STUDENTS' NATURAL SCIENCE CONTEST: TASK ANALYSIS IN THE ASPECT OF KNOWLEDGE AND UNDERSTANDING

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Abstract

National contest "Lithuanian naturalist" 1st -2nd form students' team (15) performed task (from animate nature and people's living environment sphere) analysis was carried out. The attention was paid to students' natural science knowledge and understanding.
The research was grounded on the attitude that this contest as a non-formal education form is an effective device because it contributes to natural science education quality in primary school: 1) develops primary school students' natural science literacy; 2) makes possibilities for teachers to reflect on their experience and proposes ideas for the education process improvement; 3) for students – future primary school teachers – provides a possibility to acquire new experience (task creation, conducting theoretical and practical parts of the contest, preparation of evaluation instructions, students' work evaluation).
Keywords: *natural science knowledge, natural science contest, primary school students, pre-service teachers*.

Introduction

In the society considerations can be heard if students' participation in contests is *good* or *bad*, in which students are inevitably accompanied by competition and negative emotions. Discussing this question, one should search and find more positivity. Students' contest organisation is useful due to many things: teamwork skills are improving, inner motivation is increasing, academic achievements are stimulated. Neubert (2016) also mentions: Enhancing Social and Emotional Learning, Building Mental Toughness, Improving Risk Analysis and other. In addition, the contest "Lithuanian naturalist" helps to better cognise the nearest natural environment, improves natural environment research skills, develops environmental attitudes. The contest is carried out by Lithuanian students' non formal education centre, its partner – Vilnius university. Childhood study programme (Primary education pedagogy) 2nd course students, taking part in this event, improve many pedagogical and subject competencies.

Speaking about knowledge and understanding in primary education, concepts play the most important role, which in future will form the foundation making laws, theories and ideas, and this means that the acquired scientific concept system will be the basis learning in senior forms. In psychology the concepts are divided into scientific and

non-scientific (domestic, pre-scientific) (Gučas, 1986). According to Vygotskij (2000), natural science knowledge acquisition first of all is related to the fact, term and concept learning. Cognitive concepts, according to the author, include assumptions, explanations and grounded assertions about natural science phenomena and processes.

The main knowledge acquisition peculiarity is the fact that the acquired knowledge is long term and stable. It is very important how students are able to reflect on it according to certain features. 7 to 9- year old child learns to logically and abstractly think and understands that certain features can differ one from another, and this means that he is able to discern them and to name:

- certain essential object features called a group of features, each of which separately is necessary for an object, and all of them are sufficient that owing to them a certain object could be separated from the adjacent objects;
- non-essential object features, considered such features, which an object can have or cannot have, however, not having them, an object remains the same as it was;
- general features, which are common to all particular concept objects. Any object group namely forms a concept because particular general features are common to all of them (Plečkaitis, 2004).

Contest theoretical tasks were prepared taking this into consideration. Though a contest is not only check-up of knowledge and understanding. In the practical part which takes place in the laboratory or in the natural environment, students' abilities are checked: to research, group, classify, contrast and compare, analyse, recognise and so on. Except the competitive part, the participants have also entertainment: peers give concert to them, education takes place. Therefore, the participants have a possibility to get acquainted, share, find out, experience something new. Children having completed the tasks and evaluation board having evaluated them, all participants are presented remembrance gifts, participant's certificates, and those who collected most points receive diplomas. Teachers are presented with the former tasks, students typical mistakes are discussed, it is advised how to teach one or another natural science subject. This part is rather important for the teachers, because it is a possibility to reflect on one's work practice and generate new ideas.

Research aim was – to analyse 1st -2nd form student, having participated in the republican contest "Lithuanian naturalist" carried out theoretical part tasks, and after evaluation of students' knowledge and understanding give recommendations to primary school teachers.

Research Methodology

Research Characteristics

The research was carried out in May 2019. This is a republican contest "Lithuanian naturalist" 2nd - round theoretical part students' performed task analysis. The performed theoretical tasks at this stage are oriented into "World cognition", integrating social and natural science content, the following spheres: animate nature and people's living environment.

The research is grounded on the attitude that various non formal education forms including a republican contest "Lithuanian naturalist" is an effective device developing students' natural science literacy and seeking natural science quality in primary school.

Research Sample

In the research participated 30 1st -2nd form students (8-9 years old), from 15 different Lithuanian schools. These are 15 teams (two students in each), having expressed willingness to participate in the republican contest "Lithuanian naturalist"

Instrument

A questionnaire was used for the research (activity sheets), which comprised 4 tasks: 1) animal cognition; 2) Lithuanian map and the weather; 3) the plant needs; 4) parts of the plant. For the result evaluation, evaluation instructions were prepared.

Research Results

The first theoretical task was devoted to animal cognition. 10 animals were chosen belonging to different animal groups: insects, molluscs, amphibia, reptiles, birds and mammals. Demonstrating these animal photos on the screen, the teams had to name the presented animal and to do one task each, related to this animal. How 15 students' team succeeded in cognising animals is depicted in Figure 1.

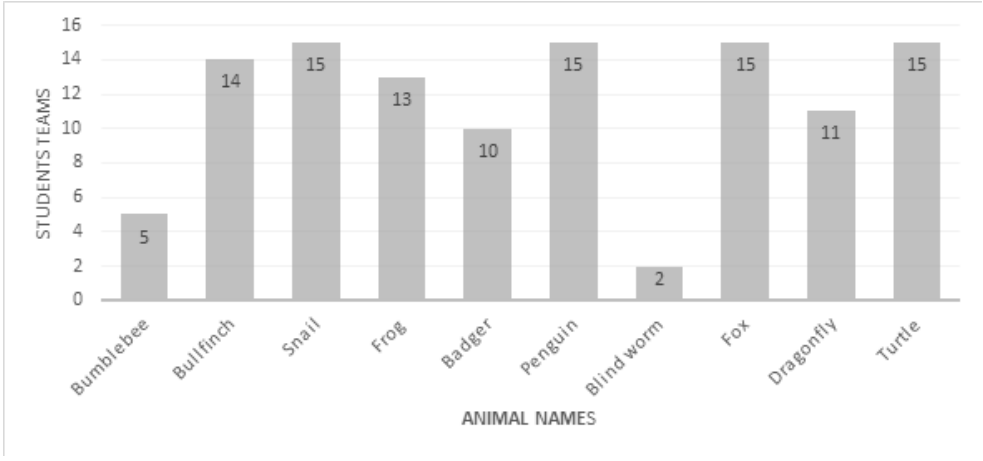

Figure 1. The team number, having correctly named the presented animal names.

Only one third of the teams recognised *a bumble bee*. Students usually confused it with a *bee, hornet*, *wasp.* The task required to *name at least one related animal to it [bumble bee]*. More than half of the participants pointed out *a bee.* The remaining part selected the other Hymenoptera group insects: *hornet, wasp.* Thus, presenting related animals the contest participants were not mistaken, they indicated Hymenoptera group representatives.

Even14 teams properly named the second animal – *a bullfinch.* And even though no one indicated animal species, however, the family was named correctly, because they knew the feature – the abdominal side of the body was brightly red. It was asked to *indicate what the body of this animal was covered by.* All the teams indicated correctly– *by feathers.* Thus, the students know this characteristic feature of the bird class.

All the teams recognised *a snail*. It was asked *to name an animal part shown by an indicator* (an indicator marked a shell). All the teams pointed out correctly. One of them wrote more precisely *shell or cockle shell,* and the other: *shell – little house.* This shows the relationship still existing between scientific and domestic concepts, though they related the feature to an animal without any problems.

Most of the participants cognised – a *frog* – the fourth animal. A few teams were convinced that it was *a toad*. Students were asked *to contemplate what relates this animal to a tadpole* Two thirds of the teams contemplated like this: *tadpoles are frogs' children; it is related to a tadpole, that it is a frog's child; both are frogs; tadpoles are small frogs; tadpole is a growing frog; from a tadpole develops a frog*. However, as can be seen, three last answers are more scientific. Besides, speaking about animals, the concept young should be used, but not a child. On the other hand, the concept young is used when we talk about birds and mammals. However, as one can see, the respondents still do not pay attention to this. The third of the teams did not demonstrate deeper natural science knowledge. According to them, a frog to a tadpole relate: *eyes; the same appearance of the head* or *water* and that *both of them swim.*

Two thirds of the teams recognised *a badger*. It was asked to tell how this animal *spends the winter*. Students teams contemplated correctly: *it sleeps all winter; it sleeps a winter sleep; accumulates fat and falls asleep; sleeps.* However, one pair of participants was wrong saying that in winter a badger *is walking.* The teams which named an animal wrongly (*ferret*, *raccoon, skunk)* still thought that it *during winter sleeps*.

The sixth presented animal was *a penguin*. All teams recognised it, two of them even indicated an animal species – *a royal penguin*. It was asked to tell, *where this animal lives*. One fourth of the teams were wrong indicating that these penguins lived in the north. This is a frequent primary school students' mistake: penguins' living place is associated with cold, which is supposed to be in the north; and Santa Claus also lives in the North where it is cold. Children's poems also add up to the wrong image formation, which children learn in preschool age and remember the lines about a penguin living in the north.

The other animal was *a blind worm* – a legless lizard was the most complicated for students. Only two teams recognised it. Anyway, both these teams were from the rural places! The others called this animal *a snake*, *a grass snake* and one team – *a worm*. The students were asked to express an opinion whether this animal was poisonous, to explain why they thought so. Having recognised a blind worm, the students wrote: *not poisonous, because it is from the lizard family, and lizards are not poisonous; it is not poisonous, because it is a lizard.* The teams which wrote that this animal was a grass snake held the opinion that *the animal was not poisonous*, that it did not have poison. And those who pointed out that it was a common adder – a venomous snake, claimed that *it had venom glands*; *its bite was dangerous and so on.* Thus, students had knowledge about the latter reptiles.

One more animal was a *fox cub,* which was properly named by all teams. It was asked not only to recognise an animal, but also *to describe in brief how this animal orientates in the environment*. It was hopeful that the students would enumerate all five senses helping to orientate in the environment: eyesight, hearing, smell, taste, touch. About half of the teams pointed out eyesight, a little less smell, hearing. None of the teams thought about touch, though in the photo one can see tactile hair very well. The content of this question is scholastic therefore, it is hard to believe that students could not apply knowledge in the new context. Some of the students' answers went beyond logic. E.g. *a fox has a magnetic particle in its head; orientates according to the trees; a tail helps to orientate*. Two more answers have nothing in common with the question. E.g., *a fox eats smaller than itself; hunts.* An obvious problem is with the text /image perception.

A lot of teams correctly named a *dragonfly.* The other teams were not precise: *an insect; yellow-legged dragonfly* or were mistaken*: a glow worm.* One students' pair did not name this animal. The contest participants were asked to name *how many legs insects have.* The same part of the researched students' pairs correctly indicated that *insects have 6 legs* or *3 pairs of legs*. Four students' teams were wrong claiming that *insects have 4 legs* (anyway, in the illustration one could see only 4 legs). Thus, a part of respondents still lacked elementary knowledge about this animal group, because they did not name the main feature.

In the last photo was *a freshwater turtle* living in Lithuanian southern regions, recorded into the Red book. It was a wish that 8-9-year old children name at least the family– turtle. All the teams recognised a turtle. Moreover, it was a wish that students in a few sentences tell about *this animal conservation*. Because, this animal is endangered and conservationists, regional park workers carry out their accounting, raise them in the zoo and then let them into freedom. There were quite a lot of reports on TV, radio, press about conservation of these animals. However, none of these teams related this question to the turtle conservation, but wrote about how this animal was adjusted to survive: *has a shell; when somebody attacks it gets into a shell; has a shell, therefore, it hides in it; the shell is very strong, withstands even the shot from the gun.* Under such situation, the task organisers have to take up the responsibility: they had to clearer form the question or to present an entry.

The second given task for the students was – *Lithuanian map and weather* (Figure 2).

In the activity sheets, Lithuanian map was given with the indicated eight cities. The teams were asked to work with this map and to carry out some tasks: there was a wish to ascertain students' abilities to orient oneself on a map, to name the world countries and so on. Indicating a city*, which is the furthest to the south,* two thirds of the teams were not mistaken. Their answer was – *Alytus.* The remaining teams indicated the other cities.

It was asked, which state *was northern Lithuanian neighbour.* Only 9 teams indicated correctly: *Latvia.* In the other answers were Poland, also Russia even Estonia, with which Lithuania does not have common boundaries.

Figure 2. Lithuanian map, given in the task.

The question, *What city is in Lithuanian west,* correctly answered 9 teams: *Klaipėda.* The other, apparently, still hardly oriented themselves on a map, did not know world countries, therefore, in their answers random cities were indicated.

Only one third of the teams managed to indicate the directions of *the wind blowing from the east*. The rest of the teams were wrong indicating the west and the north wind blowing.

It was asked to describe the weather: In Siauliai – *raining*, In Panevėžys – *cloudy,* in Kaunas – *clear*. Only half of the teams using conventional signs properly described the weather in all indicated cities. The others correctly used two conventional signs. Most often the students were mistaken describing *clear* by a conventional sign. Their conventional sign was *cloudy with clear intervals.*

The third task was *Plant needs*. It was asked to indicate what was necessary for any plant to grow. All teams indicated that *water* was necessary for the plant. A big part of the participants (*N*-12) know that *soil* and *warmth* are necessary for the plant to grow. More than half of the teams (*N*-8) indicated that *sunshine* was necessary, a little less (*N*-6) remembered that the plant still needed *air.* One team separately named that *human care, fertilizers* were also necessary. This, certainly, is not important because a lot of plants grow unattended, and not fertilized. Materials, being in the soil are sufficient for them.

The fourth task was *Plant parts.* Poppy is described in the picture. One can see very well a blossom, leaves, a stem, a fruit in it. It was asked to show the poppy's parts. All 15 teams correctly showed leaves. More than a half (*N*-9) correctly showed the stem. The remaining part (N-6) called the stem *stalk,* i.e. used a domestic concept. Most of the teams (*N*-13) correctly named a blossom. The remaining part (*N*-2) called the blossom petals. And this is only a part of a blossom.

More than half of the (*N*-8) contest participants correctly named *fruit*. Quite a big part of the respondents (*N*-6) called fruit *a bud*, one – a *seed.* And this is an inability to read visual information, because the features remained unfixed.

Students' teams were asked what part of a plant was not depicted in the drawing. Everybody answered correctly: *root.* Another question: *what matures in the fruit – in a porous box?* More than half (N-8) of the participants indicated *seeds.* The others

said *poppies mature in the fruit*. The answer was considered incorrect because the plant was called like this. It was the wish that the students name the concept. One of the teams wrote an unexpected answer – *grains.* This can at least illustrate the students' understanding about very small poppy seeds.

Conclusions

More than half of the students having participated in the contest have a sufficient amount of natural science knowledge corresponding to their age and are able to apply it in new contexts. However, the knowledge of a part of 1-2 form students still is not long term and stable, their used concepts are not always scientific. Though theoretical tasks were of a different size and students could check themselves in different situations, nevertheless it was noticed that part of the teams did not sufficiently go deep into the question, did not attentively read it, therefore, not understanding what they were asked for, gave not full answers, and did not earn points for the team.

Another important natural science knowledge and understanding peculiarity is – features. Students being able to cognise them and recognise, discern, name, practically did not make mistakes cognising animals, parts of the plant or answering questions about them.

A discussion having taken part after the contest with the students and with the teachers in some way is growing them. This is like the news being sent about the variety of tasks, other contexts, natural science content complexity. Together an attention has been drawn to the World cognition subject drawbacks, that in future children do not come in touch with the more serious difficulties. Teachers were recommended to give more natural science lessons for primary school students not in class, but in natural education environments. If students grow plants themselves, take care of them, they will not only know their parts better, but also will use scientific concepts, will know and understand the plant's needs. Besides, they would experience the cognition joy, would better understand human and environment interaction problems.

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