

Overview of Erasmus+ NetChem project: ICT networking for overcoming technical and social barriers in instrumental analytical chemistry education

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Abstract

The paper briefly presents goals, main activities, challenges and outcomes of the NetChem project (<http://www.netchem.ac.rs/>) that was co-funded by the Erasmus+ Programme of European Union (project no. 573885-EPP-1-2016-1-RS-EPPKA2- CBHE-JP). The project has been started in October 2016 and with extension lasts until April 2020. Western Balkan region has been targeted by upgrading capacities for education in environmental and food analysis of Albania and Serbia in cooperation with partners from France, United Kingdom and Czech Republic. Dedicated NETCHEM platform and SQL database were created to improve the cooperation and educational capacities of Higher Education Institutions (HEIs) involved.

Keywords NETCHEM, open education, continual professional development, remote access to laboratories

Rationale behind the project

Due to the low economy in Western Balkan region, investments in expensive instrumental equipment needed for education in environmental and food-related fields are not sufficient. Such a situation influences not only the sector of education, but also the sectors of food and environmental quality control. Young professionals need more time for development of their skills after the studies and additional investments are needed in their specific education. The Erasmus+ project named "ICT networking for Overcoming Technical and Social Barriers in Instrumental Analytical Chemistry Education" (NETCHEM) addressed important Western Balkan priorities related to Environmental protection and Education, namely Learning and teaching tools, methodologies and pedagogical

approaches including outcomes and information and communication technology (ICT)-based practices (Official Gazzete RA No. 80/2015; Official Gazette of RS, No. 55/05 and 71/05; Official Gazzete RS No. 107/2012; Official Gazzete RS No. 88/2017, 73/2018, 27/2018, 67/2019 and 6/2020). Main goals of the project were to improve technical capacity of the involved HEIs from Serbia and Albania (in total four universities from Serbia and 2 universities from Albania) with help of 3 EU universities and other partners form EU and local SMEs to apply and promote technology enhanced learning and mutual cooperation.

Project activities and results

The main outcome of the project is the NETCHEM platform, <http://netchem-eu.com/home.html> that has been established at the University of Niš, project coordinator. The platform consists of three parts:

- SQL based system for EFSC data collection,
- Focal point for web accessed remote instrumental analytical laboratories (WARIAL) and
- Open education resource (OER)- a Moodle platform for various teaching materials sharing.

The target audience are HEIs' teachers, researchers, students and regional professionals. Life-long learning opportunities for HEIs' teachers and professionals are promoted and established. Also, distance education and virtual mobility of students within universities, overcoming technical and social barriers between Partner and EU Countries is made possible.

A survey conducted at the beginning of the project amongst the Serbian and Albanian HE Institutions, showed the following:

- The training of the teachers for using remote desktop software, web conferencing software, Moodle platform or Learning Management Systems (LMS) was needed.
- Practical skills development in work with analytical instruments and training in solving complex analytical problems are needed. Students would like to have more experience in learning by doing during their education.
- Also regional professionals expressed their need for training and wish to participate in various continual professional development courses (CPDs).

More detailed results of this survey are published at the project web site <http://www.netchem.ac.rs/documents/send/35-outputs/754-prep-1-2-report-on-pc-practice-in-using-oer-and-warial-pdf> (Adamov et al., 2017).

Main project activities were a) to deliver training to the university staff for use of massive open online courses (MOOC) platform and established WARIAL network b) to create SQL database at University of Niš c) to develop, modernise and deliver various lectures for PhD and MSc courses and create and deliver CPD courses and d) to target broad audience in the region by various dissemination activities.

Training of the university staff

After the purchase of the equipment for the NETCHEM platform establishment, the partner country (PC) university staffs were trained in the United Kingdom, France and the Czech Republic. PC HEIs delegates visited laboratories with modern analytical instruments at first hand; we're able to take part in staff development/updating activities in partner institutions. That contributed to staff knowledge improvement which was shared with colleagues at home institutions upon return. Basis for development of closer academic ties between institutions is established. After the initial training, the joint event was organised in Serbia to transfer the knowledge to colleagues from the region.

Creation and Implementation of SQL based system for EFSC data collection

Relational database (SQL type) tool is used for development of user-oriented, WEB accessible data collection, designed as professional OER aimed for students and stakeholders interested in the field. It includes professional's Forum for interactive discussions on the topics (threads) (<http://forum.netchem-eu.com/>) and Data collection of various entities on which discussions can be attended to (<http://database.netchem-eu.com/>). Registration (Sign up) of new User is administration-free and welcome to everyone with the username (personal or business e-mail) and user-defined password.

Development and delivery of courses via NETCHEM platform

In total 40 MSc courses, 17 PhD courses and 16 CPD courses were (re)designed by modernization of selected lectures. Their content is freely available at NETCHEM platform (<http://netchem-eu.com/home.html>) under subtitle Moodle (<http://mdl.netchem.ac.rs/>). New interactive teaching and learning materials are provided. Students have wider possibilities to learn, while teachers also can use them to develop flipped lessons, remote lectures, WARIAL invited lectures on certain topics that are missing in own chairs, etc. The content of courses is directly or indirectly linked to the fields of instrumental analysis in environmental and food quality. Gas chromatography, liquid chromatography, atomic absorption spectroscopy, UV VIS spectrophotometry and other techniques (XRF, TOC, sensory techniques, microscopy, various sample preparation, electrochemical techniques) are covered by developed materials. Electronic Catalogue of courses is available on the link: <http://netchem.ac.rs/documents/send/324-published-documents/1699-catalogue-of-modernized-courses-netchem-pdf> (Anđelković et al., 2019). It is expected that this facilitate dialogue in between the partners, easier education exchange, introducing guest lecturers among partner universities, etc.

Case studies incorporated in teaching material, deal with water, sediment, food, landfill leachates, fuels samples and are focused on pesticides, metals, polyaromatic hydrocarbons, secondary biomolecules. Furthermore, laboratory quality control procedures, monitoring activities and technological applications are presented.

When it comes to remote lectures, the “virtual” offer is defined by each partner. (<http://netchem.ac.rs/remote-access>). At the same project link, <http://netchem.ac.rs/remote-access>, via sub-link <http://netchem.ac.rs/documents/category/205-remote-access-laboratory-giuides> it is possible to see and download lecture guides of all available lectures from NETCHEM network. However, still challenge of organizing sessions, finding free time and space for delivering such lectures is an issue and the easiest way is to apply it within the institution. If well planned in advance, it can be utilized also among different institutions. Briefly, students' impressions were very positive. Last but not the least project outcome is training of the teachers in terms of better defining courses outcomes and using a variety of new teaching tools. Even specialized continuous professional development course related to this topic was developed within the project.

Presenting the results of the NETCHEM project to the professional and general public

Project results were communicated to the professionals in Western Balkan region and to the general public. Numerous workshops and Open days at each PC University, with near 1200 participants, were organized. Discussions with representatives of enterprises were used to tackle the future needs of active inclusion of companies into education. One Summer school was organized and one Center for Professional Development was established at the Faculty of Science and Mathematics, the University of Niš, Serbia.

The project contributed to modernization of Serbian and Albanian HEIs. Established ties should further contribute to internationalization strategies. Learning and teaching innovations in every day educational practice were introduced. Relevance of higher education for the labor market and society is highlighted in the public. Contacts established usefulness and quality of achieved results and outcomes give motivation for future collaborations as well as the exploitation of the NETCHEM platform and SQL database after its completion.

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Compliance with Ethical Standards - Disclosure of potential conflicts of interest

Conflict of Interest: The authors declare that they have no conflict of interest.

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