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Slovenian Chemical Society

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## Chemical Society Annual Report to the EuCheMS Division of Chemical Education for 2019-2020<sup>1</sup>

### 1. Abstract

There were no official changes in national educational policy in Slovenia in the last year except the project that is currently going on can suggest some guidelines for future changes. But discussions for changing lower and upper secondary school chemistry national curriculums are starting. KemikUm carried out some activities for primary, secondary and university students before COVID-19 lock down in March 2020. As in previous years a Commission for Chemical Education of Slovenian Chemical Society cooperates with ZOTKS, an organisation that organises chemical competitions for primary and secondary school students. Some papers about chemical education research were published in Acta Chimica Slovenica. Division of chemical education in the Slovenia chemical society is organising the 9<sup>th</sup> Eurovariety conference in 2021 in Ljubljana.

### 2. National educational policy

There were no changes in national educational policy in Slovenia in the last year regarding chemistry education. A project (<https://www.zrss.si/objava/projekt-na-ma-poti>) supported by the European Structural and investment funds ([https://www.eu-skladi.si/?set\\_language=en](https://www.eu-skladi.si/?set_language=en)) Slovenian Ministry of Education, Science and Sport (<http://www.mizs.gov.si/en/>) led by National Education Institute Slovenia (<https://www.zrss.si/en/>) in cooperation with three major Universities in Slovenia (University of Ljubljana (<https://www.uni-lj.si/eng/>), University of Maribor (<https://www.um.si/en/Pages/default.aspx>) and University of Primorska (<https://www.upr.si/en>) who educate science teachers for primary and secondary school try to implement scientific literacy development activities into the curriculums from kindergarten to upper secondary school is still running. This could lead to the possible changes of national curriculums and policy in the near future.

However, also a national group for reforming national chemistry curriculums for lower and upper secondary school is formed and a few online zoom meetings were held. According to

<sup>1</sup> July 2019-July 2020, all levels of chemistry education: primary, secondary schools, universities, LLL, general and vocational education.

the analysis of national curriculums the reform will be done in the next few years. The exact plan is still unknown.

Because of the COVID-19 situation from March 2020 most of the students (except last years of lower and upper secondary school) finished the school year with distant learning. What will happen in September is still unknown, when the new school year starts.

### 3. Events in chemical education

In the period from July 2019 to June 2020 KemikUm also organised a few workshops (all before March 2020) for primary and secondary students, such as: »*KemikUm doing research*« (hand warmers; tattoo colours, essential oils, fungus' chemical structure, plastics) »*KemikUm solves crimes*«, »*KemikUm molecular astronomer*« and »*KemikUm drives on methane*«.

All other workshops were postponed due to the COVID-19 situation; also the call for lower and upper secondary school students for develop experiments, on the greenhouse effect and global warming.

### 4. Activities of the National Chemical Society

Commission for Chemical Education of Slovenian Chemical Society cooperates with ZOTKS, an organisation that organises chemical competitions for primary and secondary school students. In cooperation with Faculty of Chemistry and Chemical Technology (University of Ljubljana) they also prepare secondary school students for Chemical Olympiad.

### 5. Publications

Slovenia Chemical Society publishes SCI journal Acta Chimica Slovenica ACS (<http://chem-soc.si/acta-chimica-slovenica>) – four issues per year. There is also a section Chemical Education Research in the journal and from the last report three papers were published:

(1) **Assessment of the 14- and 15-year-old Students' Understanding of the Atmospheric Phenomena** by *Janja Majer, Miha Slapničar* and *Iztok Devetak* (Acta Chim. Slov., 2019, 66, 659–667) is focused on the identification of understanding of atmospheric pollution phenomena such as acid rain, global warming, ozone layer depletion and photochemical smog among grade 9 lower secondary school students (aged 14 to15), in all Slovenian regions. The research involves the development of a three-tier multiple-choice diagnostic test entitled the Atmospheric Pollution Phenomena Diagnostic Test (APPDiT). APPDiT is a 15-item diagnostic test comprising items for assessing students' understanding and self-confidence of atmospheric pollution problems. The results reveal that the majority of the participants demonstrated a lack of knowledge or misconception about atmosphere pollution since the overall success rate on the APPDiT was 39.6%. In particular, only 36.7%, 5.1%, 42.7% or 19.1% of the students have adequate knowledge regarding understanding of the formation, consequences, and strategies to reduce acid rain, global warming, ozone layer depletion and photochemical smog, respectively. This shows a substantial students' knowledge deficits related to atmosphere pollution at the end of the compulsory education in Slovenia.

(2) **Demographic Characteristics of Chemistry Teachers in Croatia Affecting the Use of Pre-laboratory Activities in the Classroom** by Snježana Smerdel and Meliha Zejnilagić Hajrić (*Acta Chim. Slov.* 2020, 67, 435–444) discusses the pre-laboratory activities that are designed to focus the attention of students on some aspects of the experiment they are pre-paring to do during the week. Previous research has found that such activities reduce the cognitive load in laboratory time and tend to increase the efficiency of students' laboratory work. This research aims at comparing the importance of demographic characteristics affecting the teachers' use of pre-laboratory activities in a chemistry class. In the frame of the quantitative survey research, an online questionnaire was completed by 166 chemistry teachers from all regions in Croatia. In pre-laboratory sessions, the teachers most commonly used a pre-lab discussion and pre-lab worksheets whereas computer simulations were represented the least. Three characteristics affecting the teachers' use of pre-laboratory activities in chemistry classes were their gender, age and teaching subjects. The teachers' education, teaching experience and school types were nonsignificant characteristics.

(3) **Students' Achievements in Solving Authentic Tasks with 3D Dynamic Sub-Microscopic Animations About Specific States of Water and their Transition** by Miha Slapničar, Valerija Tompa, Saša A. Glažar, Iztok Devetak and Jerneja Pavlin (*Acta Chim. Slov.* 2020, 67, accepted for publication) presents the differences in the justification of the selection of 3D dynamic submicroscopic-representation (SMR) of the solid and liquid states of water, as well as the freezing of water presented in selected authentic tasks. According to students' achievements in solving these tasks at different levels of education, their explanations were identified. To explain in greater detail how students attempted to solve the authentic tasks, an eye-tracking method was used to identify the differences in the total fixation durations on specific areas of interest at the specific SMRs between successful and un-successful students in three age groups. A total of 79 students participated in this research. The data were collected with a structured interview conducted with students when solving three authentic tasks displayed on the computer screen. The tasks comprise text (as problem and questions), macro-images (photos of the phenomena) and SMRs of the phenomena. The eye-tracker was also used to measure the students' gaze fixations at the particular area of interest. The results show that successful students' justifications for a correct SMR include macroscopic and sub-microscopic representations of the chosen concepts. Along different stages of education, the selection success increases and sufficient justifications comprise the sub-microscopic level. It could be concluded that there are mostly no significant differences between successful and unsuccessful students within the same age group in the total fixation duration at the correct SMR. Further studies are needed to investigate the information-processing strategies between high and low achievers in solving various authentic tasks comprising SMRs and those that integrate all three levels of the representation of chemical concepts.

## 6. Liaison with the chemical industry

Pharmaceutical industry in Slovenia (Lek and Krka) sponsor chemical competitions organised by ZOTKS (see above).

## 7. International and European initiatives

Members of the Commission for chemical education participated at: Eurovariety conference 2019 (Prato, Italy, 2019), ESERA conference (Bologna, Italy, 2019), ESERA summer school (online organised by Oxford University, UK, 2020) and ECRICE conference (Israel, 2020).

Members of the Commission for chemical education and other commissions in the Slovenia chemical society are organising the 9<sup>th</sup> Eurovariety conference in Ljubljana, University of Ljubljana, Faculty of Education, 7 - 9 July 2021 (<http://www.eurovariety2021.si/>).

#### 8. Other events and activities

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#### 9. Name of delegate and deputy

Delegate: Dr Iztok Devetak

Deputy: Dr Vesna Ferk Savec

#### 10. Contact details of delegates.

##### **Dr Iztok Devetak, Prof. for Chem. Ed.**

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