EXPERIENCE IN USING E-LEARNING MATERIALS FOR ENVIRONMENTAL EDUCATION

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Natural and social sciences, techniques and the complexity of everyday life are nowadays developing too quickly to be followed in education in all their integrity and diversity. In order to solve this problem, the most important topics have to be selected and appropriate didactic strategies are necessary. Since the appropriate personal characteristics are the essential part of every competence, we shall mention them with regard to the following list of generic competences:

1. Ability to collect information.
2. Ability to analyze the literature and organize information.
3. Ability of interpretation.
4. Ability of drawing conclusions.
5. Ability to learn and solve problems.
6. Transfer of theory into practice.
7. Ability of individual work and organization and planning activities.

We have found that the e-learning materials concerning the subject *Environmental education* in primary school can be an appropriate and interesting way of improving the pupils' understanding of the basic concepts of natural and social sciences. In order to accomplish this, there is a need for additional courses for teachers in using these web pages. More generally, teachers should become aware of specific and generic competences that their students must develop in order to be successful in modern society.

Keywords: Environmental education, e-learning, competences, natural and social sciences

ИСКУСТВО У КОРИШЋЕЊУ Е-НАСТАВНИХ МАТЕРИЈАЛА ЗА ЕКОЛОШКО ОБРАЗОВАЊЕ

Природне и друштвене науке, технике и сложености свакодневног живота данас се развијају сувише брзо да би могли да их пратимо у образовању у свој њиховој целовитости и разноврсности. У циљу решавања овог проблема, морају да буду изабране најважније теме и неопходне су одговарајуће дидактичке стратегије. Пошто су одговарајуће личне карактеристике битан део сваке компетенције, ми ћемо их поменути у вези са следећом листом општих компетенција:

1. Способност да се прикупљају информације.
2. Способност да се анализира литература и организовање информација.

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3. Способност интерпретације.
4. Способност извођења закључака.
5. Способност учења и решавања проблема.
6. Пренос теорије у праксу.
7. Способност за самосталан рад и организацију и планирање активности.

Утврдили смо да материјали за е-учење који се односе на предмет Еколошког образовања у основној школи могу да буду одговарајући и занимљив начин за побољшање разумевања основних концепата природних и друштвених наука. Да би се ово постигло, постоји потреба за додатним курсевима за наставнике за коришћење ових страница. Уопштено, наставници треба да постану свесни специфичних и општих компетенција које њихови ученици треба да развијају да би били успешни у савременом друштву.

Кључне речи: Еколошко образовање, е-учење, компетенције, природне и друштвене науке.

Introduction

Natural and social sciences, techniques and complexities of everyday life unfold too quickly for us to keep up with and incorporate into education. In order to solve this problem important topics and appropriate teaching strategies that are necessary should be selected. Some basic aspects of social and natural sciences are presented to students as early as the first years of primary education. Here we will focus on the subject *Introduction to the environment* that is taught from 1st to 4th grade in elementary school. The goal is to give students basic knowledge about the world around us and training in general and specific competencies to function properly in modern society. Part of any competence is not only formal knowledge, but also skills and personal characteristics (attitudes, habits, beliefs, etc.).The subject Environmental education also indicates eternal ethical questions: altruism and tolerance, respect for nature and sustainable development, etc. On the other hand, science brings new insights and challenges of the surrounding world and new technological developments, whose rapid grow this very difficult to follow.However, it is obvious that children are very sensitive to acquiring experimental and other skills, [1] as well as learning with ICT (Information Communication Technology) from sources such as computer web pages. Therefore, combining experiments with ICT can be a very effective way of learning natural (and partly social) sciences at a satisfactory level.

8 key competences of European legislation, Key Competences for Lifelong Learning, 2011, that every citizen should obtain in the ordinary course of education:

1) Communication in the mother tongue

2) Communication in foreign languages
3) Mathematical competence and basic competences in science and technology
4) Digital competence
5) Learning to learn
6) Social and civic competences
7) Sense of initiative and entrepreneurship
8) Cultural awareness and expression

There are some other lists of competencies that are either specialized in more subjects (e.g. natural-scientific competencies for respective sciences) or have narrower meanings of competencies shown above. For example, the Council in Australia's list of competencies Australian Education Council, 2011 is very convenient because it includes several well-defined competencies. Among these, we can focus on the following 14 competencies that are particularly associated with natural sciences:

1) Ability to collect information
2) Ability to analyze the literature and organize information
3) Ability of interpretation
4) Ability of drawing conclusions
5) Ability to learn and solve problems
6) Transfer of theory into practice
7) Using mathematical ideas and techniques
8) Adaptability to new situations
9) Care for quality
10) Ability of individual and team work
11) Organization and planning activities
12) Verbal and writing communication
13) Inter-personal interaction
14) Safe operation

In this paper we will describe the goals and methods of environmental education which is implemented through other teaching subjects, the relationship with key competencies and the corresponding e-learning and teaching materials that are an addition to the textbook for

Introduction to the environment for the third grade of nine-year primary education in the Republic of Macedonia. We will also give an explanation of the limitations in the use of e-materials for this subject, as well as ways to get over these difficulties. Among other problems, we will try to explain the need for ongoing training of primary school teachers so that they will be updated with the development of science and technology. In particular we will focus on the importance of competencies for natural sciences which we discuss from the perspective of 14 general competencies listed above.

2. Course content of the subject *Introduction to the Environment* for 3rd grade

Since the age of students at this level is about nine years, the concepts of *Ecological education* must be appropriate to their cognitive development so that they are able to understand the planned topics. In the Macedonian educational system the subject *Ecological education* is not present as a separate subject. It is studied in cross-curricular correlation and integration with contents from other subjects, especially through the subject *Introduction to the environment.* As a subject of study the following topics that include issues of natural and social sciences are specifically treated, Stavreva Veselinovska, 2007.

- **Who are we and what were doing**: In this theme the students find the importance of: school and knowledge, production and goods, work, profession, leisure activities and money.
- M**e and you, you and us**: wanting to teach students about cooperation and tolerance among people and why assistance and solidarity are necessary in society
- **Where we live:** shows students institutions such as post-office, shops, galleries, banks, museums and churches. The second part speaks about neighboring countries and citizens.
- **Macedonia, my country:** presents basic information about Macedonia and the symbols of Macedonian country.
- **Celebrations**: wants to teach students about holidays, free workdays and holidays in Macedonia and other celebrations that are working days, but are very important to society (e.g. International Women's Day, Earth Day, World Book Day, and Children's Day etc.).
- **Once upon a time:** wants to show changes in time in the place we live in; wants to teach about history, culture and people's customs – songs, dances, stories, and fairy tales.

- **I and nature:** explains the position of man in the environment. Through themes about animals and plants we want to influence individuals to behave correctly.
- **I and health:** wants to influence students' eating habits. They must know which food is healthy and what its benefits are.
- **Man and nature:** is an extension of the theme I and nature. The value of water and the effects of pollution are presented in all manners. An important topic is the problem of smoking. We do not want our children to start smoking.
- **Diseases:** wants to teach students about the symptoms of diseases and the importance of following doctors' prescriptions.
- **Protection against diseases:** teaches about personal hygiene and germs.
- **What I can do**: shows what can be done from paper, how to sew on a button, how to apply pieces of fabric, how to treat iron panels and wires, and collect garbage.
- **Things are changing:** shows changes in objects exposed to air, water and light.
- **Air:** shows the characteristics of air and the importance of oxygen for living organisms.
- **Movement:** shows how objects move under the influence of forces of air and water.
- **Light:** shows the importance of lighting and the properties of sunlight. The prevention of sunburn is especially important.
- **Sky:** describes the virtual movement of the sun; night sky; Polaris.
- **Weather conditions:** describes rain, thunder, snow, wind, and temperature.
- **Sound**: describes the properties of sound and how sound is produced, how fast sound travels in different media.
- **Time**: studies relationships between days, hours and minutes, how to measure time (digital and analog clock) and relevant timeframes of events.
- **Looking around**: learns about waste and waste treatment
- **Transportation:** learns about transportation and the impact of traffic upon people.
- **Transmission of data and information**: learns about communication devices and their use (phone, internet)
- **Data storage**: intended to learn about storing data on magnetic, optical and electronic media

- **Things and their parts**: shows that almost all appliances are built from parts. Shows how the parts are connected and why it is important to distinguish the parts of the product.

Materials for e-learning

Materials for e-learning in *Environmental education* cover all didactic objectives prescribed by the school curriculum. For example, in 6 themes related to physics (Motion, Light, Sky, Weather conditions, Sound and Time) the basic idea of e-materials is to help teachers and students to repeat the presented experiments in a similar or same way and encourage them to make their own versions of the experiment. Thus, through the use of active forms of work in what leads to the development of several specific competencies for life sciences, as well as some key competencies, such as "learning to learn" is specified. All topics are presented by various means: numbers, sound, films, explanatory text, motivational questions and interactive knowledge tests.

Using materials for e-learning in school practice can be a problem for teachers. First, teachers need to develop their own digital competence satisfactorily. Next, some content in these materials may be new to the teacher so he / she must learn how materials should be used in school. And, most importantly, teachers should choose the best didactic approach (frontal or group work, discussion of test results, partial homework for students, etc.) in accordance with the digital competence of children, their initial knowledge about the topic, the availability of computers at school etc.

Experience in using materials for e-learning

A preliminary experiment was first conducted with teachers from primary school on the subject – Environment, teaching unit Parts of the plant, through the use of e-learning as supplementary textbook materials *Introduction to the environment* for the third grade. Students were not involved at this stage. At the end of the experiment teachers wrote an essay whose content was a preparation of the teaching unit – “Parts of the plant”, Figure 1 and Figure 2.

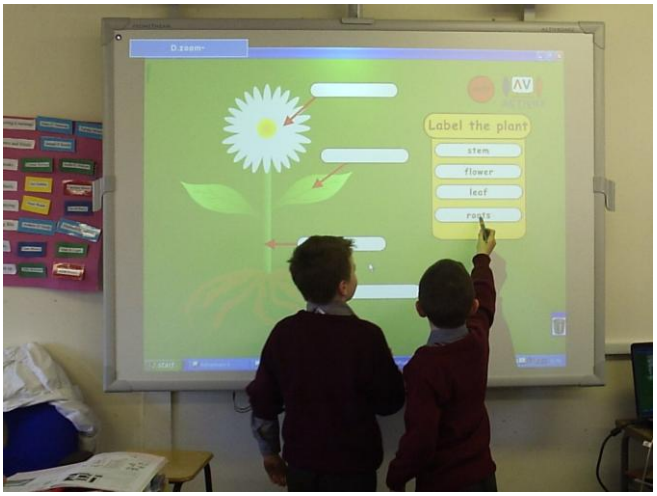

Figure 1. *Typical screen elements in topic presentations*

Figure 2. Examples from a teaching lesson (Stavreva Veselinovska,S., 2011)

The Teachers' response to the experiment with materials for e-learning has been very positive. Here are some of their positive comments:

1) It is encouraging that someone started using materials for e-learning for this level, Repnik et all, 2003.

2) Modern didactic principles are applicable.

3) As students, their parents and school manager continuously force teachers to use ICT, the new e-Learning materials are welcome.

4) The teachers at this level usually need basic knowledge of the area of natural sciences so that they could get ideas to perform experiments; thus e-learning is a good guide for them. All this knowledge teachers receive through the study of the teaching subject "Fundamentals of natural sciences" which is a compulsory subject.

5) A good set of multimedia items is presented in the materials for e-learning.

6) All pedagogical goals can be met with the additional use of e-learning. For example, when the weather is bad and some experiments in nature are prevented, then there is a corresponding simulation on a website.

For the following didactic experiments teachers first learn about e-learning materials and then they use them in practice in their classes. Three main conclusions are drawn:

1) Students were enthusiastic about conducting experiments with the following instructions for e-Learning materials.

2) Acquired knowledge was not satisfactory because they did not work systematically.

3) Textual explanation was too long compared to the students' reading skills.

As a result, the need for a bit less self-initiative by students and a more organized guide for teachers have become a real need. Teachers themselves expressed a need for additional courses for e-learning so that they could be more confident in conducting classes with this technique. In particular, the texts explaining web pages should be shorter, and instead, teachers should give an oral explanation of the topic and experiments. In further research (mainly of 6 biological topics, but we believe that it will expand to other topics) with an informal collaboration of teachers by testing of partially upgraded materials, some additional feedback

from teachers has been obtained and some of them mentioned possible problems or made positive suggestions, Dorup (2004).

1. All these 6 topics should be covered in part with materials for e-learning in an appropriate manner: either by performing experiments by students, or by using e-materials (going through all the readings, simulations, animations and tests of e-materials and implementation of all described experiments).

2. The problem arises if the school is equipped with an insufficient number of computers. If students sit at computers in pairs, all of them should invest equal effort. The positions of the students in pairs must be exchanged so that every student has a computer for writing instead of getting bored and just watching what his / her partner is doing. It is not good when when the abilities of students in the same pair are too different.

3. In particular difficulty arises with the teacher if he/she needs to take full control in the classroom and help the individual work of students at the same time (or in understanding of the text or user operations in e-materials or in performing the actual experiment) because of different students' abilities. Therefore, at least part of teaching with materials for e-learning must have a frontal form. Frontal work is also more suitable for checking students' answers on tests in e-materials.

4. Some topics are appropriate not only for the third grade, but also for lower or higher grades - from first to fifth grade.

5. E-materials are very easy to use in the event of a need for substitute teacher (for example, when the class teacher is absent), especially when the substitute teacher teaches other courses in higher grades and who is not familiar with natural sciences.

6. It would be a good idea if two teachers for the third grade at the same school cooperate in some sort of exchange of classes in the following manner: each has three of the six biological topics and presents them with e-learning materials in both classes. This will probably be interesting for students. This would not be against the rules as it would only be part of adjustments of the material and not the evaluation of students.

7. Tests are rarely used on computers. Teachers are much more likely to test the knowledge of their students traditionally. Teachers also say that 45 minutes that are usually sufficient for teaching, donot allow all users to log in and use electronic tests. Materials for e-learning can be used in a multimedia-equipped classrooms, but tests require a computer classroom, which is an additional limitation. It is evident from teachers' comments that they often feel insecure when using new teaching resources in school practice. They should participate regularly in seminars or workshops appropriate teaching strategies with new learning tools, such as e-learning materials are taught. In this way, competencies of both teachers and students can be developed simultaneously. But this is only the first important step to improve the educational competencies of teachers.

Topics of natural sciences and general competencies

Many topics listed above relate to biological or physical phenomena. For example, there are 6 topics directly related to physics (although students' cognitive development at the given age does not allow the development of ideas about physics as subject): movement, light, sky, weather, sound and time. These topics are extremely important for the development of some physical concepts later, when students in higher grades study physics as a separate subject. Many physical concepts are associated with interpretations that are placed in the human intuition as a result of everyday experience. Thus, it is useful to begin the fight against such errors as early as possible in education. A typical example is a deficient understanding of the first and second law of Newton. The theme of "Movement" in the third grade for the subject *Introduction to the environment* provides examples of the impact forces of change on the movement of a body on quantitative level, including the forces of friction. This can help students to gain an understanding that the body cannot just stop without some force to cause it. Of course, teachers of the subject *Introduction to the Environment* should be familiar with the basic physical principles (though he/she does not need to be a specialist in physics), because teachers will not be able to guide young students beyond safe from the traps of misunderstanding. Here teachers receive basic knowledge through the study of topics from *Fundamentals of natural sciences* and they further transmit this knowledge to students when teaching topics from the teaching subject *Introduction to the environment* that offers the opportunity for interdisciplinary with

environmental education which, unfortunately, is still not present as a separate subject in the Republic of Macedonia.

But learning skills for natural sciences within the themes of environmental education is even more important than gaining some basic formal knowledge in natural sciences. We have talked about some of the above 14 general competencies related to materials for e-learning. Students can gradually develop these competencies through a process of long term learning (in the course of several years). On the other hand, teachers should already have these competencies (or they are forced to acquire them in as soon as possible). Therefore, in the following discussion of general competencies that are particularly developed with using our e-learning materials we will take into account only students' competencies. As respective personal characteristics are an essential part of each competency, we will mention them in relation to the following list of general competencies, Kennedy et. al., 2007, Oliver and Goerke, 2007; Margaryan et all, 2011.

1) Ability to collect information.

2) Ability for analysis of literature and organizing information.

3) Ability to interpret**.**

4) Ability to draw conclusions.

5) Ability to learn how to solve problems.

6) Transfer of theory into practice.

7) Ability for individual work and organization and planning of activities.

If we turn to the competencies of teachers, there is no doubt that a teacher's role model (behavior, manners, methods of work) is worth much more than many words. We can take the first general competencies in our list as an example. The teacher should show his/her own approach to gathering information instead of spending time on long explanations of this responsibility. For example, the teacher needs to compare information from two or three different sources of different types (web pages, printed textbooks, scientific article). He / she should briefly comment on possible differences in data from different sources: which data are more probable and reliable, if there is an obvious error somewhere, if differences are only

apparent, not real, and the like. The teacher must be aware that students quickly notice his/her characteristics, beliefs and views on the subject that is being taught. In our opinion, perhaps the most important thing to advise the teacher is to show a reasonable combination of confidence and humility with caution (in the areas where his / her knowledge is not deep).

Conclusion

We have found that the materials for e-learning related to the teaching subject *Environmental education* in the third grade of elementary school can be an appropriate and interesting way to improve students' understanding of the basic concepts of natural and social sciences. In order to achieve this, there is need for additional courses for teachers about using these web pages, because teachers need to be aware of specific and general competencies that their students must develop in order to be successful in modern society.

References

Australian Education Council, *Young people'sparticipation in post-compulsory education and training,Report of the Australian Education Council ReviewCommittee* (1991), available at: http://www.voced.edu.au/docs/dest/TD_LMR_85_658.pdf (25. May 2011).

Dorup, J. (2004). Experience and Attitudes towards Information Technology among First-Year Medical Students in Denmark: Longitudinal Questionnaire Survey, *Journal of Medical Internet Research*, 6(1).

Kennedy, G., Dalgarno, B., Gray, K., Judd, T., Waycott, J., Bennett, S., Maton, K., Krause, K., Bishop, A., Chang, R. and Churchward, A. (2007) The net generation are not big users of Web 2.0 technologies: Preliminary findings from a large cross-institutional study. In: Atkinson, R., McBeath, C., Soong, A., and Cheers, C. (Eds.) *Providing Choices for Learners and Learning: Proceedings of the 24th Annual Conference of the Australasian Society for Computers In Learning In Tertiary Education*, pp. 517-525, Singapore, ASCILITE.

Key Competences for Lifelong Learning, available at: http://europa.eu/legislation_summaries/education_training_youth/lifelong_learning/c11090_en.htm (25. May 2011).

Margaryan, A., Littlejohn, A. & Vojt, G. (2011) Are digital natives a myth or reality? University students' use of digital technologies, *Computers & Education*, 56(2), pp. 429-440.

Oliver, B., & Goerke, V. (2007). Australian undergraduates' use and ownership of emerging technologies: Implications and opportunities for creating engaging learning experiences for the Net Generation. *Australasian Journal of Educational Technology, 23*(2), pp. 171-186.

R. Repnik, Z. Bradač, S. Kralj and M. Krašna. "Presentation of liquid crystals' structure and its defects for educational purposes", in: B. Aurer (ed.), D. Kermek (ed.), *IIS 2003: 14th International Conference on Information and Intelligent Systems, September 24-26, 2003, Varaždin,Croatia: proceeding,* Faculty of Organization and Informatics Varaždin, Varaždin, 2003, pp. 121-128.

Stavreva Veselinovska, S., 2007. "Zapoznavanje na okolinata", Prosvetno delo, Skopje.