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XXV

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*EcoIst '17*

**Editors**

**Radoje V. Pantovic**

**Zoran S. Marković**

Vrnjacka Banja, Serbia  
12-15 June 2017

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**"TIMOK SCIENTIFIC TORNADO - TNT" - A MODEL FOR SCIENCE  
POPULARIZATION AND THE DEVELOPMENT OF COMPETENCIES  
THROUGH COOPERATION WITH THE STAKEHOLDERS**

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**ABSTRACT**

"Timok Scientific Tornado – TNT" is a complex project that is being implemented for five years in Eastern Serbia. The aim of project is to contribute the reform of the educational system by developing specific extracurricular models and activities for popularization of natural and technical sciences, increase the knowledge and motivation of students for further education in these areas, develop the skills and competencies of students and teachers, raise environmental awareness, strengthen cooperation between schools and the surrounding stakeholders. Project activities include realization of the Science Festival, the Night of the Researchers and various scientific exhibitions. Due to the great success of previous events of such kind and the constant increase in the number of participants and demonstrations it is expected that the programs of the TNT will become part of the annual work plans of primary and secondary schools, and that all municipalities in Eastern Serbia become participants in this program.

**Key words:** Scientific caravan, popularization of science, science festivals.

**INTRODUCTION**

Strategy for development of Education in Serbia and other strategic documents refer to the need for reforming education not only within schools but also through cooperation of schools and all relevant actors (stakeholders) in the region [1]. At the same time, the decline of students' motivation for the realization of the classical school curricula (especially in the field of natural and technical sciences) is noticed, accompanied by increased interest for various forms of extracurricular programs and activities. Schools are unable to meet these interests without cooperation with the other schools and the wide range of different stakeholders outside the schools: civil society organizations (CSO`s), various institutions and companies, the media and others. Formal school education does not substantially contribute to the development of students and teachers competencies, nor it opens enough space for innovative teaching methods, implementation of ICT, or creates linkage with the surrounding stakeholders. Schools are lacking well-equipped laboratories for conducting the experiments in the field of natural and technical sciences. At the same time, the Science Festival and the Night of the

Researchers are being realized in Belgrade and other major cities as similar type of programs, but they are inaccessible to the majority of students and teachers from Eastern Serbia.

The newly adopted Strategy of Scientific and Technological Development envisage promotion of science through campaigns and actions as one of the priorities. They will be implemented by the interested institutions and organizations of civil sector in order to ensure the encountering of students with new or innovative approaches to learning and mastering scientific methodology [2]. National Strategy for Youth in Serbia provides a range of activities in education and training of young people, the development of youth competencies in the process of lifelong learning, leadership development programs, youth activism support, and health promotion programs [3]. New course in development of the civil sector suggests that CSOs should strengthen their role and involvement in formal education in cooperation with schools, as well as their participation in non-formal education and lifelong learning.

Scientific caravan TNT is designed to gather all interested stakeholders in order to contribute to the solutions for problems of educational reform, the science popularization and the lack of youth activism, in order to meet new needs of students and teachers, and to help in implementation of strategic documents in the fields of education, science and youth activities in municipalities of Eastern Serbia. The project includes the preparation and realization of scientific events (the Night of the Researchers and Science Festival) and scientific exhibitions (in Bor, Zajecar, Negotin, Knjaževac). These scientific events are conducted through scientific demonstrations and experiments and presentation of diverse scientific achievements. Their main task is to promote education in the field of natural and technical sciences, affecting the increase of knowledge in these areas, to develop the skills and competencies of students and teachers, raise environmental awareness, strengthen partnership and cooperation between educational institutions and the surrounding stakeholders.

As an innovative and a partnership program of science popularization, this project contributes in solving various problems in the reform of education and science by linking them with other sectors (culture, environment, civil society), by connecting schools with their local and regional surrounding, contributing to professional orientation and providing support to talented students and peer educators.

## **MATERIALS AND METHODS**

Strategic documents relating to education, science, youth and CSOs were used as a base for designing Scientific caravan as an innovative model of education. Questionnaires for different target groups and reports of organizers (containing the data on number of participants and visitors, the number and variety of demonstrations, quality activities, degree of media coverage) were conducted as the evaluation tool for the planned targets of each activity. In an adaptive manner, monitoring and evaluation results are annually used for further improvement of the program.

## **RESULTS AND DISCUSSION**

The project "Timok Scientific Tornado - TNT" has been implemented in the municipalities of East Serbia since 2012. The project is supported by the Ministry of Education, Science and Technological Development, Ministry of Agriculture and Environmental Protection, Ministry of Youth and Sports and the Center for the Promotion of Science through call for support of educational activities for CSO's. Around 60 institutions from the area of education, culture, professional, public and commercial, as well as other CSO's from East Serbia are included in the realization of this project [4]. Schools from Bulgaria and Romania also joined the project.

The project objectives are:

- development of applicable model for extracurricular activities of students and teachers in the field of natural and technical sciences;
- promotion of peer learning and active participation of students in the education of the wider population and the science popularization;
- fostering the potentials and talents of students;
- service of professional orientation and strengthening the motivation of young people for further education in the field of natural and technical sciences;
- promotion of mutual school partnerships with the participation of CSOs and other institutions and organizations;
- improving the competencies of teachers and students: work planning, organization and learning, interaction, thinking and reasoning skills, competences for lifelong learning, communication, work with data and information, problem solving, cooperation, environmental competencies, and individual competencies for health care, life in a democratic society, aesthetic and entrepreneurial competence, organizing, processing and presentation of data, secure electronic communication, using social networks for educational purposes, readiness to accept new ICT technologies, etc.
- improving the competence of teachers for teaching-oriented learning, monitoring trends in natural and technical sciences, application of the principle of obviousness and applicability (because of it's importance to improve the content and outcomes of the educational process, which is base orientation of modern education). Special support is achieved by positioning teachers in the role of facilitators that guide the process of learning to students with diverse interests and abilities.
- promotion of additional extracurricular learning programs: Green package, the Danube Box, and similar.

Primary target groups are students of preschool, primary and secondary schools in the municipalities of Bor, Zaječar, Negotin, Kladovo, as well as their teachers. Secondary target groups are students and university professors as promoters of natural sciences and motivators for development of the innovative capacity of children and young people, scientific experts, experts from cultural and other professional institutions, experts from non-governmental organizations dealing with education, company

representatives that may present their technologies and innovations. Target groups are also the visitors of scientific events as well as media through which the additional objectives of the project are achieved.

Innovativeness of the project is reflected in the correlation of advancement in knowledge, skills and competencies of different target groups (students, teachers, various experts). Through a collaborative and interactive learning student/teacher, pupil/student and teacher/ teacher the final selection of themes, experiments, demonstrations and presentations is achieved, as well as a multidisciplinary approach to specific topics. Other institutions and organizations from the local community and beyond show experiments, demonstrations and presentations of their working programs with youth, while and high schools and faculties perform practical experiments, demonstrations and presentations, promoting their educational profiles for the purpose of professional orientation. In particular, the inventiveness of the project is reflected in the fact that all the mentioned objectives are integrated into one unit which provides a synergy of these effects.

#### **Main groups of project activities:**

**1. Preparation of the organizers, educational institutions and other institutions and organizations from local communities for the realization of scientific events** - selection of topics for scientific events, determination of the manner for selection of the participants, methods of presentations at scientific events, proposing the list of institutions and organizations that will participate in scientific events.

**2. Preparing students to perform experiments, demonstrations, presentations at scientific events** - the implementation of preparatory workshops in partner institutions (Pictures 1 and 2)



**Pictures 1 and 2.** Preparatory workshops for students and partner institutions

**3. The realization of scientific events** - The Night of the Researchers in Bor and Zaječar, the Science Festival in Bor, Zaječar, Negotin and Knjaževac, where students are the main performers and promoters of science (picture 3). Each year, festivals are complemented with additional contents: a scientific theater "SCINEMASCIENCIA",

CPS's program "Planetarium", etc. Through interactive contents and scientific quizzes the active participation of visitors in scientific activities is ensured (pictures 4 and 5).



**Pictures 3-5.** Scientific Festivals – students as a science promoters and visitors as active participants

**4. Realization of scientific exhibitions in Bor, Zaječar, Negotin and Knjaževac**  
(pictures 6-8)

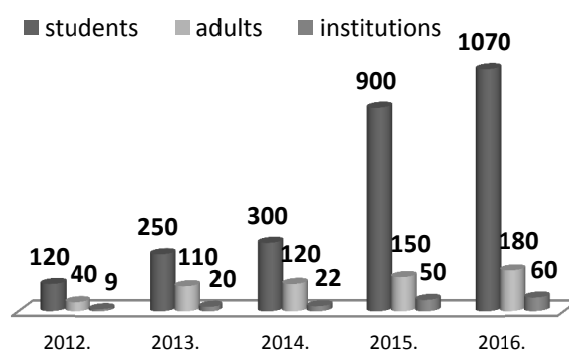


**Pictures 6-8.** Scientific exhibition "Secret world of metals and minerals" at Museum of Mining and Metallurgy in Bor

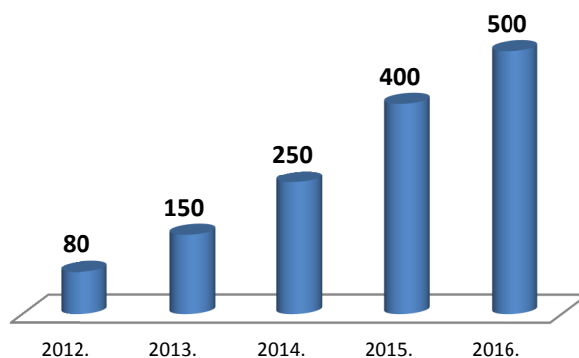
**5. Media campaign** – project activities are followed and reported by all media in East Serbia, as well as through internet portals, networks and sites.



**6. Project monitoring, evaluation and reporting** - monitoring and evaluation activities were done by interviewing participants and visitors, and at the meetings of the project team. Based on the evaluation of the participants and visitors program activities were estimated to be very successful. On the base of comments and suggestions derived from the questionnaires project is being upgraded each year. The comparative analysis of festivals from 2013-2016. showed that the best rated aspect of festival was the *development of cooperative relations between the stakeholders*. Each year the number of participants in project, as well as individuals and institutions, is enlarging (Figure 1), so as the number of experiments, demonstrations and presentations (Figure 2). Project activities have spreaded from Bor to Zaječar and Negotin, and the cooperation with educational, scientific, cultural institutions, CSOs and businesses in these local communities has been established.



**Figure 1.** Change in the number of participants on scientific manifestations from 2012 to 2016.



**Figure 2.** Change in the number of experiments, demonstrations and presentations on scientific manifestations from 2012 to 2016.

## **CONCLUSION**

The complexity of the project objectives has resulted in the multiplicity of the project results, starting from the development of specific forms of education in the science popularization that allowed the improvement of students and teachers skills and competencies, increased the student's level of knowledge and motivation for learning, developed cooperation between educational institutions and other institutions in local communities and beyond. Besides, through these programs talented students are given the special support in education, science, skills of practicing science have been combined, different types and departments of high schools and universities have been promoted, the use of existing or created teaching materials and peer learning has been promoted. A motivation of educational and other institutions (especially the teaching staff and students) for the continual improvement of science promotion through Scientific caravan TNT in the future has been increased. The plan is to expand the activities to other interested schools and municipalities in Eastern Serbia, and to establish international cooperation in the realization of the Science Festival.

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