

## Application of the scientific research approach in science education in Language School “Plovdiv”, Plovdiv

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In this article two science teachers from one Bulgarian high school share their experience with teaching science using inquiry based science education approach (IBSE). They describe their point of view for the importance of the IBSE and its impact on the effectiveness of teaching.

**Key words:** inquiry based science education

*The important thing about science is not so much the discovery of new facts as the discovery of new approaches for their explanation.*

Sir William Henry Bragg

The National Program for the development of secondary education and the educational training in schools (2006-2015 year) mark as the first major problem the “orientation of the system towards memorizing and citing, and not to provoke critical thinking, independence and formation of skills” [8].

Studies conducted in the country by the Institute for Population and Human show that “80 % of teenagers explore the world by using emotions for what they do and this style is the exact opposite from the elder’s style, which is dominated by logic and structure.” Ass. Prof. Antoaneta Hristova, who conducted the study, believes that “in order to overcome the negative effects, it is necessary to introduce the research approach in education, in order to change priorities in teaching” [9].

We support this view, because if such an approach is used, then the teaching will be more based on “studying” the problem or the phenomenon. The end goal is the self-discovery of the facts and the connections between them. This can develop critical thinking, which is only characteristic to humans.

Today dynamic life requires changes in the educational policies, in order a modern educational system, which allows for expression of each student, to be build. There is a real need for rationalization of the leisure time of young people through activities, which develop their creative interests and abilities.

A review of the educational reforms worldwide, highlights a general trend towards the main aim of

natural-school education – the formation of natural science literacy (Hurd, 2000; Bartholomew et al., 2004; Hodson, 2006, 2008; Osborne & Dillon, 2008; Dillon, 2009).

Besides the specific characteristics of educational reforms in the different countries, a general trends and problems are being observed. Their discussion and coordination is in the focus of the work of international organizations involved in educational activities. Such an international project, sponsored by the European Commission with a duration of 3 years is “Chain Reaction”. Its purpose is to train science teachers to use an approach in which the students are performing real research (“learning by research” (IBSE)) [10].

This is completely understandable In light of the new strategy of the European countries, called “2020”, which focuses on the key areas of knowledge and innovation to achieve more sustainable economy and higher employment. It is guaranteed by the EU, which targets to be implemented at national level.

EG “Plovdiv”, which include the project in 2013 by PW “P. Hilendarski”, have traditions and continuity in terms of science education, held by qualified teachers, graduates of language schools. (It is among the few schools in the country associated with UNESCO by Decree of the State Council of the People’s Republic 1517 / 19.05.1983, the school was awarded with medal “Cyril and Methodius” - first grade for high achievements in educational activity. On 10.07.1988 year, the Presidium of the League of friendship between peoples in Berlin, awarded the school with medal for friendship between peoples, and on 19.05.2001 The Ministry of Education has

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recognized the school with an honorary award "Neophyte Rilski", for a comprehensive and highly professional activity in the system of public education. Decision of the municipal council, from the city of Plovdiv, on 15.05.2003, gave the high school the proud name "Plovdiv", as the highest honorary award from the city, for the significant contribution to the development of the city and its contributions to the citizens).

Our extracurricular activities, which accompanies and support the learning process, have a significant role in enhancing students' interest to the education. They contribute to the formation of civic personalities, associated with the values of a democratic society and are a form of prevention of risky behaviors and health promotion through health and civic education. They provide ample opportunities for the involvement of various stakeholders, partners and supporting structures - parents, NGOs, the media, civil society in education.

Over 95 % of graduates of EV "Plovdiv" continue their education in high schools in the first year after graduation, thanks to the exceptional performance of internationally recognized exams such as: SAT, TOEFL, DSD, Test DAF and others. Currently, about 180 alumnus are working in world universities in USA, UK, Germany, France, Canada and Japan.

Project "Chain Reaction" offers an interactive and entertaining training methods "learning through research" (IBSE), which is contributing to the professional development of science teachers from each participating countries. The teacher can organize a series of lessons in which students independently examine the proposed topics, in series of materials using applied resources and practical tests as scientific resources.

The seriousness of the phenomenon "free time" among the youth, objectively necessitates a concerted action to create a multipurpose model to attract young people and engage them in various activities carried out in school environments. The lack of these features among the younger generation puts the issue of missed educational impacts. N. Boyadjieva states that "much of the phenomenon free time" is riddled with extremely neuralgic points "in the education and socialization of today's young generation in the country" [1].

Overcoming these weaknesses is training and educating, which gradually is becoming a priority. It is the school, which has to become a desirable area

for exhibiting knowledge, skills and competencies of adolescents.

Project "Chain Reaction" is a good opportunity for students aged 14-16 years to have meaningful leisure time and work together on the proposed scenarios, forming their critical thinking skills and problem solving.

In their writings writers M. Andreev, D. Tsvetkov, Pl. Radev and others are describing the multiples "extra-organizational forms", "extracurricular non educational, organizational systems" or "external forms of education" [1,3,5] P. Petrov also pay attention summarizes that "in the system of organizational forms of training, extracurricular activities at school play prominent role" [2].

Generally, extracurricular activities, are targeted activities performed outside of school hours, but organized with the funds and resources of the school or the university. They also are targeted activities outside of school hours, which are organized by various educational institutions and NGOs, without using resources of the school in which they are trained [1-4].

E. Feldman and J. Matyasko bring concrete evidence that the involvement of students in extracurricular activities has a positive impact on their personal development. They pay special attention to the details of the extracurricular environment. They are certain that under these conditions youths develop number of specific skills, that are essential for their development (coping skills in atypical situations, communication with a wide range of people with similar interests, a sense of collective responsibility etc.), which cannot be utilized in the classroom. Young people get to know, prove and define themselves in a characteristic environment. Relationships change in the direction of cohesion and understanding in atypical conditions, which is a good opportunity to show students and others how to develop their skills. Particularly sensitive is the change of the communication and implementation of joint tasks. Gradually young people acquire the skills to complement each other's work and to flexibly allocate tasks, which leads to increased enthusiasm and motivation for new activities [7].

Our observations in the course of the implementation of the main tasks, during the execution of the project, have confirmed this. Despite the time constraints, insufficient information, etc., participants found ample opportunities for creative expression. The demand for and the use of additional sources of knowledge – Internet, encyclopedias, movies, dictio-

**Table 1.** Stages of the research process

Preliminary stage (What is this?)							
Subject			Goal				
Subject	Object	Expected Product	Task of the study				
Research stage (What?)							
Hypothesis			Proof Of Hypothesis				
State of the object and the subject of study in the theory	Status in the subject viewed in practice	Summary of hypothesis	Theoretical proof of concept	Experimental proof	Description of facts, processes	Experimental evidence	Conclusion
Final Stage (What is next?)							
Evaluation of the results, including and final verification of the hypothesis			Opportunities for the implementation of the results in practice		Guidelines for new research		
REPRESENTATIVE (formal) stages (“The Shell”!)							
Shaping	Binding	Reviews	Autoreference (summary, annotation) of the study (printing)		Protection of development (presentation and sale of research products)		

naries, books and others, not only confirmed and enriched the learning process for them, but they also unleashed their personal, emotional and intellectual potential. In their joint activity they showed an exceptionally high degree of motivation.

The summary of the main stages of research process is presented in Table 1 (1).

Project participants saw the result of their activity – the fruit of their joint efforts. The team of young scientists – physicists, were ranked first.

Research in recent decades from scientists, educators and psychologists definitely prove that “the formation of the whole person is done best in terms of its activity” [1,7,8]. The systems of The “research approach” is well distributed in highly developed countries, says noted academician. D. Damianov – Deputy Chairman of the BAS.

The world has changed and the education system, which is conservative, cannot react as fast in order to incorporate all innovations in it, said Academician. Kenderov Peter, who also noted that “lifelong learning” takes on a new meaning and is backing the research approach that does not force knowledge and learning, but instead motivates young people to experiment. According to him, this approach has already entered the Bulgarian educations system through Eu-

ropean projects [8].

We are proud that EG “Plovdiv”, which has celebrates its 55th anniversary, has more than 7,000 alumni who assert and develop the best, which they have learned from it.

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ПРИЛОЖЕНИЕ НА НАУЧНО-ИЗСЛЕДОВАТЕЛСКИЯ ПОДХОД В ОБУЧЕНИЕТО  
ПО ПРИРОДНИ НАУКИ В ЕЗИКОВА ГИМНАЗИЯ "ПЛОВДИВ", ГРАД ПЛОВДИВ

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(Резюме)

*"Важното за науката не е толкова откриването на нови факти,  
а откриването на нови подходи за тяхното обяснение."*

Sir William Henry Bragg

Националната програма за развитие на средното образование и пред училищна подготовка (2006-2015 година) отчита като първи основен проблем *"ориентираност на системата към запаметяване и възпроизвеждане, а не към провокиране на мислене, самостоятелност и формиране на умения"* [1].

Динамиката на съвременността налага промяна в образователната политика и изграждане на модерна образователна система, която да даде възможност за изява на всеки ученик. Наред със специфичните характеристики на образованието в различните държави, се открояват и общи тенденции и въпроси за решаване. Тяхното обсъждане и съгласуването им е във фокуса на работата на международни организации, ангажирани с активни образователни дейности. Един такъв международен проект, спонсориран от Европейската комисия с продължителност 3 години, е "Chain Reaction". Неговата цел е да обучи учители по природни науки в използването на подход, при който учениците да се включват в изследователска дейност (*"учене чрез изследване"* (IBSE)) [3].

Проектът "Chain Reaction" предлага интерактивно и занимателно обучение по метода *"учене чрез изследване"* (IBSE), което е и принос към професионално развитие на учители по природни науки от всяка една от участващите страни. Обучаващият може да организира серия от уроци, в които учениците самостоятелно да разглеждат предложените в материалите теми, използвайки прилагани и тествани в практиката научни ресурси [2].

В статията се описва работата и резултатите от нея на учителите Р. Калева - Леви (биология) и К. Кацарова (физика) от ЕГ "Пловдив", гр. Пловдив, която се включи в проекта през 2013 година чрез ПУ "П. Хилендарски".

Темите, по които е работено по време на организираното по този метод обучение са: Зелена светлина и Животоподдържаща система в Космоса. В предложената работа се описват наблюденията на учителите по отношение на резултатите от използването на изследователския метод в обучението по природни науки по отношение на дейността на учениците, тяхната активност, мотивираност и личностна ангажираност, както и постигнатите учебни резултати.

Смятаме че, тя представлява интерес, както за учители по природни науки така и за изследователи в областта на педагогическите науки.

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