A Constructivist Learning Environment in Science Classes at Polish, Turkish and Bulgarian High Schools

Iliya Emilov
University of Sofia, BULGARIA
iemilov@chem.uni-sofia.bg, iliyaemilov@yahoo.com

This cross-national research study is entitled: "In the past and now: Constructivist practices in teaching chemistry - Bulgaria, Balkans and Europe. The purpose of the research was to assess science secondary classroom environment in terms of constructivist approaches, specifically to explore the high school science classroom of a constructivist teacher and examine how constructivist-based teaching influences students' learning of chemistry in Bulgarian and neighboring schools. The study was conducted at international and state schools in Tirana (Albania), Pristina (Kosovo), Bucharest (Romania), Bielsko - Biala and Warsaw (Poland), Vienna (Austria) and Istanbul (Turkey). The questionnaires have been given to 1127 secondary school students and 27 teachers. The data collection methods for students were three surveys: What is happening in this class? (WIHIC); Constructivist Learning Environment Survey (CLES); and Modified Attitude Scale Modeled on Test of Science Related Attitudes (TOSRA). For teachers, we used the Teacher Pedagogical Philosophy Interview (TPPI). The results show that the majority of the surveyed teachers practise a blended, traditional-constructivist type teaching. Their students also placed them into this category. In this study, the survey results from Polish, Turkish and Bulgarian schools have been analyzed in more detail.

Това проучване е част от международно изследване, озаглавено „В миналото и сега: Конструктивистки практики в обучението по химия - България, Балканите и Европа". Целта на изследването е да се оцени учебната среда в природните науки в гимназиалните класовете от гледна точка на конструктивисткия подход, да се опознае гимназиалната природонаучна класна стая на конструктивисткия учител и да се разгледа как конструктивистко - базирано преподаване влияе върху учениците и тяхното обучение по химия не само в българските училища, но и в съседните страни. Проучването е проведено в международни и държавни училища в Тирана (Албания), Прищина (Косово), Букурещ (Румъния), Биелско - Бяла и Варшава (Полша), Виена (Австрия) и Истанбул (Турция). Досега въпросниците са били дадени на 1127 ученици от средните училища и 27 техни учители. Методите за събиране на данни за учениците са три анкети - Какво се случва в този клас? (WIHIC), Изследване на конструктивистка учебна среда (CLES) и модифицирана скала на нагласите моделирана върху теста за научните нагласите (TOSRA) и за учителите: философко – педагогическа анкета (TPPI).

Тъй като проучването за нагласите на учителите по природни науки към конструктивистка учебна среда вече е реализирано в България, резултатите от наличните изследвания са били използвани в това проучване. Резултатите показват, че по-голямата част от анкетираните учители практикуват смесен, традиционно- конструктивистки тип обучение. Техните ученици, според проучването с CLES също ги причисляват към тази категория. В това проучване, резултатите от проучването от полски, турски и български училища са анализирани по-подробно.

Тази публикация е изготвена с финансовата помощ на Европейския социален фонд по проект № BG051PO001-3.3.06/0026. Илия Невенов Емилов носи цялата отговорност за съдържанието на настоящия документ, и при никакви обстоятелства не може да се приеме като официална позиция на Европейския съюз или на Софийски университет "Св. Климент Охридски", Факултет по педагогика.

Keywords: Constructivist teaching approach, science education, teaching chemistry, cross- national study

Introduction

The declining popularity of science among students, including chemistry, is a global trend (Toshev, 2007). The application of the constructivist approach is a better and more interesting way of teaching that can help students to understand abstract concepts in chemistry. Student learning in a constructivist-learning environment is one of the modern trends of continuous reforms in education and science (Tafrova-Grigorova, *et al.*, 2012). Constructivism in education seeks to address how people learn and the "nature" of knowledge. Constructivism considers knowledge as something that is acquired, and is constructed in the mind of the individual, and therefore cannot simply be transferred from one person to another. The new knowledge is built on the basis of prior knowledge and experience of the individual as a result of purposeful actions in a particular situation.

The most prominent representatives of the constructivist philosophy as the basis for learning and intellectual development of man are: Swiss psychologist, biologist and epistemologist Jean Piaget (1896-1980); the Russian psychologist Lev Vygotsky (1896-1934); and, the American philosopher, founder of functional psychology and education reformer John Dewey (1859-1952) (Tafrova-Grigorova *et al.*, 2012).

Jean Piaget (1929, 1950, and 1952) introduced the constructivist concepts of assimilation and accommodation, which describe the way students construct their own meaning as they experience the world. Jerome Bruner (1966, 1971, 1986, 1990, and 1996) built upon the constructivist philosophies of Dewey, Vygotsky, and Piaget as he explored the process and the culture of education (Wagner, 2008).

During the 20th century, Swiss scholar Piaget (1896-1980) was one of the most influential proponents of constructivism (Brooks, 1999). Piaget was concerned with cognitive development and how knowledge is formed.

On the other hand, according to social constructivism, learning takes place through interaction with other students and teachers around the world (Vygotsky, 1978). Lev Vygotsky is famous with the theory for cultural-historical activity of dependence of mental development. According to this theory, knowledge formation is impacted through social experience. According to Vygotsky, concepts are designed individually by each child. They can be spontaneous and daily, and are formed from everyday life experiences and scientific knowledge achieved through formal schooling. The "learning process happens with emergence of new structures and improvement of old ones"(Выготски, 2005).

Social constructivism emphasizes the importance of context for understanding what occurs in the world. Knowledge is a human product that does not exist in the world without social intervention. Humans must construct knowledge when engaged in social activities (Kim, 2001).

The psychologist Bruner (1915-) also influenced the theory of social constructivism. His theory, like Piaget's, was based on cognitive development studies. He believed that learning is an active, social process in which students construct new knowledge based on what they already know. Teachers should involve their students in active dialog and encourage their students to make their own discoveries (Bruner, 1966, 1973).

Psychologist Ernst von Glasersfeld (1917-2010) is typically associated with radical constructivism. It is termed radical since it

is so different from conventional constructivist learning theory, which assumes there is a reality that one must discover. With radical constructivism, knowledge does not fit an ontological reality; it is an individual ordering of the world based on personal experience (Busbea, 2006). Von Glasersfeld was influenced by the theories of Piaget. He also believes knowledge is actively received either through communication or through the senses and connects to previous knowledge (von Glasersfeld, 1989).

Nearly a century ago John Dewey (Dewey, 1915, 1916, 1938) laid out a progressive new approach to education. He believed that experience is the best education and created a system that would focus instead on learning-by-doing. If Dewey believed that all education is experience, then Lev Vygotsky (Vygotsky, 1978, 1986, 1997) believed that all experience is social. It follows then that all education is social (Wagner, 2008).

These theories have clear points of disagreement with each other. This paper will focus on both cognitive and social constructivist theories as they both contribute to understanding a constructivist science classroom environment.

Cross-National Studies

The research was conducted in six countries. In the present study the results from the previous Bulgarian investigations is discussed with the findings from Polish and Turkish science classroom environments. According to Barry Fraser (Fraser, 2012)

Science education research which crosses national boundaries offers much promise for generating new insights for at least two reasons. First, there usually is greater variation in variables of interest (e.g. teaching methods, student attitudes) in a sample drawn from multiple countries than from a one-country sample. Second, taken - for - granted and familiar educational practices, beliefs and attitudes in one country can be exposed, made 'strange' and questioned when research involves two countries (p.1229).

Methodology of Research

Aim, questions and tasks

The **aim** of the study is to investigate the science classroom environments in Bulgarian and other European schools. For this purpose it is necessary to seek teachers' and students' views on the application of constructivist-based teaching and learning practices and thus to explore the high school science classroom environment.

The research questions are:

1. What are the students' perceptions of the science classroom?
2. What is the teachers' pedagogical philosophy of secondary science teachers?
3. Do the science teachers apply constructivist teaching approach in their classroom?
4. What are the current characteristics of constructivist approaches in Bulgarian, the Balkan and European schools?

The research tasks are:

1. To conduct a survey of samples of science teachers and their students in some European countries including some schools from the Balkans (Table I).
2. To explore patterns that emerged after close observations and careful documentation.
3. To analyze the survey results and to draw conclusions about constructivist-based teaching in high school science classroom environment.
4. To propose recommendations for future projects, initiatives and studies.

The research instruments

Different instruments have been used (QTI, SLEI, CLES, WIHIC, TPPI) by educational researches to identify the characteristics of constructivist learning environment (Tafrova-Grigorova *et al.*, 2012a). The instruments used to collect student data were: What is happening in this class? (WIHIC); Constructivist Learning Environment Survey (CLES); and, the Modified Attitude Scale Modeled on Test of Science Related Attitudes (TOSRA). For teachers, the Teacher Pedagogical Philosophy Interview (TPPI) was conducted. These instruments were chosen because other researchers have used them and their validity has been established.

In this study of the research for Polish and Turkish schools, the TOSRA and TPPI questionnaires were applied.

The Test of Science-Related Attitude, (TOSRA) (Fraser, 1981), is the most widely-used attitude instrument in science education research today (Fraser, *et al.*, 2009). TOSRA clearly defines each of the constructs to be measured by providing distinct subscales based on Klopfer's (1971) classification of students' attitudinal aims: (1) attitude to science and scientists, (2) attitude to inquiry, (3) adoption of scientific attitudes, (4) enjoyment of science learning experiences, (5) interest in science, and, (6) interest in a career in science. These six constructs are clearly defined and each represents a different 'object' about which students are likely to form opinions (Fraser *et al.*, 2009).

In order to investigate the relationships between the learning environment and students' attitudes in the investigated countries, the TOSRA tool was selected. The final version of TOSRA measures seven distinct science-related attitudes among secondary school students: (1) Social Implications of Science; (2) Normality of Scientists; (3) Attitude to Scientific Inquiry; (4) Adoption of Scientific Attitudes; (5) Enjoyment of Science Lessons; (6) Leisure Interest in Science; and, (7) Career Interest in Science (Fraser, 1978 and 1981). This instrument is composed of seven scales and each scale is composed of 10 items. The response scale is a five-point Likert scale and has response categories ranging from Strongly Agree to Strongly Disagree. Teachers and researchers have found that the TOSRA is useful and easy to use for measuring and monitoring progress of science-related attitudes of individual students or whole classes of students. In particular, TOSRA also makes it possible for researchers and teachers to obtain a 'profile' of attitude scores for a particular group of students (Fraser, *et al.*, 2009). In the present study "Enjoyment of Science Lessons" scale with 10 items has been administered to students. The responses were given by on a three-level Likert scale: 1- Disagree, 2- Not sure, 3- Agree. Maximum score per item is 3 and total maximum score is 30.

Table 1. Number of surveyed students and teachers – distribution of the schools according to the countries.

Country	Students	Teachers
Albania	206	8
Austria	94	1
Kosovo	98	1
Poland	286	4
Romania	104	4
Turkey	339	9
Total	1127	27

Data on the composition of the teachers' sample is given in Table II. The distribution of the teachers by age, pedagogical internship and sex has been done in this way to comply with the total for the countries.

The Teachers Pedagogical Philosophy Interview (TPPI) is a questionnaire which was designed and developed by Richardson and Simmons (Richardson, 1994). The teachers' responses to the survey questions provide information on their views and perceptions of their role in science teaching as well as their relationships with students in the learning process (Tafrova-Grigorova *et al.,* 2012a). In order to obtain more detailed and concrete answers concerning teaching and learning methods, we adapted the TPPI by reducing it up to six questions (Boiadjieva, 2009).

These six questions can be divided into two groups. The first group of questions is related to their way of teaching. Respondents have to describe themselves as teachers and to highlight their professional qualities. The answers of the second group questions require information how both teachers and students learn.

The evaluation and scaling is discussed in the previous research (Tafrova-Grigorova, *et al.,* 2012a):
The 30 surveyed teachers answered questions in written individually and independently from each other. Each answer is evaluated by four experts. Three of them are university professors with experience in the field of chemical education and one is novice teacher (Tafrova-Grigorova, *et al.,* 2012a). Evaluation is determined by the scale presented in Table II. Experts independently ranked the teachers' responses from 1 to 5. Responses with a score of 4 or 5 relate to constructivist, inquiry-based and student-centered classroom, 1 and 2 - to traditional teacher-centered teaching, 3 - to a transitional - between traditional and constructivist environment (Boiadjieva, 2009).

For the analysis of the surveys from the schools in Poland and Turkey, the same process and scale was adapted.

Background of research
The basic parameters of the study are the following:

- Time Frame: October 2012 - May 2013.
- Target group: high school students, science teachers (chemistry, biology and physics).
- Volume and composition of the sample: The study has been conducted at international schools and state schools in Tirana (Albania), Pristina (Kosovo), Bucharest (Romania), Bielsko-Biala and Warsaw (Poland), Vienna (Austria) and Istanbul (Turkey).
- The questionnaires have been given to 1127 secondary school students and 27 teachers. 286 Polish students and four Polish science teachers, and 339 Turkish students and nine Turkish science teachers participated in the study. In our previous research 30 teachers were surveyed from 28 schools of 9 areas of Bulgaria.

Procedure:
In Poland the survey was conducted in two cities: Bielsko-Biala and Warsaw. The school in Bielsko-Biala was a public school and the one in Warsaw an international school. In Bielsko-Biala, the WIHIC, CLES and TOSRA questionnaire was given to 195 students and one teacher answered the TPPI questions. In Warsaw, these questionnaires were administered to 81 students and three teachers. In Istanbul, Turkey 339 students and 9 teachers participated in the survey from four public

and one international school. The distribution of the students and teachers are given in Table I and only students in Table III.

Table II. Composition of the teachers' sample.

Characteristics		Al	A	Ks	Pl	Ro	Tr	Total
Age	up to 30 years	4		1	2	3	1	11
	31 – 40 years	3			1	1	1	6
	41 – 50 years		1				6	7
	over 50 years				1		1	2
Pedagogical internship	up to 10 years	7		1	3	4	2	17
	11- 20 years		1		1		4	6
	21- 30 years						3	3
	over 30 years							
Sex	women	6	1		2	1	7	17
	men	1		1	2	3	2	9

Legend: Albania: Al, Austria: A, Kosovo: Ks, Poland: Pl, Romania: Ro, Turkey: Tr

In the formerly mentioned previous research on "Science Teacher`s attitudes towards constructivist environment: a Bulgarian case" a survey was conducted as a part of our research activities on the constructivist science teaching practices in the Bulgarian schools. The Teacher Pedagogical Philosophy Interview (TPPI) was applied as a research instrument by adapting and reducing it up to six questions. The sample of research consisted of 30 secondary science teachers at 28 schools from 9 areas of Bulgaria

General results of the present survey

Data resulting from the TPPI (administered to the teachers) and the TOSRA (administered to their students) will be discussed. From a total of 1127 students surveyed with the TOSRA questionnaire, their are 1040 valid students (Figure 1). The measures of the central tendency: mean score, median, mode and the standard deviation for the total of 10 items of all 1040 are calculated by the Statistical Package for the Social Sciences (SPSS). The reliability is 0.870 according to Cronbach's Alpha. For the test of Homogeneity of Variances for TOSRA, the Levene statistic is 6.35. The ANOVA results for TOSRA is less than 0.05.

TOSRA mean score and standard deviation of the sample of 1040 students are shown in Table III.

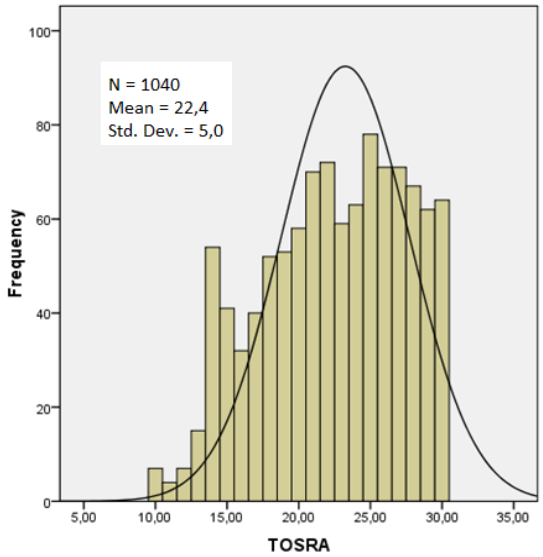

Figure 1. The distribution of the total scores for the ten TOSRA items.

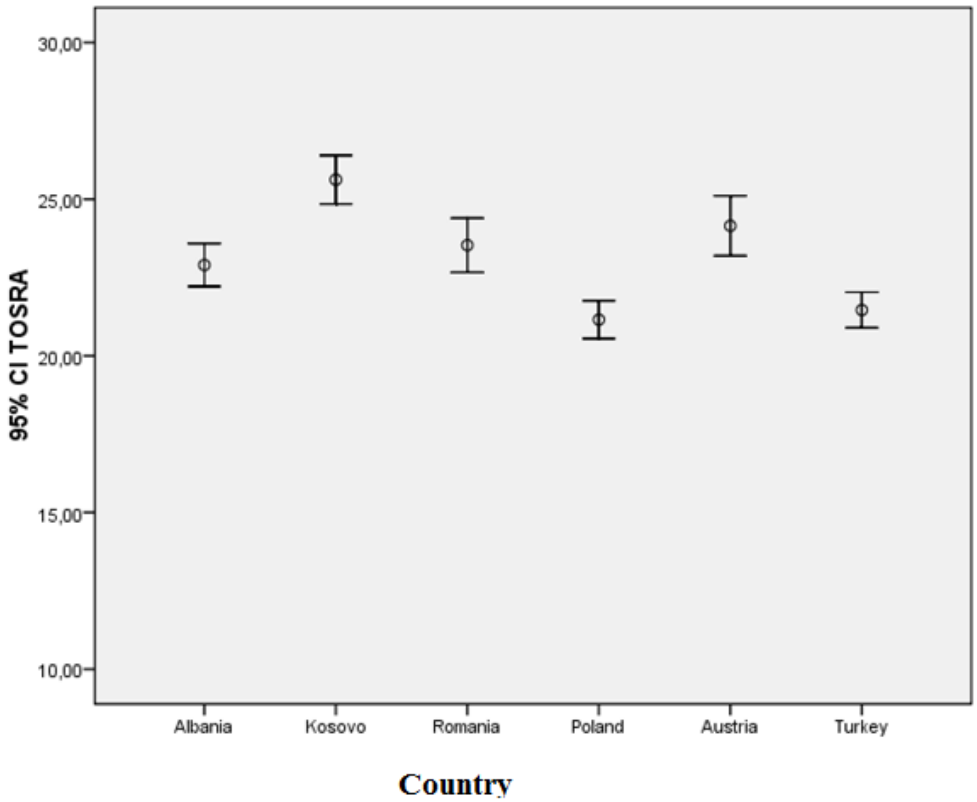

Figure 2. Mean total score of schools by countries for a confidence interval of 95%.

Table III. The distribution of Polish and Turkish students. Legend: 1,2,3 : High school classes; 1,2,3-JHS: Junior high school classes;10,11,12:High school classes. 1,2 and 3 refer to 10, 11 and 12 grades.

Country	City/School	Class	Number of students
Poland	Bielsko-Biala/Public School	1	-
		2	115
		3	80
	Warsaw/international school	1-JHS	14
		2-JHS	12
		3-JHS	16
		1	11
		2	23
		3	15
Turkey	Istanbul – Beylikduzu/International School	10	57
	Istanbul – Besiktas/ Public School -1	10	50
		11	47
		12	27
	Istanbul - Besiktas / Public School - 2	10	21
		11	22
		12	24
	Istanbul - Besiktas/ Public School -3	11	21
		12	23
	Istanbul - Besiktas/ Public School - 4	11	20
		12	27

Table IV. TOSRA mean score ($\bar{x}$) and standard deviation (s) of the sample of 1127 students.

	$\bar{x}$						s						
	Al	A	Ks	Pl	Ro	Tr	Al	A	Ks	Pl	Ro	Tr	All
Q1	2,40	2,46	2,77	1,91	2,42	1,92	0,72	0,73	0,52	0,69	0,74	0,76	0,69
Q2	2,15	2,45	2,47	1,95	2,29	2,08	0,75	0,67	0,69	0,78	0,73	0,79	0,74
Q3	2,28	2,48	2,66	2,11	2,46	2,11	0,80	0,66	0,56	0,77	0,72	0,83	0,72
Q4	2,19	2,38	2,47	2,06	2,36	2,19	0,81	0,82	0,75	0,88	0,79	0,83	0,81
Q5	2,82	2,63	2,88	2,66	2,70	2,80	0,41	0,63	0,36	0,60	0,59	0,47	0,51
Q6	2,91	2,83	2,90	2,81	2,80	2,86	0,33	0,41	0,30	0,48	0,51	0,41	0,41
Q7	1,21	2,53	2,59	2,10	2,28	2,01	0,74	0,69	0,62	0,76	0,73	0,78	0,72
Q8	2,01	2,24	2,53	1,83	2,10	1,87	0,75	0,77	0,69	0,78	0,80	0,78	0,76
Q9	1,66	1,76	1,94	1,65	1,84	1,70	0,74	0,80	0,81	0,79	0,77	0,84	0,79
Q10	2,18	2,31	2,42	2,05	2,25	1,95	0,72	0,65	0,75	0,74	0,74	0,79	0,73
$\bar{x}$	**2,18**	**2,41**	**2,56**	**2,11**	**2,35**	**2,15**							

Discussion

Polish and Turkish students gave nearly maximum scores to the question: "Finding out about new things is important," the TOSRA. The standard deviation is low and close for both of the countries. This result shows that the great majority of the students from these countries unanimously wish to discover and acquire new scientific knowledge.

On the other hand Polish and Turkish students gave low scores to the question: "We should have more science lessons each week." The students do not wish to have more lessons, but they would be happy if their present lessons were more interactive, attractive and interesting.

The highest value of the standard deviation for question number four, "Science is one of the most interesting school subjects," the 286 Polish students and the 339 Turkish students are heterogeneous in their preferences and attitudes towards science.

The Polish and Turkish students have very close mean scores for all these 10 questions (see Table IV and Figure 2)

According to the teachers' answers to the first question from the TPPI, "Describe yourself as a teacher":

- 42% of them give priority to the interaction with students
- 26% of them describe themselves as professionals
- 16% of them put emphasis on personal qualities
- 16% of the teachers did not comment on this question.
- There is a tendency to have a student-centered science class-room.
- A teacher from Poland describes himself as "I am a teacher full of passion and commitment, I am professional and well prepared to teach."
- A teacher from Turkey says, "I am a teacher who tries to keep up with the developments, and to carry out all the responsibilities desired by

regulations and am a normative teacher". In the constructivist classroom the students are active.
- The teacher is a mediator.

According to the data from the evaluation form:
- 1/3 of the Bulgarian teachers describe themselves as professionals
- almost 30 percent prioritize their interaction with students.
- About 1/4 put emphasis on personal qualities.
- Only three Bulgarian teachers do not assign themselves in teacher-centered teaching style, but they are so depicted by the actions of students.

To the second question, "What are your main strengths as a teacher?":
- 66 % of the teachers rely on the class inclusion of their students by making experiments, participating in projects, experience and games.
- 34 % of the teachers give priority to their professional and personal qualities.
- One of the Polish teachers says, "As I am preparing my PhD thesis, I am in the permanent contact with chemistry and I improve my chemical and pedagogical knowledge. Teaching chemistry in a new way through experiment and everyday applications allows students for better understanding world around, teach them of logical thinking and drawing conclusions."
- A Turkish teacher says, "To have a positive communication with the students, to be able to analyze their strengths and weaknesses."
- Over half of the Bulgarian teachers rated with a score of 3 which means that for them the good teacher combines the best qualities of a traditionalist and constructivist teacher, because he is open to students.
- Four of the Bulgarian teachers rely on the skills and experience of their students.
- As in the previous question, about 1/4 of the teachers give priority to their personal qualities.

Questions number 3, 4, 5 and 6 seek responses on how teachers and their students learn. To the third question, "How do your students learn best?":
- 50 % think that their students learn best by interactive lessons, discovery learning, pair work, group work, discussions, doing and experiencing.
- The rest of the teachers think that their students learn by taking notes, writing, doing their homework and testing.
- 25 Bulgarian teachers explicitly state that their students learn mostly through their own actions and their interaction with the teacher, which is expressed in: "more exercises, inclusion in experimental work, problem solving," "an accessibly presented curriculum," "solving problems planned for the lesson," "and use of presentations to present the new curriculum."

To the next question, "How do you, as a teacher, learn best?":
- Some of the teachers answered "Similar as my students, I learn best by meeting chemistry in everyday life"
- One Turkish teacher said "I learn by using different sources, repeating, updating my knowledge and catching memorability in visual studies."
- On the other hand, there is a tendency of teachers to learn by taking notes, reading, watching

video clips or movies and solving problems.

- Almost half the Bulgarian teachers consider the use of visualization and further reading as a priority in their preparation and method of learning.
- Thirteen teachers (except the ones mentioned above) point out an important way for them to learn and exchange experience with colleagues is attending seminars, conferences, and training for additional qualifications.

These answers of the teachers are indicative for the trend in the change of the profile of the Bulgarian teacher in the direction of stepping out from the traditional role in the learning process.

To question five, "What are the characteristics of a good learner?":

- One Turkish teacher says, "If a person can comment on the subject correctly, it means that he/she has learnt."
- Most of the teachers consider that a good learner should be patient, good listener, open-minded for new ideas, striving to discover new things, analytical, logical and explorer.
- As the main features, Bulgarian teachers indicate "to be competent on various issues," "not to reproduce, but to think and understand the studied material, "concentrated, thorough, persistent, and continuous in learning."
- Half of the teachers indicate traits of the personality that are definitely formed in the constructivist learning environment. Views in this direction are: "to be motivated to explore new, unknown," "to be able to lead the debate with facts and arguments," "to be inquisitive and to evaluate the usefulness of knowledge," "to decide cases and to show initiative in activities carried out in class and outside it," "to be willing to express."

These answers from the teachers are a good sign of willingness and desire to form such qualities in their students. This can be realized differently from the traditional learning environment provided with new approaches and teaching methods

To the last question, "How do you know that your students understand the curriculum content?":

- Almost all of the teachers who responded said that their students understood the curriculum content by asking questions, giving quizzes and tests.
- A Polish teacher responded, "I ask them if they understand, check them on organizing projects, quizzes and tests."
- A Turkish teacher answered, "If I can get the desired answers in the quizzes, exams or the questions I ask, it means that they learnt well. At the same time, they should be able to apply what they learn in the classroom in their daily life."
- Some of the teachers check during the lesson and some of them at the end of the lesson.
- Two of the teachers give small projects or experiments to check the studied material.
- As the basic criteria, half of the Bulgarian teachers indicate "ability to solve logic and test tasks to deal with practical exercises," "to answer questions related to curriculum," "to place the individual tasks," "through lectures and discussions with students on learned curriculum content."
- An important criterion for success to one-third of Bulgarian teachers

is the extent to which the students apply new knowledge in different situations.

Almost as many are the teachers for whom the results of examinations and tests are conclusive evidence for understanding the studied material.

Limitations

Cross-national studies are usually challenging since it is necessary to get permission from the authorities to be able to conduct them in schools. Also the schools should be chosen carefully to map the whole nation. Obviously, this process needs to be given a lot of time. In this research, the surveys were given to a limited number of schools from certain areas of the countries, therefore the results cannot be generalized to the whole country.

Factors that could affect the results

In this part, some data and arguments will be mentioned about the education system and curriculum in these three countries, as the system and the requirements of the state may affect the teachers' behavior and practice.

First, the surveyed schools in Istanbul, Turkey are representative of prestigious schools. The students are enrolled into these schools after a national entrance exam. The average scores of the accepted students are very high. Most of the students in these schools prefer to be in a science class, because in order to be an engineer, doctor and IT specialist, they need high scores from their science courses for the national university exam. If it is considered that there are 2 million university candidates and just about one half million are placed, the great competition is inevitable. This leads to a test-orientated educational system. Besides the school, there are also numerous educational centers that prepare the candidates to the university exam. Nowadays, there is an issue with the exam preparation educational centers is in agenda in Turkey. Student-oriented learning and inquiry-based learning require more time. Class activities are directed instead towards problem solving and test items instead of experimental practices and interactive techniques. The students from the surveyed schools are generally in the top 1% of the university exam results. They are accepted by prestigious universities in Turkey and abroad with scores from SAT and TOEFL. It cannot be claimed that a test-oriented educational system increases the success of the students. On the other hand, it cannot be claimed that student-centered classroom and inquiry-based learning will increase the success of the students.

Second, in Bulgaria, Poland and Turkey, every three or four years the curriculum is changed and teachers are obliged to adapt their yearly plans to it. In most cases, this adaptation brings about a decrease in the number of experiments and activities in the lessons. In many cases, students enter the university without any practical experience. These students may face difficulties in lab lessons and can struggle with the subjects. All of these factors may lead to unqualified specialists and individuals that work extremely hard in their first years in order to survive in their field.

Third, in these countries, there is a tendency to diminish the number of science lessons in the curriculum. For example, if this year a science class (physics or chemistry) has three or four hours lessons in a week, in the following year they will be two or three hours. After the Polish educational reform, there has been an improvement in education according to PISA. On the interviews with the teachers, it has been clarified that the decrease in the number of lessons will affect the preparation of science profiled students for their career.

Conclusion

The results from TOSRA show that Polish and Turkish students have close perceptions of science classroom according to the mean scores of questions 2, 4 and 7 which manifest average enjoyment, fun and interest of students. In the same questions the standard deviation is high which means that there is a heterogeneity and anonymity in their perceptions.

TPPI results of the survey show that in both sets of questions, the answers of the majority of surveyed Bulgarian teachers rank in the middle of the scale, which characterizes them as teachers of traditional – constructivist type. Their students, according to the study with CLES, also count them into this category. Despite the pursuit of practice the control in the process of learning, the attitude of teachers towards change is obvious.

With 66 % result of the question number two, most of the Polish and Turkish teachers reveal themselves as constructivist teachers. On the other hand, the results of question number three show that half of the teachers, in fact, do not apply the constructivist approach in their lessons because of the reasons mentioned above.

The discussed results show that some of the teachers apply constructivist teaching approach in classroom while some do not. Based on the interviews with the teachers it can be concluded that there is a tendency of the European teachers to apply a constructivist teaching approach and the students are ready to initiate and collaborate a constructivist science classroom environment.

The analysis of the survey will continue with the other instruments CLES and WIHIC which are not discussed in this article to get a more precise picture of science classroom environment with the previous contribution of Telli (2010) on typologies in classroom environments and other studies.

It is expected that the study will make some contributions to create a basis for the development of worldwide partnership in the field of science education, practitioners, and policy makers and to the officially declared "European year (2013) of citizens" by EU.

The necessity to continue the research on the development of understanding and interest in chemistry by implementation of modern teaching methods and strategies is crucial.

In this context this study will be useful for universities, schools, and other educational and cultural organizations in the realization and development of partnerships and international cooperation in theory and practice.

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Iliya Emilov was born in Krushari, Dobrich (Tolbuhin) in 1977. He went to primary school in Efreitor Bakalovo and Telerig, Bulgaria. After the migration of his family to Turkey in 1990, Iliya continued his secondary education in Corlu and attended high school in the Luleburgaz Kepirtepe Anatolian Teacher Training High School. He succeeded in passing the university entry exam with a high score in 1997 and entered the Bogazici (Bosphorous) University, which is one of the most prestigious universities in Turkey. After the graduation in 2001, he had two years' experience in a Russian school as a chemistry teacher. In 2003, he returned back to Bulgaria and started teaching chemistry in English at Drujba Private High School in Bankia, Sofia. He was the deputy head at this school for the period 2006-2008 and was the school coordinator of a European project with partner schools from Germany, France, Poland and Turkey under the Lifelong Learning Program, sub-programme Comenius with title Teaching Tolerance. In 2008, Iliya started a master programme "Teacher of Chemistry" at Sofia University, Faculty of Chemistry and Pharmacy, Research Laboratory on Chemistry Education and History and Philosophy of Chemistry. In January 2012, he passed the doctoral exams and became a PhD student. He is a participant and beneficent of the Doctoral School at Sofia University which is sponsored by European Social Fund. He is married with two children. At the moment he is the Director of theEducational Center "Drujba" and continues teaching chemistry at Drujba High School.