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SCIENTIFIC RESEARCH ACTIVITY IN COMPREHENSIVE SCHOOL: A POSITION OF UPPER SECONDARY SCHOOL STUDENTS

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Abstract
The formation of scientific research activity (SRA) abilities acquired in comprehensive school is undoubtedly a very important field that has not received a proper attention yet. It makes student analytical thinking stronger and develops abilities to search for and use information. Thus, the object of the conducted research is SRA in comprehensive school. The purpose of research is to ascertain how the students of upper secondary comprehensive school in Lithuania evaluate the current SRA system. The following main research questions have been included in the questionnaire:
• How do the students evaluate their participation in SRA? How do the students evaluate the teaching/learning process in Lithuanian comprehensive schools in terms of SRA?
• What are the essential promoting and hindering factors of student participation in SRA? How do the students evaluate scholar`s profession?
Research was carried out in January-April, 2011. More than 1300 respondents of senior classes participated in the event. A survey (completing a questionnaire) was chosen as a method for conducting research. In order to analyse research data, measures for descriptive statistics (absolute and relative frequencies, popularity indexes) were applied. To identify differences between variables, non parametric chi-square ($\chi 2$) criterion was used.
Keywords: comprehensive school, science education, scientific research activity, teaching process.

INTRODUCTION

The current approach to learning is based on the cognitive theory putting emphasis on the internal processes of knowledge acquisition. The essence of the cognitive theory points to student education related to the concept of constructivism – creation of individual understanding. In terms of constructivism, learning can be accepted as a permanent active process for proposing hypotheses and making decisions. The supporters of the theory underline the fact that student education cannot be based on observing, hearing and feeling only. The main structures are those having relationship with thinking and are developed referring to personal experience and activity. The goal of such education comprises not only the ways of how to transfer and receive information, but also enhances student understanding and leadership, helps with perceiving environmental issues and meaning of events, promotes research skills and experiments, suggests a collective method for dealing with the arising problems (Woolfolk, 1995; Brooks and Brooks, 1999).

To become a creative individual, student encouragement to be actively involved in the acquisition process is given a priority. The process covers student engagement in observing, exploring, analyzing and making conclusions about the environment. The scientists agree that intensive learner's cognitive activity may be a crucial factor in personal development. While considering the methods for developing thinking at the highest level, the researchers most frequently discuss techniques similar to those used for exploring and discovering. Therefore, to stimulate active learner's acquisition, the scientists suggest different teaching strategies (methods) such as *evidence based teaching* (Petty, 2008), *problem-based learning* (Maggi, 2000), *project-based learning (*Atkinson, 2001; Berman, 1997), *critical thinking* (Paul, Binker, Martin and Adamson, 1989) etc. All these teaching strategies (methods) can be implemented organizing scientific research for the students, which is a kind of activity where the learners encounter problems, argue, provide critical statements, discover new things etc.

A teacher more frequently tended to organize the reproductive activity of students, is given an opportunity to achieve the required results; however, even if the learners acquired new abilities and skills, it does not mean they considerably broadened experience of creative and scientific research activity. There is no point to teach researching and discovering if a teacher and his/her students still feel lack of skills at discussing things and if there are no adequate standards allowing an open and straightforward exchange of ideas through a dialogue or discussions. Studies following a certain model do not provide a possibility of acquiring skills at learning and discovering on individual basis. A teacher can interpret or describe a phenomenon in the classroom; however, a direct method of exploration is a more efficient way of knowledge acquisition and cannot be achieved through theoretical teaching only. Independent learning has to be focused on solving the issues dealing with life experience and different projects rather than on remembering material included in course books. Teaching is not the way of repeating the already presented information but an active creative process that can be interpreted. In this case, the value of learning carries a twofold character: a number of different important things are learnt; moreover, skills at investigation and self-independence that will be helpful tools in the future are developed. Therefore, a more powerful effect will be produced if a learner encounters a situation where s/he feels uncertainty and doubts and is addressed different questions rather than interpretation and teaching on the basis of the chosen standard. A similar situation can be easily created during SRA raising possibilities of developing student scientific and critical thinking, insights, creativity and personal qualities. The stimulation of SRA offers conditions for intensive individual activities. The teachers applying methods for discovering and research, raise questions and problems while the latter have to put forward the produced ideas. The teacher "does not teach or consider" the basic ideas in the classroom but create fair conditions and encourage carrying on research and exploration (Arends, 1998). It has been previously determined that essential hindering factors of student interest in SRA include a) lack of teachers' motivation; b) student orientation to choosing an easier less efforts requiring way, c) poor material base at school, d) shortage of methodology of how to organize scientific research activity for students; e) insufficient teachers' preparation for SRA (Lamanauskas and Augienė, 2009).

Hence, the object of the conducted research is gain information about a position of upper-secondary school students on scientific research activity. The goal of investigation is worked towards the analysis of students' opinions on SRA disclosing the current situation on how the upper-secondary school students in Lithuania accept the job of a scientific researcher.

METHODOLOGY OF RESEARCH

General Characteristics of Research

Research was carried out in January - April 2011. The method of research was based on surveying (filling in the questionnaire). The undertaken research mainly agrees with Lithuanian context as the survey involved respondents from different comprehensive schools (concerning type and localization). Data were collected from more than 20 upper secondary schools. Research has revealed the attitude that student opinions and assessment researches are important factors that allow identifying urgent problems or specifying the already known issues. With reference to the analysis of suggestions made by the respondents, it is possible to propose ways so that to find an appropriate solution to the encountered problem and to evaluate possible consequences.

Research Instrument

For data collection, an anonymous questionnaire was distributed. The applied questionnaire was prepared by the authors themselves. The instrument of research is composed of the following main parameters:

- evaluation of general statements about scientific research activity, for example, 'I like exploring nature' (11 statements);
- self-evaluation of personal abilities to carry on scientific research activity (6 options);
- evaluation of respondent's scientific research activity (profession) (21 statements);
- evaluation of statements about the sources of information on the specificities of activity (profession) done by a scientist (9 statements).

The questionnaire also included a demographical part and some other additional variables (for example, open-type questions *if respondents would like to become scientists/researchers in the future, if teachers support participation in research activity* etc.

Sample

1338 respondents participated in the research. The distribution of the respondents in terms of the sex and grade is presented in Table 1.

Table 1. Characteristics of the respondents (N/%).

Class (year of studies at school)	Sex		Total	
	Female	Male		
Nine	182/25.5	185/29.6	367/27.4	
Ten	173/24.3	197/31.5	370/27.7	
Eleven	152/21.3	112/17.9	264/19.7	
Twelve	206/28.9	131/21.0	337/25.2	
Total	713/100.0	625/100.0	1338/100.0	

The distribution of the respondents in light of the sex is mainly proportional, and therefore the sample can be accepted as reliable.

Statistical Procedure

To assess the obtained data, the indexes of descriptive statistics (absolute and relative frequencies, popularity indexes, standard deviations) were employed. Every statement was given the calculated popularity/significance index ($0 \leq PI/SI \leq 1$). The closer is PI/SI value to 1, the more important is the statement to the respondent. To establish differences between variables, non-parametrical chi-square criterion χ^2 was applied. To measure relations between indications, Spearman's rank correlation coefficient rho (ϱ) was used. The instrument of data processing is SSPS statistical software package.

RESULTS OF RESEARCH

As expected, the respondents do not support an idea of doing research work. Only 11.5% of those would like to carry on research while 43.4% - have a different opinion. The rest had no clear position and were not sure about their choice. In this case, a statistically significant deviation regarding the variable of the sex has not been established ($\chi^2=4.09$, df=2, $p>.05$).

The assessment of the proposed statements about scientific research activity (Table 2) discloses that the respondents greatly prefer *searching for information on the Internet* (PI=0.65) and *excursions based on environmental studies* (PI=0.60).

Table 2. Activity evaluation (N/%).

Statements	Like	Partly like	Dislike	PI
Searching for information on the Internet	615/46.0	524/39.2	199/14.9	0.65
Excursions based on environmental / nature studies	510/38.1	584/43.6	244/18.2	0.60
Different observations and experiments	427/31.9	716/53.5	195/14.6	0.58
Lab works	482/36.0	540/40.4	316/23.6	0.56
Research activities involving other students	433/32.4	555/41.5	350/26.2	0.53
Exploring nature	372/27.8	611/45.7	355/26.5	0.50
Presentations of conducted investigations and findings	214/16.0	490/36.6	634/47.4	0.35

Searching for information in reference books, dictionaries, encyclopaedias etc.	202/15.1	505/37.7	631/47.2	0.34
Conducting different experiments on chemistry at home	227/17.0	423/31.6	688/51.4	0.32
Preparing different environmental / nature projects	156/11.7	457/34.2	725/54.2	0.28
Describing the obtained results of the conducted experiments and findings	91/6.8	406/30.3	841/62.9	0.22

However, the respondents avoid such activities as preparing different environmental / nature projects (PI=0.28), conducting different experiments at home (PI=0.32) etc. It has been established that female (42.6%) rather than male (33.0%) respondents like excursions based on environmental studies, which points to a statistically significant deviation (χ^2=20.39, df=2, p<.000). Also, nature studies are more preferred by girls (31.6%) rather than by boys (23.5%), which indicates statistically significant deviations χ^2=21.31, df=2, p<0.000). However, an important point is that male respondents (20,3%) are more interested in conducting different experiments at home if compared with female respondents (14,0%), which also shows statistically significant deviations (χ^2=10.20, df=2, p=.006).

The self-evaluation of personal abilities to carry on scientific research activity is presented in Table 3.

Table 3. The self-evaluation of personal abilities to carry on scientific research activity (N/%).

Abilities to carry on scientific research activity	Good	Average	Weak	PI
Conducting research	464/34.7	624/46.6	250/18.7	0.58
Planning research	250/18.7	765/57.2	323/24.1	0.47
Choosing an appropriate research technique (method)	269/20.1	685/51.2	384/28.7	0.45
Dissemination (presentation) of findings	305/22.8	594/44.4	439/32.8	0.45
Describing research (preparing a report)	237/17.7	672/50.2	429/32.1	0.42
Defining a problem of research	161/12.0	686/51.3	491/36.7	0.37

Table 3 discloses that the respondents agree that in the majority of cases research abilities reach an average or lower than an average level. Only the process of carrying our research is evaluated more positively (PI=0.58), though the index itself is not high enough. Defining a problem of research has been found as the weakest ability. It can be considered that research works at school are poorly focused on developing abilities of the respondents, and therefore the process of conducting research is accepted as activity.

The results of the analyzed data on how the respondents evaluate scientific activity of a researcher are shown in Table 4.

Table 4. The evaluation of respondent's research activity (N/%).

Statements	Agree	Partly agree	Disagree	PI
Scientific discoveries play an important role for public welfare.	898/67.1	354/26.5	86/6.4	0.80
Participation in research activity helps with practical knowledge acquisition and evaluation.	751/56.1	503/37.6	84/6.3	0.75
Participation in scientific research activity at school helps with further preparation for further studies	713/53.3	504/37.7	121/9.0	0.72
Scientists are important knowledgeable people	674/50.4	535/40.0	129/9.6	0.70
Research activity is useful for learning in order to achieve better results	576/43.0	627/46.9	135/10.1	0.67
Participation in research activity creates conditions for demonstrating different hobbies and abilities	573/42.8	601/44.9	164/12.3	0.65
Participation in research activity creates conditions for gaining self-knowledge	553/41.3	626/46.8	159/11.9	0.64
Research activity stimulates creativity	537/40.1	603/45.1	198/14.8	0.63
Research activity at school is a meaningful occupation	473/35.4	730/54.6	135/10.1	0.62
Research activity raises young-man self confidence and willingness to seek new challenges in science	494/36.9	684/51.1	160/12.0	0.62
Scientist is a way of life	520/38.9	579/43.3	239/17.9	0.61
Research activity is useful for practical daily life	454/33.9	705/52.7	179/13.4	0.61
Research activity is a good opportunity for self-realization	441/33.0	713/53.3	184/13.8	0.60
Scientists are a very respectful part of our society	471/35.2	651/48.7	216/16.1	0.60
Research activity encourages searching, analyzing, experiencing the joy of life	470/35.1	661/49.4	207/15.5	0.59
Research scientist is a very prestigious profession	407/30.4	692/51.7	239/17.9	0.56
Scientist's wages are rather high	416/31.1	664/49.6	258/19.3	0.56
Research activity at school is excellent employment and meaningful leisure time	427/31.9	643/48.1	268/20.0	0.55
Research activity at school is student appreciation and certain evaluation	333/24.9	736/55.0	269/20.1	0.52
Research activity is more appropriate for different centres, clubs and other establishments rather than for school	341/25.5	572/42.8	425/31.8	0.46
Research activity can be accepted after school only	307/22.9	586/43.8	445/33.3	0.45

The obtained results show that the respondents find scientific discoveries important for public welfare (PI=0.80). Participation in research activity helps with practical knowledge acquisition and evaluation (PI=0.75) which assists in preparation for further studies (PI=0.72). However, mainly the evaluation of a scientist/researcher job is rather low. The respondents do not accept that the profession of a researcher is extremely prestigious (PI=0.56). They do not tend to agree that research activity at school is excellent employment and meaningful leisure time. In terms of the surveyed participants, research activity at school is not student appreciation and certain evaluation.

Rather negative evaluations can be related to the situation that students at school are not sufficiently encouraged to be engaged in scientific research activity. The results presented in Table

5 indicate that more than one third of teachers and parents do not support an idea of being involved in similar activity.

Table 5. The role of teachers and parents in stimulating student participation in scientific research activity (N/%).

Supporters	Level	Sex		Total	Chi square test	
		Female	*Male*			
Teachers	*Give support*	101/14.2	118/18.9	219/16.4	χ^2 =9.28;	
	Partial support	382/53.6	287/45.9	669/50.0	df=2;	
	Discourage	230/32.3	220/35.2	450/33.6	p=.010	
Parents (foster-pars)	*Give support*	70/9.8	103/16.5	173/12.9	χ^2 =13.18;	
	Partial support	263/36.9	210/33.6	473/35.4	df=2;	
	Discourage	380/53.3	312/49.9	692/51.7	p=.001	

The obtained results show that only 16.4% of teachers and 12.9% of parents support the idea of participating in similar activity. Parents obviously show less support than teachers. It seems to be logical, because teachers in one or another way are directly involved in the teaching/learning process. In both cases, statistically significant deviations are found. The male learners more positively evaluate the latter parameter than the female ones. Direct correlation appears between these two features (Spearmen ϱ=0.31, when p<0.000). Moreover, statistical significant correlation between students' intention to become researchers in the future and investigation into new unconventional areas has been established (Spearmen ϱ=0.34, when p<.000). It also seems to be a logical relation, because all those students who find research activity interesting have the intention to become researchers in the future.

DISCUSSION

Today, the ability to research becomes the crucial factor in the knowledge-based society. These abilities help with acquiring knowledge of fundamental and applied nature. Therefore, every society raises new educational goals and strives for reforming its own educational system so that it could manage innovations influenced by globalization and prepare the young generation for life in the globalized world and take actions in the competition based market economy. Thus, more and more attention should be given to improving skills in doing research work and developing critical thinking, creativity and self-expression. However, presently, the number of those seeking to dedicate their lives and activities to the scientist's carrier is decreasing, and therefore the amount of would-be teachers of sciences also becomes reduced. In this manner, comprehensive school plays a fundamental role in developing students' cognitive abilities forming skills and qualities of scientific research activity and a positive attitude to the scientist's carrier. The conducted research has proved that scientific research activity at school is mainly given scant attention. On the other hand, if this is a kind of activity a student is interested in and given support at school, it is an adequate incentive to his/her professional activity in the future. Works by other authors show that

learning in an authentic research environment assisted through cognitive apprenticeships with mentor scientists can provide a powerful method to prepare students for the high performance future workplace (Erdosne, 1996). The carried out research has discovered that only the minority of respondents would like to do research work in the future. Statistically significant deviations considering the sex are not recorded which means that similar position holds both – male and female students. Earlier research performed by other authors reveal that males are more focused on learning than girls (boys had more positive attitudes to science and greater levels of participation in scientific extra-curricular activities (Breakwell and Beardsell, 1992). Research also shows that French high school students, as in other countries, opt out of scientific tracks in the 6th and 7th grades, often selecting scientific courses simply to increase their chances of being accepted at prestigious universities (OECD Programme..., 2006). An obvious point is that teacher's assistance in showing interest in research activity is extremely important. Besides, research has revealed that more than one third of the teachers do not support an idea of taking part in similar activity. Investigations done by other authors clearly indicate that in this case the role of teachers is crucial (Clark, 2006).

Appropriate teacher's methodological preparation for organizing students' SRA makes conditions for a learner to achieve the level when s/he can independently formulate hypotheses, choose research methods, make decisions on different attitudes critically and individually evaluating them, present personal research and share experience gained during SRA. Hence, the major point is that a student should be provided a possibility of having knowledge about the peculiarities of scientist activity and carrier.

CONCLUSION

The performed research has established that upper secondary school students are not tend to do research work in the future as it is supposed to be of having no future and low prestige. The idea has been supported by both – male and female students. It can also be noticed that older students are not tend to be involved in scientific research activity, apart from the fact is has some relations with ICT. Excursions based on environmental / nature studies are more acceptable for female than male students. An interesting point is that a female rather than male part is more engaged in exploring nature, whereas different trials and experiments at home are preferred by male. The researched students' abilities are accepted to be at an average and below average level. The ability to identify and define a problem of research is in the lowest position. The students perceive that scientific activity has an impact on society in general, assists in applying the acquired knowledge in practice and preparing for further studies in university; however, they are rather pessimistic in terms of the profession of a scientist-researcher. SRA in terms of students is not excellent employment and meaningful leisure time. It has been established that both parts teachers and parents show insufficient support for students so that to participate in scientific research activity. Moreover, parents are in a more passive position than teachers. The above described situation is

supposed to be caused by a common and prevailing in our society attitude to SRA and the carrier of a scientist in general.

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