SOME IDEAS ABOUT SCIENCE AND TECHNOLOGICAL EDUCATION ACTUALITIES AND PERSPECTIVES

Dear Readers!

Science Education (hereafter-SE) actuality in the world is not only not decreasing but on the contrary, it is constantly increasing. As you know, very interesting and contradictory results were received in 2004 having carried out international comparative ROSE research. Once again I'd like to encourage all who are interested in science education actualities and problems to get familiar with already mentioned research. This is also important for the reason that Lithuania didn't take part in this research, therefore we can approximately judge about our position according to the results shown by the pupils of neighboring Latvia. However, these results are not enjoyable because 15 year old pupils' preferences with respect to science disciplines in many aspects are negative. This is a common tendency of so called developed countries. You can find detailed information about this research on http://www.ils.uio.no/english/rose/. There are lots of publications and other interesting material related to research and its perspectives. It is foreseen to carry out a similar research once again this year and to compare the results of 2004 and 2008. It is difficult to predict how the situation will have changed. However, it is obvious that in the last decades the results of pupils' tests in most developed countries are not getting better despite big investments and constant efforts to improve the quality of education. The conception of science education changes, much higher requirements are set for the youth science literacy. In the change of science education understanding the necessity arises to prepare new teaching devices, both traditional devices and the devices which are realized by the help of modern ICT. All this undoubtedly has direct influence on the quality of education. Quality imperative is especially emphasized in the report of UNESCO EFA, 2005. Those who are bringing up youth generation have to be interested in this.

National Lithuanian native language, mathematics, science and social education research of the 4th and 8th form pupils was carried out in 2007. It was found that pupils succeed better in completion of the tasks requiring knowledge presentation. The hardest appear the tasks requiring application of practical abilities. The research also showed that there was not sufficient pupils' research planning and task completion experience, the abilities of conclusion formulation, measurement device indicator reading, using of various sources of information. Pupils lack deep understanding of phenomena, processes and concepts, application of theoretical knowledge and its relation to practice (Bigeliene, Uginciene, 2008). These results are not surprising, in fact, because in the education process not much attention is given to the formation of practical research abilities. This situation is caused by different reasons, e.g. poor material equipment of science subject rooms (laboratories, appliances, chemicals for doing experiments and so on.) too little time (lessons) is allotted to science subjects, inadequate teachers competence and so on. By making social education significant and sometimes unreasonably integrating the latter with science education the second component remained impoverished. Such pseudo- integration didn't give any positive results as well as unreasonable profiling of teaching in the higher comprehensive school forms. The possibilities of informal education are also quite often used not for the benefit of science education. Here we can mention neighboring Latvians who became seriously concerned about the situation of science education. Science education modernization project on strengthening the material basis of science education has been going on for several years (the leader dr.Dace Namsone). At the moment the project is being carried out in more than 50 pilot schools therefore we hope that the other schools will share the accumulated experience too.

On the international level concern was given to science education textbooks. With the initiative of International Organization for Science and Technology Education (IOSTE) an International meeting

on "Critical Analysis of School Science Textbook" was organized in Tunisia, in February, 2007. It was emphasized that every country has a great variety of textbooks from totally traditional textbooks and their appliance to modern approaches. For example, African countries and Malta usually use old British and French textbooks. Only recently new original textbooks started to be prepared (Clement, 2008). Despite the variety in every respect (e.g. the quality of textbooks, supply, their usage and so on) it is stated that science education should be more common, similar because science knowledge is universal and every country is seeking to strengthen so called knowledge society. Scientists from more than 35 countries participated in the above mentioned meeting. A very important attention was paid to such topics given in the textbooks as Sex Education, Health Education, Human Genetics, Human Brain, Ecology and Environmental Education and other. During this seminar the scientists returned to still existing and becoming urgent – the problem that in our textbooks you can still find quite a lot of subject mistakes and old conceptions which are incompatible with modern science education achievements. Without any doubt, we should give much more attention to this problem in Lithuania than we did up to now.

Teacher qualification question remains urgent. The majority of the researches both national and international in one way or another reveal direct link between children's achievements and teachers' competence. Teaching is not a simple thing. On the contrary, the complexity of teaching points out the necessity for deeper research into the relations between the different elements that constitutes teacher knowledge, and how these are developed and integrated during teacher education (Nilsson, 2008). In this context the suggestion of Lithuanian Education leaders to justify Education law amendments allowing the students of higher schools to work in schools is totally not understandable. This is perhaps J. A. Komenskis times (Lamanauskas, 2008a). According to statistics, there is a lack of science teachers in Lithuanian schools. So called "retrained" pedagogues don't solve the problem. Nevertheless, not a small part of teachers still work without proper qualifications. Therefore, more attention should be paid to teacher training problems. The science teacher training is a very important part for the future quality of science education (Nezvalova, 2007). Not without reason, in recent years a lot of international projects on science teacher training, analysis on competence issues are being carried out. One of them is international project IQST (Improving Quality of Science Teacher Training in European Cooperation). The project results you can find on http://www.iqst.upol.cz. One of the purposes of the project is to analyze science teacher training practice in some European countries and to prepare possible teacher training development mechanisms on the basis of constructivism theory.

The question of using the newest information communication technologies remains problematic. We can't assert that teachers don't use ICT in the teaching process, however, their usage remains inadequate, e.g. inefficiently are used opportunities from the internet in science education (Lamanauskas, Vilkonis, 2006). On the other hand, particularly innovative technologies, such as augmented reality technologies for learning penetrate into schools. Since 2006 international project "ARiSE" has been carried out to reveal the possibilities of augmented reality technology application in education process. You can read about this on http://www.arise-project.org or on Siauliai University Science Education research centre website http://www.gutc.su.lt/ariselt.htm. Application of ICT in science education is inseparable from teaching and learning visualization, implementation of knowledge, perception problems. This sphere should be analyzed in detail, broadening the basis of empiric research. Technologies should not alienate from human being and reality. We should devote all our efforts to stimulating youth interest in science and technologies and reinforcing scientific-technological education at all levels. Although hardly anyone suspects that technologies are having a growing impact on our daily life, however, they are still remain alienated from the major par of society members and policy makers and what is more, frequently stand outside the door of the education system. Hence, opening the door is the obligation of all of us (Lamanauskas, 2008b).

All mentioned problematic questions are in one way or another related to scientific-research pupils' activity in comprehensive school. We can safely assert that especially in primary school practically not an appropriate attention is paid to formation of scientific-research abilities. It is obvious, that modern teaching process is not favorable orientating pupils for scientist (researcher) career. It is very important to analyze in detail which factors disturb/encourage to train pupils' interest in scientific-research activity. Finally, teacher's competence and also personal interest are very

important while forming and developing pupils' scientific research abilities in teaching- learning process. From the managerial point of view, incentive program is necessary for such teachers. The formation of scientific research activity abilities in comprehensive school is undoubtedly, a very important sphere still awaiting of particular attention. Current teaching and learning process has basically changed looking from the paradigmatic point of view. Teaching subjects become the means of realization of learners' demands and interests. Scientific research activity is not an entertainment but a very responsible, thorough work requiring great self- independence. During this activity children's analytic thinking becomes stronger, information search and usage abilities are being developed, they can learn to analyze the accumulated material, make presentations, prepare research reports and so on. It is important to make more pupils interested in this activity. This shouldn't be the privilege of gifted pupils only. However, talking about the developing of scientific research activity at school, several essential questions arise:

- Is it possible to teach every child to perform research activity?
- What to do if a pupil wants to take up scientific research activity but school can't provide elementary conditions for this purpose (for example, there is no equipment, no competent leader and so on.)?
- How to integrate effectively scientific research elements into teaching/learning content?

Scientific research activity in comprehensive school is undoubtedly a meaningful, integral sphere, however, for developing such kind of activity in Lithuanian comprehensive schools not an adequate attention was paid up to now. Comprehensive school teachers seeking to form scientific research abilities and to develop such activity in the training process face various difficulties: lack of administration support, lack of pupils' motivation, shortage of material and financial resources, etc. Some factors disturbing pupils' interest in scientific research activity in the teaching process are: a) lack of teachers' motivation, b) pupils' orientation to choose an easier, less effort demanding way, c) poor material basis of schools, d) lack of methodology how to organize pupils' scientific research work, e) insufficient teachers' preparation for scientific research work. On the other hand, some essential encouraging factors in the pupils' interest in scientific research activity are such: a) teacher's personality and activity, b) pupils' curiosity, their wish to develop knowledge, to show themselves, c) pupil's abilities, d) different teaching subjects' pupils scientific conferences, seminars and other similar arrangements, e) trips, excursions to scientific establishments, meetings with scientists (Lamanauskas, Augienė, 2008).

Recently in Gothenburg (Sweden) one week course took place for PhD students in science education sphere (Goteborg University, November 16th - November 21st, 2008). The subject of the course was 'The Role of Theory in Science Education'. The focus of the course was on the role of theory in developing doctoral theses in the context of science education. The event took place according to a common project of Baltic and Scandinavian countries 'NordForsk'. During the course the students presented their researches, shared experiences, listened to interesting lectures, such as: 'Theoretical perspectives on science learning: an overview' (P. Scott), 'Science learning in a sociocultural perspective' (R.Saljo), 'Theory: who needs it?' (J. Donnelly), 'Appeal to reason, appeal of reason: fostering argument in science education' (S. Erduran) etc. Students' presented works were interesting as well. Their subjects are various indeed, e.g. 'Personalized learning for the most able learners in science' (B.Knutsen, Norway), 'A design-based research on motivation: learning materials with science inquiry' (A.Loukomies, Finland), 'The development of science achievement motivation in Iceland: longitudinal quantitative study based on social cognitive theory' (K.K.Stefansson, Island), 'Establishing learning demands about biological evolution-exploring the constituents, actors and communicative processes' (C.Olander, Sweden), 'Science education outdoors-effects and attitudes' (E.Fagerstam, Sweden) etc. In general, the importance of such courses can be evaluated as a positive contribution into training of young generation of scientists and as an obvious contribution into science education development. However, after analyzing at least minimally the works of doctorates becomes evident that the latter are ready to choose a rather pragmatic and simple way. I mean, such spheres of researches are chosen which are popular at the moment. The great majority of the works are linked to motivation, interests, attitudes and so on. We can't assert that this is not important. In

fact, this is the sphere of psychology. However difficult it were to find out the reasons for low interest to science and technologies, the fallen prestige of sciences in comprehensive schools, nevertheless, they are not essential things from the educational point of view. All the more, inquiry based researches give only a panoramic view of the situation, i.e. have a stated character. It is completely not clear or almost not clear what causes such a situation. The main goal of educators is to change, develop teaching-learning process using educational devices. Already mentioned ROSE research revealed that pupils understand the meaning of sciences and technologies to society in general, but they are not satisfied with school science. It is obvious, that we come in touch with deeper didactic problems here, for example, the content of teaching, teaching-learning methods, teacher and pupils relations, scientific research activity (the latter is a very important part of the whole science education process), at last, teaching-learning process management in general. If we concentrate only on psychological parameters (interests, motives, demands, attitudes and so on), essential didactic parameters remain outside. In other words, the essential question – effective pedagogization of the whole science and technological education process hasn't been solved yet (it considerably deviated towards psychologization and sociologization). Such conclusion can be made from the experience acquired during the course in Gothenburg.

The actualities of science education discussed in this article make one take up research, analytic, expert job. There are no drawn limits for the development of science education. More serious theorists and practitioners efforts are simply necessary. There is a hope that this issue remains one of the main science education efficiency catalysts not only in Lithuania but also in the international arena.

References

Bigelienė, D., Ugінčienė, E. (2008). Nacionalinių mokinių pasiekimų tyrimų pristatymas švietimo konsultantams. Vilnius: ŠPC. Prieiga per Internetą: http://www.pedagogika.lt/index.php?1475461344 (2008-08-30).

Clement, P. (2008). Introduction to the special issue of SEI relating to critical anglysis of school science textbooks. *Science Education International*, Vol. 19, No. 2, pp. 93-96.

Lamanauskas V., Vilkonis R. (2006). Internetas gamtamoksliniame ugdyme: situacijos analizė ir prognozės. Šiauliai, p. 116.

Lamanauskas, V. (2008a). Ar tikrai grįšime į Jano Amoso Komenskio gadynę?! *Lietuvos Aidas*, 2008-09-01, Nr. 195, p. 1, 3, 5.

Lamanauskas, V. (2008b). The Augmented Reality Teaching / Learning Platform: Some Implications for the Present and Future. In.: *Information and Communication Technology in Natural Science Education – 2008* (Proceedings of International Scientific Conference). Siauliai: Siauliai University Press, p. 5-7.

Lamanauskas, V., Augienė, D. (2008). Mokinių mokslinės tiriamosios veiklos gebėjimų ir susidomėjimo ugdymas bendrojo lavinimo mokykloje: situacijos analizė ir prognozės. *Gamtamokslinis ugdymas / Natural Science Education*, Nr. 3(23), p. 6-29.

Nezvalova, D. (2007). Initial Science Teacher Training. In.: *Improving Quality of Science Teacher Trainingi n European Cooperation – Constructivist Approach*. Olomouc, p. 7-14.

Nilsson, P. (2008). Recognizing the neeis – Student teachers` learning to trach from teaching. *Nordina: Nordic Studies in Science Education*, Vol. 4, Nemmer 1/08, p. 92-107.

UNESCO, EFA Global Monitoring Report 2005, Education for All: The Quality Imperative. Prieiga per Internetą: http://portal.unesco.org/education/en/ev.php-URL_ID=35939&URL_DO=DO_TOPIC&URL_SECTION=201.html (2008-08-30).

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