

ANALYSIS OF SCIENCE (LIFE SCIENCE) TEXTBOOK IN THE LIGHT OF ACTIVITY-BASED CURRICULUM

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Abstract

Curriculum is a standards-based sequential framework of planned experiences, which helps the students gain proficiency in content incorporated and also facilitates them to apply learning skills in their real life situations. Though the old concept of curriculum was much centered, the new concept has much variation in itself as well as flexible, as it should be. The traditional method of teaching-learning process was focused mainly on lectures, which somehow restricts our 'little scientists' from exploring the greater aspects of life and content. This traditional method has been considered to cause hindrance to their social and emotional development mainly. The learnt concepts can be easily assessed based on the marks obtained by the children in their examinations, but how much did they learn practically so that they can apply them in real life, is not assessed. A debate is ongoing nowadays on the impact of activity-based learning strategies, rather than only lecture-based methods. Activity-based curriculum implies 'Learning by doing', rather than rote learning and mere recalling of information. This paper is a sincere attempt to showcase the pre-existing activities in each chapters in a Class 10 Life Science textbook of West Bengal Board of Secondary Education, as well as some fun and engaging activities which involves both individual and group effort, are suggested. It is hoped that this article motivate the academicians and mainly new generation curriculum developers to recognize the importance of learning by doing and also give importance to cooperation and collaboration among children, which definitely will be a positive approach.

Keywords: Curriculum, Activity-Based Curriculum, Teaching-Learning, Science textbook

Introduction

Education and curriculum are the two sides of a coin. Teaching and learning go side by side in the field of education. Education is a tool that equips and empowers the learners all over the world with the right knowledge. The first and foremost important element for acquiring this knowledge is the teachers, who have a positive impact on the society. The teachers are the central figure and have to set goals according to the various needs of their learners. Quality of teaching decides the quality of education received by the learners [1]. Traditionally, the curriculum was teacher-centered and mainly lecture-based, whereas in modern education, the focus is being shifted towards learners i.e. child-centered. In teacher-centered curriculum, the students are passive learners and in child-centered curriculum, the

students are active learners. The word curriculum is derived from the Latin word ‘*currere*’ which means ‘run’, ‘run away’, or ‘to run a course’. Students learn actively by doing hands-on activities in learning. One such method is Activity-Based Learning (ABL), where students are engaged constantly. With passive teaching, the students may feel boredom after a certain period of time. To remove this boredom and to increase motivation among the learners, this ABL method has proven to be an effective strategy [2]. This method enhances critical thinking skills, self-directed learning and self-evaluation among them. The relationship between teachers and learners nowadays should be friendly and interactive, which will enhance the classroom learning.

ABL strategies help to enhance the cognitive, affective and psychomotor domains of the learners. These strategies can be used individually by giving projects, making charts and models and present them in exhibitions, seminars etc, as well as collaboratively in groups. This collaboration infuses in them the sense of cooperation and team work [3]. Activity should involve head, heart and hand (3H). The advantages of developing and implementing activity-based curriculum is that the learners can retain the gained knowledge for a long period of time, ‘*learning by doing*’, having control over the subject matter and developing mastery-oriented skills, the students learn themselves and come up with creative and diverse solutions to a problem, facilitates learning beyond school environment [4]. As much as there are pros marked, there remains some cons too. ABL style of learning cannot be implemented in schools having large pupil-teacher ratio because supervision of each and every individual in that environment becomes difficult, as this process requires competent and skilled teachers. Designing different activities keeping in mind the individual differences of the learners may be time consuming and the teachers may not be able to complete the content. With all these facts taken into consideration, it can be said that Activity-Based learning in a curriculum will definitely make the learners active in whatever they want to learn, can cope up with the recent trends in technology and style of learning, making them inquisitive as well as independent to think analytically.

Objectives

The objectives of this study are:

- 1) To see the different types of work that has already been done related to activity-based curriculum.
- 2) To find out any development or findings related to curriculum studies.
- 3) To try to analyze the science textbook of Class 10 of WBBSE on the basis of activities already present in the books.
- 4) To see what other effective activities related to the context can be incorporated to be done by both the teachers and learners are suggested.
- 5) To find significant future opportunities for research related to activity-based teaching-learning methods.

Methodology

It is basically a meta-research, along with review-based analysis is being done by the researchers, which includes the key words for the literature search like curriculum and activity-based curriculum. Minute analysis of the already incorporated work in the textbook

is being done, along with suggestive measures for the better incorporation of the activity-based learning amongst the students is implied.

Studies undertaken for reviewing

Sarpong (2020) conducted a study on “The Influence of Activity-Based Teaching Method Used in Teaching Social Studies on Students Retention and Academic Performance: A Quasi-Experimental Study of Selected Junior High School Students in Sekyere South District of Ashanti Region, Ghana” in which it was found out that activity-based learning among the students through methods like collaborative learning, problem-solving and co-operative learning positively affected the students interests in Social Science studies and fulfilled their needs [5]. Awasthi (2014) conducted a survey on “Activity Based Learning Methodology can bring improvement in quality education in India”. Quality of education in Government schools in India is worsening due to traditional lecture methods. So activity based learning related to Indian context should be well-adopted in the curriculum and enhance the understanding and motivation in students thereof [6]. Lijanporn & Khlaisang (2015) formulated and investigated on “The development of an activity-based learning model using educational mobile application to enhance discipline of elementary school students”. The purpose of this research work was to enhance the discipline of elementary school students by devising an activity based learning model using educational mobile application. The experts strongly agreed and believed that this model can be an effective device and can be used in real context [7].

Saha & Biswas (2022) conducted a review study on “Different aspects and dimensions of activity-based curriculum: A Review”. The main purpose of the review study was to find the effectiveness of activity-based approaches in curriculum by comparison with traditional teaching methods [8]. Rathee & Rajain (2017) conducted a study on “Activity-based teaching in higher education institutions” in which it was found out that the students positively perceived the activity-based approaches for their overall development and also there was no significant difference between the perception of female and male students [9]. Oribhabor (2020) studied on “Evaluating the Effect of Activity-Based Method of Teaching Mathematics on Nigerian Secondary School Students’ Achievement in Mathematics”. The analysis of this paper resulted in the fact that Mathematics can be studied in an interesting way if activity is involved in teaching rather than only lecture-based. It also suggests that the teachers in secondary schools should be trained to update knowledge of activity-based approaches for making the teaching-learning of Mathematics more interesting [10].

Saha & Biswas (2022) carried out a review study on “Perspectives of curriculum: A Review”. The objective of this review paper was to determine the importance of core, hidden, null and latent curriculum in textbooks. It was concluded that most of the part of the textbook was core curriculum, whereas hidden and latent curriculum needs to be updated in future for better development of curriculum [11]. Cahapay (2021) conducted a review work on “A systematic review of concepts in understanding null curriculum”. The purpose of this paper was to synthesize the concepts in understanding the null curriculum as there still lies difficulties in it. The process used was called Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). From the reports, it was found out that the null curriculum being described as a phenomenon taking multiple dimensions, occurs at hierarchial levels and can be identified by various frames of reference [12].

PROCEDURAL DETAILS

Selection of Textbook:

Name of the Textbook	Life Science and Environment
Class	10
Name of Author	Dr. ArdhenduSekhar Nandi, Dr. TrilochanMidya, Dr. Dulal Chandra Santra
Publisher	Santra Publication Pvt. Ltd
Board	West Bengal Board of Secondary Education (WBBSE).
Year of Publication	2018
Language of the book	English
Number of Chapters	Five (5)

The units in the ‘**Life Science & Environment**’ book of Class 10 (WBBSE) is marked accordingly [13]:

- ❖ Control and Coordination in Living Organism
- ❖ Continuity of Life
- ❖ Heredity and Common Genetic Diseases
- ❖ Evolution and Adaptation
- ❖ Environment, Its Measures and Their Conservation

Content Analysis of the Textbook:

1. Control and Coordination In Living Organisms

Subject/Content	Activity-based component present in the book and curriculum	Suggestive measures for formulating activity-based curriculum
<p>a) <u>Sensitivity and Response in Plants</u></p> <p>Concept of Sensitivity: Ability of organisms to detect change and respond to it (stimulus) is sensitivity.</p> <p>Plant movement and Its Types: Tactic- plant movement induced by external stimuli like temperature, light etc. Tropic- direction of movement of plant organ is related to direction of stimulus. Nastic- movement of plant</p>	<ul style="list-style-type: none"> • Experiment of AJC Bose on sensitivity in <i>Mimosa pudica</i> is given. • Short experiment on hydrotropic movement is given. • Table showing differences between tactic, tropic and nastic movements. • To find out a <i>Mimosa pudica</i> plant 	<ul style="list-style-type: none"> • Sensitivity in <i>Mimosa pudica</i> can be shown visually either through a video or through live demonstration. • Learners can be given a task of demonstrating each type of plant movement using live models in class. • Photonastic movement in sunflower can be

<p>organ is responsive to the intensity of the stimulus.</p> <p>b) <u>Response and Chemical Coordination in Plants-Hormone:</u></p> <p>Phytohormones regulate growth and differentiation in plants in minute concentrations.</p> <p>Plant Hormones & Types:</p> <p>Auxin- helps in apical dominance.</p> <p>Gibberellin- helps in breaking of seed and bud dormancy.</p> <p>Cytokinin- helps in delaying leaf senescence.</p> <p>Synthetic or Artificial hormones:</p> <p>They are not produced in plants. Helps in rooting of cutting, delay of pre-harvest fruit crop, herbicide, developing parthenocarpic fruit.</p> <p>c) <u>Response and Chemical Coordination in Animals-Hormones:</u></p> <p>Proteinaceous or steroidal in nature, transported from source to target site, destroyed after completion of its activity etc.</p>	<p>in a garden and touch its leaf, and observing the leaf droop is given to the learners.</p> <ul style="list-style-type: none"> • An activity experiment to observe the production of roots from the cut at the stem-end under the influence of auxin after a few days is given to the learners. • Representation showing a dwarf plant (before gibberellin application) grows into an elongated plant after gibberellin action. • Diagrammatic presentation of human body showing 	<p>shown live in open ground or garden under sunlight.</p> <ul style="list-style-type: none"> • Learners can be instructed to prepare a table having name of the scientist with year, origin, constituents and functions of natural plant hormones. • A schematic representation of the mechanism of phytohormones on plant growth regulation after transporting from their source to target site can be displayed in the class. • A video demonstration can be presented to the learners showing the action of artificial auxin as herbicide for weed control and in the development of parthenocarpic fruit (seedless fruit) like <i>Brassica rapa</i>, grapes etc. • A model showing the feedback control of hormones from pituitary gland
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<p>Human endocrine glands and the hormones secreted from them- Hypothalamus: Oxytocin Pituitary: ACTH, TSH etc. Adrenal: Adrenalin, nor-adrenalin. Thyroid: Thyroxin. Gonads: Sex hormones. Effect of deficiency of hormone secretion in animals: Dwarfism: STH Diabetes insipidus: ADH Goitre: Thyroxine Diabetes mellitus: Insulin</p> <p>d) <u>Response and Physical Coordination in Animals- Nervous System:</u></p> <p>Concept of neural control and coordination- The neurons and the nerves constitute our nervous system, which carries out neural control and coordination.</p> <p>Nervous Pathway- Stimuli-> Receptor-> Sensory neuron-> Nerve centre-> Motor neuron-> Effector-> Response.</p> <p>Reflex action and Reflex Arc- Spontaneous sudden involuntary motor-effector response due to sensory stimulus is reflex action. Complete neural pathway involved in reflex action is reflex arc.</p> <p>Accomodation in eye- Eyes help us in coordinating with our environment. Power of the eye to adjust its focal length, when object to</p>	<p>the position of various endocrine glands is given.</p> <ul style="list-style-type: none"> • Pictorial representation of structures of thyroid gland, pancreas, prostate gland & testes, etc with labelling is provided. <ul style="list-style-type: none"> • A labelled diagram of nervous pathway showing the response to a stimulus is provided. • Nervous pathway components starting from stimulus to receptors is given schematically. • Short experimentation of Pavlov's experiment on conditioned reflex is given with diagram. • A labelled diagram of human eye and its tabular presentation of functions of each part is given. 	<p>(positive and negative effects) can be presented to the learners.</p> <ul style="list-style-type: none"> • A short drama play can be arranged with learners where each one of them will act as a gland and present their origin, target and functions as their dialogues. • A model of human endocrine glands in the body can be prepared by the learners using different wastes and unused materials with labelling. <ul style="list-style-type: none"> • A powerpoint slide or video demonstration can be presented to the students with audio showing the mechanism of neural control and coordination. • A live representation of reaction to a stimulus can be shown to the learners by the teacher. • Students can be divided into two groups and suggested to prepare models of human brain with clay and spinal cord with unused water pipes. • A quick quiz session can be done in class
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<p>view its image should fall on retina.</p> <p>Defects of vision and corrective measures- Myopia: concave lens. Hypermetropia: convex lens Presbyopia: bifocal lens Cataract: removal of opaque lens</p> <p>e) <u>Locomotion as a type of response in animals:</u></p> <p>Importance of movement of animals from one place to another- When one animal preys on another for food, mating and reproduction, when prey escapes from the predator etc.</p> <p>Concept of locomotion- Movement from one place to another in animals by coordinating muscles, bones and joints.</p> <p>Motivations behind locomotion- Finding food, dispersal, finding new and favorable habits, shelter etc. e.g: <i>Paramecium</i>- ciliary movement. <i>Euglena</i>-flagellar movement</p>	<ul style="list-style-type: none"> • Tabular representation of locomotion process with involving organisms is provided. • A labelled diagram of structure of joint is shown. • Role of skeletal muscle in different processes with diagrams and explanations are given. 	<p>for students about different parts of brain and spinal cord, as well as in which situations the reflex arc acts.</p> <ul style="list-style-type: none"> • A camera can be shown in class and its parts compared with that of our eye and also the functions. • A live demonstration of movement of our hands and locomotion from one place to another by our legs can be shown to differentiate the processes. • A brainstorming quiz session can be created about different locomotion processes we observe around us in animals, birds and humans.
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2. Continuity of Life:

Subject/Content	Activity-based component present in the book and curriculum	Suggestive measures for formulating activity-based curriculum
<p>a) <u>Cell Division and Cell Cycle:</u></p> <p>Interrelationship among chromosome, DNA, gene- Chromatin reticulum and chromosomes are different folding states of DNA. The specific parts of DNA carry genes.</p>	<ul style="list-style-type: none"> • Pictorial representation of interrelationship between chromosome, DNA & gene is given. • A photographic 	<ul style="list-style-type: none"> • A chart can be prepared by the students in which names of different species, their chromosome number, in both

<p>Types of chromosomes- Autosome: somatic cells (2n) Allosome: germ cells (n) Chromosome number- Haploid: gametic cells(n) Diploid: somatic cells (2n) Differs among species. Chemical components of chromosome- Nucleic acid (DNA,RNA)+Proteins (histones, non-histones) Heterochromatin: more condensed form Euchromatin: less condensed form DNA: Adenine(A), Guanine(G), Thymine(T), Cytosine(C) RNA: Adenine(A), Guanine(G), Uracil(U), Cytosine(C) Significance of Cell Division- Growth of organisms. Reproduction in organisms. Repair of damaged cells. Types of cell division- Amitosis (Direct) Mitosis (Equational) Meiosis (Reductional) Cell Cycle- Series of events that occurs during the growth of a cell. Phases of cell cycle- Interphase : G₁, G₂ and S phase Mitosis or M phase Stages of mitosis in plant and animal cells- Prophase Metaphase Anaphase Telophase Cytokinesis</p> <p>b) <u>Reproduction:</u> Necessity of reproduction for an organism-</p>	<p>diagram of a karyotype-differentiating the autosomes and allosomes are marked.</p> <ul style="list-style-type: none"> • Differences in appearance of DNA and RNA are given with labelled structures. • A short experiment is provided to students to perform the activity and observe metaphase and anaphase stage of mitosis in mature onion root. • A schematic representation of cell cycle with the different phases is given. • Pictorial representation showing alignment of homologous chromosomes and crossing over during meiosis is provided. <p>• Tabular representation of</p>	<p>haploid and diploid states will be present.</p> <ul style="list-style-type: none"> • Students can be divided into two groups and suggested to prepare models of DNA and RNA with labelling to understand the structural differences. • A Venn diagram of similarities and dissimilarities between DNA and RNA can be given. • A video demonstration of heterochromatin taking up more stain and euchromatin taking up less stain can be shown. • Students can be suggested to draw the cell organelles along with labelling involved in a cell division in colourful papers. • A powerpoint presentation showing how these cell organelles are exactly involved or play their roles in cell division can be displayed to the students. <p>• A video presentation</p>
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<p>Necessary for the production of a new generation of individuals of the same species. It is essential for continuation of species.</p> <p>Modes of reproduction- Asexual: from a single parent without fusion of gametes. Sexual: from fusion of two different gametes. Vegetative propagation: directly from vegetative parts of plant body.</p> <p>Concept of Alternation of Generation; especially in fern- Two phases of life cycle (gametophytic and sporophytic) occur in regular succession alternating with each other is called alternation of generation. Sporophytic: diploid (2n) Gametophytic: haploid (n)</p> <p>c) Sexual Reproduction in Flowering Plants: Typical structure of a flower- Calyx: outermost and lowermost whorl of floral members and is composed of green leaf-like structure, the sepals. Corolla: second whorl from outside towards centre and is composed of petals. Androecium: third inner whorl, composed of stamens. Gynoecium: innermost whorl, consisting of carpels. Pollination & Its Types- Transfer of pollen grain from anther of stamen to stigma of carpel. Self-pollination: transfer</p>	<p>asexual reproduction in different organisms and respective reproduction process is provided with each diagram.</p> <ul style="list-style-type: none"> • A short experimentation on micropropagation is presented to the students. • Alternation of generations in Fern is presented schematically dividing the two phases. • Diagrammatic representation of L.S of a typical flower is given. • Diagrams of self and cross pollination is provided with arrows marking the transfer of pollen grains. • Differentiation between self and cross pollination along with corresponding features is presented in a tabular form. • Schematic representation of simplified process of fertilization in plants is given both diagrammatically 	<p>of cell division helping in reproduction can be given.</p> <ul style="list-style-type: none"> • Students can be advised to pick out the flowering and non-flowering plants from their surroundings and categorize them. • A quiz session can be created about different modes of reproduction along with their examples. • Students can be asked to prepare charts on alternation of generation in organisms other than fern by discovering from resources. • Students can be divided into groups and asked to collect and bring 2-3 medium sized flowers and their parts can be shown by dissecting them through live demonstration. • A class discussion can be conducted in which the students discuss about the significance of fertilization in plants. • Apart from fertilization in plants, fertilization process in animals giving rise to offsprings can
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<p>between same flower or different flowers of same plant.</p> <p>Cross-pollination: transfer between different plants of same species.</p> <p>Agent of pollination- Air: Anemophily Water- Hydrophily Insect- Entomophily Bird- Ornithophily</p> <p>Process of fertilization leading to development of a new plant- Union between male gamete (produced by pollen grains) and female gamete (present in ovule) in plants.</p> <p>d) <u>Growth and Development:</u> Concept of growth and its phases- Irreversible increase in dry mass followed by synthesis of new cellular material with changes in organisms. Phases: 1) Phase of cell division 2) Phase of cell enlargement 3) Phase of cell differentiation</p> <p>Concept of human development and its phases- Series of sequential and orderly changes of cells and tissues giving rise to an adult organism. Types- Physical, Cognitive, Social and Emotional developments. Stages- i. Infancy: Birth to 2 years ii. Childhood: 3 to 12 years iii. Adolescence: 13 to</p>	<p>and in flowchart form.</p> <ul style="list-style-type: none"> • Diagrammatic representation of phases of cell division, cell enlargement and cell differentiation of plant and animal cells is given. • Pictorial form of different phases of human development from infancy to adulthood is provided to the students. 	<p>be demonstrated through video-audio mode.</p> <ul style="list-style-type: none"> • Students can be asked to list out the differences between growth and development in humans. • Students can be given a task of asking the age of each of his family members and thereby determining at which of development that member is in present. • A chart showing the different phases of human development along with age group and their distinct characteristics at each stage can be displayed. • Concept of similarity and difference in 'division of cell' and 'multiplication of cell' can be discussed among the learners for a brainstorming
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iv. 18 years Adulthood: 19 to 40 years		activity.
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3. Heredity and Common Genetic Diseases:

Subject/Content	Activity-based component present in the book and curriculum	Suggestive measures for formulating activity-based curriculum
<p>a) <u>Heredity:</u></p> <p>Transmission of characteristics from one generation to another in an organism- Passing of characters from parents to the offsprings is heredity. It maintains the continuity of life and helps in preserving species in nature.</p> <p>Concept of mutation and variation- Mutation: permanent change of the nucleotide sequence of the genome of an organism. Variation: manifestation of the differences between individuals.</p> <p>Nature and Types of Variation-</p> <ol style="list-style-type: none"> Morphological variation: free ear lobes-attached ear lobes. Physiological variation: Normal HbA-Sickle cell HbS Psychological variation: affects the mental status. Continuous variation: Body weight, skin colour etc. Discrete variation: Roller tongue and non-roller tongue. <p>Mendel's work on pea</p>	<ul style="list-style-type: none"> Pictorial representations showing roller and non-roller tongue, free ear lobe and attached ear lobe. A cross showing parental (P) generation to first filial (F₁) to second filial (F₂) generation is given. Schematic representation of dominant and recessive characteristics according to Mendel is provided. Tabular presentation of Mendel's chosen seven characters and their contrasting features, along with their diagrammatic form is given. A checkerboard or Punnett square of events of Mendel's monohybrid cross with genotype and phenotype produced at the end of F₂ generation is given. A monohybrid cross of guineapig (homozygous black and homozygous 	<ul style="list-style-type: none"> Students can be asked to make a chart of the different types of variation with pictures and display it in class. Monohybrid cross can be given as an activity to students-cross between heterozygous mother and homozygous father. Chart presentation showing pedigree or family tree can be given or displayed to the students. Avery, McCarty and MacLeod experiment on DNA as a genetic material can be displayed in a powerpoint slide along with significance. Finding out the exceptions on Mendel's laws in complimentary genes, epistasis, duplicate genes etc can be suggested. Test cross and Back cross can be presented in a chart. Students can be suggested to discuss

<p>plants-</p> <ol style="list-style-type: none"> I. Law of unit character. II. Law of dominance and recessiveness. III. Law of segregation. IV. Law of independent assortment. <p>Contrasting characters in pea plants- Mendel selected 7 contrasting characters for hybridization experiments: Seed shape, Seed colour, Seed-coat colour, Pod shape, Pod colour, Flower position and Stem length.</p> <p>Derivation of Mendel's laws from his experiments on pea plants-</p> <ul style="list-style-type: none"> ○ Law of segregation: from monohybrid cross. ○ Law of independent assortment: from dihybrid cross. <p>Deviation of Mendel's laws of heredity- Law of dominance and Law of independent assortment deviate from expectation sometimes. example- Incomplete Dominance (4 o' clock plant).</p> <p>Sex determination in man- XX: female XY: male Now, SRY gene on Y-chromosome is actually responsible for male sex determination.</p> <p>b) <u>Some Common Genetic Diseases:</u> Some genetic diseases in population- Colour blindness, Haemophilia, Thalassemia etc</p> <p>Causes of genetic diseases-</p>	<p>white) is given.</p> <ul style="list-style-type: none"> • A checkerboard of events of Mendel's dihybrid cross with genotype and phenotype produced at the end of F₂ generation is given. • A dihybrid cross of guineapig (between pure black & rough and pure white & smooth variants) is presented. • Diagrammatic representation of 4 o' clock plant (<i>Mirabilis jalapa</i>) showing incomplete dominance is shown. <ul style="list-style-type: none"> • A pictorial representation of a thalassaemic patient (child) is given. 	<p>and find the relation between fertilization and heredity.</p> <ul style="list-style-type: none"> • A video demonstration of how SRY gene on Y-chromosome helps in sex determination in man can be displayed. <ul style="list-style-type: none"> • Students can be asked to prepare a list of changes in chromosome number or chromosomal aberrations leading to various syndromes
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<p>Colour blindness: X-linked recessive. It is the disability to recognize colours.</p> <ul style="list-style-type: none"> ○ Protanopia- cannot recognize red colour. ○ Deuteranopia- cannot recognize green colour. <p>Haemophilia: X-linked recessive. Inability of clotting of blood in case of damage of blood vessels due to external injury.</p> <p>Thalassemia: autosomal chromosomal disorder. It occurs due to mutation in haemoglobin-producing gene. Suffers from anemia.</p> <p>Thalassemia as an autosomal chromosomal disorder-</p> <p>Inherited blood disorder, characterized by the abnormal formation of haemoglobin.</p> <p>Genetic counselling helps in preventing thalassemia-</p> <p>Genetic counsellors after detecting the genetic state of the couples may advise them for the risk they bear for producing thalassaemic child. Helps in reducing genetic load in population.⁷</p>		<p>with diagrammatic or pictorial representation of each.</p> <ul style="list-style-type: none"> ● A chart can be prepared containing in a tabular form the name of genetic disease, causes, symptoms and effects, remedial measures and hung beside the board for quick learning. ● Students can be suggested to gather information about gene therapy and stem cell therapy in remedy of genetic diseases (apart from thalassemia) and share with class in a debate session or through oral presentation.
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4. Evolution and Adaptation:

Subject/Content	Activity-based component present in the book and curriculum	Suggestive measures for formulating activity-based curriculum
<p>a) Evolution:</p> <p>Life forms changing over time-</p> <p>From no life on earth to evolution of simple organisms or single cells to highly organized complex organisms.</p> <p>Concept of Evolution-</p> <p>Origin of a genetically</p>	<ul style="list-style-type: none"> ● Pictures of different scientists- Aristotle, Haldane, Oparin, Miller and Urey are given. ● A short experiment of Miller and Urey i.e. Chemosynthetic 	<ul style="list-style-type: none"> ● Contributions of other scientists in the field of evolution (other than Darwin, Lamarck) can be provided to the students in a chart. ● A video presentation

<p>distinct type of organism from the pre-existing life forms through gradual modifications.</p> <p>Origin of Life- Chemical evolution: Coacervate->Microsphere->Proto-cell. Biological evolution: Chemosynthetic theory (Miller and Urey).</p> <p>Major evolutionary events- Formation of earth->origin of life->unicellular->multicellular->fish-like vertebrates->land plants evolve->quadrupeds->four-limbed vertebrates move to the land.</p> <p>Theories of Organic Evolution- Lamarckism: Jean Baptist de Lamarck. Theory of Inheritance of Acquired Characters. Darwinism: Charles Robert Darwin. Theory of Natural Selection.</p> <p>Evidences for the theory of evolution- (A) Palaeontological evidence: A pre-existing form of life as missing link may be an evidence in favour of biological evolution from palaeontology. Eg- Evolution of horses. (B) Comparative Anatomy: Comparative study of the organ systems in different vertebrates. Eg- Homologous organs, Analogous organs, Vestigial organs, Vertebrate heart.</p> <p>b) <u>Survival Strategies:</u></p>	<p>theory is given diagrammatically.</p> <ul style="list-style-type: none"> • A table of a list of organic components formed in Miller-Urey experiment is provided. • A schematic representation of origin of life through major evolutionary events is given. • A pictorial flowchart of Lamarckism in giraffe i.e tendency of giraffe to elongate its neck through ages is given. • A tabular presentation of observations of Darwin and his deductions from them is provided clearly. • A table showing the increase in size of horses and their appearances is provided. • Diagram depicting the similarities among the early embryos of some vertebrates. 	<p>of how life originated on earth can be demonstrated.</p> <ul style="list-style-type: none"> • Students can be divided into groups and asked to gather information on Neo-Lamarckism and Neo-Darwinism and to compare them with Lamarckism and Darwinism through a debate session. • A brainstorming session on why diversity and unity are considered as the fundamental units of the Theory of Evolution can be conducted. • A video-audio presentation on the evolution of horses as a palaeontological evidence can be demonstrated. • Models showing the homology in the organs of whales (flippers), birds(wings), human(phalanges) can be demonstrated. • Students can be instructed to prepare a project in which models of vertebrate hearts and their evolution from fish to mammals with proper labelling is to be demonstrated by them.
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<p><u>Adaptation:</u> Importance of behaviour in the process of evolution- Living organisms are guided by their behaviour and adaptation for evolution in nature.</p> <p>Adaptation evolving in the population of an organism- Adaptation refers to the phenomenon of adjustment of one organism to its surrounding environment. Adaptation is the key criteria in promotion of evolution.</p> <p>Examples of Adaptation-</p> <ol style="list-style-type: none"> Morphological: Cactus, Swim bladder in fish etc. Physiological: Salt adaptation in Sundari. Behavioural: Problem solving in Chimpanzees. 	<ul style="list-style-type: none"> Pictorial representation of morphological adaptation in cactus plant, structure of swim bladder in fish is given. Labelled diagram of position of air inside a bird's body and structure of air sacs is provided. Diagram showing the round dance and waggle dance as modes of communication by honey bee with proper arrows in directions is shown. 	<ul style="list-style-type: none"> An oral presentation can be suggested to the students on relation between and differences between evolution and adaptation. A live demonstration of adaptation in cactus and swim bladder in fish can be given. An animated video on behavioural adaptation in chimpanzees can be demonstrated.
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5. Environment, Its Resources and Their Conservation:

Subject/Content	Activity-based component present in the book and curriculum	Suggestive measures for formulating activity-based curriculum
<p>a) <u>Nitrogen Cycle:</u> Process of nature recycling and replenishing its reservoir of elements- The biotic and abiotic components of ecosystem are linked together by the nutrient cycles and energy flows.</p> <p>Nitrogen Cycle- Organisms take nitrogen from the nature and from the organisms this is released to the nature again and its equilibrium maintained.</p> <p>Influence of various human activities on N₂ cycle-</p>	<ul style="list-style-type: none"> A schematic representation of nitrogen cycle- nitrogen fixation, ammonification, nitrification, denitrification is given. Balanced equations at each step of nitrogen cycle is provided. 	<ul style="list-style-type: none"> Students can be asked to prepare a chart in which each step of nitrogen cycle and the respective microorganisms involved will be present. Students can be divided into 3 groups and prepare 3 charts or presentation on carbon cycle, sulphur cycle and phosphorus cycle in

<p>○ Fertilizers increase the amount of nitrogen that is cycling between the living world and the abiotic components.</p> <p>○ Fresh water acidification can cause aluminium toxicity and mortality of pH-sensitive fish species.</p> <p>b) <u>Environmental Pollution:</u></p> <p>Concept of Pollution- Pollution is the unfavourable alteration of our environment largely as a result of human activities.</p> <p>Pollution affects our daily life-</p> <p>○ Increase in temperature of earth due to green-house gases.</p> <p>○ PAN in air: eye irritation.</p> <p>○ Aerosol: respiratory problems.</p> <p>○ Acid rain: damage to buildings, historic monuments etc.</p> <p>○ Water pollution: cholera, amoebiasis, itai-itai etc.</p> <p>○ Benzene (soil): leukemia.</p> <p>○ Noise: cardiovascular problems.</p> <p>c) <u>Environment and Human Population:</u></p> <p>Problems caused by ever-increasing population- Birth rate=Death rate (population structure constant) Birth rate > Death rate</p>	<p>• A tabular representation of causes and effects of air, water, soil and noise pollution is given.</p> <p>• A pie-chart of percentage of different types of green-house gases is provided.</p> <p>• Pictorial representations of effects of acid rain on monuments, air pollution on lungs, agricultural run-off, <i>Giardia</i> causing water pollution, eutrophication and algal bloom due to water pollution, noise pollution etc is shown.</p> <p>• Pictures showing how over-population looks like and how it leads to</p>	<p>environment.</p> <p>• A powerpoint presentation of different types of ecosystems in a schematic form and their components can be demonstrated.</p> <p>• Students can be asked to find out the effect of green-house gases and climate change on significant ozone depletion.</p> <p>• Students can be asked to prepare poster in groups on how to decrease different pollutions and make people aware of the harmful effects and present it through a campaign.</p> <p>• A video presentation of how eutrophication leads to algal bloom which in turn has harmful effects on aquatic plants and animals can be demonstrated.</p> <p>• Over-population leading to competition among</p>
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<p>(population explosion)</p> <p>Problems-</p> <ul style="list-style-type: none"> ○ Over-exploitation. ○ Deforestation. ○ Shortage of fresh water. ○ Shrinking of agricultural land. ○ Destruction of wetland. ○ Food scarcity. <p>Environment and Human Health-</p> <p>i. Asthma: Chronic lung disease caused by inflammation and narrowing of the airways. Pollutants are dust in air, smoke and soot.</p> <p>ii. Bronchitis: Inflammation of upper respiratory tract. Pollutants are dust, fumes and smoke.</p> <p>iii. Cancer: Chewing tobacco causes oral cancer.</p> <p>d) <u>Biodiversity and Conservation:</u></p> <p>Importance of biodiversity-</p> <ul style="list-style-type: none"> ✓ Source of food. ✓ Source of medicines. ✓ Maintenance of ecological balance. ✓ Increases the economy of nation. ✓ Control of climate etc. <p>Biodiversity Hotspots- The eastern Himalayas. The Western Ghat and Sri Lanka. Indo-Burma Sundaland.</p> <p>Environmental problems of Sundarbans-</p>	<p>deforestation, air pollution, destruction of wetland is provided.</p> <ul style="list-style-type: none"> • Diagrammatic representations of hoe pollution causes lung diseases (picturization of symptoms of asthma), bronchitis is given. • A tabular presentation of some carcinogenic pollutant and cancers caused due to them is provided. <ul style="list-style-type: none"> • Pictures of paddy plant and <i>Cinchona</i> plant is provided. • Pictures of hunting & poaching, Cheetah, <i>Lantana camara</i>, mangrove forest, Royal Bengal tiger, Sundarbans is given. • A tabular presentation of different in-situ conservation, their characteristics, examples in west 	<p>individuals and species for their survival can be discussed through a debate session.</p> <ul style="list-style-type: none"> • A power point presentation on progression of cancer in human body leading to malignant tumor can be shown. • A poster presentation can be made by the students on harmful effects of tobacco, how it can be avoided and immediate treatment can be demonstrated by the students on 'World Cancer Day'. <ul style="list-style-type: none"> • A power point presentation on different ways to measure diversity i.e. species richness, genetic diversity, ecosystem diversity can be displayed. • A poster on causes, effects of deforestation on both biotic and abiotic components of nature, how to make people aware of
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<p>Mangrove destruction, freshwater crisis, habitat destruction, prey-predator disbalance, submergence of islands due to rising sea level.</p> <p>Conservation of biodiversity-</p> <p>In-situ conservation: National Park, Sanctuary, Reserve Forest, Biosphere Reserve.</p> <p>Ex-situ conservation: Zoological garden, Botanical garden, Cryopreservation.</p> <p>Some endangered species of India & their conservation-</p> <p>Tigris (<i>Panthera tigris</i>)- Tiger Reserve Forest (27)</p> <p>Red Panda (<i>Ailurus fulgens</i>)- Red Panda Project etc.</p>	<p>Bengal and rest of India is shown.</p> <ul style="list-style-type: none"> • Pictorial representation of Zoological Garden, Botanical Garden, Cryopreservation are provided. 	<p>these and prevent deforestation can be presented.</p> <ul style="list-style-type: none"> • Students can be asked to share their experiences if they have visited any of the biosphere reserves with their peers.
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Conclusion

The WBBSE Life Science textbook ‘**Life Science and Environment**’ of Class 10 explores the fundamentals of biology in a lucid and an understandable manner. All the five chapters are relevant and related to each other. It has been possible to critically analyse the activity-based component in the curriculum. The analysis also helped us put forward the fact that the activity-based components are mainly tabular presentation, schematic diagrams, pictures and labelled diagrams. Some parts also contain a few short experimentations and real-life based activities. But these are not much in number. Also, pen and paper work is not given much importance. The activity-based components present are relevant and can be easily done by the students, but they may not always get the environment to do so.

Some recent and fun activities related to the syllabus topics like chart, poster, video-audio presentation, power point presentation, live demonstrations, preparing labelled models, and also some brainstorming activities like debates, oral presentations, quiz sessions has been suggested by the researchers to enhance the holistic development of the learners as well as inculcating the technological skills to keep up with recent trends. Therefore, it can be said that the curriculum present in the textbook could advance in many ways to benefit the students of today’s world.

Future Perspectives

There is a scope of further improvements and reshaping the curriculum by taking into account the suggested measures in the paper and incorporating them after analysis in the textbooks,

also the limited time period of a session should also be kept in mind. Advanced researches in this field can be undertaken so that enriched curriculum can be developed in near future keeping up with the recent advancements in education.

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