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PERCEPTION OF BIOLOGICAL CONCEPTS AMONG HIGHER SECONDARY TEACHERS: A STUDY

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Abstract

Biology is an important subject in curriculum. It helps to develop the scientific attitude, scientific temper, logical reasoning, *scientific literacy, awareness of environmental issues, and respect about surrounding life among students. Biology textbook content is a authentic source of information for teachers & students. According to the National Focus Group has made important consideration about higher secondary biology curriculum that, scientific concepts should be within reach of the learner and also content components i.e. key terms, facts, concepts, principles, illustrations etc introduced and delivered in the classroom by meaningfully and simplified manner. The biology teachers play an important role to transfer biology content knowledge to the students. If the biology teachers already perceived some misconceptions or alternative conceptions regarding the biology concepts, it may transform as it is in their students. It will be adversely affected the conceptual understanding of the students.*

In the present paper researchers has made an attempt to study the perception about Biological concepts among higher secondary teachers. The content analysis method and descriptive survey method was adopted for the study. The data collected from higher secondary biology teachers (N=50) with the help of researcher made questionnaire and analyzed with the descriptive statistics. It was found that most of the higher secondary biology teachers are unaware about the biological concepts in textbook. Most of the teachers are unable to differentiate between biological terms, facts, attributes and concepts. The present paper will be helpful to know more about the present status of perception of higher secondary biology teachers and the content analysis.

Keywords: *Biological Concepts, Content Analysis, Higher Secondary Teachers, Biology Textbook etc.*

Introduction

Biology is the most common subject required for admission into many professional courses like medicine, pharmacy, nursing, agriculture, biotechnology, etc. Biology helps students to understand the environment and expects students to develop awareness, positive attitude, scientific temper, value and skills. According to National Focus Group (NFC) emphasis on the consideration of Higher Secondary Level biology curriculum that, scientific concepts within the reach of learner and content element (terms, facts, attributes, concepts, principles, theory, formula, diagrams etc) included and delivered in the classroom by meaningful and simplified manner.

At higher secondary level (XI & XII std) biology textbook play bridge role in between teachers and students. Biology textbook is considered to be the mirror of the curriculum and syllabus of higher secondary biology subject. American biology teachers solely rely on textbooks for use in their instruction and nearly 90% of teachers use a textbook 90% of their time (Ambibola & Baba,1996). In India too biology teachers are solely rely on biology textbooks.

The biology textbook content consists of facts, terms, attributes, concepts, characteristics, generalizations, rules, laws, principles, signs, diagrams, formulae, arrangements, process, method, theories etc. Biology teachers fails to perceived these content elements scientifically and meaningfully it may creates misconceptions in teachers and these misconceptions may transform in students.

Review of Related Literature

Chavan, R.(2016) reported the difficulties in teaching biology concepts by science teachers at upper primary school. The study was descriptive in nature. The VI, VII & VIII grade science textbook biology content was analyzed by the content analysis technique and important biology concepts was identified. It is found that science teachers faced difficulties in comprehension of biological concepts like cell, sporogenesis, segmentation, etc.

Samuel & Babola (2011) studied science teachers and students perception about the difficult topics in the integrated science curriculum of lower secondary schools in Barbados. It is found that the certain science topics are perceived to be more difficult than other and this issue is related to science teachers' classroom teaching. It is found that some science concepts are abstract and concrete in textbook, so difficult for teachers to provide concrete experience for the students to facilitate more effective learning. This is a major source of students misconception

Abimbola (1998) studied 'Teachers perceptions of important and difficult biology content secondary schools in Kwara state; it is found that 'applied biology' is an important concept perceived by the teachers. Ecology, chromosomes, cellular, growth and heredity, are the concepts perceived as difficult to teach by the teachers.

Finely & etal. (1982) studied the teachers perceptions of important and difficult science content. The results of the study reported that in biology photosynthesis, mitosis, meiosis, cellular respiration, chromosome concepts were found to be difficult to teachers and its creates alternative concepts in students.

Need and Rationale for the study

Based on the review teacher is a facilitator of knowledge. Biology is a quite observable, practical oriented subject. Biological concepts are interconnected to other subjects. Biology teachers play an important role in curriculum content transformation. Due to inappropriate or wrong perception about the biology concepts to biology teachers, there might be responsible to create false conceptual knowledge in students and it cause misconceptions in higher secondary students. At present teacher is important source of knowledge & information at higher secondary level. Hence, researcher found this study needful.

Research Question

1) Which are the biological concepts included in eleventh grade biology textbook?
2) Are the higher secondary biology teachers aware about the biological concepts?
3) Do the higher secondary teachers are able to identify & differentiate between biological facts, terms, attributes & concepts**?**

Statement of the Study

Perception of Biological Concepts among Higher Secondary Teachers: A Study

Terminologies used in the Study

Higher Secondary Teachers: In the present study the teachers who teach biology subject for higher secondary level (Junior College Level-XI and XII grade) are considered as higher secondary teachers.

Biological Concept: A biological concept is assumed to be a set of specific objects, symbols or events which share common characteristic and can be referenced by a particular name or symbol. E.g. Cell

Perception: Perception is considered as a higher secondary teachers awareness about biology textbook content and their ability to identify and differentiate in content knowledge about terms, facts, attributes & concepts.

Objectives of the Study

1) To analyze the eleventh standard biology textbook and identify biological facts, terms, attributes and concepts
2) To study the perception about biological concepts among higher secondary teachers

Assumptions

The Biology textbook of XI grade consisting biological concepts recognized and produced by Maharashtra State Bureau of Textbook Production & Research Curriculum, Pune.

Delimitations

The present study is delimited to perception of higher secondary biology teachers in Karvir Tahsil of Kolhapur and also delimited to Biology Textbook produced by Maharashtra State Bureau of Textbook Production & Research Curriculum, Pune.

Tools & Research Methodology

The researchers attempt to analyze the XI grade biology textbook with respect to facts, terms, attributes, concepts. Hence, qualitative analysis-document analysis method is used. The main objectives is to study the perception of the biological concepts among higher secondary teachers, therefore researchers select survey method from descriptive survey.

Sampling procedure and Sample

In the present study fifty (N=50) higher secondary biology teachers working in different higher secondary schools in Karveer taluka were taken as a sample. The purposive sample technique has been adopted for the selection of sample. The population is considered as all the higher secondary biology teachers

Tools and data collection

Researchers attempt to study the perception of biological concepts among higher secondary biology teachers hence, researcher made questionnaire, and unstructured interviews of biology teachers were used as tool for the data collection. The data was collected with the prior permission of the higher secondary biology teachers and open ended questionnaire was administered.

Research Procedure

1) Analyze the XI grade biology textbook and according criteria's of facts, terms, attributes and concepts embedded in textbook content.
2) Preparation of open ended questionnaire based on analyzed biological facts, terms, attributes & concepts
3) Selection of the sample and collection of the data with the help of open ended questionnaire
4) Unstructured interviews of the higher secondary biology teachers

Data Analysis

Researchers analyzed the collected data with the help of statistical analysis i.e. tabulation and percentage. The qualitative analysis was done by the coding of the data

Table No.1

Content Analysis of Eleventh Grade Biology Textbook (State Board Syllabus)

Sr. No.	Name of the Chapter	Facts	Terms	Attributes	Concepts
1	Diversity of Organism	The term classification was coined by A.P. de candolle. Kingdom is the highest and species the lowest category	Plant, Animal, Synonyms, Organisms	Category, Taxon, Kingdom, Division, Class, Sub-class, Series, Order, Family, Genus, Species, Saprophytic, Phycobiont, Photobiont, Mycobiont	Growth, Reproduction, metabolism, Diversity, Fungi, Taxonomy, Classification, Nomenclature, Lichen, Virus, Fungi
2	Kingdom-Plantae	The Angiosperm possesses fruit with one or more seeds.	Chlorophyll, Chlorophyll-a, Chlorophyll-b, Zygote, Moss, Seta, Capsule, Fern, Taxonomic Key	Aquatic, Terrestrial, Motile, Biflagellate, Perennial, Vascular tissue, Heteromorphic, Prostrate,	Algae, Bryophyte, Pteridophyte, Angiosperm, Gymnosperm, Herbarium, Botanical Garden

				Haploid, Diploid, Monocotyledonae, Dicotyledonae, Heterosporus.	
3	Biochemistry of Cell	-Cell is fundamental, structural, functional & unit of life -Watson and Crick proposed the double helix structure of DNA in 1953.	Cellualar Pool, RNA, Protein, Lipids, Nucleotides, Harmones, Wax, Hydrogen atom, Nucleic Acid, Sugar, Purine, DNA	Anabolic reactions, catabolic reactions, Monosaccharides, Disaccharides, Plysaccharides, m-RNA, t-RNA, r-RNA, endoenzyme, Inhibitors, Co-factors, Ligases, Lysaes.	Energy, Enzymes, Carbohydrates, pH, Metabolism
4	Cell Division	-Growth and Development of every living organism depends on cell division, -Cell Division is of two main types- Mitosis and Meiosis	Daughter Cell, Cell cycle, Nucleolus, Cytoplasm, Centriole, Centromere, chromosome, Nucleolus, Spindle fibre, Chiasmata,	Interphase, G1-phase, Synapsis, S-Phase, pachytene, Prophase, Metaphase, Anaphase, Telophase, Leptotene, Zygotene,	Cell, Cell Division, Mitosis, Meiosis, Amitosis, Karyokinesis, Cytokinesis, Diakinesis,
5	Morphology of Flowering Plants		Radicle, Root, Root cap, Raphe, Plumule, Pneumatophores, Coleorhiza, Bulb, Corm, Rhizome, stem, Tendril, Thorn, Cladode, Embryo Axis, Stipules, Petiole, Hypocotyl, Lamina, Inflorescence,	Aggregate Fruit, Meristematic region, Region of elongation, Region of absorption, Cell differentiation, Adventitious root, Tap root, Fusiform root, Conical root, Napiform root, Simple Tuberous root, Noon-	Morphology, Anatomy, Venation, Floral Formula, Phyllode, Phyllotaxy,

				endoplasmic, Fasciculated root, Prop root, stilt root, Climbing root, Epiphytic root, sucking root, Meristematic Tissue, Secondary meristem, offset, sucker, Composite fruit, Bulbils, Hypopodium, Leaf hooks, Reticulate venation, Parallel venation, Endopserm, Pinnately compound leaves, Palmately compound leaves, leaf spines, leaf tendrils, Plant Tissue,	
6	Plants Water Relations and Mineral Nutrition	-Water is essential for all life activites of plants. -Levit proposed the Proton concept in 1974.	Water, Mineral, Root hair, Sap, Hydathode, Stomata,	Hygroscopic, Gravitational water, Capillary water, Symport, Antipost, Endosmosis, Exosmosis, Turgor Pressure, Pressure deficit, Turgid, Suction force, Water Potential, Apoplast pathway, Symplast pathway, Water absorption, Passive	Imbibition, Diffusion, Osmosis, Plasmolysis, Permeability, Absorption, Absorption, Guttation, Cohesion, Adhesion, Transpiration, Translocation, hydrophonics, Deficiency, Necrosis, Necrotic, Biological Nitrogen fixation, Nitrogen Metabolism, Nitrogen Cyle, Mineral toxicity,

				absorption, Ascent of sap, Root pressure, Transpiration Pull, Cohesion tension theory, Circular transpiration, stomatal transpiration, Lenticular transpiration, Mineral nutrients, Micronutrients,	
7	Plant Growth Development	Growth is an irreversible increase in size, weight and volume of an organism.	Cytokinin, Gibberllins, Auxins, Abscissic acid, Ethylene, Florigen	Seed Dormancy, Seed Germination, Hypogeal Germination, Epigeal germination, Viviporous germination, Cell Elongation, Differentiation, Redifferentiation, Growth curve, Growth regulators,	Growth, Dormancy, Germination, Senescence, Photoperiodism, Photomorphogenesis, Phtochrome, Vernalization, Devernalization
8	Kingdom Animalia	The largest phylum of kingdom animalia is Arthropoda	Corallium, Leech, Crab, Sepia, Myxine, Saw fish, Hyla,Cobra, Parrot, Crow, Tiger, Wolf, Nerve cord, Anus, Tentacles, Papillae, Notochord, Gonad, Scales, Operculum, Forelimb,	Kingdom, Kingdom Animalia, Body Symmetry, Asymmtrical animals, Radially symmetrical animals, body cavity, Acoelomates, Nematocysts, Corals, Diploblastic, Aschelminthes,	Omnipresent, Dimorphism, Bioluminescence, Endoparasites, Parasites, Locomotion, Symmetory, Exoskeleton, Carnivorus, Oviparous, Placoid, Biconvex, Metamorphosis, Adaptation, Equilimbrium,

			Pneumatic,	Ganglionate, Gastropods, Buccal Cavity, Terrestrial, Solitary, Pentamerous, Acorn worms, Proboscis, Cartilagenous, Urochordata, Phaymgeal gill slits, Agnatha, Gnthostomata, Cyclostomata, Typhlosole, Piokilothermic, Planktons, Caudal fin, male copulatory organ, Heterocercal, Homeotherms, Crowling animals,Limbless pikilothermic, Sexual, Olfactory, Pentaductyl digit, fightless birds, streamlined,	Marsupials, Zoological Park, Breeding
9	Organization of Cell	Cell is structural and functional unit of life	Anabena, Nostoc, Mucor, Rhizopus, Cellula, Cyanobacteri, Spirulla,	Living organism, Postulates, Bacilli, cocci, Bacilli, Vibrios, glycocalyx, Plant cell, Animal cell, Cell wall, Cell envelop, Prokaryotes, eukaryotes, macromolecules, Centriole, Lysosomes, Peroxisomes	Cytology, Cell Biology, Genetics, Cell Theory, Chromosomes, Totipotency, Virus, Capsule, Endoplasmic reticulum, Detoxification

10	Study of Animal Tissues	Cells usually work in groups called tissue.	Axon, Synapse, Cyton, Dendrons, Neuron, Ligamnet, Mast cells, Macrophages, Z-line,	Epithelium, Squamous epithelium, Cuboidal epithelium, Columnar epithelium, Grandular epithelium, Endocrine gland, compound epithelium, Fibroblasts, Neuromuscular junction, Connective Tissue, Haversian system, sacromere,	Tissue, Blood, Organ, Gland, Tendons, Ossein,
11	Study of Animal Type	Cockroaches are omnipresent.	Animal, Abdomen, Cockroach, Thorax,	Omnipresent, Species, Class, Chitinous,	Cannibalism, Sexual Diamorphism, Nervous System, Respiratory Syatem,
12	Human Nutrition	The processes which are providing energy to bodies are nutrition and respiration	Fat, Protein, Carbohydrate, Jaundice, Diarrhea, Vomiting,	Heterodont, Diphodont, Disorder, Chyle, Marasmus ,	Nutrition, Digestion, Assimilation, Peristalsis, Absorption, Egestion, Indigestion, Constipation
13	Human Respiration	Hydrolysis of ATP converts it to ADP & energy is released	ATP, ADP, COPD, Asthama,	Nostrils, Vestibules, Pharynx, Larynx, Trachea , Branchioles, Lungs, Asbestosis, Emphysema, silicosis, Silicosis,	Respiration, Breathing, Inspiration, Expiration,
14	Human Skeleton and Locomotion	The Human endoskeleton consists of 206 bones in	Central Axis, Thoracic cage, Backbone, Spine, Ligament,	Endoskeleton, Exoskeleton, Immovable, Movable,	Bone, Locomotion, Skeleton, Joints, Arthrology, Synothrosis,

		an adult		**Interverbal Joints, Synavial Membrane, Synavial fluid, Striated Muscle, Skeletal Disorder, Rheumatoid arthritis,**	**Amhiarthrosis, Contractility, Arthritis, Myasthenia gravis , Tetany**

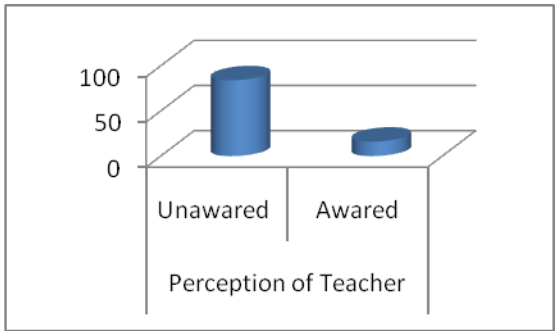
Observation and Interpretation

From the above Table No. 1 it is showed that, Eleventh grade biology textbooks consists of 14 chapters and according the content analysis criteria's each chapter included the biological facts, terms, attributes & concepts .

Table No. 2.

Higher Secondary Biology Teachers Perception about the Biological Concepts

Biology Teachers correctly identified & differentiate between the Biology concepts & terms, facts, attributes included in Biology textbook content		**Biology Teachers couldn't identified & differentiate between the Biology concepts & terms, facts, attributes included in Biology textbook content**	
Number of Teacher	**Percentage**	**Number of Teacher**	**Percentage**
07	**14%**	**43**	**86%**



Graph No.1 .Higher Secondary Biology Teachers Perception about the Biological Concepts

Observation and Interpretation

From the above Table No.2 & Graph No.1 It is showed that, Most of the (86%) Higher secondary Biology teachers are not able to identify & differentiate between the Biology concepts & terms, facts, attributes included in Biology textbook content. Very few (14%) Higher secondary Biology teachers correctly identified & differentiate between the Biology concepts & terms, facts, attributes included in Biology textbook content.

Results and Conclusion

1) It is found that higher secondary Eleventh grade biology textbooks consists of 14 chapters and by the selected content analysis criteria's each chapter consist of biological facts, terms, attributes & concepts. It is concluded that biology textbook content is made up of facts, terms, attributes, concepts, characteristics, generalizations, rules, laws, principles, signs, diagrams, formulae, arrangements, process, method, theories etc. The similar findings reported by Hsing Wang (1998), Myint Khine (2013) that content analysis is helpful for identify the important concepts , facts, theories, principles included science textbooks and content analysis increases the conceptual understanding of students and teachers.

2) Sampled higher secondary biology teachers among them most of the teachers are not aware about the biological concepts, they are unable to identify & differentiate between the biology facts, terms, attributes and concepts included in biology textbook content which supports the conclusion of James David Williams (2013) that the pre–service science teachers failed to identify and differentiate the key scientific terminology i.e. theory, fact, law, hypothesis. They were unaware about the scientific meaning of it.
3) Sampled higher secondary biology teachers among them very few teachers are aware about the biological concepts & they are able to identify & differentiate between the biology facts, terms, attributes and concepts included in eleventh grade biology textbook. It supports Lenton & McNeil (1993) in their research they found that some science teachers are able to differentiate in important concepts and categories and scientific facts.

It is clear from the preceding that there is still teachers have difficulty in identification and differentiation in different textbook content components. It is important reason and source of students misconceptions.

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