OPINION OF TENTH GRADE PUPILS FROM LATVIA AND LITHUANIA ABOUT COGNITIVE INTERESTS IN NATURAL SCIENCE: RESULTS OF PILOT RESEARCH

Renata Bilbokaitė, Daina Možeika
Šiauliai University,
University of Latvia

Introduction

Before Latvia and Lithuania achieved independence the pedagogical situation in both countries was more or less similar. After 1991 the development progressed differently in the education systems. The continuous tension and changes both in school and in society adversely affect education process and result in pupils' lack of interest to learn chemistry (Mozeika, Cedere & Gedrovics, 2008). The currently low level of pupils' knowledge and skills in chemistry makes us look for its actual causes and determine the main factors which are under pupils' interests and competence (Van Aalsvoort, 2004). Education system is also under continuous changes and the role of a school is being redirected from continuous increase of amount of facts in all the subjects to creation of a skill for using the obtained knowledge in non-standard situations of life, and a skill to be able to find the necessary information and interpret it on one's own.

However in practice changes are being introduced in schools slowly. Natural science education is important component of all-round education. The general attitude of the new generation can be named by the term of scientific literacy (Laugksch, 2000) that became known at the late end of 20th century. The pupils' interest in natural sciences should be coming into question because lots of pupils do not like to study (Slater, 2006; Haas, 2005); their motivation is lower than ever (Haas, 2005; Foster, 2008). This research is mainly aimed to compare in visual, emotional and sensory way the differences in interesting topics of natural sciences (including chemistry and chemical processes) between Latvian and Lithuanian pupils.

Research subject is the cognitive interest of tenth grade pupils in natural science.

The main research questions are:

1) What are the statistically significant differences between Lithuanian and Latvian pupils' opinion about various natural phenomena?
2) What kind of natural phenomena interest pupils from Lithuania more than pupils from Latvia?
3) What kind of natural phenomena interest pupils from Latvia more than pupils from Lithuania?

Justification of the study

The study is conducted within the framework of interest groups by using questionnaires. Acquiring pupils' opinion is important in order to create chemistry education contents according to contemporary needs, abilities and interests of pupils more successfully, and to make learning of the subject more important and binding to the pupils. The questionnaire was tested by Kolmogorov-Smirnov Z test and it was determined that variables are far from normal dispensation. For data analysis, analytical statistics was used. The test of Mann-Witney showed statistically significant differences when the data was coded as nonparametric. With a view to expand the data we had used descriptive statistics which showed the percentage of respondents' answers.

Peculiarity of questionnaire

A survey of pupils according to consecutive principle (interest – understanding – knowledge) was used. The survey questionnaire consists of three parts – F, G and H. Part F was about "*My interest in natural sciences*". Pupils' interest in natural sciences is detected through pupils revealing of their opinion. 20 closed type questions were used for the parts F and H of the questionnaire. Pupils had to answer according to the 4 – category Likert scale, e.g. a respondent had to choose one of the four answers (Schreiner, Sjøberg, 2004) that expresses his/her opinion in parts F/G best: *disagree*/*do not know* (coded 1); *rather disagree*/*partly know* (coded 2); *rather agree*/*I know* (coded 3); *agree*/*I know and understand* (coded 4). 15 questions with four answer variants were used for the part H of the questionnaire. The questions in the part F were constructed in accordance to psychological aspects: visual interest *I like…;* emotional interest *I want to know..., I am interested in...*; sensory interest *I use to observe..., I would like to understand…*

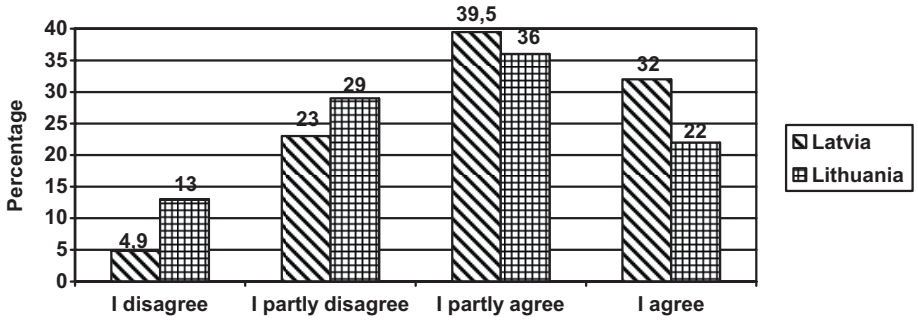
Research group

The participants were tenth graders from Lithuania and Latvia. The aim was to get preliminary results that could be used as the pilot research for later researches. The questionnaire was translated from

Latvian language into Lithuanian language and was distributed to random sample of pupils. There participated 107 pupils from Lithuania and 85 tenth grade pupils from Latvia. The questionnaires that had been filled in incorrectly were omitted. The rate of return of questionnaires was 94%. Nearly all pupils were 16 year old and all of them were in the tenth grade. According to D. Beresnevičiene (2003), this age group is called adolescents and they are able to think critically and to select the opinion from various possibilities.

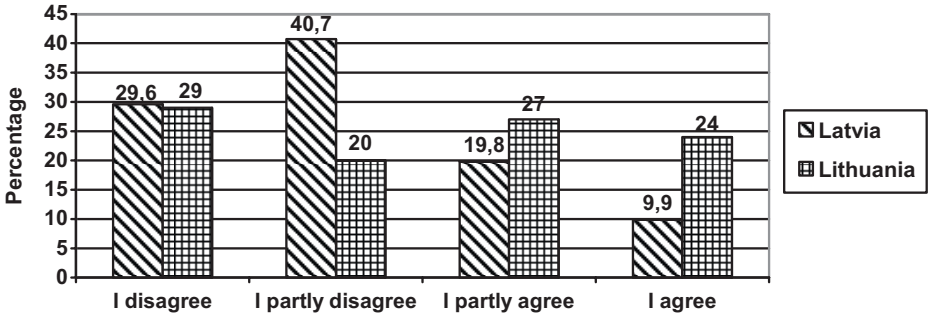
Findings

Using analytical statistics it was found that there are only seven statistically meaningful differences between answers of pupils from Latvia and Lithuania to the questions provided in the questionnaire. The pupils' viewpoint revealed particular interest in phenomena of nature and holes in ozone layer, the need to observe coming into flowers and to know about soap, pleasure to observe objects through a magnifying glass, the need to know more about summer lightning and the reasons of climate warming. All other statements do not have statistically meaningful difference (see appendix).



Picture 1. The pupils' cognitive interest in natural phenomena from emotional aspects

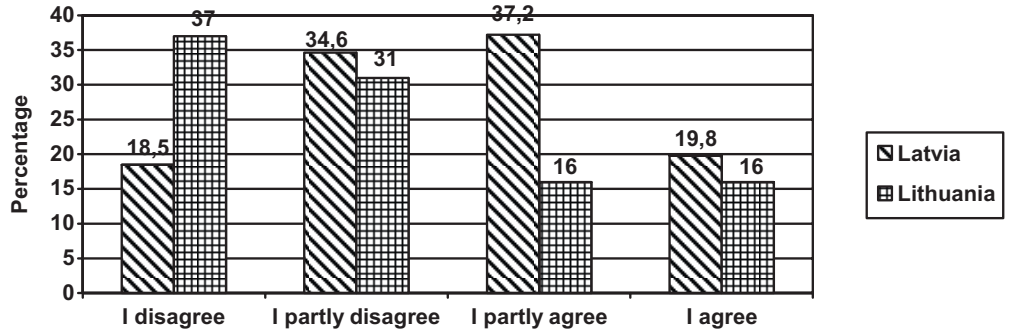
Latvian pupils' mean rate of interest in natural phenomena is 100.04 (sum of rates is 8103.50) and mean rate of Lithuanian pupils' opinion on this question is 83.68 (sum of rates is 8367.50). While testing statistical meaning of the found differences there were analyzed Z statistics and its p-value. The results of the analysis show that Z meaning $\int Z \int = -2.192$ and p-value $p = 0.028$ when $p < \delta = 0.05$, it means that *Latvian and Lithuanian pupils' opinions about interest in natural sciences are statistically significantly differentiated.* It is possible to state that tenth grade pupils from Latvia are more interested in natural phenomena than pupils learning in Lithuania. Visually looking at the data of Picture 1 it is possible to say that in both countries there is a similar number of pupils who like natural phenomena, though there are less negative answers of Latvian pupils than of Lithuanians. The explanation of it could be the goings outdoors together with parents on holidays. Spending the holidays actively becomes popular not only in summer time, but also in winter. Due to a long way from a city to a recreational area pupils are watching the nature through the window. They can see different natural phenomena and to be interested in them.



Picture 2. The pupils' interest in observing coming into flowers in spring time in sensory aspects

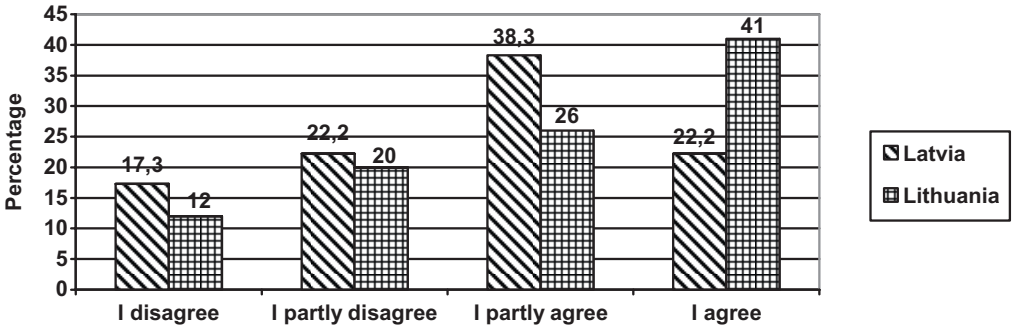
Undoubtedly, many pupils like to observe nature, though because of technological progress which encompasses a lot of human interests, time and space, the doubt arises that maybe pupils rarely think about the most beautiful phenomena. One of the last mentioned phenomena is an observation of coming into flowers in spring. The data obtained from analytical statistics reveal that mean rate of Lithuanian tenth grade pupils' interest to observe coming into flowers is 82.22 (sum of rates is 6660.00).

Z meaning ∫Z∫ = -2.102, and p-value p = 0.036, it means that p < δ = 0.05, and this supposes that pupils' opinion in both countries is statistically significantly different. *Tenth grade pupils living in Lithuania more than pupils from Latvia like observing coming into flowers*. Results of descriptive statistics in Picture 2 visually display redistribution of answers of respondents in percentage that can be grounded thinking that lots of flora are coming into flowers during spring time. The schools in Lithuania are less modernized than in Latvia and this supposes that a lot of Lithuanian pupils have better space for cognition of more natural environment.



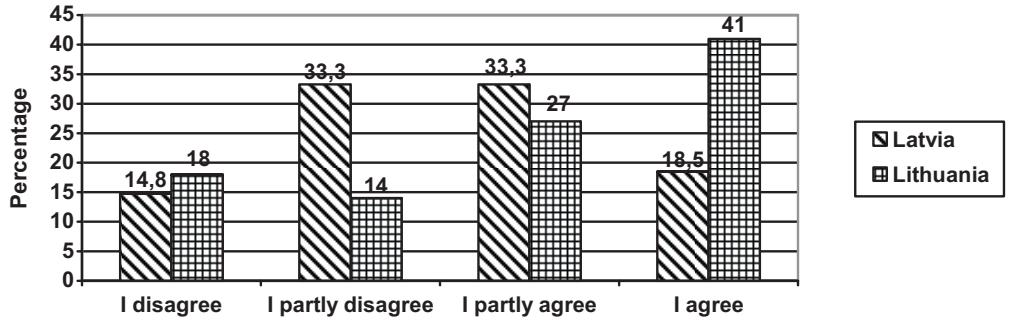
Picture 3. The pupils' cognitive interest in observing objects with a magnifying glass by using the sensory interest

The mean rate of interest of Latvian pupils in observing objects with a magnifying glass is 82.58 (sum of rates is 8258.50) and the mean rate of interest of Lithuanian pupils is 101.39 (sum of rates is 8212.50). Z meaning ∫Z∫ = -2.494, and p-value p = 0.013, p < δ = 0.05, this shows that pupils' opinions in both countries are statistically significantly different. The results show that *Latvian pupils like more to observe objects through a magnifying glass*. 57 percent of pupils from Latvia (Picture 3) think that they like to observe objects of nature through a magnifying glass. More than half of tenth graders from Lithuania do not like to use a magnifying glass in this way to see small objects. According to the authors of this article, the situation in Lithuania can be explained by the assumption that during class work pupils mostly do not use a magnifying glass; view goes to the information conveyance and motivation to remember it. Teachers are oriented to the results of education process, e.g., to the marks that show level of pupils' knowledge.



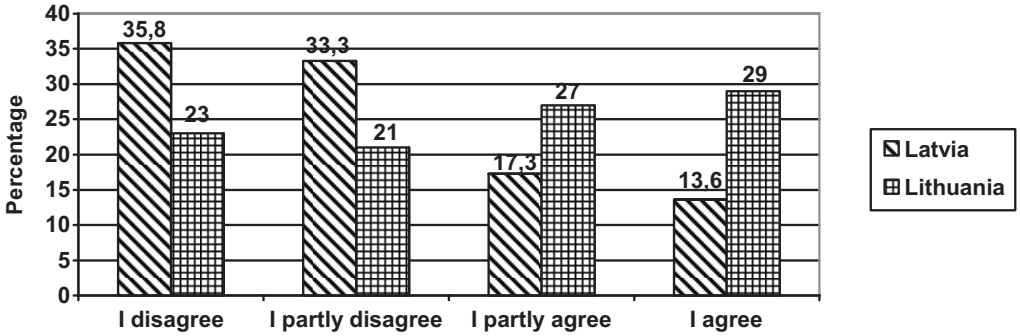
Picture 4. The pupils' need to learn more about holes in ozone layer based on feelings and emotional interest

One of the most important problems of nature is holes in ozone layer. The last mentioned holes conduct damaging sun beams that are harmful to human. Holes in ozone layer condition skin cancer and many problems of climate warming. The pupils' interest in different countries was not the same. The mean rate of tenth graders from Lithuania is 98.62 (sum of rates is 3288.00) and the mean rate of pupils from Latvia is 81.59 (sum of rates is 6609.00). Pupils' opinion in both countries is statistically significantly different because Z meaning ∫Z∫ = -2.264, and p-value p = 0.024, p < δ = 0.05. It is possible to state that pupils from Lithuania are more interested in ozone. 67% (Picture 4) of Lithuanians think that they want to know more about the mentioned phenomena. The authors highlight an assumption as a prediction that pupils in Lithuania have less information about ozone or maybe they are more sensitive to such kind of problems.



Picture 5. Sensory psychological aspect of pupils' cognition interest in climate warming

The climate warming is one of the biggest problems in the planet Earth. It was important to find out whether it is interesting for pupils. Data shows that the tenth grade Lithuanian pupils' mean rate of the need to know about this problem is 99.46 (sum of rates is 9946.00), the mean rate of Latvian pupils' opinion is 80.56 (sum of rates is 6525.00). Z meaning $\int Z \int = -2.506$, p-value = 0.012, i.e., $p < \delta = 0.05$, it means that there are statistically significant differences. *Pupils from Lithuania are more interested in the reasons of climate warming than their coevals in Latvia are*. Picture 5 visually shows the data of descriptive statistics. It is clear that Lithuanian teachers accentuate the climate warming problems in various lessons because warmer winters are evident results of the mentioned problem. Pupils are asked to do lot of projects connected with climate warming solving solutions. This applies to all classes because pupils must think themselves how to create more natural environment. Latvian pupils are more interested in drinking water quality topic, because that one becomes familiar and directly involves the human needs. The greatest part of pupils has a centering on themselves in daily life. In general, the biggest problem in both countries is that our pupils think about nature scientifically only during classes of biology, chemistry or physics.



Picture 6. The pupils' attitude to summer lightning from emotional aspect of interest

Summer lightning is very important for all humans since the ancient times because it was connected with the rites, religious rituals and beliefs that lighter day is closer to heaven. In modern times people are happy with day lighting because everyone can do more work. The analytical statistics encloses that the mean rate of Lithuanian respondents is 101.67 (sum of rates is 10166.50), the mean rate of Latvian pupils is 77.83 (sum of rates is 6304.50). Tenth grade pupils' opinions are statistically significantly different because Z meaning $\int Z \int = -3.146$, and p-value p = 0.002, it means that $p < \delta = 0.05$. Picture 6 shows the results of descriptive statistics; Lithuanian pupils are more interested in summer lightning than Latvian pupils are. It is unknown why pupils from Lithuania want to know more about this phenomenon in comparison to Latvian pupils. Prediction can be highlighted that Lithuanians feel lack of knowledge and feel the need to know better. Latvian pupils show low interest in facts which are well-known in pupils' statements.

Conclusions

1. There were found only seven statistically meaningful differences between Lithuanians' and Latvians' answers to the questionnaire. An assumption was made that the pupils live in the same geographical conditions and experience the like influence from the environment. Some differences can be explained by better technological situation in Latvian schools that conditioned the lower interest in natural science. There is no dominant position of cognitive interest in natural

science education for all pupils. Equal status is taken by visual, emotional and sensory psychological aspects.
2. Lithuanian pupils are more interested in holes in ozone layer, in climate warming reasons and in summer lightning than pupils from Latvia are. Furthermore, Lithuanians more than Latvians like to observe coming into flowers in spring time.
3. Tenth graders from Latvia are more interested in natural phenomena and like to observe various objects with magnifying glass more than pupils from Lithuania do.

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Appendix

Table 1

Pupils' opinion about natural science (results of analytical statistics)

Proposition	Latvia			Lithuania			Mann-Whitney U	Z	p
	N	Sum of Rates	Mean Rate	N	Sum of Rates	Mean Rate			
I am interested in natural phenomena.	81	8103.50	100.04	100	8367.50	83.68	3317.500	-2.192	*.028*
I like to watch the snow melt.	81	6938.50	85.66	100	9532.50	95.32	3617.500	-1.315	.189
I like to watch rivers, lakes and the sea.	81	7703.00	95.10	100	8768.00	87.68	3718.000	-1.008	.314
I like to watch how flowers start to bloom in the spring.	81	6660.00	82.22	100	9811.00	98.11	3339.000	-2.102	*.036*
I like to observe birds and insects in the nature.	81	6881.50	84.96	100	9589.50	95.89	3560.500	-1.475	.140
I like to observe fog forming.	81	7638.50	94.30	100	8832.50	88.32	3782.500	-.824	.410
I am interested in how the wind rises.	81	6961.00	85.94	100	9510.00	95.10	3640.000	-1.214	.225
I want to know what a rainbow is.	81	7777.00	96.01	100	8694.00	86.94	3644.000	-1.198	.231
I am interested in what happens to sewage water in a city.	81	7708.50	95.17	100	8762.50	87.63	3712.500	-1.008	.313
I am interested in quality of drinking water.	81	7404.50	91.41	100	9066.50	90.67	4016.500	-.111	.912
I want to find out about processes in nature.	81	6950.50	85.81	100	9520.50	95.21	3629.500	-1.257	.209
I understand that waste has to be sorted.	81	7706.00	95.14	100	8765.00	87.65	3715.000	-1.177	.239
I like to observe objects with a magnifier.	81	8212.50	101.39	100	8258.50	82.58	3208.500	-2.494	*.013*
I am interested in nuclear reactions.	81	6898.00	85.16	100	9573.00	95.73	3577.000	-1.399	.162

Table 1 to be continued

I want to know why soap solution is not clear.	81	6392.50	78.92	100	10078.50	100.79	3071.500	-2.965	*.003*
I am interested in how the holes are formed in the ozone layer.	81	6609.00	81.59	100	9862.00	98.62	3288.000	-2.264	*.024*
I like to watch sugar melting in tea.	81	7572.50	93.49	100	8898.50	88.99	3848.500	-.631	.528
I would like to understand the reasons why the atmosphere is warming up.	81	6525.00	80.56	100	9946.00	99.46	3204.000	-2.506	*.012*
I want to know how the summer-lightning is formed.	81	6304.50	77.83	100	10166.50	101.67	2983.500	-3.146	*.002*
I want to learn why a glass vessel breaks if water freezes in it.	81	7657.00	94.53	100	8814.00	88.14	3764.000	-.843	.399

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Summary

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There were found only seven statistically meaningful differences between Lithuanians' and Latvians' answers to the questionnaire questions. An assumption was made that pupils live in the same geographical conditions and experience the like influence from the environment. Some differences can be explained by better technological situation in Latvian schools that conditioned the lower interest in natural science. Lithuanian pupils are more interested in holes ozone layer, in climate warming reasons and in summer lightning than pupils from Latvia are. Furthermore, Lithuanians like to observe coming into flowers in spring time more than Latvians. Tenth graders from Latvia are more interested in natural phenomena and like to observe various objects with magnifying glass more than pupils from Lithuania do. There is no dominant position of cognitive interest in natural science education for all pupils. Equal status is taken by visual, emotional and sensory psychological aspects.

Keywords: cognitive interests in nature, natural science, comparative analysis.

LATVIJOS IR LIETUVOS DEŠIMTOKŲ NUOMONĖ APIE KOGNITYVINĮ DOMĖJIMĄSI GAMTOS MOKSLAIS: PILOTINIO TYRIMO REZULTATAI

Renata Bilbokaitė, Daina Možeika

Santrauka

Iki nepriklausomybės atkūrimo ir Latvijoje, ir Lietuvoje pedagoginė situacija buvo maždaug panaši. Po 1991 m. švietimo sistemų raida vyko skirtingai. Šiuo tyrimu siekta vizualiai, emociškai ir jutimiškai palyginti įdomių gamtos mokslų temų (įskaitant chemiją ir cheminius procesus) skirtumus tarp Latvijos ir Lietuvos moksleivių. Dalyviai – Lietuvos ir Latvijos dešimtokai. Tikslas – gauti preliminarius rezultatus, kuriuos būtų galima panaudoti kaip pilotinį tyrimą tolesniems tyrimams. Anketa iš latvių kalbos išversta į lietuvių ir pateikta atsitiktinei moksleivių imčiai. Dalyvavo 107 Lietuvos ir 85 Latvijos dešimtokai. Neteisingai užpildytos anketos buvo atmestos. Grąžinti 94% anketų. Beveik visi moksleiviai buvo 16 metų amžiaus.

Aptikti tik septyni statistiškai reikšmingi skirtumai tarp lietuvių ir latvių atsakymų į anketos klausimus. Daryta prielaida, kad moksleiviai gyvena tokiose pačiose geografinėse sąlygose ir patiria panašų aplinkos poveikį. Kai kuriuos skirtumus galima paaiškinti geresne technologine Latvijos mokyklų situacija, lėmusia mažesnį domėjimąsi gamtos mokslais. Lietuvos moksleiviai labiau nei Latvijos domisi ozono skylėmis, klimato šiltėjimo priežastimis ir žaibavimu vasarą. Be to, lietuviai labiau nei latviai mėgsta stebėti žydėjimą pavasarį. Latvijos dešimtokai labiau nei Lietuvos moksleiviai domisi gamtos reiškiniais ir jiems ypač patinka stebėti įvairius objektus pro didinamąjį stiklą. Nėra visiems moksleiviams vyraujančios kognityvinio domėjimosi pozicijos gamtos mokslų mokyme. Vizualiniai, emociniai ir jutiminiai-psichologiniai aspektai užima vienodą padėtį.

Prasminiai žodžiai: kognityvinis domėjimasis gamta, gamtos mokslai, gretinamoji analizė.

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