THE USE OF CONCEPTUAL MAPS IN ASSESSING KNOWLEDGE ACQUIRED IN BIOLOGIC DISCIPLINES

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Abstract*: The paper at hand presents the research results regarding the use of conceptual maps in the study of biology. We discuss methodological aspects when applying the conceptual map method in teaching-learning-assessing the biology discipline, existing in specialty literature. We also analyze the results of student assessment at specialty disciplines with the help of conceptual maps, as well as their opinion on how to use the method in biology studies. The results of student knowledge assessment at specialty disciplines demonstrate the fact that the use of conceptual maps in student assessment contributes to knowledge consolidation, insuring a better understanding of the field's concepts*.

Key words**:** *constructive learning, conceptual map, assessment, biologic concepts, didactic methodology*

INTRODUCTION

Considering the realities as well as the specific features of the romanian educational system, the improvement of the educational process requires firstly a reform of mentality. The biological higher education, in the present context of globalization, is faced with the need to develop student-centered academic learning, whose success is, according to NEACȘU (2006) dependent on "key competencies specific to intellectual work effective at academic level [...] defined and understood as packages of knowledge, skills, abilities and attitudes, whit the students and graduates of higher education need to secure academic success, for personal evolution, employment and subsequent insertion on the labour market", by the need for harmonization of learning content, learning strategies, the sources of information-documentation, learning time (increasingly less) as well as the particularities of today's students (age of entry to the university, socio-professional experience, status, lifestyle and study orientation table of values, motivations and interests spectrum, living more actively, "the double spiral of learning and labor" (GIARINI, O., MALIȚA, M. (2005) in NEACȘU (2006).

At present, the role of biology teacher is to help students understand the living world and its interrelations, didactically transposed in professional competences to which is added transversal competences of metacognitive type. In this regard, the use of teaching strategies that stimulate metacognitive skills training, not just those professional, is demonstrated by numerous studies and previous research (NOVAK, J.D., CANAS, A.J., (2008), GARDNER, H., (2005, 2006), OPREA, CRENGUȚA – LĂCRIMIOARA (2007), TANNER K., ALLEN D. (2004), EFKLIDES, A., (2006), MEAGHER, T., (2009), MOGONEA, F.R., MOGONEA F. (2014), is became an necessity.

We believe that the dominant feature of the changes adopted in the teaching process from the academic education must be the transformation of the ways of acquiring knowledge, skills, attitudes and values that take into account the fact that tradition and innovation are not mutually exclusive, but mutually reinforcing. In learning the biological sciences, a problem

often identified is not understanding the correct appropriation of biological concepts by the students, whether they relate to previous incorrect or missing knowledge or the new knowledge are not understood and not logically gained. FISHER, KATHLEEN M., WANDERSEE, JAMES H., MOODY, DAVID E (2002) explains the importance of graphical representation of biological knowledge, understanding and for proper formation of their interrelatedness, consolidation and integration in different contexts, emphasizing the evolution of conceptual maps of Novak, which is derived from Ausubells learning theory (Ausubells (1963, 1968) in FISHER, KATHLEEN M. et al., 2002) emphasizing the importance of highlighting the relationships between different concepts or ideas. Thus is ensured the learning ”with meaning”, learning that occurs together with a process of evaluation and self-evaluation.

In the didactic practice, using the evaluation/self-evaluation in learning biological sciences at university level meets unfortunately certain limits, determined primarily by the specific forms and methods of evaluation applied: lack of initial evaluation in most of the cases, the formative evaluation is not often enough and well harnessed by the teacher, mostly due to insufficient time allotted to teaching, the summative assessment is briefly performed due to the evaluation methods applied for this purpose (it does not necessarily aim to evaluate the competences or, sometimes, it can favour the subjectivity).

METHODS

In order to obtain and improve the effective learning, we started from the assumption that the students need time and opportunities to essentialize and to reflect on what they have learned. In this paper, we examined the way in which it is possible to use conceptual maps in teaching-learning-evaluation of biology knowledge.

Thus, the goals that we've pursued in performing the research aimed the discussion with students and analysis of methodological aspects of the implementation of the ”conceptual map” method in the teaching-learning-evaluation at biology discipline, existing in specialized literature, methods of optimizing the valorising the methodological resources in biology lessons.

There are analyzed the results obtained following the evaluation of 18 students (16.66% boys and 83.33% girls) of the second year Biology in the academic year 2014-2015 at discipline Hydrobiology, through the method of conceptual maps, as well as their views on the method of using and effectiveness of method in learning biology.

RESULTS AND DISCUSSIONS

The first activity undertaken in the research has been carried out within the hours of Teaching biology and aimed the analysis by the students of the methodological aspects of applying the method of conceptual maps in teaching-learning-evaluation of biology. The theoretical substantiation of the method was analyzed, the conceptual maps being defined as graphical tools used for knowledge representation (NOVAK, 2008).

We used the debate in which previous knowledge on learning theories was refreshed, with an emphasis on constructivist theory on learning, the significance and methods of stimulating the development of metacognition abilities in students, didactic principles. The students identified the importance of direct involvement of the students in the process of learning and building of logical structures, based on the correct understanding of concepts and relationships between them.

The students analyzed the particularities of the various types of conceptual maps and the exemplification of their concrete application on various specialized topics: systematic lessons of the plants and animals, anatomy and morphology lessons, ecology - general biology lessons, zoology lessons.

Methodological stages of applying the method (after NOVAK, 2008) were analyzed: establishing a "focus question" which must clearly specify the issue/subject on which the conceptual map tries to solve/describe, the identification of key concepts that are applied to that subject, drawing up the list of concepts, their verification, ordering the concepts from the most general (most inclusive concept is first) to the specific ones, less general, the construction of preliminary conceptual maps, identification of cross links (on different levels) as well as finding the most explicit linking words/definitions that connect the concepts, and in the end, the revision of the map, reposition of concepts so that the whole structure be logic, clear and easy to read. There were discussed the ways of effective valorising of didactic materials and digital competencies in students by valorising TIC in developing conceptual maps. Subsequently, there were analyzed the current difficulties encountered by students/pupils in the elaboration of maps, among which we include: proper identification of the concepts related to a subject, identifying a large number/maximum of concepts, identifying and defining the relations between concepts, multiple integration of concepts within the theme discussed, correct exemplifying thereof. The ways of overcoming difficulties were discussed and identified, according to the method of organizing the activity; in case the students work in small groups, in the initial brainstorming stage in order to establish the concepts the teacher can provide to the students a working sheet containing few key questions or may interfere with any questions, if the case, and in the case of independent activity, the students will have a working sheet. If there appears to be a blockage, the student is advised to take a short break for 1-2 minutes in which it is required to prepare the materials necessary for the map (sheets of paper, markers, photos, post-it, etc.) after which it resumes the activity, or the teacher comes with helping questions. The students analyzed the methods of evaluating conceptual maps presented, method of establishing the criteria and the correction and notation scale. In the end, the students analyzed the possibility of using conceptual maps in biology lessons both in the teaching stage (for example, the draft lesson consists in a map), in the independent learning stage, for the purpose of fixing and consolidating the knowledge, with the aim of recapitulation, systematization and synthesis of knowledge (at home and in the classroom), but also for the purpose of assessing the method of understanding the knowledge by the students.

The students received a homework assignment, with the purpose of creating two conceptual maps, one in the biological discipline of choice, gymnasium level, and one at the teaching of biology discipline, "*Instructional-educational objectives of teaching biology*" theme, maps which were analyzed and discussed in the coming hours. The students were encouraged to use conceptual maps in independent learning and during the participation to activities within the Hydrobiology discipline.

Subsequently to going through the learning unit ”*The biological characteristics of lacustrine environment”* (Grozea, A., 2002), the students were assessed and the requirement was to draw up a conceptual map according to the rules known individually.

The evaluation of conceptual maps elaborated by the students was made after the following criteria: correct hierarchy of concepts (5 x ... = ... points) for every sentence/correct word linking (1 point = x ... ... points), for cross-lines/links between the two levels (10 points x = ... points) for each correct example, valid (1 point = x ... ... points), have revealed the following: with regard to the number of correctly identified concepts , these are to be found between minimum 10 and maximum 26, with the following frequencies: *10 –*

11,11%, *14* - 11,11%, *16*- 11,11%, *17* – 16,66%, *19* – 11,11, *20* – 22,22%, *21* - 11,11%, *26* – 5,55%, with an arithmetic average 18,11 +-3,49, the median being of 19 and module 20. The scores obtained in the assessment of conceptual maps drawn by the students were as follows: 61; 82; 86; 99; 105 (2); 107; 112; 119; 124; 129; 130 (2); 137; 139; 140; 146; 156, with an average of 117.05 points. It is easily noticed that only in 27.77% of analyzed maps, cross-lines between different levels were identified. The results of the evaluation of conceptual maps have been analyzed together with the students as strong and weak points have been highlighted. Students appreciated the method of work as relevant to them in particular in order to systematize and fixing knowledge, for example, " it helped me to clarify and better understand the content of the theme, I summarized in a few words ...", "You Can an overview on which to build further details to come ... ", "it's catchy, it's logical ...", "it's a good way to structure content for review.

CONCLUSIONS

The results of evaluating the knowledge of students in specialized disciplines shows that using conceptual maps in assessments contributes to the recapitulation, systematization, synthesis and consolidation of knowledge, providing a better understanding of the field concepts. For improving the quality of training in higher education, it is recommended the modernization and adaptation of the teaching methodology applied both in the teaching-student-centered, on the student's particularities and needs of learning, and in the evaluation methodology so as to represent a powerful motivational factor in learning support.

BIBLIOGRAFY

1.EFKLIDES, A., 2006 – Metacognition and affect: What can metacognitive experiences tell us about the learning process?, Educational Research Review 1 (2006), 3-14

2. FISHER, K. M., WANDERSEE, J. H., MOODY, D. E., & ebrary Academic Complete, 2002 – *Mapping biology knowledge*, London; Dordrecht: Kluwer Academic

3. GARDNER, H., 2005 - Multiple lenses on the mind. Paper delivered at Expo-Gestion. Bogota, Colombia, May 2005. available at howardgardner.com.

4. GARDNER, H., 2006 - Inteligențe multiple. Noi orizonturi, Editura Sigma, București

5. GROZEA, A., 2002 - Hidrobiologie, curs, Editura Eurobit, Timișoara,

6. MEAGHER, T., 2009 – Looking inside a student's mind: can an analysis of student concept maps measure changes in environmental literacy?, Electronic Journal of Sciences Education, Vol. 13, No. 1

7. MOGONEA, F.R., MOGONEA FLORENTINA, 2014 – The constructivist teaching and the optimization of learning trough cognitive maps, Procedia Social and Behavioral Sciences 128 (2014) 164-168

8. NEACȘU, I., 2006 – Învățarea academică independentă. Ghid metodologic, disponibil pe http://www.unibuc.ro/n/despre/amfi-acad/docs/2011/apr/12_10_37_45Invatarea_academica_independenta.pdf

9. NOVAK, J. D.; CAÑAS, A. J. , 2008 - The Theory Underlying Concept Maps and How to Construct and Use Them, Technical Report IHMC CmapTools 2006-01 Rev 01-2008, Florida Institute for Human and Machine Cognition, 2008, available at: http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf

10. OPREA, CRENGUȚA LĂCRIMIOARA, 2007 - Strategii didactice interactive (ediția a II-a). Editura Didactică și Pedagogică, București

11. TANNER K., ALLEN D., 2004 – Approaches to Biology teaching and learning: Learning styles and the problem of instructional selection – Engaging all students in sciences courses, Cell Biology Education, vol. 3., 197-201.