THE LATVIAN 12TH GRADE STUDENTS` UNDERSTANDING OF PARTICULAR ISSUES OF NATURAL SCIENCES

Irmeli Palmberg
Åbo Akademi, Vasa, Finland

Gunita Praulite, Janis Gedrovics
Riga Teacher Training and Educational Management Academy, Riga, Latvia

Abstract

Students after graduating school must have both, knowledge and basic skills for active life-action, which includes their ability to evaluate their knowledge and skills for usability both in everyday life and in future. In this article knowledge of different problems within science education and its usability for future life, evaluated by the Latvian 12th grade students, has been analysed by using a poll, which has been previously approved in Nordic countries.

Results show that Latvian students' knowledge about different problems of human biology is relatively higher than in other fields of science. On the other hand students demonstrate a lack of skills for generalization, therefore knowledge is sometimes insufficient. Only slightly more than half of students recognized their knowledge in science, obtained at school, as suitable for their future life.

Key words: *basic skills, human biology, knowledge, school science.*

Introduction

The labour market in 21st century expects young people with knowledge and basic skills ready for an active life-action. It comprehends usage of the knowledge and skills obtained at school in different realistic situations, including cooperation, digital and many other skills, solving different problems every member of society faces in his or her everyday life. In other words it means that a member of society obtained a modern education in the natural sciences will be characterized by a high comprehension of the natural sciences in both, personal and social life context (Namsone, 2010).

Still, there is a high demand for the labour force with a professionally high education that also includes usage of skills obtained at school, in such areas as engineering; studies in this area in a longer period has a tendency to become les popular amongst the youth. Medicine is another are requiring youth with a good knowledge not only in the humanitarian area, but also in maths and natural sciences, physics, chemistry and biology due to the of new technologies into this are, despite the fact that medicine is far from the engineering.

In the 90s of the 20th century a education organization system was introduced in the Latvian schools, giving a chance for the students to choose a significant part of the subjects, however, it has cause a situation, when students preferred the humanities, thus neglecting the most difficult subjects such as chemistry and physics. It is true, however, that on the one hand gradually raise the number of those students from 12 grade, who choose to pass the centralized exams in the natural sciences, and on the other hand the average results of these exams are little bit improved. If 2002, for instance, the centralized

exams in chemistry and physics were chosen by 500 students, then same exam in biology were chosen by two and half thousand students (Guļāne, 2009), whereas after some years, for instance, in 2008 the centralized exams from whole number of the 12 grade graduates was 15.7% in biology, 12.08% in physics and 6.07% in chemistry (Valsts pārbaudes darbi 2009./2010. m.g., 2010). Unfortunately 2010 showed a fall not only the absolute numbers, which could be understandable with the fall of the birth-rate, but also a fall of relative numbers (exam in Biology: 10.58%, Physics: 10.68%; Chemistry: 5.92%). Supposedly such a fall can be explained with the fact that many institutions of the higher education do not require exam results from the natural sciences, on the one hand, and on the other hand since 2009/2010 school year the student can choose only one centralized exam – before 2010 two centralized exams were mandatory to pass. Besides three other exams are mandatory to all students, and, for instance, in 2010 none of them were from the natural sciences.

Moreover, an important indicator is also the division of the results of the centralized exams in different groups of grades (A, B, C, D, E and F). For example, if the average grade in the exam of Biology, Physics and Chemistry in 2005 was 51,72; 40.32; 53.90 accordingly, then in 2010 the average numbers are 58.35; 54.90 and 63.61 accordingly (Valsts pārbaudes darbi 2009./2010. m.g., 2010). Moreover, analyzing the number of the students with the highest grade (nA) against the number with the lowest grade[1] (nF), the obtained information shows that in 2005 this proportion (nA/nF) was 0.84 in the results of exam in Biology, 0.20 in Physics and 0.43 in Chemistry, while in 2010 this indicator was 1.16, 1.41 and 1.92 correspondingly. The numbers itself may demonstrate a raise of a more positive attitude towards the natural sciences amongst youth.

A positive attitude towards the natural sciences, of course, is a significant factor to raise interest towards thematic of natural sciences. Besides the interest-related education plays a significant role in raising interest about the natural sciences. Unfortunately children and youth pay little attention towards natural sciences. For example, the division of students amongst different interest-related fields in Riga shows that 56% of students prefer culture-related programs, whereas the number for technique-related programs attract only 10.2% of students, but environment-related education is popular only amongst 2.3% students (Zalāne, 2011)

The aim of our research is to clarify knowledge and comprehension about topics of Biology as well as some particular topics of Natural Geography, Physics and Chemistry amongst students from 12th grade; topics youth may face either in their future studies, either in the everyday situations.

Methodology of Research

In order to clarify the knowledge and comprehension in different topics in Biology, a research[2] was carried out in four secondary schools (two of the in Riga, one in suburbs of Riga and the other one is located in an administrative centre of a local municipality), involving 96 respondents between January and April, 2010 of the students from 12 grade from institutions from the general secondary education. The selected schools are not considered to belong to the ones so-called élite schools, nor the schools with histori-

[1] Calculations are bases on census published in the State Education Centre (Valsts izglītības satura centrs) home page, http://visc.gov.lv/eksameni/vispizgl/statistika/2010/stat2010.shtml [*in Latvian*]
[2] A parallel research was carried out amongst the pedagogy students of the 1st course in several Latvian institutions of the higher education; the results will be published separately

cally strong traditions in teaching the exact sciences or Biology. This allows to suppose that the results of shows the average indicators in Latvia.

A questionnaire surveying method based on a questionnaire developed by the author, I. Palmberg, has been used in the study. This questionnaire has previously been approbated in Finland, Sweden, and Denmark by conducting a questionnaire survey among 1st year students (future primary school teachers or so-called class teachers (Palmberg et al, 2011). The questions included in the questionnaire practically fully correspond to the topics and questions discussed as part of the subjects of the cycle of natural sciences in Latvian Upper secondary schools, except the question about succession, which is not specially discussed in Latvian schools. A question on sustainable development (namely, its essence) has been included instead. Accordingly five questions from the area of *Physics and Chemistry* (PhCh) were included in addition to the initial version of the questionnaire.

The questionnaire consists of two parts. In the first part, respondents are offered 25 multiple-choice questions with four possible answers each. Although 3 *partly correct* replies are offered for several questions, only one reply is fully correct, and, if the respondent knows and fully understands the respective question, they should specify the fourth reply *All the previous statements are right* (or similar). Such questions or, to be more precise, such possible answers to them enable to evaluate the respondent's overall understanding of certain processes, problems etc., namely, whether their knowledge is sufficiently profound and comprehensive or rather fragmentary.

The questions are grouped into sections: *Organisms and Various Environments* (OVE)*; The Earth and Human Habitat Environment* (EHE)*; The Human and Health* (HuHe)*; Europe* (EUR)*; Diversity of Human Life and Habitat* (DHH), as well as *Physics and Chemistry* (PhCh), which were included in addition to the initial version of the questionnaire.

In the second part of the questionnaire, the respondents were asked to evaluate test questions, including an assessment of the degree of difficulty of the questions and the value of the knowledge included in the question in the young person's future life. One should consider here that the use of questionnaire surveying requires that the person conducting the survey should always be aware of whether the respondents have correctly understood the wording of the question and whether they have an in-depth understanding of the offered possible answers, or they have rather marks their answers randomly. All this has impacts on the honesty in the completion of the test, and this largely determines the credibility of the results.

Usually it is essential to evaluate the extent to which the obtained results characterise the views of the group of respondents (knowledge, attitudes etc.) against their neutral state, which, in case of a dichotomous answer, determines the correlations between the affirmative (*yes*) or negative (*no*) answers. When performing a computerised processing of the answers, both possible anwers can be number-coded as 1 or 2 respectively, and, in such case, the neutral state $M_n = 1.5$. On the one hand, such distribution of answers (50%: 50% or near to this in either of the answers) leads to an assumption that the respondents have simply made guesses, i.e., they do not have a clear opinion or knowledge. On the other hand, the larger the difference between the neutral state and the median value, the more convincing the overall opinion of the group of respondents.

This evaluation can be carried out using coefficient *Cohed d*, which is calculated using the below formula

$$d = M_n - M_i / SD_i \qquad (1)$$

where M_i - *i*-variable, M_n – neutral value, but SD_i - *i*-standard deviation of the *i*-variable. Using this methodology, if $d<0.2$, then the formal deviations of the median values from the neutral are insignificant, and the result can be deemed neutral, i.e. the respondents have not preferred either of the answers. Higher *d*-values ($0.2\leq d<0.5$; $0.5\leq d<0.8$; $d>0.8$) can be suggestive of respectively a *small, moderate* or *large* effect namely a *slight, medium* or *strong* deviation from the neutral state (Lavonen et al, 2008).

The questionnaires have been processed using SPSS, Version 17, and partly also EXCEL. This article mainly discusses the topics acquired by students in their Biology course (in various years, however).

Students' Basic Kowledge

The results of the study (Table 1) show that the overall basic knowledge of students in biology is average, i.e., the number of respondents with correct answers only slightly exceeds 50% in a majority of cases, or is even below the average level of correct answers have been given by less than 50% of the respondents. Students have a better understanding of the questions regarding the human himself (human health), such as regulation of water and salt levels in the *kidney* has been correctly answered by 80.9 % of the respondents. Also for the role of blood circulation in maintaining a constant body temperature, immunity, and the elimination functions, the most correct answer was indicated by 62.4 % of the respondents.

Table 1. Knowledge of Year 12 Students in Biology Questions (percentage).

Questions/ possible answers	Answers	Questions/ possible answers	Answers
Which organ regulates the content of water and **salt content** in the body?		What are the functions **the cerebrum** is responsible for	
Kidneys	**80.9**	***For such cognitive functions like thinking and memory***	**24.7**
Liver	10.6	*For the the balance and the reconciliation of motions*	9.7
Urinary bladder	6.4	*For the essential functions like respiration and blood circulation*	17.2
Intestines	2.1	*All the previous statements are right*	48.4
Which of the statements regarding the **thyroid gland** is correct?		Which of the statements dealing with **vestibular organ** is right?	
The thyroid gland is located below the larynx	4.3	*The vestibular organ is situated in the middle ear*	33.0
Since thyroid gland produces hormones, it needs iodine	8.7	***The vestibular organ records the movements of the head***	**8.5**
Thyroid gland hormones regulate metabolism and are essential for growing and mental development	42.4	*The vestibular organ responds to movements of the muscles*	18.1
All the previous statements are right	**44.6**	*All the previous statements are right*	40.4
In which of the below functions is **blood circulation** involved?		What happens during **photosynthesis**?	
Immune defence	8.6	*The plants utilize the sunlight to produce carbon dioxide and sugar*	21.3

Thermal regulation	26.9	***The plants utilize the sunlight, carbon dioxide and water to synthesize sugar***	**57.4**
Formation of urine	2.2	*Plants use carbon dioxide and water to produce glycogen*	13.8
All above mentioned functions	**62.4**	*The plants utilize (disintegrate) sugar to produce energy, carbon dioxide and water*	7.4
Which of the statements regarding the **liver** is correct?		What does a **seed** contain?	60.4
The liver secretes bile	14.9	***A plant's embryo***	**61.7**
All eaten and drinken agents circulate via the liver	27.7	*Pollen*	7.4
Liver participates to the regulation of the sugar balance in blood	13.8	*Ovary*	27.7
All the previous statements are right	**43.6**	*Pistils*	3.2
Which of the statements regarding **lichen** is correct?			
Lichen partly consist of fungus	**31.9**	*Lichen is partly composed of brown alga*	29.8
Lichen tolerate weakly the drought	17.0	*Lichen tolerate very well air pollution*	21.3

Note: the correct answers are highlighted using ***semi-bold*** letters.

Also for questions close to human life from the section *Organisms and Various Habitats,* more than a half of the students give correct answers about the seed (61.7 %), photosynthesis (57.4 %) and ecosystem (55.3%). However, an overall conclusion is that this is a remarkably average level of knowledge of students of the final year of Upper secondary school.

Students demonstrate the weakest understanding in the part *The Earth and Human Habitat Environment.* For instance, correct answers for the *Ice Age* have been given only by 7.5% of the respondents, for the conditions causing *Rain* – by less than one fifth (19.1%) of the students, but for the concept *Biosphere* only every fourth respondent (24.5%) has been correct.

The result is not much better in the section *Diversity of Human Life and Habitat*, e.g. only 20.4% of the students have been correct in their answers regarding *Rainforests* or tropical forests. The respondents have also had difficulties in understanding the possible effects of individual environmental factors (*acidification of the habitat (lakes), excessive use of fertilizers, heavy metals, greenhouse effects*) on *Fish farming* – only 26.1% of the respondents have indicated the correct answer – *excessive use of fertilizers*. Therefore it seems that a certain part of these issues is not very topical for young people in Latvia nowadays (e.g., *rainforests*, *Ice Age,* etc.), however, as these issues are included in the educational content in a particular context, apparently, it was not without reason. Moreover, if we think that the school's task is to prepare a child or an adolescent, using socialisation process, for activities in a society imbued with globalisation tendencies where each member is requested to show co-responsibility not only for local, but also for global problems, at least on the level of understanding, then good knowledge of these conditionally less important issues is as important as the knowledge on human health.

15-year-old Latvian student's progress in competence in natural sciences stated by OECD (*Organisation for Economic Cooperation and Development*) within the frameworks of International Student's Assessment Programme in 2006 and 2009 are 490 and 494 points respectively of the maximum number of points 500±100 (Geske et al, 2007*;*

Geske et al, 2010), and it confirms, that 15-year-old Latvian student's progress are close to the average level of OECD countries due to improved quality of Latvian educational system, and students can use their competences in natural sciences in real life situations.

However, an unexpectedly low level of 12-grade students' basic knowledge in biology stated in our study sets us thinking about possible causes: whether these results are caused by young people's belief that natural sciences are unpopular subjects or there are other factors which somehow fail to stimulate successful learning of natural sciences, e.g., student's inability to consider the knowledge and abilities acquired in the subjects of natural science cycle as useful for career development further in their life, which is partially confirmed by the results shown in the study (Гедровицс, 2010).

A.Geske (2004), using structural equation simulation techniques, proved that the factors, such as cultural capital of the family, parents' education, microclimate of the class, schoolchildren's activities in their spare time are related to student's progress in science subjects (natural sciences and mathematics). A.Turmo also indicates that there is a close connection between respondents' comprehension of natural sciences and socio-economic background which is characterised by so-called socio-economic status (SES) also shown in the study (Turmo, 2007; Geske et al, 2010).

The attainment of students in replies on physics and chemistry questions in comparison to the attainment in biology is higher, although the results of the previous researches (Mozeika et al, 2008) regarding high achievements in individual tests indicate a weak interest of students in natural sciences. Indeed, the chosen physics and chemistry questions are already dealt with during natural sciences course in elementary school, yet those issues students also encounter in various contexts also in further school years. 90.3% of the respondents give a correct answer on the question regarding iron object in wet air, therefore the majority of the students know that iron corrodes (rusts) in wet air. Also regarding diamond as the hardest mineral even 89,2% of respondents provided the correct answer, because, even though hardly many students have had the possibility to see a diamond itself, this correct statement for a long time can be found from book to book. Therefore every pupil is informed about these facts (*iron* corrodes, *diamond* is the hardest material) already in his every day life.

However, surprisingly low correct assessment, although slightly more that in the half of the questionnaires (59.8%), is provided on the amount of oxygen in the air, and that can most likely be explained by the dominance of direct memories of the respondents, as, on one hand, one of four numbers from the test's statements has to be chosen and, on the other hand, the students have not inquired into the essence of the problem, although the issues of the significance of oxygen in the nature and living organisms and its amount in the atmosphere is taught both in Chemistry and also Biology.

However, on the test's statements, the assessment of which more require abstract thinking, which reaches its full development at the age of 18-19, the students still do not comprehend the differences between physical and chemical changes. For instance, only 37.6% of the respondents provide correct answers to the questions on burning as a chemical reaction. The students do not comprehend that water expands when it freezes and therefore its density decreases; thus, the largest density of water is in liquid state of aggregation (only 24.0% correct answers). Also in this example, the students prove that they are not really able to link their knowledge with practical life, although they most likely are aware that the ice floats on the water. Besides, many definitely know that if a container is left with water in it outside in the garden in winter, it will break.

The other side of the „coin" – do the students consider why that happens and are the students themselves able to justify choice of one or another answer. For example, in

several questions in the test, where 3 or more answers are correct (circulation of blood, liver, thyroid gland), but the real correct answer is *All the previous statements are right*, it can be established that only 62% of the respondents have sufficiently wide knowledge and understanding regarding circulation of blood, but only 44% of the youth – on other two organs. That indicates that in general the knowledge of students of the 12th grade on separate, but not irrelevant issues, is quite fragmentary and they lack the ability to generalize.

When girls' and boys' answers are compared, the following conclusion can be drawn – no statistically significant differences can be observed in the largest share of the questions, except the definition of the biosphere and liver functions (in both cases $p = 0.001$, $\alpha = 0.95$). Besides, it is interesting to note that only the fifth part of girls (19.6%) and almost the third part of boys (31.6%) have provided the correct answer to the question *Biosphere* (biosphere is *The entireness of all ecosystems on the Earth*), while more than the half of the girls (57.1%), but only one quarter of the boys (23.7%) have correctly indicated the functions of liver. Generally, it testifies that the group of respondents is sufficiently homogenous in terms of gender, namely, no significant differences can be observed depending on the gender of the respondent.

The assessment of the test

In the second part of the questionnaire the respondents had to answer several questions, such as – *Is a question difficult?, Is the question formulated unambiguously and clearly?* and *Do you consider that the question relates to the so called basic knowledge (knowledge, which might be relevant for you in your future life)?* The possible answers to those questions are only *yes* or *no*, providing with the possibility to carry out simplified calculations, using formula (1). The results are summarized in the Table 2.

Table 2. The assessment of questions by the students.

Question (topic)	Section	Difficulty		Unambiguity		Usefulness	
		Yes (%)	*Cohen d*	Yes (%)	*Cohen d*	Yes (%)	*Cohen d*
Biosphere	EHE	64.9	**0.3**	65.2	**0.3**	54.3	0.1
Brain	HuHe	71.3	**0.5**	74.5	**0.6**	55.9	0.1
Chemical changes	PhCh	48.9	0	72.5	**0.5**	56.0	0.1
Circulation of blood	HuHe	61.7	**0.2**	72.0	**0.5**	59.1	**0.2**
Deserts	DHH	46.3	-0.1	73.1	**0.5**	50.0	0
Eco-system	OVE	54.3	0.1	69.6	**0.4**	59.8	**0.2**
Equilibrium system	HuHe	75.8	**0.6**	64.5	**0.3**	51.6	0
Euro (currency)	EUR	52.7	0.1	77.2	**0.6**	70.7	**0.5**
European Climate	EUR	62.1	**0.2**	66.7	**0.4**	65.6	**0.3**
Fish farming	DHH	73.1	**0.5**	58.7	**0.2**	44.1	-0.1
Ice Age	EHE	60.2	**0.2**	71.4	**0.5**	40.7	**-0.2**
Iron (corrosion)	PhCh	33.0	**-0.4**[1]	81.5	**0.8**	66.3	**0.3**
Lichen	OVE	51.1	0[2]	76.6	**0.6**	43.0	-0.1
Liver	HuHe	59.6	0.2	69.9	**0.4**	54.8	0.1

Material qualities	PhCh	43.0	-0.1	78.3	**0.7**	63.3	**0.3**
Oxygen in atmosphere	PhCh	37.6	**-0.3**	72.0	**0.5**	73.9	**0.5**
Photosynthesis	OVE	60.6	**0.2**	67.4	**0.4**	62.0	**0.2**
Rain	EHE	53.8	0.1	69.2	**0.4**	58.7	**0.2**
Rain (tropical) forests	DHH	61.1	**0.2**	73.1	**0.5**	50.5	0
Seed	OVE	49.5	0	61.3	**0.2**	51.1	0
Sustainable development	DHH	69.9	**0.4**	68.8	**0.4**	45.1	-0.1
Thyroid gland	HuHe	72.3	**0.5**	71.7	**0.5**	58.3	0.1
Volcanoes	EUR	61.1	**0.2**	64.5	**0.3**	53.8	0.1
Water and salt in body	HuHe	53.8	0.1	77.4	**0.7**	60.9	**0.2**
Water density	PhCh	55.3	0.1	79.3	**0.7**	57.6	**0.2**

[1] Cohen d value $d<0$ shows that the respondents mostly gave a negative answer

[2] Cohen d value $-0,2<d<0,2$ shows that group of the respondents generally is not sure about one or the other alternative,

Sections:

OVE – Organisms and Various Environments
EHE – The Earth and Human Habitat Environment
DHH – Diversity of Human Life and Habitat
HuHe – Human Being and Health
EUR – Europe
PhCh – Chemistry and Physics

The majority of the students sadly deem the test questions to be difficult (Table 2), which is proved not only by the number of affirmative answers (*yes*) above 50%, but also the values of the *Cohen d* coefficient in a large part of the questions ($d>0.2$). On the other hand, a larger number of respondents positively note that the questions are formulated unambiguously and clearly, in some cases even 75% and more respondents, as it is indicated, for instance, in the question on the regulation of the amount of salts in the organism, where 77,4% of the respondents provided an affirmative answer (*yes*).

The weakest knowledge is about *Ice Age* from the chapter the *The Earth and Human Habitat Environment*, as well as about question on human's Equilibrium system from the chapter *Human Being and Health* (accordingly only 7.3% and 8.3% of the respondents have given the correct answers). Therefore it is not difficult to comprehend that these questions are considered to be different by many, although a relatively large number of respondents have noted that the question is formulated unambiguously and clearly. For example, regarding the understanding about Ice Age (7.3% have given the correct answer) the unambiguity of the formulation was noted by 71.4% of respondents. That proves that the completion of the test was honest, but the knowledge of youth on the questions analyzed above are weak, not no say that are very bad.

In our opinion, the question in the II part whether knowledge that relates to the questions included in the test could be useful for the youth in their future life, was especially important. The formulation of this question is very significant as such, as in the 21st century, when the development of the state can only ensured by the knowledge based society, one of the aims of the education policy is to harmonize the common interests of the whole society and each individual. In this context those individual's skills, that are useful in life, are relevant. Therefore: *Are students well prepared for the challenges that await in the future life? Are they able to effectively analyze and justify their ideas and discuss them? Have students found fields that could interest them in their future life and professional activities*? These are the questions which not only are asked by the education pol-

icy researchers and teachers, these are the questions on which every student him/herself has to provide answers indirectly, but unambiguously.

In this research we thought it would be important to clarify the assessment of the respondents themselves on the suitability of the questions in their further life. From these answers it would be possible to conclude on the comprehension of students in the context of the future society.

As it is in the Table No.2 the majority (more than 50%) of the respondents confirm the suitability of the contents of the test what regards the basic knowledge in majority of questions. According to the students the basic knowledge of the all the questions in the chapter *Human Being and Health* (HuHe) will be suitable for further life. True, the respondents have not indicated how in practice some of the questions will be suitable for their future life (Equilibrium system). Of course, the question is specific enough; moreover, when taken out of the context, it may appear less important. This, however, does not reduce the significance of the overall all relevance of the chapter *Human Being and Health* (HuHe), besides statistically there are not significant differences between the overall assessment of the chapter by boys and by girls ($p>0,05$; $\alpha = 0,95$).

The knowledge in the context of Europe (chapter *Europe* (EUR)) is (will be) suitable according to the view of the respondents; although, there are very few questions in this chapter, the suitability of them are high in the eyes of the students, 70.7% of the respondents are in favour of the currency topic.

More pleasure-raising results are gained from the questions of the area of Physics and Chemistry (PhCh, Table 2). Basic knowledge of all the topics is necessary for the choice of the future profession, 73.9% of the respondents admitted that knowledge on oxygen in the atmosphere is suitable, despite the fact that 59.8% of the respondents answered correctly to these questions. This and other observations let us hope that in future the interest on the natural sciences may increase. Students understand and foresee the significance of the natural sciences better. In this chapter significant differences between overall assessment of boys and girls have not found ($p>0.05$; $\alpha = 0.95$) as well.

Less than 50% of the respondents the knowledge of the chapter *Diversity of Human Life and Habitat* (DHH) has admitted as significant for their future life. Topics are related to the processes far from the life of our region (rainforests, deserts), also the problems touches topics that are not actual issues for our national economy, such as fish farming. Perhaps, this is the main reason, why this group of questions has not been significant to the respondents enough, but most of all, suitable for the future. However, the issue of the sustainable development has not attracted high attention of the respondents the same as other questions of this chapter, a deeper analysis is needed here. On the one had the formulation of the question itself requires an analytical thinking of the students, which is harder from the point of view of the cognitive processes. And, perhaps, this is the reason why the number of the correct answers has reached only 55.9%, which is a little bit more than a half of the respondents. On the other hand students of the Upper secondary schools unfortunately are not ready to immerse themselves in the future processes despite the fact that they have reached the age, when their way for the future education is opened only now and they have to start thinking what to do after the graduation. Very possible that the current organization of the education process can be partially blamed as well, same as the methodological component of the content of the education.

Conclusions

The basic knowledge of students from 12th grade is average in a wide range of topics in Biology and in some topics of the Physical Geography and Chemistry. The level of knowledge and comprehension is relatively higher in the field of human health, although, the knowledge in this area is sometimes only fragmentary, students lack the skill of a generalization.

Significant differences between answers of boys and girls have not found in general, thus, the group of the 12th grade is homogeneous enough. This shows a correct approach in methods and pedagogy in the context of the gender.

The relatively high assessment of the level of difficulty of the questions, on the one hand, and the level, which cannot be called high, of the knowledge, on the other hand, shows the existence of imperfection in the content as well as in the assessment of the results of the education process.

Students cannot find the necessity of the education within the context of the sustainable development as far as it requires analytic thinking as a global problem to see the future opportunities.

Acknowledgement

The authors are thankful to Antra Berziņa, Janis Butins, Dzintra Porozova and Nadezhda Pisareva for support by collecting of questionnaires.

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Received 22 February 2011; accepted 29 March 2011

Irmeli Palmberg
Dr., Lecturer, Abo Academy, Vasa, Finland.
E-mail: irmeli.palmberg@abo.fi
Website: http://www.abo.fi/public/

Gunita Praulite
Professor Emeritus, Riga Teacher Training and Educational Management Academy, Imantas 7, line 1, LV-1083 Riga, Latvia.
E-mail: gunita.praulite@rpiva.lv
Website: http://www.rpiva.lv/

Janis Gedrovics
Dr., Assoc. Professor, Riga Teacher Training and Educational Management Academy, Imantas 7, line 1, LV-1083 Riga, Latvia.
E-mail: janis.gedrovics@apollo.lv
Website: http://www.rpiva.lv/