



Text Structure: A Tool for Effective Biology Instruction and Learning

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Abstract

The significant role of biology to the functioning of various systems of our body, as well as, the need to widening its scope through integration of biology with other subjects as was suggested in realization of sustainable development goals, make it a vital subject that every student must study and apply the knowledge when the need arises. It is therefore desirable that students are exposed to a well-structured, and detailed contents so as to enable them learn everything they need to learn, for proper knowledge demonstration. This paper focuses on how genetics content could be structured using logical prose to raise awareness about how to structure contents for effective instruction. The process involved in such structure was also described. In an attempt to do that, this article examined the topic under the subheadings: introduction, theoretical bases of text structure pattern, meaning and nature of logical prose structure, application of logical prose to biology instruction. A detailed exposition of its application in biology instruction is presented. Lastly, the paper recommended that teachers should utilized logical prose in structuring difficult concepts in biology and science in general. It was also recommended that text book author should utilize logical prose in structuring their instructions.

Key words: Text structure, Text structure patterns, Biology instruction, learning, Logical prose.

Introduction

Studying what was taught and preparing for examinations require the consultation of many books and materials that could aid understanding. The extent of understanding of what is read depends on how well the information is arranged, and how well one is able to conceptualize what was read. Conceptualizing information in a text depends greatly on how information within text is arranged. The arrangement of these instructions and information is what is known as text structure. Text structure involves exposing students to all fundamental elements that constitute given concepts. It is often described as detailed exposition of fundamental elements found within a concept (Alabi, 2016).

Text structure could also be defined as the semantic and syntactic organizational arrangement used to present written information (Teacher Content Literacy, 2009). Akhondi, Malayeri and Samad (2011) defined it as the structural element that guides students to locate and organize information. The ease of comprehending scientific text could be traced to a well arranged text. This implies that a well-structured text is crucial to understanding scientific texts and to the success of students in examinations.

This assertion could be linked to the saying of Mann and Thompson (1988) that students should be exposed to the complete instruction i.e. all they need to know as far as the instruction is concerned and they must be exposed to the interrelatedness of those instructions. Emianvari and Kheirabadi (2013) submitted that knowledge of text structure is likely to facilitate comprehension and learning.



Studies have established the significance of differently structured instructions in comprehending information in textbook, reading comprehension, and alleviating difficult concepts in sciences. For instance, Douglas and Kahle (1977) examined the effect of differentially sequenced individualized instructional materials on students' achievement in biology and found that students exposed to deductive style gain better than those exposed to inductive style. Their study often found that field independent students had a higher level of retention than field dependent. Shaibu (1998) explored structured text approach to remediating difficult concepts in the teaching- learning of science in Nigerian schools. The researcher found that students that were exposed to structured text performed significantly better than the control group; and that, students' understanding of relevant concepts was significantly enhanced.

Alabi (2016) explored comparative effects of text structures on the achievement in genetics of senior school students in Ilorin, Nigeria. The study indicated that there was a significant difference in the achievement of students taught genetics using logical prose and those taught without logical prose in favour of the logical prose structure. This article seeks to raise awareness about logical prose of structuring text, by highlighting some of the important components relating to the topic. This is presented below.

Theoretical Bases of Text Structure Patterns

Text structure knowledge emanated from Bruner's (1960) theory which states that structure greatly influences teaching and learning. The theory further stressed the significance of knowing the structure to knowing the pattern and contents. This implies that awareness of the underlying structure is very paramount to the teaching and learning processes. Knowledge of text structure also shares from Ausubel (1963) theory explains that, for meaningful learning to take place, there should be an integration of new concepts and propositions into already existing concepts and framework held by the learner.

It could be concluded from the two theories that for meaningful learning of concepts to take place, instructions must be explicitly structured to reveal its pattern and concepts. Not only that, the concepts to be taught must be examined taking into cognizance the students' experience with respect to what is to be taught. Students' experience or prior knowledge are therefore desirable and could be detected through series of questioning. Knowing their prior knowledge could assist on where to start from and how to structure the concerned concepts.

Several patterns of structuring text have been identified. Scientific texts may be structured inductively or deductively, using exposition, graphics, images, symbols, concept map, prose, mathematically or diagrammatically. Scientific texts are often described as expository because they explain, illustrate and interpret scientific phenomena. This type of text contains unfamiliar words that could inhibit understanding of scientific principles. Expository text is sub divided into five, these are order or sequence; description; comparison or contrast; cause and effect and problem and solution (Heydari and Mustapha, 2009). These sub divisions have peculiar signal words that are used to recognize them. Sequence expository text; for instance, are characterized with signal words, such as first, next, last, among others.



Meaning and Nature of Logical Prose Structure

Logical prose originated from Latin word “prosa orato” meaning straight forward discourse or clear. Soanes, Hawker and Elliot (2006) defined prose as ordinary written or spoken language. It could be defined as ordinary free flow of expression and another way of explaining difficult simile. Gross (1998) cited the instance of prose as a well-argued legal judgments, a mentally clear scientific paper and a readily mastered set of technical instructions. This is to say that prose should always be known for unambiguous and clear expressions.

What makes a prose logical is the order of presentation and explanation of thought ideas or concepts. Logical prose is a descriptive expository structure that delineates concepts, facts, generalizations, laws, and theories for better understanding. Logical prose is an orderly explanation of difficult terminologies for clarity. It involves finding other sentences or terms that mean the same to explain a concept for more clarification. This activity comes between translating and paraphrasing (Alabi, 2016). It is about clarifying progressively all the terminologies and concepts that arise from explanation of scientific concepts and that may prevent proper understanding of scientific terms, when not simplified.

Logical prose is an act that is embarked upon to ensure that all the underlying concepts are clarified to encourage complete information. It is largely descriptive, involving translation or paraphrasing. Dictionary plays a paramount role in this act. The subject and English dictionaries are used simultaneously to ensure complete exposure to all the instructions that are expected of learners. The logical prose is always accompanied with appropriate lesson plan to expose the reader to what the teacher and the students will be doing at every point in time. It is often described as a stimulus instrument because it could serves as motivator to students’ learning during instruction. This stimulus instrument could be utilized in tackling difficult concepts in Biology and other difficult science concepts.

Logical prose has ways of representing the main concepts and the subordinate ones. The main concepts are flushed to the left, italicized and bolded, for emphases, while every other one is usually indented, italicized and bolded. Logical prose take into consideration the language of expression. It places emphasis on syntactic and semantic expressions of concepts, usually characterized with speaking and writing in prose. Widely used in linguistic for narrative and expository text, the usage had extended to sciences because of its applicability.

Depending on the concepts under consideration, the logical prose here could show some level of sequence, description, compare and contrast, problem and solution and cause and effects. Main concepts in logical prose are usually represented using heading that are italicized and aligned to the left. This is to introduce Text features that can help readers locate and organize information in the text. For example, headings help introduce students to specific bits of information. Presenting heading to students to introduce them to little information that could be easily managed in their short-term memory. A write up without headings, looks awesome, difficult to be processed and effectively internalized.



Applications of Logical Prose to Biology Instruction

Biology plays a significant role in understanding of nature, wealth and employment generation, poverty eradication, possession of appropriate entrepreneurship skills as well as ensuring other goals of sustainable development. For these reasons, there is the need to ensure meaningful understanding of Biology concepts. As crucial as the aforementioned goals are to ensuring the sustainable development, studies have indicated poor conceptualization of Biology knowledge reflected from poor performance at the West African Senior School Certificate Examinations. It is evident from Table 1 that out of the ten year under consideration, the first six years had less than 50% percentage pass. This could be unconnected to the fact that during these years, every student offered Biology as the prefer science subject that they must offer with or without interest.

Meaning that not up to half of the candidates that registered for Biology at the senior school level, could be admitted to study Biology related courses in the higher institutions of learning. This could also be interpreted as inability of students to demonstrate expertise with regards to entrepreneurship skills and other goals of sustainable development skills with regards to Biology. However, for year 2013 – 2016, when Biology is offered only by students having interest in the subject, the percentage pass was above 50% indicating increase in the performance trend. The increment may be due to the facts that only interested candidates registered for it during those year when biology was optional. This trend of performance is not good enough and should be improved upon owing to the fact that Biology is a subject that is required by everybody, irrespective of their areas of specialization. This is because it provides them with basic knowledge of health and reproduction.

Table 1: *Trends of Students' Enrollment and Performance in May/ June SSCE Biology (2007-2016)*

S/no	Year	Biology Total Enrolment	Biology % Pass
1	2007	1,238,163	33.37
2	2008	1,259,964	33.94
3	2009	1,903,552	33.87
4	2010	1,300,418	33.90
5	2011	1,505,199	38.50
6	2012	1,646,150	35.66
7	2013	1,648,363	51.73
8	2014	1,365,384	56.17
9	2015	1,390,234	57.42
10	2016	1,200,367	61.68

Studies had also established the difficulties of some biological concepts. Genetics for instance had been identified as one of such concepts that is difficult to learn by (Knippels, Waarlo & Boersma, 2005; Tanimowo, 2005). The difficulty of genetics might have contributed



to the problem of poor performance, hence, the need to look into ways by which such performance could be improved upon. One of such ways is to delve into how Biology instructions is structured, hence, application of logical prose in Biology instruction, especially, the difficult biological concepts like genetics.

Most terms in Biology are Latin and Greek and are characterized by seemingly strange concepts and vocabularies. The term Biology for instance was derived from the two greek words ‘bio and logos’, these words are not English and must be clarified for meaningful learning. The English or scientific terminologies emanating from such instruction must also be clarified for easy comprehension of the intended meanings. In doing this, a Biology dictionary is used in conjunction with English dictionary. In using logical prose for Biology instruction, headings of what is to be done is of paramount significance and should be written in upper case. This is to create awareness to the reader and sensitize them to what is to be done.

This is followed by the description of the meaning of the concept, usually under a heading in title case and left alignment. As conversation continues, any terms or sub-concepts that emanated from such descriptions must be simplified before proceeding to the next concepts. In this attempt, the sub-concepts are usually indented and italicized to differentiate the hierarchies of such concepts. This continues till every concept involved is simplified. A typical illustration of such structure on Introduction to Genetics is illustrated as a way to demonstrate to teachers about how to structure the content.

Logical Structure of Concepts Involved in Genetics (LSCIG) (Transmission and Expression of Characteristics in Organisms)

Introduction to Genetics

Genetics is the study of **heredity** and **variation**; or the study of behaviour of the **genes** as they move from generation to generation.

Heredity. Heredity is the transmission of **characters** from **parent** to **offspring** via the **chromosomes**. It is also described as the passage of instructions required for specific traits from generation to generation.

Characters. Characters are distinctive or inherited features of an organism. It is otherwise known as traits. For instance, if Ade’s father had a pointed nose and the mother had a flat nose, Ade is likely to have either pointed or flat nose, it could be inferred that Ade inherited this feature from the father or mother. This feature is therefore Ade’s character.

Parent. Parent implies either male or female that produces offspring together during sexual reproduction

Offspring. Offspring refers to a person’s child; New organism formed from sexual or asexual processes.

Chromosome. A chromosome is a threadlike structure, many of which are found in the nucleus of plants and animals of eukaryotic cell. These chromosomes contain **chromatin** and **genes** which control the characteristics of organisms



Chromatin. Chromatin refers to substances that form chromosome; it consists of **DNA, RNA and proteins.**

DNA. DNA is an acronym of Deoxyribo -Nucleic Acid. It is the genetic material of most living organisms and major constituents of the chromosomes.

RNA. RNA stands for Ribo Nucleic Acid. RNA is a complex organic compound in living cell. Its function can be felt in protein synthesis and serves as hereditary materials of some viruses. Most RNA are synthesized in the nucleus before distributing them to various parts of the cytoplasm.

Proteins. Protein refers to large group of organic compound in all living things containing carbon, hydrogen, oxygen, nitrogen and sulphur.

Genes. Genes are the basic unit capable of transmitting characteristics from parents to children.

Variation. Variation is the difference between individuals of a plant or animal of the same species. The plant or animal species consists of **eukaryotic** or **prokaryotic** cells.

Eukaryotic cell. Eukaryotic cell is a cell type containing **nucleus**, and its genetic material is enclosed within the nucleus. All organisms, except bacteria, are eukaryotes. Bacteria cell is a form of prokaryotic cell.

Nucleus. Nucleus is a large centrally placed organ in the cytoplasm of all eukaryotic cells. It contains chromosomes.

Prokaryotic cells. Prokaryotic cells are cells that lack nucleus but contain **nucleoid.**

Nucleoid. Nucleoid is that part of prokaryotic cell containing genetic material (single, circular DNA), and as a result, controls the activity of the cell. It is not bounded by a membrane but serves the function of nucleus. The single, circular DNA in nucleoid therefore carries the genetic information, which controls genetics. There is exchange of these genetic materials during **sexual reproduction.**

Sexual Reproduction. Sexual reproduction is the type of reproduction that involves the fusion of the two reproductive cells called **gametes.**

Gamete. Gamete is the reproductive cell found in male and female organisms.

Conclusion

Biology learning at the senior school level is faced with arrays of problems, some of these are students related, teacher related, school related, curriculum and textual material related. Textual materials, when not well-written may misinform and confuse readers on the intended meaning of biology concepts and as such hinder effective information management. For this reason, great attention must be given to the quality of instruction that would be presented to the students to ensure the mastery of all Biology contents.

Recommendations



From the discussion, the study recommends that

1. the teachers should be acquitted with the skill involve in the logical prose and utilized the knowledge in structuring contents in Biology.
2. logical prose should be used by teachers in structuring difficult concepts in Biology and Science in general. This will assist students in meaningful understanding of the intended contents.
3. logical prose should be used by textbooks authors in structuring their instruction. This will consequently provide the users with the needed detailed of instruction for better learning of a given concepts.
4. the basic steps and skills involved in logical prose should be disseminated to teachers via Biology Teachers Association / Science Teachers Association yearly conference, workshops or seminar to popularize its application in sciences.

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African Journal of Educational Archives

Vol.5, Issue 1, July –Sept. 2018. ISSN:P2536-748X,E-2536-7498

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