

An Analysis of Biological Terminology used in Textbook of Biology

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Abstract

The study of science subjects includes several concepts and numerous terms. This study was conducted to analyse the biological terms in the textbook of biology at grade IX. This study was descriptive in nature. The results of Board of Intermediate and Secondary Education examinations (Multan 2018 for class IX) revealed that the passing percentage in biology (76 %) is less than other science subjects as chemistry (78%). The results and views of science students of Pakistan depicted that learning of biology as a subject is difficult. In this study the textbook of biology for class IX was analyzed. Several difficult terminologies were identified. Then a questionnaire was developed to seek the opinion of students about those terminologies. Each questionnaire contained 104 biological terms and 11 abbreviations used in textbook of biology for class IX . Thirty two schools were sampled from 4 Tehsils of district Khanewal. From each school 30 students were randomly selected for the study. It was found that majority of terms were derived terms and mainly belonged to zoology as compared to botany. The study finally suggested that use of meanings of derived terms or alternate and easy terms will be helpful in overcoming the difficulty in understanding of biology.

Keywords: analysis, biological terms, derived terms, zoology, botany

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Introduction

This is an era of science and technology. Usage of scientific methods, concepts, and scientific tools have become a global phenomenon. Scientific information is shared across the regions. Every object is described by specific word which helps in building concepts. single word or group of words are helpful in concept formation of things when they are out of context. Scientific research is going on all over the world providing knowledge in all fields of life. Scientific knowledge is increasing at a tremendous rate as science unfolds knowledge about surroundings and diversity of life. Out of physical and natural field of science, the researcher selected the biological fields of natural sciences, because it is an ever-expanding area and is directly related to the branch of science dealing with real life.

There are many objects (living/non living) around us and each object is described by specific word. The need of information and understandable communication require specific designation to each item. This will lead to globalization and will help in global competition and global cooperation. Global communication is based on the vocabulary in all fields to convey the contents in meaningful ways. The vocabulary includes the words, concepts which ultimately in confined form, become specific terms. The designation of defined biological concept in a special language by a linguistic expression are known as biological terms. Textbook is a prime source of lessons for teachers and students. Through textbook the knowledge is transferred to next generations. So, it should be appraised according to new discoveries and needs of the nation. According to encyclopaedia of education 2008 “textbook is a printed and bound artefact for each year or course of study and contain fact and ideas around certain subjects.” Due to much dependence on textbooks, it is essential that textbook should be complete in itself. So textbook should be appraised on continual basis.

The content relevant to biology living organisms are given in textual form to students as “textbook of biology for class IX. Terms are used to give specific concepts”. Shafi (2010) stated that terminology used in the subject of biology for class X was difficult for most of the students. She recommended that relevant teachers should explain the source of the words and their meanings so that difficulty of students may be solved. Khokhar (2008) as cited by Hussain (2001) pointed out the availability of ‘glossary’ in the textbook which was not fulfilling the requirements of the teachers as well as the students. That is why, a good glossary was recommended for curriculum development.

This study is an attempt to analyse these biological terms with different aspects of their origin, composition, nature and conceptual and diagrammatical explanation. The study was an attempt to analyse biological terms given in the textbook of biology for class IX.

Statement of the Problem

Textbooks are the centre of all teaching and learning activities. The content of textbook provides interaction between the teacher and the students. If the content is overloaded with high profiled concepts and terms, it creates problem in understanding the text. The contents (text and informative box) and diagrams are included in textbook of biology for class IX. The difficulty in learning of biology may be due to high profile terminology. This study has been designed to analyze the biological terms included in Textbook of Biology of Punjab Text book Board for class IX.

Literature Review

According to Durrani (1999), the diversity and expansion in science and technology is over passing all boundaries of languages and countries. This is becoming essential to store and arrange new knowledge to keep pace with rapid growth and development of science and technology. According to him, terminologies are always challenging to communities but majorly these challenged the Greek, Arab, Chinese and Indian communities. Even nowadays 25 terms are being added in one million terms daily (Durrani, 1999). While there are 250 disciplines that are growing in the domain of knowledge. These large numbers of technical terms are conveyed in terms of dictionaries, books and thesaurus.

The specialized communication of diverse disciplines of knowledge took place by combining all mental concepts in the form of carriers. In speaking and writing these carriers are linguistics symbols and these linguistic symbols are the words, the terms and thesaurus words (Durrani, 1999).

Scientific and Biological Concepts

Many things are present around us which we can observe and see. Our mind has ability to perceive the object and can create conceptual image. This conceptual image helps to recreate the object even when it is not in the reach of our senses. Students build their concepts about the

world by studying science and use these concepts to interpret the world. According to Akhtar (2000), biological concepts are built by sensation of things around the learner, perception of ideas and conception in mind.

Washton (1967) stated that concepts are built by actual experience of pupils. Chauhan (1987) described that concepts are built by following the principles of simple to complex, analysis to synthesis, from induction to deduction and from particular to generalization. Concepts are mental perception and we use certain carriers to describe our concepts in languages. These carriers of language (word) have specific meanings and are in common use as they become technical terms.

Term

A term is defined as the designation of defined concept in a special language by a linguistic expression.

Terminology

The study of terms is called terminology. It is defined as According to Din (1986);

“The total concepts and their designations in a specific domain is called terminology” (p.7).

Terminology is helpful for the learner in every specific subject, as described by (Condamines, 1993) the level of competence of the text users on the subject presented increases in accordance with the amount of terminologies used.

Types of Terms

According to online dictionary, there are three dimension signed with the word term.

- a. Linguistics means the formal (symbolic representation) aspect of term.
- b. Cognitive means the conceptual representation of term.
- c. Ontological, the referent, the object form of reality to be named.

Characteristics of Terms

Rodilla (1998) Describe that there are three main characteristics of term these are as follows:

Precision

Precision means delimited, and a monosemic and related to a concept. According to Wright and Buddin (2001), a term will be precised when:

1. Its meaning must be defined in advance (in dictionary or thesaurus related to a particular discipline).
2. This means there is a monosemic word which means having single meaning, and should not be synonymous.

Emotional Neutrality

Terms will be affective when these are free of personal or subjective components, and belong to the standard record. Edit the words and the information relevant to specific discipline, so that conceptual influence of the content became clear. Emotional categorically rejected interference in certain areas. Scientific terminology is used when a number of conditions in certain areas with the emotional neutrality disappears and intersect the common language. A term is emotionally neutral when it is affective, have subjective component and are standardized.

Stability

Stability is a measure of fitness and stability can attained when the term is valid with its concept and referent associated over time.

Scientific and Technological Terms

According to American Heritage Science Dictionary (2016), in science the scientific terms are used to represent the mind processing perception, understanding and communication. In nature when scientists encounter new material object or concept, they compelled to give them authorized name that become the scientific term understandable by scientist worldwide.

Biological Terms

The terms which are used to represent living organisms and their environment are called biological terms. Specific terms are in use to represent biological processes and their behaviour and environment. Researcher while working on the “Analysis of Biological Terms” has found different aspects of biological terms. These aspects are as follows:

Difficult /Easy Terms

Specific terms are given to the students and they have pointed out many terms as difficult. For examples quiescence, triglyceride, aortic semilunar valve and many others from textbook. They have also pointed out some terms as easy to learn. For example a biotic, ascent of sap, bolus and many others.

Simple /Complex Terms

According to online dictionary of grammar, a term is simple when it is made of a single morpheme e.g. “aqueous”. A term is complex when it is made of two or more morphemes. Complex terms consist of a base or root and one or more affixes e.g. inhibitor is complex term is also formed by the combination of two roots. According to Durrani (1999) where ever terms are used it is important to give their source that should be reliable and according to international standards (ISO 690). Source should be given with full title, abbreviated title or codes. Abbreviated titles are user friendly, when they are given in frequently used source (dictionary or thesaurus). In Pakistan the primary sources for student learning in most of the areas is text book. Text book contains many abbreviated terms. For examples NACP, NAD, NADP,NADPH. These terms are not properly explained in textbook. The terms when analyzed by researcher it was found that their origins were missing.

Teaching of Biological Terms

Biological terms are of two types while teaching

1. The terms which are represent able with the help of diagram e.g., urinary system.
2. The terms which cannot be represented by the help of figures, pictures, graphs, illustrations map/movies. e.g., denaturation of enzyme.

Objectives of the Study

The objectives of this study were:

1. To identify the biological terms with respect to their origin.
2. To classify the biological terms with reference major domains of biology (botany/zoology).

Research Questions

Following were the research questions of the study:

1. What is the origin of biological terms?
2. Are biological terms equally related to botany and zoology?
3. Which chapters of the biology textbook IX are mostly overloaded with difficult terms?

Methodology

Study was conducted to analyse the biological terms used in textbook of biology for class IX. Researcher has given 6 Textbooks of Biology for class IX of Punjab textbook board in Pakistan, to students to underline difficult terms. Students have underlined total 4095 words from which terms which belonged to psychology, language, intra-chapter repeated, chemistry, physics and apparatus were dropped. Later on, the names of the contributors / scientists, common and simple terms between botany and zoology; and all of the two and three letter terms were dropped and a questionnaire comprising upon 312 biological terms was developed. When students gave views about terms, majority of Biological Terms were difficult for different students. Difficult biological terms when analysed which belonged to ancient languages.

Population of the Study

Population of the study consisted of all male and female students of biology at secondary level in rural and urban areas of government schools (district Khanewal). Total 205 secondary and higher secondary schools were taken as population. List of School was taken from EDO office Khanewal.

Sample and Sampling Technique

Initially, list of rural and urban male and female schools in 4 Tehsils of District Khanewal were obtained from District Education Officer Khanewal. Using stratified random sampling technique, four rural (2 girls, 2 boys) and four urban (2 girls, 2 boys) schools were taken randomly from the list of schools in each tehsil. Total numbers of sampled schools from four Tehsils were 32. First 30 students were selected from each school.

Tools of the Study

Questionnaire was the main data collecting instrument in this study because of its advantage in collecting data from institutions from a wide distribution of the population of the study. A questionnaire was developed, for the students of biology. Each questionnaire contained 104 biological terms and 11 abbreviations used in textbook of biology for class IX. Then the questionnaire was presented to the experts of biology. In the light of their comments, some changes were made.

Results

Here is the detailed description of the results obtained from data analysis.

Table 1

Section-wise Allocation of Chapters and Text

S. #	Section	Chapters	Chapter-wise Number and Percentage of pages, figures and informative boxes of Textbook							
			Pages	%	Fig	%	Box	%	Difficult Term indicated by students	%
1	Study of Life and Biodiversity	Introduction To Biology	16	9	09	4	09	7	562	14
		Solving Biological Problem	09	5	02	0.9	10	7.3	274	7
		Biodiversity	17	9	22	10	13	9.5	888	22
2	Cell Biology	Cells and Tissues	32	18	60	27	14	10	537	13
		Cell Cycle	17	9	34	15	11	8	292	7
		Enzymes	08	4	16	7.2	03	2.2	161	4
		Bioenergetics	20	11	15	7	13	9.5	285	7
3	Life Processes	Nutrition	28	15	25	11	29	21	592	14.4
		Transport	34	19	39	18	34	25	504	12
4	Total	Chapters–nine	181		222		136		4095	

Table 1 depicted that some chapters were very lengthy and other having normal text. More detailed structure and functioning were described about cells and tissue, energy production and assimilation in living organisms, and about transport of food and water in plants and blood in human. Certain informative box were also included to relate text with previous knowledge and interactive with daily usage. Students underlined terms they felt difficult from each chapter and majority of that were from introductory pages and new concepts that were included at grade IX.

Textbook of biology enclosed enough information but equality in description of concepts of biology was not found.

Table 2

Distribution of Difficult Terms Used in Other Domains

S.#	Chapter	Terms Indicated (N)	<u>Non-Biological but Difficult for Students</u>			
			Language Related		Psychology Related	
			n.	%	n.	%
1	Introduction To Biology	562	247	23.41	059	22.95
2	Solving a Biological Problem	274	172	16.30	045	17.50
3	Biodiversity	888	167	15.82	014	5.44
4	Cells and Tissues	537	124	11.75	015	5.83
5	Cell Cycle	292	077	7.29	009	3.50
6	Enzymes	161	032	30.3	021	8.57
7	Bioenergetics	285	069	6.54	014	6.22
8	Nutrition	592	080	7.58	045	18.67
9	Transport	504	087	8.24	026	11.28
	Total	4095	1055	25.76	248	6.05

Table 2 shows the analysis of difficult terms indicated by students of biology. Researcher has found that all underlined terms were not scientific terms. Students have underlined 32 % terms that were belonging to language and psychology. There is no need of difficult and confusing words of languages and psychology in textbook of biology. Those terms should be replaced by easy and alternate terms. As common terms were not necessary so that were dropped and only scientific terms analysed further in detail.

Table 3
Difficult Science Related Terms Indicated by Students

S.#	Chapter	Underlined Science Terms	Biochemistry Related terms		Physics Related terms		Biology Related terms	
			n.	%	n.	%	n.	%
1	Introduction To Biology	258	045	17.44	021	8.14	192	74.42
2	Solving a Biological Problem	104	020	19.23	014	13.46	070	67.31
3	Biodiversity	307	049	15.96	001	0.33	257	83.71
4	Cells and Tissues	505	048	9.50	036	7.13	421	83.37
5	Cell Cycle	300	012	4.00	000	0.00	288	96.00
6	Enzymes	284	085	29.93	010	3.52	189	66.55
7	Bioenergetics	366	074	20.22	010	2.73	282	77.05
8	Nutrition	663	131	19.76	006	0.90	526	79.34
9	Transport	496	068	13.71	018	3.63	410	82.66
	Total	3283	532	16.20	116	3.53	2635	80.26

Table 3 shows analysis of scientific terms. The researcher found that 20% of scientific Terms were belonged to chemistry, physics as that terms are not related to living organisms so those terms should be included in relevant textbooks of science but not in biology and replaced by easy word that will help in easy learning of biology for students of IX grade. Only 80 % terms were pure biological. That were analysed further in study.

Table 4
Distribution of Biology Related Terms used in major Domains of Biology (Botany, Zoology)

S. #	Chapter	Underlined Science Terms	Biology Related terms		Botany Related terms		Zoology Related terms	
			n.	%	n.	%	n.	%
1	Introduction To Biology	258	192	74.42	060	23.26	132	51.16
2	Solving a Biological Problem	104	070	67.31	018	17.31	052	50
3	Biodiversity	307	257	83.71	120	39.09	137	44.63
4	Cells and Tissues	505	421	83.37	205	40.59	216	42.77
5	Cell Cycle	300	288	96.00	129	43.00	159	53
6	Enzymes	284	189	66.55	091	32.04	098	34.51
7	Bioenergetics	366	282	77.05	161	43.99	121	33.06
8	Nutrition	663	526	79.34	144	21.72	382	57.62
9	Transport	496	410	82.66	111	22.38	299	60.28
	Total	3283	2635	80.26	1039	31.65	1596	48.61

Table 4 reflect that biological terms were belonging to two major domains, botany related to plants and zoology related to animals. The Text was not equally divided and majority of biological terms were from zoology. Authors should give equality in building concept of Biology by giving equal information related to plants and animals.

Table 5

Chapter-wise Summary of Biological Terms Included in the Questionnaire

Ch. #	N	Botanical	COM (B+Z)	Zoological	Greek	Latin	Others
One	19	00	10	09	07	08	04
Two	07	02	02	03	04	02	01
Three	27	06	09	12	08	09	10
Four	56	24	20	12	22	25	09
Five	42	04	28	10	21	13	08
Six	24	01	21	02	13	06	05
Seven	21	19	01	01	12	05	04
Eight	44	01	02	41	20	20	04
Nine	72	18	03	51	31	28	13
Total	312	75	96	141	138	116	58

Table 5 biological terms were derived from many languages as 44% are Greek 37% are Latin 18% are of different origin. These languages are ancient and are not native to Pakistan. So these terms should be replaced by alternative and easy native language terms or their meaning and origins must be clearly described in textbook of biology. If authors attempts to described their meaning and origin it will enhance learning of biology and will make it easy to understand and building better concepts.

Discussion

Analysis of terms of textbook of biology was done by researcher. This analysis showed that Textbook contained difficult words that were related to language and psychology. 32% of total underlined difficult Terms were belonged to these disciplines. These terms were not necessary in this Textbook of Biology. Compilers of Biology's Textbook can avoid there usage and it might be helpful in making Textbook easy and understandable. Authors of textbook of biology should consider this fault and should replace these terminologies with easy words. But when analysis of pure biological terms were done there were inequality in distribution of terms in botanical and zoological domains. Biology is study of living organisms both plants and animals. Most of biological

terms were zoological and difficult for students. Compilers of the textbook should equally divided text in botanical and zoological.

According to sample of this study, most of the terms were found difficult. The main reason found during this analysis was that, majority of biological terms were derived from Greek and Latin and from other languages that were not native to Pakistan. These terms may be made easy for them if proper information is provided to the students. According to Durani (1999) where ever terms are used it is important to give their source that should be reliable and according to international standards (ISO 690). Source should be given with full title, abbreviated title or codes. Abbreviated titles are user friendly, when they are given in frequently used source (dictionary or thesaurus). This study was an attempt to make learning of biology easy for our students. It would be helpful worldwide as well it will open new doors for researchers to find out alternate biological terms which are standardized also.

Conclusions

From the above mentioned major findings, it was concluded that:

1. The content of the book was not equally distributed between botany and zoology. Text related pages, difficult terms of zoology were found more than that of botany.
2. Most of the terms contain more than 7 alphabets and were considered as complex terms. Due to this complexity, students feel difficulty in learning of biological terms.
3. Most of biological terms were derived from Greek and Latin and other ancient languages, so students cannot understand their meanings.
4. Chapter numbers 4,5,8,9 are overloaded with most of difficult terms and students felt difficulty in preparation of these chapters.

Recommendations

1. Textbook of biology should have equal distribution of botanical and zoological terms.
2. Terms should be of native language or in those languages which are taught in Pakistan or its origin and meanings should be written in common languages (Urdu or English).
3. Terms should be simple and authors have to avoid terms above 7 alphabets.
4. Difficult terms should be replaced by easy alternate terms.

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