus developed a 2-Kingdom system of classification with plants and animals with no distinction between eukaryotes and prokaryotes, unicellular and multicellular organisms and photosynthetic and non-photosynthetic organisms.	Yes/No	2
LL3	:	Whittaker (1969) proposed a 5-Kingdom classification Monera, Protista, Fungi, Plantae and Animalia using characters of cell structure, thallus organization, mode of nutrition, reproduction and phylogenetic relationships.	Yes/No	3
LL4	:	An attempt has been made to evolve a classification system which reflects not only the morphological, physiological and reproductive similarities but is based on evolutionary relationships as well.	Yes/No	4

Unit I :Chapter 3

Problem

Q. 6 : Mention the ploidy of the following :

a) Protonemal cell of a moss **Problem-solving**

			Ans.	W.
LL1	:	The moss is a Bryophyte.	Yes/No	1
LL2	:	Bryophytes are amphibians of the plant kingdom and they grow in moist shaded areas in hills.	Yes/No	2
LL3	:	The predominant stage in the life cycle of a moss is the gametophyte.	Yes/No	3
LL4	:	The gametophyte produces gametes through antheridium and archegonium.	Yes/No	4

LL5	:	The gametophyte of moss has two stages – the first stage is the protonema stage.	Yes/No	5
LL6	:	The protonema stage develops directly from a spore.	Yes/No	6
LL7	:	Spores are haploid.	Yes/No	7
LL8	:	Therefore, the protonema cell of a moss is haploid.	Yes/No	8
LL9	:	The second stage is the leafy stage which develops from the secondary protonema as a lateral bud.	Yes/No	9

b) Zygote of a fern **Problem-solving**

			Ans.	W.
LL1	:	The plant body of a pteridophyte is differentiated into true root, stem and leaves.	Yes/No	1
LL2	:	The pteridophyta has macrophylls in ferns (large leaves).	Yes/No	2
LL3	:	In Ferns, the major phase is a sporophyte.	Yes/No	3
LL4	:	Fern sporophytes have sporangia on sporophylls.	Yes/No	4
LL5	:	Sporophylls form compact structures called cones or strobili.	Yes/No	5
LL6	:	Sporangia produce spores by meiosis in spore mother cell – therefore the spores are haploid.	Yes/No	6
LL7	:	Spores germinate to form free living photosynthetic thalloid gametophyte called prothallus.	Yes/No	7
LL8	:	The gametophytes bear male and female sex organs called antheridia and archegonia respectively.	Yes/No	8
LL9	:	Fusion of male gamete (n) from antheridium and female gamete (n) from archegonium is fertilization.	Yes/No	9
LL10	:	Fertilisation (n + n) results in the formation of a diploid zygote.	Yes/No	10

Unit 1 : Chapter 3
Problem **Critical thinking**

Q. 7 : Both gymnosperms and angiosperms bear seeds, then why are they classified separately?

			Ans.	W.
LL1	:	Gymnosperms are plants in which the ovules are not enclosed by any ovary wall.	Yes/No	1
LL2	:	Ovules remain exposed both before and after fertilization.	Yes/No	2
LL3	:	Ovaries are borne on megasporangia or female strobili.	Yes/No	3
LL4	:	The female strobili/cones are borne in the same tree/or on different trees.	Yes/No	4
LL5	:	The multicellular female gamete that bears two or more archegonia are female sex organs.	Yes/No	5
LL6	:	In angiosperms the pollen grains and ovules are developed in specialized structures called flowers.	Yes/No	6
LL7	:	The seeds are however enclosed by fruits unlike the gymnosperm.	Yes/No	7
LL8	:	Angiosperms are divided into two classes – the dicotyledons and monocotyledons.	Yes/No	8
LL9	:	The dicotyledons have two cotyledons in their seeds.	Yes/No	9
LL10	:	The monocotyledons have one cotyledon in their seeds.	Yes/No	10
LL11	:	Gymnosperms have naked and angiosperms have covered seeds with one/more cotyledons.	Yes/No	11

Unit 1 Chapter 3
Project
Q. 8. Match Col. I and II.

I	II
Chlamydomonas	**Moss**
Cycas	**Pteridophyta**
Selaginella	**Algae**
Sphagnum	**Gymnosperm**

Chlamydomonas			**Problem-solving Ans.**	**W.**
LL1	:	Algae are chlorophyll bearing, simple, thalloid, autotrophic and largely aquatic organisms.	Yes/No	1
LL2	:	*Chlamydomonas* has a single cup-shaped chloroplast, 2 flagella, one eye spot and nucleus in a single cell.	Yes/No	2
LL3	:	*Chlamydomonas* is a microscopic unicellular alga found in water.	Yes/No	3
LL4	:	*Chlamydomonas* is an alga.	Yes/No	4

Cycas			**Problem-solving Ans.**	**W.**
LL1	:	*Cycas* is a plant with unbranched stems, simple or compound leaves.	Yes/No	1
LL2	:	*Cycas* roots contain N_2 – fixing bacteria and therefore are called coralloid roots.	Yes/No	2
LL3	:	*Cycas* bears microsporophyll in cones and megasporophylls in a loose crown at the top.	Yes/No	3
LL4	:	Microsporophylls bear microsporangia.	Yes/No	4
LL5	:	Megasporophylls bear megasporangia or ovules.	Yes/No	5
LL6	:	Ovules are not enclosed by any ovary wall and therefore are exposed.	Yes/No	6
LL7	:	*Cycas* is a Gymnosperm.	Yes/No	7

Selaginella			**Problem-solving Ans.**	**W.**
LL1	:	*Selaginella* has microphyllous sporophyte.	Yes/No	1
LL2		The main plant body is a sporophyte which is differentiated into the root, stem and leaves.	Yes/No	2
LL3	:	Sporophyte bears sporangia subtended by leaf like appendages called sporophytes.	Yes/No	3
LL4	:	The sporophylls form distinct, compact structures called strobili or cones.	Yes/No	4
LL5	:	The sporangia produce spores by meiosis in spore mother cells.	Yes/No	5
LL6	:	The spores germinate to give rise to inconspicuous, small but multicellular free living, mostly photosynthetic thalloid gametophytes called prothallus.	Yes/No	6
LL7	:	*Selaginella* is heterosporous and produces two kinds of spores – mega and microspores.	Yes/No	7
LL8	:	*Selaginella* is a pteridophyte.	Yes/No	8

Sphagnum			**Problem-solving Ans.**	**W.**
LL1	:	*Sphagnum* has plant body differentiated into root like / leaf-like and stem like structures.	Yes/No	1
LL2		Plant body bears multicellular gametangia viz. antheridia and archegonia.	Yes/No	2
LL3	:	Antherozoid fuses with egg to form zygote.	Yes/No	3
LL4	:	Zygote produces a multicellular body called a sporophyte.	Yes/No	4
LL5	:	Sporophyte is not free living, but attached to the photosynthetic gametophyte and derives nourishment from it.	Yes/No	5
LL6	:	Sporophyte cells undergo division to produce haploid spores.	Yes/No	6

LL7	:	Spores germinate to produce gametophyte.	Yes/No	7
LL8	:	*Sphagnum* is a Pteridophyte.	Yes/No	8

Unit I Chapter 4

Project/Activity **Effective communication**

Q.9 Prepare a list of animals that are found parasitic on human beings.

			Ans.	**W.**
LL1	:	Animals exhibit various levels of organizations.	Yes / No	1
LL2	:	Animals have various kinds of symmetry.	Yes / No	2
LL3	:	Presence or absence of coelome (cavity between body wall and cavity wall) is important in classification.	Yes / No	3
LL4	:	Animals are classified based on presence or absence of coelome/ segmentation and notochord.	Yes / No	4
LL5	:	Porifera, Cnideria, Ctenophora, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata and Chordata are animal phyla.	Yes / No	5
LL6	:	*Taenia* (tapeworm), *Fasciola* (liver fluke), *Ascaris* (round worm), *Wucheraria* (filarial worm), *Ancylostoma* (hook worm), *Hirudinaria* (blood sucking leech), *Anopheles*, *Culex, Aedes* (vectors) - have hooks and suckers and appendages for sucking.	Yes / No	6
LL7	:	Therefore, these are parasites.	Yes / No	7

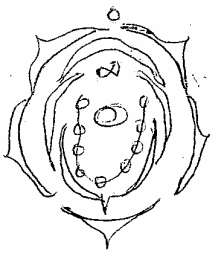
Unit I Chapter 4
Problem **Critical thinking and Effective communication**
Q.10 Reason out why Arthropods constitute the largest group of the animal kingdom

			Ans.	W.
LL1	:	Arthropods have organ system level of organization. Therefore, they are highly evolved.	Yes / No	1
LL2		They are bilaterally symmetrical, triploblastic and coelomate animals.	Yes / No	2
LL3	:	They have a chitinous exoskeleton. Therefore they are protected from harm – a survival feature.	Yes / No	3
LL4	:	They have jointed appendages. Therefore, flexible / highly mobile bodies – a survival feature.	Yes / No	4
LL5	:	Respiratory organs are gills, book-gills, book-lungs or tracheal system – as advanced as chordates.	Yes / No	5
LL6	:	Open circulatory system seen.	Yes / No	6
LL7	:	Sensory organs are well-developed (like antennae, eyes, statocysts or balance organs).	Yes / No	7
LL8	:	Excretion through malphigian tubules advanced like kidneys in mammals.	Yes / No	8
LL9	:	Internal fertilization as in higher groups of animals. Therefore, their number is more.	Yes / No	9

Unit II : Chapter V
Experiment **Creative thinking**
Q.11. Take one flower of the family Fabaceae and write its semi-technical description. Also draw the floral diagram.

			Ans.	W.
LL1	:	The Fabaceae – member here is *Pisum sativum*.	Yes / No	1
LL2	:	*Pisum* is a shrub with root having root modules; the stem is a climber.	Yes / No	2
LL3	:	Leaves are alternate and pinnately compound, leaf base pulvinate, stipulate, venation reticulate.	Yes / No	3

LL4	:	Inflorescence is racemose.	Yes / No	4
LL5	:	Flowers are bisexual, zygomorphic.	Yes / No	5
LL6	:	Calyx sepals 5; gamesepalous, imbricate aestivation.	Yes / No	6
LL7	:	Corolla petals – 5, polypetalous and papillionaceous, vexillary aestivation	Yes / No	7
LL8	:	Stamens 10; diadelphous	Yes / No	8
LL9	:	Monocarpellary unilocular gynoecium with superior ovary and single style.	Yes / No	9
LL10	:	Fruit a legume	Yes / No	10
LL11	:	The underlined words can be represented symbolically in the form of a floral formula as % ♂ $K_{(5)}C_{1+2+(2)}A_{(9)+1}G_1$	Yes / No	11
LL12	:	The underlined words can be represented schematically as	Yes / No	12



Unit II, Chapter VI
Experiment **Problem-solving**

Q.12 The transverse section of a plant material shows the following anatomical features. A) the vascular bundles are conjoint, scattered and surrounded by a sclerenchymatous bundle sheath. B) Phloem parenchyma is absent. What will you identify it as ?

			Ans.	**W.**
LL1	:	The vascular bundles consist of xylem, phloem and cambium.	Yes / No	1
LL2	:	Vascular bundles are conjoint i.e. Xylem and phloem are on the same radius.	Yes / No	2
LL3	:	Vascular bundles are scattered i.e. not arranged in a ring form.	Yes / No	3

LL4	:	Phloem shows only phloem fibres and companion cells and sieve tube and shows no parenchyma.	Yes / No	4
LL5	:	Each vascular bundle shows sclerenchymatous bundle sheath for mechanical rigidity.	Yes / No	5
LL6	:	The anatomical features are that of a monocot stem.	Yes / No	6

Unit II, Chapter VII
Problem **Problem-solving**
Q.13 Distinguish between simple and compound epithelium.

			Ans.	**W**
LL1	:	Epithelial tissues are tissues having a free surface, facing either a body fluid or the outside environment.	Yes / No	1
LL2	:	The cells are compactly packed (in an epithelial tissue) with little intercellular matrix.	Yes / No	2
LL3	:	The epithelial tissue provides a covering or a lining for some part of the body.	Yes / No	3
LL4	:	Epithelial tissues may be simple or compound.	Yes / No	4
LL5	:	Simple epithelium is composed of a single layer of cells.	Yes / No	5
LL6	:	Simple epithelium functions as a lining for body cavities, ducts and tubes.	Yes / No	6
LL7	:	Compound epithelium consists of two or more cell layers.	Yes / No	7
LL8	:	Compound epithelium has protective function and has a limited role in secretion and absorption found in pharynx, salivary glands and pancreatic ducts.	Yes / No	8
LL9	:	Simple epithelium is squamous epithelium (found in blood vessel wall), cuboidal epithelium (in gland ducts) and columnar epithelium (stomach and intestinal lining) and have a major role in secretion and absorption.	Yes / No	9

Unit II, Chapter VII
Activity/ Project **Critical thinking and Decision-making**
Q.14 Mark the odd one in the series: Areolar tissue; blood; neuron / tendon

			Ans.	W.
LL1	:	Tissues are a level of organization in the living organism.	Yes / No	1
LL2	:	Areolar tissue is a loose connective tissue present beneath the skin.	Yes / No	2
LL3	:	Areolar tissue is a support framework for epithelium.	Yes / No	3
LL4	:	Areolar tissue contains fibroblasts (cells that produce and secrete fibres), macrophages and mast cells.	Yes / No	4
LL5	:	Blood is a fluid connective tissue.	Yes / No	5
LL6	:	Blood contains plasma, red blood cells (RBC), white blood cells (WBC) and platelets.	Yes / No	6
LL7	:	It is the main circulatory tissue that helps in the transport of various substances.	Yes / No	7
LL8	:	Neuron is a unit of neural tissue.	Yes / No	8
LL9	:	Neurons are excitable cells.	Yes / No	9
LL10	:	When suitably stimulated, neuron creates an electrical disturbance.	Yes / No	10
LL11	:	The electrical disturbance travels across the plasma membrane.	Yes / No	11
LL12	:	At the neuron's endings the disturbance triggers events that may cause stimulation or inhibition of adjacent neurons.	Yes / No	12
LL13	:	Tendon is a dense connective tissue and attacks skeletal muscles to bones and ligaments.	Yes / No	13
LL14	:	Blood, areolar tissue and tendon are tissues – neuron is a cell and is the odd one in the series.	Yes / No	14

Unit II, Chapter VII
Activity / Project **Creative thinking**
Q.15. Draw a neat diagram of digestive system of frog.

			Ans.	**W.**
LL1	:	Digestive system of frog consists of alimentary canal and digestive glands.	Yes / No	1
LL2	:	Length of intestine is reduced as frogs are carnivores (draws).	Yes / No	2
LL3	:	Mouth opens into the buccal cavity that leads to the oesophagus through pharynx.	Yes / No	3
LL4	:	Oesophagus is a short tube that opens into the stomach.	Yes / No	4
LL5	:	Stomach continues as the intestine rectum and finally opens outside by the cloaca.	Yes / No	5
LL6	:	Draws the diagram as follows.	Yes / No	6

Unit III, Chapter VIII
Problem **Self-awareness**

Q.16 Match the following :

Cristae	**Flat membranous sacs in stoma**
Cisternae	**infoldings in mitochondria**
Thylakoids	**disc-shaped sacs in golgi apparatus**

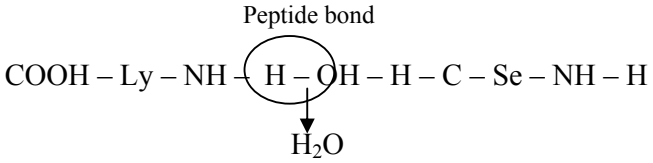
			Ans	W
LL1	:	The mitochondrion is a double membrane-bound structure.	Yes / No	1
LL2	:	It has outer and inner membranes which divide the lumen distinctly into two aqueous compartments.	Yes / No	2
LL3	:	Outer membrane forms the continuous limiting boundary of the organelle.	Yes / No	3
LL4	:	The inner membrane forms a number of infoldings called the cristae.	Yes / No	4

Q.17 Find and write down structures of at least four interesting small molecular weights of molecules. Find if there is any industry which manufactures the compounds by isolation. Find out the buyers.

Creative thinking and Self-awareness

		Compound	Formula	Mol. Wt.	Industry	Buyers	**Ans.**	**W.**
LL1	:	Glucose	$C_6H_{12}O_6$	348	Nice Chemicals Pvt. Ltd., Cochin	Ambala Durga Enterprises, Ambala, Agra	Yes / No	1
LL2	:	Serine	$C_3H_7NO_3$	105	Nice Chemicals Pvt. Ltd., Cochin	Guru Private Enterprises, Mumbai	Yes / No	2
LL3	:	Palmitic acid	$C_{16}H_{32}O_2$	256	Sigma Chemical Co., USA, Canada.	SAF/ St.Louis, MO, USA	Yes / No	3
LL4	:	Cholesterol	$C_{27}H_{46}O$	386.7	Sigma Chemicals, USA, Canada	SAF/ St.Louis, MO, USA	Yes / No	4

Unit III, Chapter IX
Problem **Creative thinking and Problem-solving**
Q.18 Illustrate a glycosidic peptide, a phospho-diester bond.

			Ans.	W.
LL1	:	Proteins are polypeptides.	Yes / No	1
LL2	:	Polypeptides are made up of amino acids.	Yes / No	2
LL3	:	Amino acid has two functional groups.	Yes / No	3
LL4	:	Amino acids have a carboxyl (-COOH) and an amino (-NH_2) group.	Yes / No	4
LL5	:	The carboxyl group of one amino acid reacts with the amino group of the next amino acid.	Yes / No	5
LL6	:	This results in the elimination of water moisture and formation of peptide bond as follows.	Yes / No	6
LL7	:		Yes / No	7
LL8	:	Polysaccharides are made of glucose units.	Yes / No	8
LL9	:	Glucose units or monosaccharides are linked by a glycosidic bond.	Yes / No	9
LL10	:	The bond is formed between two carbon atoms of adjacent monosaccharides by dehydration as follows.	Yes / No	10
LL11	:	Nucleic acids have a 3′ - carbon of one sugar linking a 5′- carbon of the sugar of succeeding molecule.	Yes / No	11
LL12	:	The bond between the phosphate and hydroxyl group of sugar is an ester bond.	Yes / No	12
LL13	:	As there is one ester bond on either side, it is called phosphodiester bond.	Yes / No	13

Unit III : Chapter IX
Activity/ Project **Creative thinking and Critical thinking**
Q.19 Can you attempt building models of bio-molecules using commercially available atomic models (ball and stick models)

			Ans.	**W.**
LL1	:	The ball and stick atomic models are made available.	Yes / No	1
LL2	:	Draw the diagram of the biomolecules to be made.	Yes / No	2
LL3	:	Fix the balls and sticks in a fashion similar to the diagram.	Yes / No	3

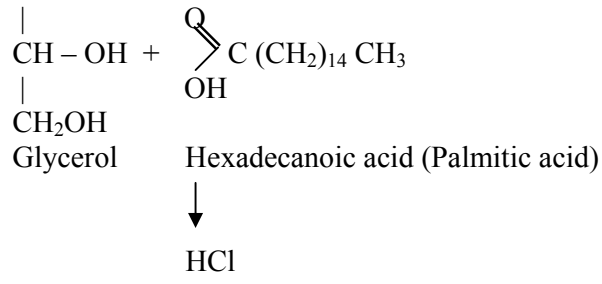
Unit III : Chapter IX
Activity/ Project **Creative thinking and Critical thinking**
Q.20 Draw the structure of the amino acid alanine.

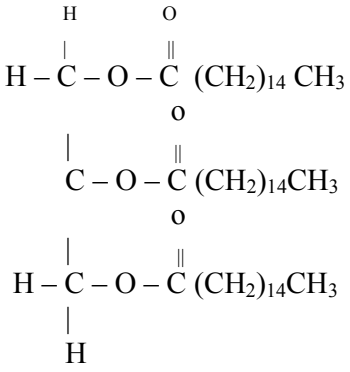
			Ans	**W**
LL1	:	Alanine is $CH_3 - CHNH_2 - COOH$	Yes / No	1
LL2	:	All the C's are linked. C | C | C	Yes / No	2
LL3	:	C has 4 valencies. CH_3 | $H - C - NH_3$ | C O OH	Yes / No	3

Unit III : Chapter IX
Problem **Decision-making**
Q.21. What are gums made of? Is Fevicol different?

			Ans.	W.
LL1	:	Gums are polysaccharides.	Yes / No	1
LL2	:	Fevicol is white and similar to gum in general appearance i.e. it is sticky.	Yes/ No	2
LL3	:	Fevicol is a compound of EVA /Ethelene Vinyl Acetate.	Yes/ No	3
LL4	:	Fevicol has extenders which offer excellent bonding properties.	Yes/ No	4
LL5	:	Fevicol is an adhesive which whets the substrate.	Yes / No	5

Unit III : Chapter IX
Problem **Effective communication**
Q.22 Explain the composition of triglycerides.

			Ans.	W.
LL1	:	Triglycerides are made up of Glycerol and fatty acids.	Yes / No	1
LL2	:	Glycerol is $CH_2OH - CH - OH - CH_2OH$	Yes / No	2
LL3	:		Yes/ No	3



1,2,3 Propanetiol hexadecanoate (Glycerol tripalmitate)

LL4	:	There is loss of water when glycerol combines with Palmitic acid.	Yes/ No	4
LL5	:	Loss of water leads to formation of a triglyceride.	Yes/No	5

Unit III: Chapter X
Problem **Problem-solving**
Q.23 What is the significance of meiosis?

			Ans.	**W.**
LL1	:	Mitosis is an equational division where there is equal partitioning of the chromosomal material.	Yes / No	1
LL2	:	Meiosis is a redirectional division which results in the reduction of chromosome into half.	Yes / No	2
LL3	:	Four half cells produced after meiosis are haploid two of which on fusion give rise to diploid parental generation.	Yes / No	3
LL4	:	Meiosis allows for maintenance of chromosome number of a species and thereby of the species per se.	Yes / No	4
LL5	:	Meiosis allows for conservation of specific chromosome number of each species across generations in sexually reproducing organisms.	Yes / No	5
LL6	:	Meiosis has a prolonged prophase allowing for genetic recombination through crossing over and therefore increases genetic variability in the population.	Yes / No	6
LL7	:	Meiosis paves the way for the process of evolution.	Yes / No	7

Unit III: Chapter X
Experiment **Problem-solving**
Q.24 Name the stage of cell cycle at which one of the following events occur?
Chromosomes are moved to the equator of the spindle

			Ans.	W.
LL1	:	Cells are of two types – germ cells and somatic cells.	Yes / No	1
LL2	:	Divisions are of two types – meiotic and mitotic.	Yes / No	2
LL3	:	Meiosis occurs in germ cells and mitosis in somatic cells.	Yes / No	3
LL4	:	Both types of cell divisions have prophase (extended in meiosis), metaphase, anaphase and telophase.	Yes / No	4
LL5	:	Interphase is the resting phase of both types of divisions where the nuclear components become prominent.	Yes / No	5
LL6	:	In the next phase, the prophase, the chromosomes become visible (in meiosis they become thicker, undergo pairing and cross-over).	Yes / No	6
LL7	:	In metaphase, the chromosomes with their two arms (chromatids) and a central centromere get attached to the equator of the spindle.	Yes / No	7

Unit III : Chapter X
Problem **Critical thinking**
Q.24 Can there be mitosis without DNA – replication in S-Phase?

			Ans.	W.
LL1	:	Cell cycle has two basic phases – Interphase and Mitosis (M phase).	Yes / No	1
LL2	:	M phase is when actual cell division occurs.	Yes / No	2
LL3	:	Interphase has three further phases. G1 S G2	Yes / No	3
LL4	:	G1 – cell is metabolically active and grows. S – DNA replication takes place. Only amount of DNA increases and not the ploidy level. G2 – proteins are synthesized and cell growth continues.	Yes / No	4

LL5	:	For equational division, duplication of DNA material followed by division is necessary. Therefore, mitosis cannot occur without DNA replication in S-phase.	Yes / No	5
LL6	:	In animals mitotic cell division is only seen in the diploid somatic cells whereas in plants mitotic division is seen in both haploid and diploid cells.	Yes / No	6

Unit IV, Chapter IX
Problem **Problem-solving and Critical thinking**
Q.26 Explain why pure water has the maximum water potential.

			Ans.	**W.**
LL1	:	Understanding water potential is fundamental to understanding water movement.	Yes / No	1
LL2	:	Water potential is determined by solute potential and pressure potential.	Yes / No	2
LL3	:	Water molecules possess kinetic energy and these molecules are in random motion that is both rapid and constant.	Yes / No	3
LL4	:	The greater the concentration of water, the greater the kinetic energy or water potential.	Yes / No	4
LL5	:	Pure water has the greater water potential.	Yes / No	5
LL6	:	Also if a solution is dissolved in pure water, the solution has fewer free water and the concentration of water decreases reducing its water potential.	Yes / No	6

Unit IV : Chapter XI
Experiment **Critical thinking**
Q.27 Why is purification of water and nutrient salts so important in studies involving mineral nutrition using hydroponics ?

			Ans.	W.
LL1	:	Hydroponics is a technique of growing plants in a nutrient solution.	Yes / No	1
LL2	:	Plants are grown in a tube or trough placed on a slight incline.	Yes / No	2
LL3	:	Nutrient solution has to be soil free and accurately prepared. Therefore water and mineral salts need to be purified. (The mineral salts are defined ones).	Yes / No	3
LL4	:	A pump circulates nutrient solution from a reservoir to the elevated end of the tube.	Yes / No	4
LL5	:	The solution flows down the tube and returns to the reservoir due to gravity.	Yes / No	5
LL6	:	Purified water is required so that the solution is soil free.	Yes / No	6
LL7	:	Defined mineral solution is required to help determine mineral nutrients essential for plants.	Yes / No	7
LL8	:	It is easy to determine essential elements and their deficiency symptoms if an element is added/ removed or given in varied concentration. Therefore, the need for a defined mineral solution.	Yes / No	8

Unit VI, Chapter XIII
Experiment **Critical thinking and Decision-making**
Q. 28 Suppose there were plants that had a high concentration of chlorophyll b but lacked chlorophyll a, would it carry out photosynthesis? Then why do plants have chlorophyll b and other necessary pigments?

			Ans.	W.
LL1	:	Chlorophyll is a yellow green pigment and an accessory pigment.	Yes / No	1
LL2	:	Chlorophyll b absorbs light and transfers the energy to chlorophyll a.	Yes / No	2

LL3	:	Chlorophyll b enables a wider range of wavelength to be utilized for photosynthesis.	Yes / No	3
LL4	:	However, it is at the absorption maxima of chlorophyll a that there is higher rate of photosynthesis.	Yes / No	4
LL5	:	Action spectra shows that most of the photosynthesis takes place in the blue and red regions of the spectrum i.e. the absorption maxima of chlorophyll a.	Yes / No	5
LL6	:	Some photosynthesis does take place at the other wavelengths of the visible spectrum.	Yes / No	6
LL7	:	Therefore, though chlorophyll b be present in high concentration, some photosynthesis may occur but not as much as with chlorophyll a.	Yes / No	7

Unit IV, Chapter XIV
Project/ Activity **Creative thinking**
Q.29 Give the schematic representation of glycolysis.

			Ans.	**W.**
LL1	:	Glycolysis has originated from the Greek words – glucose – sugar and lysis – splitting.	Yes / No	1
LL2	:	Glycolysis is the only process in respiration of anaerobic organisms.	Yes / No	2
LL3	:	It occurs in all living organisms and occurs in cytoplasm of the cell.	Yes / No	3
LL4	:	Glucose undergoes partial oxidation to form 2 molecules of pyruvic acid.	Yes / No	4
LL5	:	Sucrose is converted into glucose and fructose by the enzyme invertase and the two molecules enter the glycolytic pathway. Glucose + fructose. ↓ Phosphorylation Hexokinase Glucose – 6 – phosphate ↓ Isomerisation Fructose – 6 – phosphate ↓	Yes / No	5

LL6	:	A chain of ten reactions under the control of different enzymes takes place to produce pyruvate from glucose.	Yes / No	6
LL7	:	At various steps, there is utilization of ATP (energy) or synthesis of ATP or NADH + H^+ takes place.	Yes / No	7
LL8	:	Fructose – 6 phosphate ATP ↓ ADP Fructose 1,6 – biphosphate (6C) ↓ Triose phosphate (Dihydroxy acetone phosphate) (3C) ⇄ Triosephosphate (glyceraldehydes-3-phosphate) (3C) ↓ NAD, NADH 2 X Triose biphosphate (1,3 biphosphoglyceric acid) ADP ↓ ATP 2 X Triose phosphate (3 phosphoglyceric acid) ↓ 2 × 2 phosphoglycerate H_2O ↓ 2 × phosphoenol pyruvate ADP ↓ ATP 2 × pyruvic acid (3 C)	Yes / No	8
LL9	:	The above scheme shows that Fructose – 1,6 – diphsophate is split into dihydroxyacetone phosphate and 3-phosphoglyceraldehyde (PGAC).	Yes / No	9

LL10	:	Two redox equivalents are removed (in the form of 2 hydrogen atoms) from PGAL and transferred to a molecule of NAD^+.	Yes / No	10
LL11	:	PGAC is oxidized and with inorganic phosphate to get converted into DPGA.	Yes / No	11
LL12	:	The conversion of DPGA to 3-phosphoglyceric acid is also an energy yielding process (this energy is trapped by the formation of ATP).	Yes / No	12
LL13	:	Another ATP is synthesized causing the conversion of PEP to pyruvic acid.	Yes / No	13

Unit IV, Chapter XIV
Project/Activity **Creative thinking**
Q.30 Give the schematic representation of an overall view of Krebs' cycle.

			Ans.	**W.**
LL1	:	Krebs' cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid.	Yes / No	1
LL2	:	Citrate synthesis catalyses the reaction and a molecule of CoA is released.	Yes / No	2
LL3	:	Citrate is then isomerised to isocitrate.	Yes / No	3
LL4	:	The reaction is followed by 12 successive steps of decarboxylation leading to the formation of α-ketoglutaric acid and then succinyl CoA.	Yes / No	4
LL5	:	In the remaining steps of citric acid cycle, succinyl – CoA is oxidized to OAA allowing the cycle to continue.	Yes / No	5
LL6	:	During the conversion of succinyl CoA to succinic acid a molecule of GTP is synthesized.	Yes / No	6
LL7	:	In a coupled reaction GTP is converted to GDP with the simultaneous synthesis of ATP from ADP.	Yes / No	7
LL8	:	Thrice NAD^+ is reduced to $NADH + H^+$ and once FAD^+ is reduced to $FADH_2$.	Yes / No	8

LL9	:	The continued oxidation of acetic acid via the TCA cycle requires continued replenishment of oxalo-acetic acid.	Yes / No	9
LL10	:	Also requires degeneration of NAD^+ and FAD^+ from NADH and $FADH_2$ respectively. Pyruvic acid + $4NAD^+$ + FAD^+ + $2H_2O$ + ADP + Pi $\xrightarrow{Mito.Matrix}$ $3CO_2$ + 4NADH + 4H + $FADH_2$ + ATP	Yes / No	10

Unit IV, Chapter XIV
Problem Problem-solving and Decision-making
Q.31 What are the assumptions made during the calculation of net gain of ATP?

			Ans.	**W.**
LL1	:	This is about the respiratory balance sheet.	Yes / No	1
LL2	:	One can make calculation of the net gain of ATP for every glucose molecule oxidized.	Yes / No	2
LL3	:	These calculations are based on certain assumptions.	Yes / No	3
LL4	:	The first assumption is that there is a sequential, orderly pathway functioning with one substrate following the next.	Yes / No	4
LL5	:	This sequential pathway has glycolysis, TCA cycle and ETS pathway following one after another.	Yes / No	5
LL6	:	Second assumption is that NADH synthesized in glycolysis is transferred into the mitochondria and undergoes oxidative phosphorylation.	Yes / No	6
LL7	:	Third assumption is that none of the intermediates in the pathway are utilized to synthesise any other compound.	Yes / No	7
LL8	:	Fourth assumption is that only glucose is being respired – no other alternative substrates are entering into the pathway at any of the intermediary stages. Glucose is broken down to release CO_2 and 8 molecules of NADH + H^+. Two of $FADH_2$ also synthesized +2 molecules of ATP.	Yes/No	8

LL9	:	In electron transport system and oxidative phosphorylation when the electrons pass from one carrier to another via complex I to IV in the electron they are coupled to ATP synthase (complex V) for the production of ATP from ADP and inorganic phosphate.	Yes/No	9
LL10	:	No. of ATP molecules synthesized depends on the nature of the electron donor. One molecule of NADH = 3 mols. of ATP One molecule of $FADH_2$ = 2 mols of ATP 8 mols. of NADH = 8 × 3 = 24 mols. of ATP 2 mols. of $FADH_2$ = 2 × 2 = 4 mols. of ATP + 2 mols. 30 mols. There can be a net gain of 30 ATP molecules during aerobic respiration of the molecule of glucose.	Yes/No	10

*****

Tool 8

Preliminary Test Questionnaire For Validation

Biology Teachers may please answer the following (for Q II)

1. Is the questionnaire difficult to attempt ?

2. Is comprehension of questions difficult ?

3. Are the questions repetitive ?

4. Is the time given sufficient ?

5. How much time do you require to answer this questionnaire ?

6. Can you correlate Questionnaires I and II ?

7. Do students require a mediator for Questionnaire II ?

NOTE

The present questionnaire (along with the attached test) is an attempt to judge Life Skills attainment in XI Std.

What are Life Skills?

Life Skills are abilities for adaptive and positive behaviour that enable us to deal effectively with the demands and challenges of everyday life. Students should learn not only scholastic subjects but also different skills to become competent to face life.

WHO has advocated the development of life skills in order to promote psychosocial competence – this being the ability to deal effectively with the demands and challenges of every day life. Enhancement of psycho-social competence could make an important contribution to well-being of individuals *especially, where health problems are related to behaviour and where the behaviour is related to an inability to deal effectively with stresses and pressures of life.*

Life Skills Education

Life Skills are already being taught in many schools around the world with initiatives being taken by Non-Governmental organizations, education authorities, and religious groups. Teaching life skills as generic skills in relation to everyday life forms the foundation of life skills education for the promotion of mental well being and healthy interaction and behaviour in society.

Life Skills Training Programmes

Educational programmes teaching life skills have been developed for substance abuse, adolescent education, peace education, promotion of self-confidence and self-esteem and promotion of intelligence.

The Life Skills

A core set of skills are at the heart of skill-based initiatives (as advocated by WHO) and these are

Decision-making

Problem-solving

Creative thinking

Critical thinking

Effective Communication

Interpersonal Relationship

Self-awareness

Empathy

Coping with emotions

Coping with stress

When to develop these skills ?

These skills are to be developed during schooling process. Development of these skills may be accomplished with designing and implementing different interventions (short-term, medium-term and long-term).

The Interventions

All interventions have to be designed based on different sub-skills. A number of interventions will have to be designed for each of the sub-skills.

How to develop Life Skills

Life skills can be developed based on Brainstorming technique, role-play technique and follow up group discussions.

Self Assessment Questionnaire
Or
Interview Schedule

Instructions: Please go carefully through the attached list of 31 questions from NCERT Biology textbook. Carefully study the life skill mentioned against each question (Project/ Experiment). Have these skills be attained by you? By answering Yes/ No, you will help us highlight skills not attained/achieved by you. Each item has a weightage of 1.

Student Name : **Time : 1 hour**

Class :

General

1. What are life skills?

2. Enlist Life Skills known to you.

3. How many life skills are included in XI Std?

4. Which are the life skills lacking?

5. List out life skills incorporated in Ch. 1 – 15.

6. List out life skills that need to be further incorporated in Ch. 1 – 15.

Why Life Skills?

7. Do the exercises help you meet challenges of every day life? Yes/ No

8. Does it enhance your psycho social competence? Yes/ No

9. Does it contribute to your well being? Yes/ No

10. Does it help you deal effectively with stresses and pressures in life? Yes/ No

11.	Does it help you adapt better to the pressures of life?	Yes/ No
12.	Does it help you to develop positive behaviour?	Yes/ No
13.	Has it contributed to the promotion of your health and well being?	Yes/ No
14.	Has it helped you in making constructive decisions about your life? **(decision – making)**	Yes/ No
15.	Has it helped you to deal and manage constructively with problems in your lives? **(problem solving)**	Yes/ No
16.	Has it helped you respond adaptively and with flexibility to the situations of your daily lives? **(creative thinking)**	Yes/ No
17.	Has it enabled you to analyse information and experiences in an objective manner and contributed to the quality of your life? **(critical thinking)**	Yes/ No
18.	Has it enabled you to express yourselves both verbally and non-verbally in ways that are appropriate to our culture and situation? **(effective communication)**	Yes/ No
19.	Can you express your opinions, desires, needs and fears? Can you give advice and help in time of need? **(effective communication)**	Yes/ No
20.	Has it helped you relate in positive ways with people you interact with? **(interpersonal relationships)**	Yes/ No
21.	Has it enabled you to make and sustain friendly relationships which can be of great importance to our mental and social well being? (**interpersonal relationship)**	Yes/ No
22.	Has it enabled you in keeping good relations with family members who are an important source of social support? Has it enabled you to end relationships amicably? **(Interpersonal relationships)**	Yes/ No
23.	Has it enabled you to realize strengths and weaknesses, desires and dislikes? **(self-awareness)**	Yes/ No
24.	Has it helped you recognize when you are stressed or under pressure? **(Self awareness)**	Yes/ No
25.	Has it helped you understand and accept others who may be very different from ourselves and thus improve social interactions? **(Empathy)**	Yes/ No

26. Has it helped you recognize emotions in ourselves and others – and made you aware of how emotions influence behaviour and helped you react appropriately? **(Coping with Emotions)** Yes/ No

27. Does it help you recognize the sources of stress in our lives and act in ways that help to control our levels of stress? **(Coping with Stress)** Yes/ No

Life Skills – their sub-skills

Life Skill 1 : Decision making (11 Nos)

28. Has it enabled you to manage your emotions and remain calm in any decision making situation? **(Emotional stability in Decision Making (DM))** Yes/ No

29. Has it given you the ability to describe decision making situations / problems exactly as they are without being influenced by one's own or other's feelings/ opinions and beliefs? **(objectivity – DM)** Yes/ No

30. Has it given you the ability to make a realistic analysis of what one is capable of doing and what one is not capable of doing before making a decision? **(Self-knowledge – DM)** Yes/ No

31. Has it given you the ability to describe the context of the decision making situation as well as its elements and their interrelationships? **(Knowledge of the situation – DM)** Yes/ No

32. Has it given you the ability to identify elements of the given decision making situation by analyzing it? **(Analytical ability – DM)** Yes/ No

33. Has it given you the ability to think of diverse courses of action in any decision making situation? **(Divergent thinking ability – DM)** Yes/ No

34. Has it given the ability to synthesise different available / possible courses of action and to generate one's own course of action in decision making situations? **(Synthetic ability – DM)** Yes/ No

35. Has it given you the ability to predict the possible consequences of choosing a possible course of action ? **(Anticipation of consequences – DM)** Yes/ No

36. Has it given you the ability to think systematically and sequentially using valid principles of logic? **(Logical thinking – DM)** Yes/ No

37. Has it given you the ability to take decisions or arrive at a conclusion on the basis of valid reasons or logic (and not impulsively or by trial and error or on the basis of one's own feelings/ opinions and beliefs)? **(Rationality – DM)** Yes/ No

38. Has it given you the general mental ability to understand, think and learn and apply relevant procedures in decision making situations? **(General Intelligence – DM)** Yes/ No

Life Skill 2 : Problem Solving (9 Nos)

39.	Has it given you the ability to understand and learn about one's own capacities, emotionalities and actions in dealing with problems in various situations of life? **(Self-knowledge in Problem Solving (PS))**	Yes/ No
40.	Has it given you the ability of being hopeful and confident of approaching the problems in life? **(Positive attitude - PS)**	Yes/ No
41.	Has it given you the ability to think in multiple ways, views and manage a problem from different perspectives? **(Divergent thinking – PS)**	Yes/ No
42.	Has it given you the ability to view your problem from a third person's perspective? **(Objectivity – PS)**	Yes/ No
43.	Has it given you the ability to solve problems based on reasons and logic than using crude methods or trial and error? **(Rationality – PS)**	Yes/ No
44.	Has it given you the ability to understand and deal with the problem in a systematic and orderly fashion? **(Logical thinking – DM)**	Yes/ No
45.	Has it given you the ability to break down and understand various aspects/ components of the problem? **(Analytical ability- PS)**	Yes/ No
46.	Has it given you the ability to put together and understand various aspects or components of the problem? **(Synthetic ability – PS)**	Yes/ No
47.	Has it given you the ability to infer / foresee the after effects of the problem and/or the possibilities of the success or failure of the strategies used in the management of the problem? **(Anticipation of the consequences – PS)**	Yes/ No

Creative Thinking

Life Skills 3 : Creative Thinking (9 Nos)

48.	Has it given you the ability to think in different ways on one issue? **(Divergent thinking in Creative Thinking (CT))**	Yes/ No
49.	Has it given you the ability to think in new ways of doing things, different from the routine ways, which is cost effective if implemented and worthy of emulation? **(Innovativeness - CT)**	Yes/ No
50.	Has it given you the ability to generate new ways of thinking which the individual or group has not used in the past? **(Novelty - CT)**	Yes/ No

51. Has it given you the ability to generate fluently many ideas about a situation without any discontinuity of thoughts? **(Fluency - CT)** Yes/ No

52. Has it given you the ability to shift perspectives while thinking and generate as many ideas as possible? **(Flexibility -CT)** Yes/ No

53. Has it given you the ability to think very differently from the large majority of people on different social situations in disregard to their social approval? **(Originality – CT)** Yes/ No

54. Has it given you the ability to think in such a way where one is capable of expanding different issues to different proportions in a connected manner? **(Elaboration – CT)** Yes/ No

55. Has it given you the ability to think very differently from the practiced conventional ways of thinking by the group on any issue of social life? **(Unconventionality – CT)** Yes/ No

56. Has it given you the ability to think without being influenced by the views of others? **(Independence – CT)** Yes/ No

Life Skills 4 : Critical Thinking (5 Nos)

57. Has it given you the ability to analyse different components of a personal and social situation and put them together ? **(Analytic and synthetic ability in Critical Thinking (CriT)** Yes/ No

58. Has it given you the ability to analyse social and personal situations based on pros and cons dispassionately by delinking personal feelings and subjectivity? **(Objectivity – CriT)** Yes/ No

59. Has it given you the ability to anticipate the consequences of any line of thinking in social and personal situations? **(Anticipation of the consequences – CriT)** Yes/ No

60. Has it given you the general ability to weigh the strengths and weaknesses of any situation in the process of its understanding? **(Intelligence – CriT)** Yes/ No

61. Has it given you the ability to think and reason (through inductive and deductive modes) systematically on all social and personal situations based on objective principles of life? **(Logical thinking – CriT)** Yes/ No

Life Skill 5 : Effective Communication (14 Nos)

62. Has it given you the ability to analyse different components of a piece of information in order to understand its content? **(Analytical ability in Effective Communication (EC))** Yes/ No

63. Has it given you the ability to integrate different pieces of information available in different domains – thereby creating a meaningful picture of different sets of information into an organized whole? **(Synthetic ability – EC)** Yes/ No

64. Has it given you the ability to present your thoughts, ideals or feelings as effectively as possible through the use of spoken or written language apart from / along with the use of gestures? **(Expressive skills – EC)** Yes/ No

65. Has it given you the ability to express and understand thoughts, ideas and feelings through body postures, facial expressions and actions without the use of language? **(Non-verbal skills – EC)** Yes/ No

66. Has it given you the ability to use the movement of the body appropriately especially hands and arms to enhance the intent of communication? **(Gestures – EC)** Yes/ No

67. Has it given you the ability to express thoughts/ ideas/ feelings formally as suitable to the demands of different types of situations? **(Presentation – EC)** Yes/ No

68. Has it given you the ability to put across one's views persuasively with a strong sense of conviction (**Assertiveness – EC)** Yes/ No

69. Has it given you the ability to use different alternative ways to reach out to people suitably and successfully ? **(Creativity – EC)** Yes/ No

70. Has it given you the ability to participate in a communicative situation without any pre-conceived notions about persons involved or the content of communication? **(Objectivity – EC)** Yes/ No

71. Has it given you the ability to foresee consequences of a communicative situation which enables one to moderate the communication suitably ? **(Imaginability – EC)** Yes/ No

Life Skill 6 : Interpersonal Relationship (11 Nos)

72. Has it given you the ability to feel with others in social situations which can lead to the development of good interpersonal relationships? **(Empathy in Interpersonal Relationships (IPR))** Yes/ No

73. Has it given you the ability to express thoughts and feelings in non-threatening ways? **(Effective communication – IPR)** Yes/ No

Life Skill 7 : Self-Awareness (6 Nos)

74. Has it given you the ability to understand your strengths, weaknesses, emotions and feelings against a set of criteria? **(Objectivity in Self Awareness (SA))** Yes/ No

75. Has it given you the ability to assess one's own behaviour for their appropriateness or inappropriateness or adequacy or inadequacy shown in different life situations? **(Introspectionability – SA)** Yes/ No

76. Has it given you the ability to welcome thoughts or opinions from others if they are useful despite they being contradictory one's own initial conviction or belief? **(Openness – SA)** Yes/ No

77. Has it given you the ability to use processes of seeing, understanding, pausing and evaluating one's own self in relation to your strengths and weaknesses in order to improve oneself? **(Reflectivity – SA)** Yes/ No

Life Skill 8 : Empathy (5 Nos)

78. Has it given you the ability to sense the feelings, needs, emotions and actions of other people in social situations? **(Sensitivity in Empathy (EMP))** Yes/ No

79. Has it given you the ability to develop and show the attitude that as a member of the society one has to do something for the welfare of the society and its members as and when situation arises? **(Social inclination – EMP)** Yes/ No

80. Has it given you the ability to assess the requirement of assistance to others in need in society excluding one's own personal biases and prejudices towards an individual or a group ? **(Objectivity – EMP)** Yes/ No

81. Has it given you the ability to feel responsible for the society by way of understanding the feelings, needs, emotions and actions of people in a social situation and contribute to the welfare of society and its members? **(Social responsibility – EMP)** Yes/ No

82. Has it given you the ability to feel that it is one's duty to understand the feelings, needs, actions and emotions of people in society where one lives and extend help voluntarily in different situations without even being asked for? **(Social obligation- EMP)** Yes/ No

Life Skill 9 : Coping with Emotions (9 Nos)

83. Has it given you the ability to be aware of internal changes and different reactions given to different emotional situations in social and personal situations? **(Self-awareness – Coping with Emotions (CWE))** Yes/ No

84. Has it given you the ability to refer to evaluating the situation in terms of what led to it? **(Analytical ability – CWE)** Yes/ No

Life Skill 10 : Coping with Stress (10 Nos)

85. Has it given you abilities to become aware of feelings of stress ? **(recognisability in Coping With Stress (CWS))** Yes/ No

86. Has it given you abilities to draw blueprints or schemes for short term or long term courses of action ? **(Planning ability – CWS)** Yes/ No

87. Has it given you the ability to be in a state, quality, or an attitude of being impersonal, external or uninvolved to a problem or situation being examined or under focus? **(Objectivity – CWS)** Yes/ No

88. Has it given you the ability to develop identification with or understanding of another person's situation, feeling and motives **Empathy – CWS)** Yes/ No

89. Has it given you the ability to perceive or be aware of the objective world in relation to one's self across place, time or person **(Reality orientation CWS)** Yes/ No

90. Has it given you the ability to develop realization of oneself as an individual entity or personality ? **(Self awareness –CWS)** Yes/ No

91. Has it given you the ability to rejuvenate or refresh one's body and mind so as to bring them back to an optimal state of functioning? **(Relaxationability – CWS)** Yes/ No

92. Has it given you the ability to amuse, please or indulge in diversions that enable the individual to get back to optimal state of functioning? **(Entertainability - CWS)** Yes/ No

93. Has it given you the ability of being constant, firm, steadfast or resistant to change? **(Stability – CWS)** Yes/ No

APPENDIX – II

PROJECT PROPOSAL

REGIONAL INSTITUTE OF EDUCATION, (NCERT), MYSORE – 570 006

MODIFIED RESEARCH PROPOSAL SUBMITTED TO ERIC, NCERT, NEW DELHI - 16

1. **Title of the Project :**
   "BIOLOGY CURRICULUM OF *XI STANDARD (NEW CLASS XI TEXTBOOKS ONLY) VIS-A-VIS THE DEVELOPMENT OF LIFE SKILLS"

2. **Name of the Principal Investigator** : Dr (Ms) Geetha G Nair
   Sr. Lecturer in Botany

3. **Name of the Institution with address** : Botany Section
   Dept. of Education in Science and Mathematics
   Regional Institute of Education
   Mysore 570 006

4. **Collaborating Institution** : NIL

5. **Co-investigator** : NIL

6. **Area of priority to which the problem relates** : Science Education

7. **Statement of the Problem**

   It is observed that the present generation is more and more technologically literate with the advent and use of computers by even primary children. Does this rapid technological advance leave a lacuna somewhere in the development of actual life skills that support the cohesive functionality of body, mind and spirit and render human beings subservient to machines and technological products? For example, today's school child knows to play with the computer and has every amenity, be it food, money or entertainment at the press of a button. But what about skills of working with the hands at manifold tasks; using the brain instead of calculator or computer; using limbs instead of machine operated car; skill of putting back / recycling to sustain the environment; skills of preserving the environment around for posterity; skill of keeping environs clean and unpolluted; analytical and inference skills; skills for improving or creating crisis management; skills in case of emergencies; skills of survival in drastic conditions (adaptation with flexibility); skill of experimentation with new techniques; skill of manipulation (ingenuous thinking skills, etc).

Literature reveals that curricular information/ideas/concepts are redundant, non-contextual and least relevant in the present scenario and may very soon be forgotten. The survey also shows that passing out of school or test score achievements in school does not always indicate learner's ability to use the knowledge and skills in similar and new life situations. How to ensure reinforced learning of these skills? According to the National Policy on Education (1986), Science Education will be strengthened so as to develop in the child well defined abilities and values such as the spirit of thinking, inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility.

The student should be able to understand and assimilate principles of interdependence in the environment and nature; they should be able to identify and establish linkages between the assemblages of living and non-living resources and their utility; they should make judicious and rational exploration and exploitation and utilization of resources; they should be able to live a life of quality and dignity; have life skills of sustainable management of resources and the cybernetics of natural socio-cultural as well as bio-physical aspects of life and environment resources. These need to be inculcated to improve the quality of human life and the quality of human environment. Issues and concerns related to environmental sanitation, population explosion and their effects on the environment and the resources in the environment need be considered for developing appropriate life skills. Students in the +2 stage of education are a transitional group of teenagers, experiencing the pangs of adolescence. Special skills of adaptation and positive behaviour need to be developed in them considering the ambient socio-economic-cultural milieu. In short, science education in the +2 curriculum should be oriented towards citizenship education.

Science education programmes have to be designed to enable the learner 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. How can we ensure that science education or biology education at the +2 level relates to the above? How is science education connected with health, agriculture, industry and other aspects of daily life taking care of equity, equality and relevance? There should be extrapolation as well as interpolation of science into life skills. Learning science is doing science that is not relevant to life eg., cutting of a tree - the effect of this on forests, environment and man need to be wholistically dealt with. Concern of science education the world over has been to make it relevant, vibrant, addressing the real-life situations. Students should not find science difficult and boring. The scenario can be changed by relating science education to the concerns of life and the skills needed thereof.

WHO 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 (WHO, 1997). Skills have been mentioned at every step of the elementary and secondary stages of education in the NCF. Science and technology mentioned in NCF emphasizes the development of manipulative skills which are acquired in day-to-day life situations. Also it has been mentioned that practical activities to be chosen should have relevance for future life through acquisition of skills and values.

It is planned in this project to spell out the units of Biology curriculum to develop life skills; suggest solutions for lapses , if any, in the development of life skills; enlist the form of activities, experiments, project works, etc. that are pro-active to nurse and nurture the life skills required at the +2 stage.

In the recent deliberations on Curriculum Review by the Directors of SCERT in NIE, New Delhi, it was said that a negotiated and shared national curriculum needs to be continuously constructed and re-constructed in an inter-locked network of local, regional and national forums. They have clearly stated that curriculum reform needs to be a social experiment where the needs of rural, tribal, disabled, poor and minority required to be negotiated and shared. The basic needs mean food, clothing and shelter and these needs of society certainly relate to life skills. It has been very specifically stated that curriculum review should take note of needs of the community (NCERT News, 2005). A study of how the biology curriculum can meet the needs of the community to a certain extent through the development of life skills would be worthwhile and interesting. It is in this context that the present proposal is put forth.

8. **Objectives of the Study :**

1. To make a list of envisaged life skills in the curriculum document and NCF at *XI Std. stage in general Biology and cull out a curriculum from it.
2. To scan and review the present Biology curriculum of syllabus and text books of * XI standards developed by NCERT for net incorporated life skills and construct list of skills to be achieved at the end of the course.
3. To prepare a list of minimum levels of learning pertaining to life skills at *XI Std. level.
4. To bring out a report on life skills based on the curriculum.
5. To enlist fresh must-have-skills to be included in the curriculum. The fresh must-have-skills to be used in the curriculum are to be of two kinds – adjustment skills (physical/ physiological/psychological) and content skills pertaining to factual information.
6. To revise/update the present curriculum in the light of the observations made during the present studies.
7. To develop biology curriculum content considering the minimum levels of core life skills.

8. To make a list of achievable competencies with ingenuity which is stage-specific (viz. *XI standard) and age-specific.
9. To weave and infuse constructive creativity in the curriculum and make it environment, life and learner centered.

9. **Overview of Related Literature**

According to a draft concept paper on "Towards a vision of NCERT in early decades of the 21st century" (by DERPP, NCERT, 25th May 2005) – "the last decades of the 20th century has seen developments in communication, international trade and commerce, political changes and effects of human activity on environment, the geographical distances have vanished, thanks to the satellite communication and Internet. The probability of an individual child settling within a geographical vicinity or among one's own cultural contexts for livelihood, when he/she grows is reducing drastically".

"One of the important attractions for international capital to enter the domestic market **is the abundance of skilled manpower** and discernible consumers. Basic requirement for such a condition is quality of education provided at school-level on which all further education is built. Sudden escalation of technological changes and application of information technologies in commerce and industry coupled with globalisation **has made knowledge and information as more critical issues** than the capital and labour in competitive global market".

"Life skills required to be included to prepare children for the new economic order would be different from the currently emphasized skills. The future citizens of the country would increasingly face more open and semi-defined life situations. The education system operating through schooling in the past tended to deal with more defined structures with more definite answers. **But the rapidity of changes taking place cannot afford rigid structured approaches to curriculum and teaching processes.** Individuals who are **already** in the world of work require constant upgradation of their skills and knowledge. Hence school curricular practices need to generate learning to learn".

They have also mentioned **"the formulation and implementation of quality school curriculum as the cutting edge for the dignified survival of the nation".**

UNESCO's project 2000+ 'Scientific and Technology Literacy (STL) for all" recognizes the growing need for a scientifically and technologically literate society and emphasizes the creation of educational programmes (both formal and non-formal) that empower all so that they are able to satisfy their basic needs and be productive in an increasingly technological society.

According to National Policy on Education (1986), science education will be strengthened so as to develop in the child well-defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility. Science education programmes will be designed to enable the learner 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. It was also emphasized that every effort will be made to extend science education to the vast numbers who have remained outside the pale of formal education. However, nothing concrete has been achieved so far. There is an intense need to integrate various experiences and form an overall strategy of school science educational development and to formulate a clear-cut consistent and effective science educational policy and a national consensus on a programme of implementation.

Chelini (2001) assessed and compared the achievement of class VII students in respect of basic understandings and skills based on a content analysis of the textual experts and opinions of experts in the new language subjects. The study revealed that the highest number of concepts acquired by any student was 39 (out of 63) in science, 28 (out of 38) in mathematics and 30 (out of 41) in social studies. That is to say that majority of the students who enter the secondary stage are found deficient in more than one of the basic understandings and skills needed in science, mathematics and social studies.

When an individual possesses a capability to perform a task with a high order of proficiency, it is a skill. As a capability, skill is extremely difficult to distinguish from the traditional meaning of ability. Broadly defined, skills are the abilities to deal effectively with the demands and challenges of everyday life. These are a person's ability to maintain a state of mental well-being and to demonstrate the same in adaptive and positive behaviour while interacting with others or his/her environment (UNESCO, 2001). WHO has defined life skills as the abilities for adaptive ;and positive behaviour that enable individuals to deal effectively with the demands and challenges of every day life (WHO, 1997).

In skill development, the emphasis is more on 'what to do' and 'how to do'. There are strategies viz., curricular approaches, co-curricular approach, teacher counselling and peer education which can help students to develop skills in other disciplines (Saroj Yadav, 2002)

The NCF stresses that activities related to health should get a prominent place at primary stage so that children acquire necessary skills, attitudes and habits to keep themselves healthy and participate in games and sports sustainable for their age. Skills have been mentioned at every step of the elementary and secondary stages of education in the NCF. Science and technology mentioned in NCF emphasizes the development of manipulative skills which are required in day-to-day life situations. Also it has been mentioned that practical activities to be chosen should have relevance for future life through acquisition of skills and values.

According to the National Curriculum Framework 2005, Prof.Yash Pal in the editorial states that the document suggests movement in a particular direction – of common school system work and education and letting children enter the world of formal learning through the language of their home and environment. He mentions that the present deprived three-fourths of our people should marry their socially acquired competencies and skills with academic pursuits in our educational institutions and this would lead to a special flowering of talent and skills.

The NCF-2005 also states the following with relation to the development of skills and science.

a) The curriculum should make children sensitive to environment and the need for its protection.
b) The curriculum should help them nurture and preserve the environment.
c) The curriculum should help them reconcile human life with the crisis of the environment.
d) The curriculum should enable the younger generation to reinterpret and re-evaluate the past with reference to new priorities and emerging outlooks of a changing societal context.
e) The curriculum should show a predisposition towards social change.

f) The curriculum should be able to develop basic capabilities like language forming; sustaining relationships (with social world, natural world, one's self, promote emotional richness, sensitivity and values which form the basis of ethics and morality); and capabilities of work and action (co-ordination of bodily movements, development of skills and understanding, handling tools and technologies, ability to manipulate and organize things and experiences and to communicate). These basic capabilities form the broad basis for the development of understanding, values and skills.

g) 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 very critical for dealing with the demands and challenges of everyday life.

h) The science curriculum has to be validated using six basic criteria e.g. cognitive, content, process, historical, environmental and ethical validity.

i) At the secondary stage the curriculum should enable students to work with hands and tools to design more advanced technological modules. At the higher secondary stage, the curriculum should emphasise experiments/ technology and problem solving and select topics should be covered in depth.

j) Science curriculum should be an instrument of social change.

k) Science education in curriculum should undergo a paradigm shift with more support to inquiry skills, more emphasis on co-curricular and extra-curricular activities that stimulate investigative ability, inventiveness and creativity.

l) School health and physical education curriculum should include yoga and this curriculum is compulsory at the primary stage and optional at the higher secondary stage.

10. **Conceptual Framework:**

Includes the skills mentioned in columns 7 and 8 and the aims of NCF-2005 mentioned under col.9.

a) Concepts to be used.

- Skill of working with hands/legs.
- Skill of using the brain (not calculator or computer).
- Skill of using limbs instead of machines or vehicles in this technological age.
- Skills for analysis and inference.
- Skill of improvising in emergencies.
- Skill of experimentation with new techniques
- Psychomotor skills
- Cognitive skills
- Skill of sustaining environment
- Skill of managing environment
- Skill of environment resource management
- Skill of management of socio-cultural and physical aspects of life.
- Life adjustment skills
- Content skills

b) Demonstration of relevance of concepts for the study :

Each of the skills mentioned above are life skills essential for survival in an increasingly endangered environment because of rapid technological advances. Advance in technology is making the modern man a couch potato. Very soon limbs will become defunct and rudimentary organs.
e-waste and technological waste are being dumped continuously in the environment. This along with population explosion will make it impossible for man to survive on this beautiful green planet. These life skills are the only way to preserve the **Homo sapiens** race on this fragile planet.

c) Dimensions of empirical reality that need to be explored before investigating the problem.

There can be two ways of looking at the problem

1. Make a list of skills (as given in Item 10) and construction of a curriculum from the list.
2. Look at the *11th Std. syllabi and construct a list of life skills and include it in the secondary curriculum as minimum levels of life skills required.
3. The secondary syllabus of *XI standards needs to be explored, analysed and investigated for picking out the important life skills already incorporated in the syllabus. A comparison could be made with the syllabi of state level and ICSE schools.
4. The life skills need to be categorized as mandatory and not-mandatory, etc.
5. Alternatively, a list of minimum levels of life skills at *XI Std. stage, need to be arrived at through readings, literature review and discussion.
Life skills need to be expanded into individual chapters and then incorporated into the existing curriculum.
6. For each life skill listed out, there needs to be a prescribed activity for authenticity or testing the attainment of the skill.

11a **Research Questions**

The proposed research seeks to answer the following questions.

* In what way does the present Biology curriculum meet the needs of the *XI Std. levels of students? What life skills does it aim at ?
* What are the life skills already incorporated in the present curriculum?
* What are the life skills expected from a student who passes *XI standard ?
* Does each unit of the curriculum meet the development in life of a certain set of life skills at least ?
* How much percentage of specified life skills are learnt ?

* Why are many of the life skills not learnt? Is it because of lack of content, lack of infrastructure in lab; lack of exploratory activities; lack of hands-on experiences, etc?
* How does the existing curriculum compare with the level of life skills expected from *XI standard students?
* Have minimum levels of life skills been prescribed at the *XI Standard stage in the National Curriculum Framework? If not, can we formulate it now?

11b Hypothesis (if any)

If there is a unit on Bacteria, does the student learn to culture Bacteria through indigenous methods

- to stop the growth of bacteria in indigenous ways
- to control spread of bacteria using local, economically and medicinally important plants.

If he/she is asked to do this, the life skill is achieved. If he/she does not achieve it, the life skill is not learnt.

If there are 20 important life skills to be learnt at the +2 stage and these have been achieved as evidenced by related activities performed in class/lab, then minimum levels of life skills are achieved.

12. **Please give elaborate information**

a) Why it is contemplated to take up this study by the researcher in the given specific contents.

* This research followed as a natural corollary of our short term project on Development of Remedial Interventions for difficult lab skills of select DMS practicals of Std.XII.
* Literature cited underlines the significance of life skills in the new economic order.

The December 2004 Tsunami tragedy was a pointer towards the lack of life skills in the affected population who clung to the government for food, shelter and clothing instead of being more skilled and self-reliant. The plight of man in the present tragedy was worse than that of the caveman who used the first stone tool and lighted the first fire and later learnt to construct a thatched house. This was a pointer to the lack of skills in the Tsunami affected populace and one of the prime reasons for contemplation of this study.

b) Expected outcomes

* To bring out a list of minimum levels of life skills for the secondary curriculum.
* To bring out a revised curriculum with the set of life skills to be achieved mentioned clearly against each unit.
* To bring out a list of activities for the development of each life skill identified.

* To bring out a teacher's handbook for achieving the circumscribed life skills – consisting of activities, experiments, group work and problems to solve.

c) Likely Educational Implications for school and teacher education system

* This deployment of minimum levels of life skills identified hereby will help in bringing more civic sense in the Indian populace and will orient them towards citizenship education.
* This will help in improving quality of education and life in a technologically advancing society.
* The new economic order emerging as a result of technological advance and consequent globalisation will thrive better with these life skills.

13. **Design of the Study**

Plan, Structure and Strategy

* Collection/procurement of *XI Std. biology syllabus of DMS (CBSE and ICSE) and state syllabi.
* Preparation of a tool to analyse the syllabi.
* Unitwise listing out of the life skills already incorporated in the syllabi.
* Comparison of central and state Biology syllabi for life skills.
* Preparation of a combined list of life skills.
* Arrival at a list of minimum levels of life skills required through the conduction of a local workshop.
* Preparation of a checklist of all life skills (included and not included in the curriculum).
* Revision of *XI Std. biology curriculum in the light of compiled list of minimum levels of life skills. Organisation of a workshop.

Sample And Sampling Procedure

Sample: DMS *XI Std. students and any other CBSE/ICSE school students.

Control: State school students.

Sample size : 40 students

Type of sample : Students (boys and girls)

Units of observation : Individual units of biology curriculum of DMS *Std. XI .

Rationale; Students passing *XI Std. learn more technological skills, become couch potatoes and deliver arm-chair dialogues. This project is an effort to find out why they do not become more life-oriented and to direct them towards life skills acquisition.

14. Data Collection

Sl. No.	Kinds of data to be gathered	Source for each kind of data	Tools/ techniques to be used for gathering and analysis of data
1.	List of life skills in CBSE syllabi / State	DMS syllabus	Evaluation tool / checklist
2.	Life skills lacking in CBSE syllabus	First year college students from CBSE/ICSE streams	Interview Self-assessment questionnaire
3.	Life skills achieved from stated life skills in CBSE Biology curriculum	DMS school	Percentage analysis
4.	Minimum levels of life skills	NCF and bio-curriculum	Group Discussion

15. Data Processing

The data will be mostly pertaining to number of life skills included in each unit of the curriculum, number of life skills which are achieved and if so, by what percentage of students and the number of life skills that need to be included afresh. Number of students in each category will be represented as a percentage figure. The entire processing will be carried out using a computer.

16. *Time budgeting

Selection of staff	:	4 months
Tool preparation, pre-test, administration	:	4 months
Data collection	:	4 months
Processing of data, analysis	:	4 months
Validation of data through workshops or Discussion	:	4 months
Computer work	:	4 months
Report writing	:	4 months
Total	:	**28 months**

17 ***Organisational Framework**

1 Field Investigator for library consultancy, data collection, data entry and analysis in computer.
1 Expert for Statistical Analysis / Consultant

18. **Cost Estimation (Revised one submitted and enclosed in separate proforma Page Nos. 22 and 23)**

	Position	No. of persons	Salary		Duration	Amount
A	1.Project Assistant	One	8,000 p.m.		24 months	1,92,000/-
	2. Computer assistant	One	2000 p.m.		6 months 6 × 2000	12,000/-
B	Travel for Principal Investigator and Project Assistant		**1st year** 10000	**2nd year** 10000	2 years	20,000/-
C	Data processing		15000	15000	1 YEAR	15,000/-
D	Stationery and printing		15000	15000	2 years	30,000/-
E	Equipment, books, software and consumable items		15000	15000	2 years	30,000/-
F	Any other/ workshops/ experts' meet		15000	---	15 Days	15,000/-
G	Account keeping and pre-auditing					
	Total					**2,82,000/-**

Signature of the Principal Investigator
Name : Dr Geetha G Nair
Designation: Sr. Lecturer

Place : Mysore
Date :

APPENDIX I

EDUCATIONAL RESEARCH AND INNOVATIONS COMMITTEE

SELF-ASSESSMENT CHECKLIST

(To be filled in by the Principal Investigator and sent along with the fresh proposal)

Title of the Proposed Project

* "Biology curriculum of XI Standard vis-à-vis the development of life skills.

Problem :

1.	Amenable to research	1	2	3	4	5
2.	Relevance/implications for school education/ teacher education (please tick)	1	2	3	4	5
3.	Statement of objective(s)					
	a) Clearly stated and concise			Yes / No		
	b) Criterion operationally defined and valid with regard to the purpose of the study			Yes / No		
	c) Terms defined as needed			Yes / No		
	d) Problem adequately delimited			Yes / No		
4.	Research questions/ Hypotheses					
	a) Problem converted into researchable questions/ testable hypotheses			Yes / No		
	b) Procedure of seeking appropriate answers/ testing hypothesis clearly stated	1	2	3	4	5

Review of Literature

1.	Adequacy					
	a) Coverage comprehensive yet selective	1	2	3	4	5
	b) Critically evaluative	1	2	3	4	5
2.	Organisation : Brings the problem into clear focus, shows the problem in the perspective of current knowledge; a synthesis rather than a summary	1	2	3	4	5
3.	Continuity : Adequately structures the problem and in turn is reflected in the proposed design of the study, interpretation of the results, etc.	1	2	3	4	5

Design

1.	Adequacy : Logically and effectively geared to the demands of the problem	1	2	3	4	5
2.	Sample : Population clearly defined, sample size appropriate for meaningful outcomes	1	2	3	4	5
3.	Instrumentation :					
	a) Reliability of the instrument used clearly shown		Yes	/	No	
	b) Validity of the instrument clearly shown		Yes	/	No	
	c) Validation procedure clearly described		Yes	/	No	
4.	Analysis : Appropriate to the problem and to the data; awareness of underlying assumptions.	1	2	3	4	5

Date :

Signature
Name of the PI: Dr (Ms) Geetha G Nair

(NB: Please tick the ratings as appropriate on the five point scale. The weightings are from lower to higher).

5 – Outstanding
4 – Very Good
3 – Good
2 – Satisfactory
1 - Average

APPENDIX II

BIO-DATA OF THE PRINCIPAL INVESTIGATOR

1.	Name of the Principal Investigator	:	Dr (Ms) GEETHA G NAIR
2.	a) Date of Birth b) Place of Birth c) Date of Retirement	: : :	15.8.1959 Chittillancherry, Palghat 31.8.2021
3.	Institutional Address	:	Department of Botany Dept. of Education in Science and Mathematics, Regional Institute of Education, Manasagangotri P.O. Mysore – 6
4.	Whether recognized or not by the Govt/ a Regd. Society under Societies Registration Act 1860 with functions pertaining to research in school/ teacher education systems (attach photocopy)	:	Yes
5.	Department	:	Botany, DESM
6.	Position held and date of superannuation	:	Sr. Lecturer in Botany 31.8.2021
7.	Mailing Address with Pin Code	:	Dr.(Ms) Geetha G Nair 608 Gopikripa I Main, I Cross, Bogadi (South) Bogadi P.O. Mysore 570 026
	Telephone No. Office Residence Fax No		0821-2514515 Ext. 239 0821-2517493 0821-2515665
8.	Permanent Address	:	C/o Shri T P Balakrishna Menon Tharoor Puthan Veedu Chittillamcherry PO Palghat - 678 704 Kerala

9. Academic Qualification :

Degree	Subject(s)	University/ Institution	Division/ Grade obtained	Year of passing
B.Sc.	Botany, Chemistry, Zoology	Faculty of Science, M.S. University of Baroda	First	1979
M.Sc.	Botany and Economic Botany – Phytochemistry	Faculty of Science, M.S. Univ. of Baroda	First	1981
Ph.D.	Botany	M.S. Univ. of Baroda		1986

Also completed Post-Diploma in German from the M.S. University of Baroda.

10. List of Publications (in the last five years)

1. Published a paper on "Significance of Lab Skill Acquisition in Science Education", School Science in April 2005.
2. Communicated a paper on "Analysis of Difficult Laboratory Skills in Select DMS Std XII Practicals" to Journal of Research in Science Teaching in May 2005.

11. Experience

a) Teaching — From 1989 – 2006 – 17 years

b) Research — From 1981-1986 – for Ph.D.
1986 – 1989 – Post-doctoral research
2000 – 2006 – Doing research in Science Education

c) Any other — -----

12. Please give below the details of project(s) completed so far :

Sl. No.	Title of the Project	Duration	Total cost	Source of Budget support	Status of the project
1.	Analysis of difficulties in lab. skills related to biology at higher secondary level	Sept. 2002 to April 2003	20,000/-	RIE, Mysore	Short term project
2.	Research based Development of remedial interventions for making up the identified deficiencies in Lab Skills in Biology at +2 level	Sept 2004 to May 2005	15,000/-	RIE, Mysore	Short term project

Reports have been completed and sent for publication.

13. Research project(s), if any, currently being conducted by the applicant :
At present working on a Science Education Project entitled "Study of Relationships between socio-cultural aspects and the EVS textbooks of III, IV and V Standards of NCERT".

14. Was this proposal submitted to any other funding agency. If so, what was the outcome ?
Not applicable.

15. Is this research being supported by any other agency or is this application being submitted elsewhere? If so, please give details. Decisions about application to other agencies (including those made after the award of NCERT grant) should be reported to the NCERT as soon as available.

Not applicable.

16. Any other information that you think is relevant for the evaluation of the proposal ?
Not applicable.

Signature of the Principal Investigator

APPENDIX III

ENDORSEMENT FROM THE HEAD OF THE INSTITUTION

I am pleased to forward the proposal of **Dr.Geetha G Nair** who is **Sr. Lecturer in Botany** in our institution, for financial support to the NCERT.

This institution agrees to :

- administer and manage the finance;
- provide accommodation and furniture required for the project;
- make available all its research facilities such as library, laboratory and other requirement; and
- provide the material and managerial assistance for the project.

If the Principal Investigator of the project leaves the institution to join some other institution, after part of the sanctioned grant has been received, we would have no objection to the project being transferred to the new institution if the Principal Investigator/NCERT so desires. The institution, however, shall continue to be responsible for submitting the audited statement of accounts and utilization certificate for the grant received by it, for this purpose.

Date **Name & Designation (in block letters)** **Signature**

(Office seal)

APPENDIX IV

I certify that

a) The general physical facilities, such as furniture, space, etc. are available in the Department/College/Institution.

b) I shall abide by the rules governing the scheme in case assistance is provided to me by the NCERT for the above project.

c) In case the above research project or an allied project receives assistance from any other source, I shall inform NCERT accordingly.

d) I shall complete the project within the stipulated period. If I fail to do so and if NCERT is not satisfied with the progress of the research project, the Chairman (ERIC) may terminate the project immediately and ask for the refund of the amount received by me.

Signature of the P.I.

Name of the P.I.
(in capital letters)

Date :

Place :

APPENDIX V

PROJECT SUMMARY

It is observed that the present generation is more and more technologically literate with the advent and use of computers by even primary children. Does this rapid technological advance leave a lacuna somewhere in the development of actual life skills that support the cohesive functionality of body, mind and spirit and render human beings subservient to machines and technological products? For example, today's school child knows to play with the computer and has every amenity, be it food, money or entertainment at the press of a button. But what about skills of working with the hands at manifold tasks; using the brain instead of calculator or computer; using limbs instead of machine operated car; skill of putting back / recycling to sustain the environment; skills of preserving the environment around for posterity; skill of keeping environs clean and unpolluted; analytical and inference skills; skills for improving or creating crisis management; skills in case of emergencies; skills of survival in drastic conditions (adaptation with flexibility); skill of experimentation with new techniques; skill of manipulation (ingenuous thinking skills, etc).

Literature reveals that curricular information/ideas/concepts are redundant, non-contextual and least relevant in the present scenario and may very soon be forgotten. The survey also shows that passing out of school or test score achievements in school does not always indicate learner's ability to use the knowledge and skills in similar and new life situations. How to ensure reinforced learning of these skills? According to the National Policy on Education (1986), Science Education will be strengthened so as to develop in the child well-defined abilities and values such as the spirit of thinking, inquiry, creativity, objectivity, the courage to question and an aesthetic sensibility.

WHO 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 (WHO, 1997). Skills have been mentioned at every step of the elementary and secondary stages of education in the NCF. Science and technology mentioned in NCF emphasizes the development of manipulative skills which are acquired in day-to-day life situations. Also it has been mentioned that practical activities to be chosen should have relevance for future life through acquisition of skills and values.

The NCF stresses that activities related to health should get a prominent place at primary stage so that children acquire necessary skills, attitudes and habits to keep themselves healthy and participate in games and sports sustainable for their age. Skills have been mentioned at every step of the elementary and secondary stages of education in the NCF. Science and

technology mentioned in NCF emphasizes the development of manipulative skills which are required in day-to-day life situations. Also it has been mentioned that practical activities to be chosen should have relevance for future life through acquisition of skills and values. **According to NCF-2005, the curriculum should be an instrument of social change and development of life skills is very critical to meet the demands and changes of everyday life.**

Skills acquired by man over several ages have been unlearnt and is thus endangering his very existence on this planet. If one has to survive on this planet, one has to survive with the available infrastructure and for this basic life skills and skills of preserving the environment are a must. An effort is made in the present project to list out life skills already recognized in the syllabus, whether they are attained or not and as to what are the additional core life skills which need to be incorporated in the present syllabus so that we see a future where there are better citizens on earth who are also environment wise. Life skills listed out will be mostly pertaining to citizenship education and environment education.

The syllabi of CBSE and ICSE schools and state schools are to be analysed for life skills already being taught and a list of essential must-have core skills are to be developed through interviews, group discussions, etc. The present curriculum is to be modified according to the results arrived at during the course of these studies.

PROFORMA FOR ADMINISTRATIVE-CUM-FINANCIAL SANCTION OF ERIC PROJECTS

1. **Title of the Approved Project** : **Biology Curriculum of XI Standard (New Class XI Textbooks only) vis-à-vis the Development of Life Skills**

2. Priority Areas : **Science Education**

3. a) Total cost of the project : **Rs.90,000/-**

   b) Duration of the Project : **2 years**

4. Name and Address of the Project Incharge : **Dr (Ms) Geetha G Nair, Senior Lecturer in Botany, Dept. of Education in Science and Mathematics, Regional Institute of Education, Mysore 570 006**

5. Name of the main Institute and collaborating Institute, If any : **Regional Institute of Education, Mysore 570 006**
   Collaborating Institute : NIL

6. NCERT Faculty involved (if any) :

Name	Designation & Address	Department	Nature of Participation
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7. **Other members of the Project Team, if any** :

Name	Designation & Address	Department	Nature of Participation
Dr Lancy D'Souza	**Maharaja's College, Mysore**	**Dept. of Psychology**	**Statistical Consultancy**

8. Expenditure to be incurred :

Sl. No.	Head of Expenditure	Yearly Instalments			
		1st	2nd	3rd	Total
1.	*Junior project Fellow	---	---	---	---
2.	Travel Expenses (TA/DA) of PI and JPF	---	---	---	---
3.	Purchase of Books and Journals	15,000/-	15,000/-	--	30,000/-
4.	Development/ Adaptation of Research Tools and Materials (Workshop)		15,000/-	--	15,000/-
5.	Photocopying/ Printing of tools and correspondence, etc.				
6.	Hire charges				
7.	Data processing (computer)		15,000/-		15,000/-
8.	Report Writing, Photocopying, Binding, etc.			--	
9.	Contingency (stationery, postage, etc).	15,000/-	15,000/-		30,000/-
10.	Overhead charges upto 5% of total cost admissible on production of certificate from the Institution other than NCERT	---	---	---	---
11.	Miscellaneous	---	---	---	-----
	Total				**90,000/-**

***The JPF may be appointed only after the receipt of the grant-in-aid of the 1st instalment.**

Revised total cost of the Project : Rs.90,000/-

Signature of the Head of the Institution/
Registrar with seal

Signature of the Project Incharge
of the Project