Biological Terminology: an Opportunity for Teaching in Tandem

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Abstract

Precise terminology enables efficient communication between scientists. Therefore being capable of understanding and using scientific terms is an inseparable part of scientific literacy and science teachers should help their pupils to improve this skill. However, several studies proved that the emphasis on scientific vocabulary in science education is too heavy and that science textbooks are overloaded with terms. This is especially true for descriptive terms in biology lessons. There could be so many new words introduced in a biology lesson that it looks rather like a foreign language lesson. If we view a scientific discipline not only as a specific way of thinking but also as a specific way of expressing, we can draw an inspiration for biology from foreign language classes. There is an effective method enabling foreign language learning: the so-called tandem learning. It is based on a bilingual teaching team providing the framework for activities of pupils working in pairs. This article describes how science teacher and language teacher (either native language or Latin teacher) can participate in tandem in order to help secondary school pupils understand biological names and terms better. Since many biological terms and names consist of Latin or Greek word root, knowledge of their formation could make learning easier. A set of tasks for pupils concerning etymology and word-formation of biological terms is described in this paper. These tasks were tested on a secondary school in Prague (Czech Republic). The activities make use of Latin and Greek words to be of international applicability but they can be easily replaced with names and terms in appropriate native language.

Keywords: *Teaching in tandem, terminology, etymology, word-formation, biology;*

1. Introduction

In science textbooks there is a heavy emphasis on terms. Longitudinal studies show that the amount of terms in secondary school textbooks remains during the last forty years so high that vocabulary of one lesson could sometimes exceed that of one foreign language lesson [1]. This is especially true for biology where students are supposed to master more discipline specific vocabulary than in chemistry or physics [2]. The exaggerated emphasis on terms may demotivate or even discouradge students from learning biology. The fact that science lessons are overloaded with terms is supposed to be one of the reasons that led to science education crisis monitored since the 80s [3].

Students confronted with this situation may ask: „Why are there so many terms in scientific disciplines? Why should I learn them? Why do they look so strange? How can I learn them?“ Let us try to answer these questions.

2. Importance and logic of scientific words

The reason why there are so many scientific words lies in the history: Knowledge of the Man became so diversified that many highly specialized disciplines emerged. Communication between them was limited, thus both their vocabulary and methods became specific and differs now a lot from each other´s [2].

This is especially true as far as acronyms are concerned: Their abundance for example in current biomedical literature can make a text almost unreadable [4]. Also various synonyms broadened scientific terminology. Therefore, nowadays´ teacher has to consider carefully which term is really needful, otherwise lessons become full of verbalism. As Wandersee (1985) says: „Choose the most appropriate term and don´t try to impress students with your broad mastery of biological jargon.“ [5, p. 346]

Although students can be frustrated by the huge terminology it can not be left out totally. One of the main aims of science education is to make texts and debates about scientific problems comprehensible to students which is impossible without knowing scientific terminology [6] [7] [2].

Due to their characteristics scientific words may seem strange to students. As Flood (1960) stated scientific words usually have three qualities: 1. They have a precise meaning that does not carry ambiguity, so they enable exact communication. 2. They usually do not come from everyday life. This is convenient because they are less likely to excite emotions and evoke unwilling associations.

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3. They are usually built up from Greek and Latin elements. (Greek was held in respect because of intelectual achievements of the ancient Greeks, Latin used to be the universal language of scholars till the 19th century.) If we know Latin and Greek a little scientific terms seem self-explanatory to us. Due to this fact terms are perceived as international [7].

3. Etymology of biological terms at school

If we compare the amount of scientific vocabulary and the amout of their root elements we realize that there are relatively few of these elements. They repeatedly appear in many words: For example the word root plasma (it means that which is formed or moulded) is included in plasmodium, plasmolysis, cytoplasm etc [7]. Being able to distinguish such word roots, prefixes or suffixes in unknown terms can make learning easier [4]. For example medical terminology is derived from about 4 thousands Greek and Latin words and being familiar with them could save a student from memorizing more than 50 thousands words [8]. This linguistic skill can be employed in various disciplines, makes learning more effective and guides correct spelling of terms [9] [8] [6] [7].

This idea is not new: For example Cardinale (1992) insisted that textbooks should contain etymological passages explaining origins of terms being introduced. Another common idea was to create a short list of commonly used prefixes and suffixes and their meanings which should help students understand even a term they have not seen before [6] [9].

If we take learning scientific terminology as learning a foreign language vocabulary, we can also get an inspiration from language lessons – a method called learning in-tandem. It involves a pair of speakers, whose native languages differ and whose aim is to learn each other's language in a bilingual conversation [10]. The principle of this method can be summarized like this: „You help me learn, I help you learn, and we learn to understand each other better." [11, p. 17]

If we change the context we can take tandem teaching as an opportunity for two teachers of quite different disciplines (science and language) to act in one lesson and show their students such a „bilingual conversation". Science teacher can explain technical aspects of a chosen topic while language teacher can analyze terms used in that lesson in a linguistic manner. So, we can summarize our idea like this: „One teacher helps you learn technical issues; the other one helps you learn the logic of terminology and you will understand the discipline better."

On a secondary school in Prague (Czech Republic) the author of this paper together with her colleague (who teaches Czech language) led biology lessons in which the attention was paid not only to biology but to linguistic plays with biological names and terms as well. The lessons were mixtures of presentation, individual students´ work with dictionaries and groupwork with worksheets. Because the lessons were in Czech and not all tasks and examples used in them are utilizable in other languages the author presents here not the accurate lesson course but rather types of tasks that can be used in such a lesson. They are stated hereinafter. To cope with these tasks students need either a short list of Greek and Latin word roots meanings or some book that summarizes this topic in their native language or at least access to the internet.

3.1 Looking for parallels (recurrent prefixes, suffixes and word roots)

Instruction: Think of biological terms that contain the prefix eu-.
Possible answers: Eukaryota, eugenics, eurythermous…
Point: Pupils realize that scientific words often have a common part – either a prefix, suffix or word root.
Other examples: prefixes hetero- or epi-; suffixes –itis or -emia; word roots chromos or leucos.

3.2 Specification of things organisms are named after

Instruction: Decide what type of thing were these organisms (Borrelia, Sahelanthropus, Pulmonaria and Harpia) named after?
Answers: Borrelia was named after a scientist, Sahelanthropus after place of its discovery, Pulmonaria after its medical use, Harpia after its resemblance with a mythical creature.
Other examples: Escherichia coli, Homo neanderthalensis, Ebola virus, Hepatica nobilis…
Point: Students realize that organisms can be named after places of their discovery, after their medical effects, famous scientists, mythical creatures etc.

3.3 Derivation of terms from existing scientific words

Instruction: Look up what is amanitin and what was it named after?
Answer: Amanitin is a toxin produced by a mushroom called Amanita.

Point: Pupils realize that terms previously created to name something can be used as a source word from which other terms are derived.
Other examples: gastrin, atropin, mytilotoxin.

3.4 Translation of unknown terms

Instruction: With help of your list of Latin and Greek word roots find an appropriate equivalent of the word karyotheka.
Answer: Karyotheca means nuclear membrane.
Point: Pupils realize that it is helpful to divide an unknown word into parts, translate these part and reconstruct its meaning.
Other examples: melanocyte, intracellular, epidermis.

3.5 Understanding the logic of acronyms

Instruction: Look up what words the acronym STH is made from. Translate them.
Answer: STH is an acronym for hormone somatotropin. Soma means body in Greek and tropos direction.
Point: Pupils realize that the meaning of unknown acronyms can be clearer if we reconstruct the whole words that form the acronym.
Other examples: AIDS, HIV, ATP.

3.6 Designing new terms

Instruction: With help of your list of Latin and Greek word roots design a scientific name for a fat cell. Then compare your suggestion with the official version of the term.
Answer: Adipocyte is the scientific name for a fat cell.
Point: Students try the role of a scientist naming a new structure. They make use of the learnt roots to form a new word.
Other examples: discipline which studies Man as a species (anthropology), an instrument which records heart-beats (cardiograph).

4. Conclusion

Vocabulary that science students have to master is really huge. Although there are many dispensable terms in school textbooks and science lessons it is not possible to avoid scientific terminology completely: It is a regular part of scientific literacy. Scientific words need not seem so strange if we are acquainted with their etymology. To increase students´ skill to decode unknown terms the teacher can make use of several types of tasks when the students break scientific words down to their roots, suffixes and prefixes, translate them with dictionaries and so get into the logic of their formation. Teaching in-tandem is convenient if we want to employ linguistically more creative tasks, too.

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References

[1] Groves, F. H. A Longitudinal Study of Middle and Secondary Level Science Textbook Vocabulary Loads. School Science and Mathematics, 116, 2016, p. 320–325.
[2] Wandersee, J. H. The Terminology Problem in Biology Education: A Reconnaissance. The American Biology Teacher, 50(2), 1988, p. 97–100.
[3] Abimbola, I. O. The Problem of Terminology in the Study of Students Conceptions in Science. Science Education, 72(2), 1988, p. 175–184.
[4] Poppensiek, G. C. Meandring in Biological Etymology. Journal of Veterinary Medical Education, 28(2), 2000, p. 1–4.
[5] Wandersee, J. Are There Too Many Terms to Learn in Biology? The American Biology Teacher, 47(6), 1985, p. 346.
[6] Kessler, J. An Alternative Approach to Teaching Biological Terminology. The American Biology Teacher, 61(9), 1999, p. 688–689.
[7] Flood, W. E. Scientific Words: Their Structure and Meaning. Oldbourne, London, 1960, 220 p.
[8] Cardinale, L. Explicating Biology Vocabulary With Etymologies. Darden College of Education, Old Dominion University, Norfolk, VA, 1992, p. 1–12.

[9] Miller, D. G. Etymology in the Biology Classroom. The American Biology Teacher, 48(1), 1986, p. 41.
[10] Vassallo, M. L., Telles, J. A. Foreign Language Learning in-tandem*:* Theoretical Principles and Research Perspectives. The ESPecialist, 25(1), 2006, p. 1–37.
[11] Calvert, M. Working In Tandem: Peddling an Old Idea. Language Learning Journal, 6, 1992, p. 17–19.