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QUESTIONS QUALITY AND SUCCESS OF HIGH SCHOOL STUDENTS IN THE WRITTEN TEST SOLVING

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ABSTRACT

A large number of students choose biology at final examination and accordingly a large number of students are involved in biology competitions. In the biology competitions, from 20 % of the most successful, 362 high school students were chosen. Their results in solving written tests were analysed in order to establish the correlation between qualitative and quantitative analysis of issues. The analysis was performed in accordance with the Curriculum for certain studies and the Catalog for State Biology as the reference point of the conceptual framework and the anticipated learning outcomes. Types of questions are acceptable in quality, best are short-answer questions, and the worst quality are multiple-choice questions with two correct answers and questions with connections. Simple questions are still the most common types of questions with multiple-choice and connections. Solving of complicated questions and the estimation of the same questions are highly related. Relationships between solving the questions of lower quality and the middle quality and the assessment of the solution are the quality of the questions and the importance of forming the questions with the appreciation of the elements of the quality assessment. A better connection between solving and the quality of questions confirms the importance of preparing questions by observing the elements of quality assessment, and in particular the application of critical thinking in conceptual understanding and problem-solving questions. The results obtained by the analysis in the future can be used to improve the writing of written examination questions and the development of satisfactory biological competencies of high school students.

Keywords: *cognitive levels, professional assessment of quality issues, competition students, experience of a teacher*

INTRODUCTION

Teachers continuously and systematically follow the achievements and success of their students, and written tests of knowledge (Cindrić et al., 2010) are the best method of examining student achievements. Student competitions in different subjects are also one of the ways of measuring achievements and skills in the educational system. A large number of students choose biology at final examination and accordingly a large number of students are involved in biology competitions. Purpose for this researche were improve the quality of the questions and gain insight into the success of high school students at the County Biology Competition held in 2015, the partial aims of the research were set:

- analyze the qualitative structure of the questions and the correlation of the influence of the elements of quality assessment questions on the final quality questions
- to analyze the correlation of the elements of quality assessment with the student's success in solving them

- determine the impact of teacher experience in preparing tasks on the success of qualitative assessment of tasks.

METHODS

For research we used written tests from the biology competition for students from the first to fourth grade of the gymnasium held on March 18, 2015. In the biology competitions, from 20 % of the most successful, 362 high school students were chosen. For the analysis of the question, the method of expert quality assessment of the questions and the analysis of the answers based on the class of solving with the cognitive coding of the answers to open type questions according to Radanović et al. (2017b). After analyzing the answers to open type questions, the problems encountered in learning and teaching have been identified and in some cases certain misconceptions related to it. Statistical analysis was carried out using the Statistics Toolkit - StatsToDo (Chang, 2014), and correlations were interpreted according to Hopkins (2000). The differences in the frequency of the individual classes of students to their overall performance were analyzed by the $\chi 2$ test. The Kruskal-Wassis test was used for analyzes where the student's success is presented in the form of solving class, and covers a range of solvency of 10% (Radanović et al., 2017c). The correlation of the variables was determined by the correlation index. Pearson's correlation coefficient (r) was used in cases of linear linkage and normal distribution when determining the correlation between the estimated and actual weight of tasks and the impact of the elements of task estimation on their solvency. Spearman's coefficient correlation (ρ) has determined the correlation between the weight of questions and its estimates and the success of the examination and the corresponding cognitive level of the question. For a detailed view defense is questions that contain expected misconceptions, are important for the prescribed plan and program, are important for life, have a critical opinion, resolve is greater or lesser than the estimated, distracters of unequal weight, conceptual misunderstanding as a result of reading the introductory text, name distractors, problems in interpreting graph data, interdisciplinary character of questions, use of less important information when creating a distractor, conceptual misunderstanding, conceptual misunderstanding of reading data from a graphical representation.

RESULTS AND DISCUSSION

There was a similarity between the answers of students coming from the same County, which may be the product of the rewriting. Barksdale-Ladd and Thomas (2000) emphasize the importance of preparing and knowing the ways of checking, and therefore students need to present the types of issues / issues that will be applied in the competition. Open type questions are mostly composed of introductory texts that students readily understand or understand, and this contributes to a higher percentage of inaccurate answers. The same problem has been noted by Garašić (2012) and Lukša (2011) in their research, saying that introductory texts in written tests should not be too long or contain information and words unnecessary to solve the task. In support of this, the research of the PISA project goes on to show that the poor solving of the questions is a consequence of reading difficulties, understanding of the reading and interpretation of the answer (Braš-Roth et al., 2008).

The quality of the least handicapped issues is influenced by categories of impact on solving issues as well as the importance of issues for stimulating natural literacy, and the greatest impact is the importance of the issues for the profession. Top quality questions show a great deal of relevance to the importance of questions to encourage natural literacy in students and all its assessment elements, with the exception of medium-to-length relationships with the promotion of critical

thinking. In such matters, greater attention should be paid to the formatting and comprehensiveness of the questions (Braš Roth et al., 2008) and to reduce the influence of just logical thinking of the students without the actual application of knowledge, thereby enabling students to critically consider the task solving. Considering that there was a lower student competition, the average impact of additional pupils' learning on the success of the issue at issue at the national level would be acceptable. In relation to the achieved solving of the tasks, a higher correlation of the higher quality issues with the assessment of the solution was compared with the problems of the lower quality, which is the confirmation of the quality of the tasks. The weight of questions and the cognitive level mean is vice versa proportionally related to the achieved resolution that is to be expected, in order to check out the most successful students. Better connectivity to quality questions confirms the importance of preparing questions by taking into account the elements of quality assessment, and especially the application of critical thinking in conceptual understanding.

Misconceptions are mostly related to issues that check the concepts within the key concept of molecular organization of living organisms (DNA molecules, RNAs, amino acids) and inheritance at the organism level (gen, chromosomes, meiosis), and conceptual misunderstanding occurs in tasks that are of interdisciplinary character and require applying knowledge and skills from chemistry and physics. Garašić (2012) and Lukša (2011) also noted that most often misunderstandings and conceptual misunderstanding arise precisely in the type of tasks that examine concepts inherited. They conclude that the subject matter is difficult and abstract to the students, and that the students learn to know the knowledge without understanding. Flores et al. (2003) also note that students of different ages have problems with understanding the processes occurring in the cell and include the terms gene, chromosome, DNA, amino acids, proteins and cellular diploidy. Questions NB4-1 and NB4-3 correspond to the problem involving misconceptions related to DNA, amino acids, gene and cell division, and have very little resolution compared to the evaluated by the teachers. In Tasks NB4-1 (Level I, Weight 2) and NB4-3 (Level II, Weight 3), students show that they have problems with understanding the genetics and inheritance bases. The fact is that teachers spend a lot of time on genetic material because they know that it is difficult and demanding for students, all for the purpose of successful passage in written examinations of external evaluation (Ristić-Dedić et al., 2011). However, the fact is that the results are different and despite the efforts of teachers there are groups of students who were totally executed in solving or did not even try to find it difficult. Knight and his associates (2005) consider that the reason is a uniform approach to teaching and suggests that access continues to be different, viz. And more systematically. In NB4-1 it was noted that the word copy was the main culprit for the great inaccuracy in this task because this word was not used in the lesson and the students immediately eliminated that response. In NB4-3, students have difficulty understanding gametogenesis in plants. Garašić (2012) notes that students show very little interest in botany because they are abundant with a large amount of information and concepts. This has caused a very bad result in this matter. The students did not pay attention to the endosperm of wheat and applied the basis for the plant's developmental cycle. In addition, the concept of chromosome, chromatid and DNA was not understood.

Issues NB2-13b and NB4-12b warn of problems of a long introductory text that does not contain information related to the question and difficulty reading the data from the graph. The difference between the results of the survey of students who participated in the research works and the students who attended the written examination only went to the benefit of the students who wrote

the research themselves and used dependable and independent variables in their work and achieved a better resolution in that part of the examination. Lack of research teaching is also cited by Lujan and DiCarlo (2006). Question NB4-12b is concerned because its small resolve indicates that fourth-grade students do not have the ability to interpret data from a graphical representation. Simpson and Arnold (1982) argue that the wrong interpretation of graphic data is due to insufficient assumption of small, medium, or large, because professors do not warn students that the difference between these concepts is important when describing a graphical representation.

NB1-2 examines another cognitive level, but is not appropriate for the first grade of high school. In the first grade, basic facts about viruses are learned, and in the second class, viruses are analyzed for longer and the diseases they cause are reported. According to Garašić (2012), this type of question is not appropriate due to insufficient depth of student knowledge, and Lukša (2011) notes that solving such issues depends on the teachers and their way of structuring the materials and attaching importance to the facts they will convey to the students. In NB2-6, most of the incorrect answers (distractors) are based on understanding the texture of the peel mushroom, but use specific terms. The question would have to be the quality of the image that needs to be supplemented because the students do not understand the principle of the peel-fingers texture. Lukša (2011) states that students are better and easier to remember if they are offered a model that they must describe with their words. Questions NB3-4 and NB3-20b are of an interdisciplinary nature. NB3-4 quality is reduced by choosing a unit of measurement, because students concentrate on conversion, and not on issues that are very important and useful. Lukša (2011) and Garašić (2012) point out great concern about the student's lack of understanding of blood pressure and its influence on the body, and misunderstanding is attributed to integration with chemistry and physics with the influence of body pressure. Students do not have the habit of linking the teaching contents of different subjects and do not use the concepts taught in STEM subject areas to help explain the presented biological problem. Labov et al. (2010) point out that issues of an interdisciplinary character, and are processed and viewed from a single point of view, create misunderstandings that are later difficult to avoid. An experiment is recommended to help students reach the solution by using the knowledge they have of all subjects with the integration of knowledge. The interdependencies and impacts of collapsing, volume and surface disturbed students during the application of these sizes to erythrocytes. This points to the fact that students have difficulty when the size must be described by way of example. The most common misinterpretation referred to the relationship between volume and surface, while the plaster was mostly well-conceived. Such questions should be more common in written tests, because they require students to logically conclude and translate them into critical thinking when formulating conclusions using basic concepts of the STEM area. Won et al. (2007) in their research point out that such problems arise due to insufficient knowledge or misunderstanding of chemistry and physics and misunderstandings that may arise due to inadequate explanations from textbooks and teachers.

The great consistency of assessments of young teachers and teachers with a longer working life and poor consistency of experts and both groups of teachers point to the need for systematic education and various forms of lifelong learning that will prepare teachers for the preparation of quality questions, but not only on a theoretical basis but as a support to their work with students. Such reflections confirm the conclusions of Oleson and Hor (2013) that teachers in their classroom work to develop their professional identities, and instead of blindly modelling the behaviour of their

instructors, often rely on their own experience in teaching. The weakest link between assessing the relevance of the questions for the prescribed program and encouraging critical thinking among the students in the questionnaire and teacher training is confirmed by the lack of systematic application of the conceptual framework in biology teaching as noted in previous research (Luksa, 2011). With regard to the achieved solving tasks, a small correlation of the issues of lower quality and the medium of the connection of higher quality issues with the assessment of solvency was established, which is another confirmation of the acceptable quality of the tasks. The difficulty of the questions and the cognitive level of the middle are inversely proportionally related to the achieved solu- tions so that checks can best excel the most successful learners. A better correlation between solving and quality issues confirms the importance of preparing issues with the appreciation of quality assessment elements, and in particular the application of critical thinking in conceptual understanding and problem-solving tasks. Such a result highlights the need for systematic routing of teachers to encourage the critical thinking of students and their conceptual understanding of biology. The small difference between the evaluation of young teachers and experts in relation to long-term teachers indicates that the initial lesson during the course of the study successfully targeted students in assessing the quality of the questions. The analysis of the impact of each element of the assessment suggests that the greatest impact on the assessment of experience is the category of impact of the response question. Although the conclusions of the comparison of the quality assessment of the questions by working time and the experience of drawing up the questions according to the quality determinants are limited by a small sample, however, based on the conducted analysis can be seen the trends, which must be checked in future research.

CONCLUSION

There is a tendency for students to focus on active observation and conclusion using the knowledge gained during the biology of biology while solving their assignments in a written review at county level of biology competition, and such an approach to preparing written tests is desirable also for written check-ups in regular teaching. According to the research conducted it is possible to conclude:

- the average weight distribution is satisfactory for the competition
- the quality of the least handicapped issues has the greatest impact on the issues of the profession, and the authors have given these issues a great deal of attention in shaping the issue and its understandability
- the best quality assignments are still insufficiently encouraging students to think and conceptualize, and more attention should be focused on shaping and understanding the issues and reducing the impact of a logical conclusion without the actual application of knowledge
- since it is a competition of students at the county level, it is acceptable to have a smaller impact of the necessary additional student learning while at government level competitions acceptable and medium influence for the purpose of conceptual expansion of basic knowledge applicable in solving more complex problem situations rather than burdening students by memorizing additional terms
- a better link between solving and quality issues confirms the importance of preparing questions by taking into account the elements of quality assessment, and in particular the application of critical thinking in the concept of conceptual understanding and problem solving
- the authors of the questions should in future endeavor to pay more attention to directing the promotion of natural literacy, especially critical thinking

- it is recommended for drafters and reviewers to evaluate the quality of the questions according to the criteria of expert quality assessment of the issues in order to fully achieve the purpose of checking the knowledge of the students at the competition
- it is necessary to organize modularly certified teaching of small groups of teachers in the preparation of continuous work with error feedback and progress, and such professional training would be desirable also for the preparation of day-to-day check-ups in regular teaching.

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