

## THE PROJECT "GEOTHNK" – SEMANTIC PATHWAYS FOR BUILDING A SPATIALLY-THINKING SOCIETY<sup>1</sup>

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### BULGARIA

**ABSTRACT:** THE BASIC CONCEPTS AND IDEAS OF A NEW EUROPEAN PROJECT CALLED GEOTHNK ARE PRESENTED IN THE PAPER. IT FOCUSES ON EDUCATION IN NATURAL SCIENCES AND MATHEMATICS WITH STUDENTS OF ALL AGES. THE MAIN AIM OF THIS PROJECT IS TO ENHANCE SPATIAL THINKING THROUGH AN INNOVATIVE ICT-BASED APPROACH AND AN OPEN, COLLABORATIVE EDUCATIONAL ENVIRONMENT. THE IDEA IS TO OFFER A METHODOLOGICAL APPROACH WHICH ALLOWS INTERDISCIPLINARY ORGANIZATION AND SEMANTIC LINKAGE OF KNOWLEDGE.

**KEY WORDS:** GEOSPATIAL THINKING, STUDENTS, PROJECT, APPROACH, SEMANTIC PATHWAYS, OPEN EDUCATION, PEDAGOGY, LEARNING MODELS, AUTHORING TOOL.

<sup>1</sup><http://www.geothnk.eu/index.php/bg/>

## INTRODUCTION

**SPATIAL** thinking is a key ability which is developed in the process of education. Being able to think spatially is of crucial importance for the people working in the field of science but it is also substantial in everyday life. It is fundamental to take efforts to improve spatial thinking and to apply educational methods and approaches focusing on enquiry-based learning.

**GEOTHNK** is an European initiative which aims at promoting scientifically-based, technologically reliable framework with sustainable organization in order to develop new educational pathways in the traditional sectors of education and in informal teaching environment.

### 1. PROJECT DESCRIPTION

**THE** rationale of the project is to use effective open educational resources and good practices, to unite the efforts of many different organizations in order to develop a scientifically-based, technologically reliable European platform. New educational pathways will be built up and improved in the traditional educational sectors and informal teaching environments (Figure 1).



**Figure 1.** Schematic representation of GEOTHNK project

**THE** main objectives of the project are the following:

- 1. To improve spatial thinking using an approach based on innovative computer technologies and an open educational Internet environment.*
- 2. To propose a methodological approach that allows interdisciplinary organization and semantic relations of knowledge.*

**THESE** objectives will be achieved through a number of specific tasks [Kavouras et al., 2014 a]. One of the tasks is to build a pedagogical network that will introduce fundamental strategies for the development of an innovative educational approach for effective spatial thinking. Another task is to develop **GEOTHNK** educational pathways based on the

proposed network that will focus on the organization of fundamental training components (concepts, representational tools, thought processes and training activities), in accordance with the specific needs and requirements of each target group. An educational network will be created that will introduce key strategies for the development of an innovative educational approach for effective spatial thinking.

## 2. PARTICIPANTS AND ORGANIZATION OF THE PROJECT

**THE** European project **GEOTHNK** [ Kavouras, 2013 ], financed by the European commission programme Lifelong Learning, is a continuation of the projects LD-Skills and Pathway. The project consortium consists of 8 organizations from 6 countries: National Technical University of Athens, Greece; Ellinogermaniki Agogi, Greece; INTRASOFT International SA, Luxemburg; Association of Geographic Information Laboratories for Europe, the Netherlands; Casa Corpului Didactic Cluj, Romania; Shumen University, Bulgaria; Bundes ministerium für Unterricht, Kunst und Kultur, Austria and Stichting GeoFort, the Netherlands.

**THE** project started in 2013 and it will go on for three years. During the project freely accessible joint educational environment will be developed. The **GEOTHNK** platform [Kavouras et al., 2014 b] will allow access to different thematic resources and learning pathways. New educational pathways will be created. The educational components will be semantically connected with pertinent information to enrich the learning pathways. The participants will form rich semantic network to ensure dynamic structure that will help knowledge visualization and research. They will prepare a pilot presentation of the project approach and the tools of the user groups.

**THE** platform provides distribution of **GEOTHNK** products in a large scale so that it can reach the wider audience. It uses a systematic evaluation and validation approach of the proposed activities to determine their influence and analyzes these approaches through pilot programmes in various real life educational situations to test their efficiency.

**THE** project develops a methodological approach that will help learners apply spatial thinking and use purposefully spatial concepts in all disciplines of the curricula and on all training levels. This approach will help them understand the interdisciplinary character of fundamental spatial concepts. On the other hand, it will determine the coherence of the curriculum, it will reveal the interrelatedness of the disciplines and will provoke fundamental cognition in everyday life by improving the problem-solving skills of the target groups.

**SO** far the disciplines in the curriculum looked isolated, with no connection between them and they were often taught as a catalogue of separate terms. The various tendencies set by **GEOTHNK** allow cooperation with areas which cover three sector-specific European programmes, namely Comenius, Erasmus and Grundtvig.

**THE** target groups of **GEOTHNK** are schoolchildren, teachers, trainers at scientific centers, university students, teacher trainers and adult learners. **GEOTHNK** offers to schoolchildren the opportunity to take part in innovative learning activities in structured educational environment with extensions in the social and communicative networks: Facebook, Twitter, LinkedIn, etc.

**FOR** trainers at scientific centers **GEOTHNK** provides an easy access to build uplearning pathways for their students, an opportunity to make a virtual version of their didactic materials and share them with teachers and researchers in their field.

**GEOTHNK** offers to teachers, teacher trainers and university students educational environment for "signing in, sharing and activities" on an Internet-based platform and social networks where they can spread best practices and find mutual support. A modular approach and innovative ways that cross the boundaries between formal and informal training assist in combining a number of open educational resources in the classroom.

**FOR** adult learners (e.g. visitors at research centers, observatories, planetariums, etc.) **GEOTHNK** presents the possibility to participate in innovative training activities that are improved on the basis of successful formal and informal education, which is extended to social and communication networks. This group consists mainly of teambuilding participants, groups of people doing scientific research, students, etc.

### 3. BULGARIAN CONTRIBUTION TO GEOTHNK PROJECT

**THE** role of Shumen University team in **GEOTHNK** project is, on the one hand, to develop the ideas of the international project in national terms considering the specificity of the Bulgarian educational system and its resources. On the other hand, the fact that Bulgarians take part in the international project allows other European countries to use good Bulgarian pedagogical ideas and materials in the educational process. During the project the members of the team participate in the creation of educational materials for high-school and university students that are collected in a common repository of pedagogical materials. It is of key importance that the Bulgarian team acts as a national coordinator of the project activities in Bulgaria, such as teacher training and classes with university students [Vladev et al., forthcoming].

**THE** team organizes training and explanatory meetings in the whole country, thus it contributes to the wide promotion of the project ideas and materials. On the one hand, this increases the opportunities to choose from pedagogical resources of Bulgarian teachers and, on the other hand, it provokes them to break the limits of the traditional teaching methods and to apply new methods and resources.

**THE** Bulgarian translation of the project materials (educational materials, guides, questionnaires) provided by the team members additionally aids the fast and easy implementation and acquisition of the project ideas.

**A** significant function of the Bulgarian team is present in that international educational forums the results of good practices of teaching Bulgarian students mathematics and natural sciences. In many European countries natural museums play an essential part in teaching natural sciences.

**IN** teaching astronomy in Bulgaria National astronomical observatories and planetariums have a crucial role. There are six National astronomical observatories and planetariums in the cities of Bulgaria: Varna, Smolyan, Dimitrovgrad, Kardzhali, Gabrovo and Yambol. In the cities of Sliven and Haskovo there are astronomical classes at Municipal youth centers, and in Silistra there is a School observatory in one of the city high schools. These are the places in Bulgaria where there are extracurricular classes in astronomy during the whole year. Astronomy lectures are carried out in the star rooms of the planetariums

(sometimes they are called sessions because the stars are shown on the sky). Usually these lectures are on topics related to acquiring new knowledge. Apart from the lectures there are practical lessons and preparation for astronomical observations. The observation sites of the observatories equipped with small telescopes and binoculars are the places where the observation lessons are carried out. The majority of Bulgarian teachers of physics and astronomy include in their curricula school visits to the National astronomical observatories and planetariums. The experience gained from visiting these extracurricular astronomical educational institutions is presented in the **GEOTHNK** project as a good and successful pedagogical practice. In many countries the so-called Public observatories also aim at popularization of astronomy as a science. They could draw on the experience of their Bulgarian colleagues to assist and carry out astronomy lessons in their countries.

#### 4. EDUCATIONAL SCENARIOS

To fulfill the tasks set by the project the Shumen University team has developed 12 sample scenarios adapted for the Bulgarian conditions. Four of them are in the field of astronomy and can be used in the high school courses of physics and astronomy and extracurricular classes. These scenarios can be realized as astronomy classes at National astronomical observatories and planetariums and the Astronomical clubs organized in many schools. In the educational archives of each National observatory in Bulgaria there are intriguing and useful ideas, lesson plans for acquiring new knowledge and doing practical exercises in astronomy which were developed and carried out as observation lessons. The development of the package of astronomical scenarios aims at helping not only Bulgarian teachers but also teachers from other countries to make their lessons interesting, to achieve effective education and lasting knowledge. The scenarios also aim at provoking teachers to develop similar scenarios themselves for lessons on other topics in the astronomy curricula. Teachers of mathematics and natural sciences are increasingly using computers and the Internet nowadays. The development of each scenario in the project requires the use of new technologies – computers, scientific and educational resources on the Internet. This directive is followed in astronomical scenarios as well.

**The first educational scenario “Touch the Sun”** focuses on knowledge about the Sun, solar activity, work with a telescope when observing the Sun. It helps students prepare for the observation of Sun spots and for calculation of Wolf’s index of solar activity. The scenario is designed for students aged 15-18.

(<http://portal.opendiscovery.space.eu/eo-resource-view/774440>).

**The second scenario “Venus– Morning start and Evening star”** is designed for students aged 13-18. The purpose of this scenario is to expand the knowledge about the nature, visibility and movements of the planet closest to the Earth – Venus. Students observe Venus at dusk, just after sunset, with a telescope and register its proximity to the Sun in the sky and its shape –the phase of the planet on the date of the monitoring. Thus, they understand the movement of the inner planets, phenomena such as passages of planets on the background of the solar disk, as well as the nature of the planet, surrounded by dense atmosphere.

(<http://portal.opendiscovery.space.eu/eo-resource-view/774443>)

**The aim of the scenario “Milky Way – the backbone of the night”** is to build an image of the shape of our galaxy the Milky Way, about its structure and the objects in it: star clusters, nebulae and stars. It is suitable for students aged 15-17. (<http://portal.opendiscoveryospace.eu/eo-resource-view/774438>)

**“Lunar explorers” is a scenario** which gives an idea about the diversity of objects on the Moon surface – lunar craters, seas, mountains, valleys, etc., it also helps students to determine the size of large lunar objects. It is designed for students aged 15-17. (<http://portal.opendiscoveryospace.eu/eo-resource-view/774439>)

## CONCLUSION

**GEOTHNK** project is carried out by a large team of specialists in the field of natural and pedagogical sciences. During the realization of the project a community of teachers, students and adults is created. They teach and study using materials related thematically to different disciplines from various resources. In the process of training students develop critical thinking skills, including spatial. This is accomplished by the application of best practices for presentation, exploitation and visualization of geo-spatial information and its relation to other disciplines especially through the creation of semantic networks.

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