Chemistry dissemination and assessment using ECTN EChemtest®

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During the last General Assembly (GA) of the European Chemistry Thematic Network (ECTN) held in Krakow (http://ectn.eu/about-us/what-is-ectn/) on April 12 one of us (AL) discussed with Prof. Izabela Nowak (President of the Polish Chemical Society (PCS)), Prof. Artur Michalak (Vice President of PCS and representative of the Krakow Jagiellonian University at ECTN) and Nineta Hrastelj (General secretary of EuChems and ECTN) on the possibility of extending EChemtest® e-tests to EuChemS members. The discussion focused on the Prosumer (Producer-Consumer) [1] model developed by the ECTN Virtual Education Community (VEC) committee to the end of equipping Higher Education Institutions (HEI)s with Test Centres (TC)s suited to run EChemtest® Self Evaluation Sessions (SES)s for carrying out their Academic activities (such as inter University mobility, students' admission to Bachelor and Master studies and Thesis, students' dispersion reduction, thesis subject selection). In particular, it was pointed out how such model could be used by EuChemS member societies for improving the Image of Chemistry, disseminating Chemistry competences and issuing Individual Proficiency Certificates (IPC)s. It was also pointed out that EChemtest® is a cloud tool designed for evaluating the level of competence on core Chemistry contents (as defined by ECTN under several LLL (Life Long Learning) European projects in the period 1996-2015) and that EChemtest® TCs are trained (the VEC runs at least one in person training event a year at the ECTN GA and, when appropriate, also remote training sessions are delivered) to guarantee a high level e-testing standard. In addition, as further detailed below, several TCs have been established at several European Universities member of ECTN and have received a specific training on the TC mission and activities. It was also pointed out that, after passing an EChemTest® Self Evaluation Session (SES) at one of the mentioned TCs, any person can get from the ECTN Agency an IPC for his/her personal use (e.g. employment and/or promotion, etc.).

During the discussion held in Krakow it was also pointed out that, as shown in more detail in item 2 of Figure 1, the TCs operating at HEIs located in different parts of Europe (and outside Europe) did run, in the years 2017 and 2018, more than 2000 SESs per year in General Chemistry (GC1 and GC2), Analytical Chemistry (AC3), Biological Chemistry (BC3), Chemical Engineering (CE3), Inorganic Chemistry (IC3), Organic Chemistry (OC3), Physical Chemistry (PC3) and Conservation Science (CS4). Special emphasis was given to the SESs run by the Jagiellonian and Milano Universities (see http://services.chm.unipg.it/ojs/index.php/virtlcomm/article/view/208) which assess every year the Chemistry competences of large cohorts of students using different Q&A Libraries and were used also for calibrating the correspondence between scores obtained and evaluation. Special emphasis was also given to the use of EChemtest® made by Krakow for Chemistry dissemination at Schools through European contests in which several hundred students from different EU countries compete using the Q&A Library "Chemistry for everyday life". On this Prof. Livia Simon Sarkadi (attending the GA as member of the ECTN Administrative Council while being at the same time member of the EuChemS Executive Board and President of the Hungarian Chemical Society) commented "EuChemS, is truly interested in disseminating Chemistry competences and you should illustrate the potentialities of EChemtest® to it".

For this purpose, at the beginning of September in parallel with the 12th Computational and Theoretical Chemistry (CTC) Conference of the EuChems homonymous division (CTC EUCO 2019, Perugia Sept 1 - Sept 5 a), a parallel Open Molecular Science Cloud (OMSC) Workshop was held at the Department of Mathematics and Computer Science of the University of Perugia. During the Workshop on Tuesday September 3 afternoon various EChemtest® training events were run. The afternoon started with an introduction by *A. Laganà* on the evolution of EChemtest® in the last five years. As shown in item (1) of Figure 1 below (to be presented as a slide before the next General Assembly of EuChemS in Bucharest on October 3-4) the number of accredited EChemtest®

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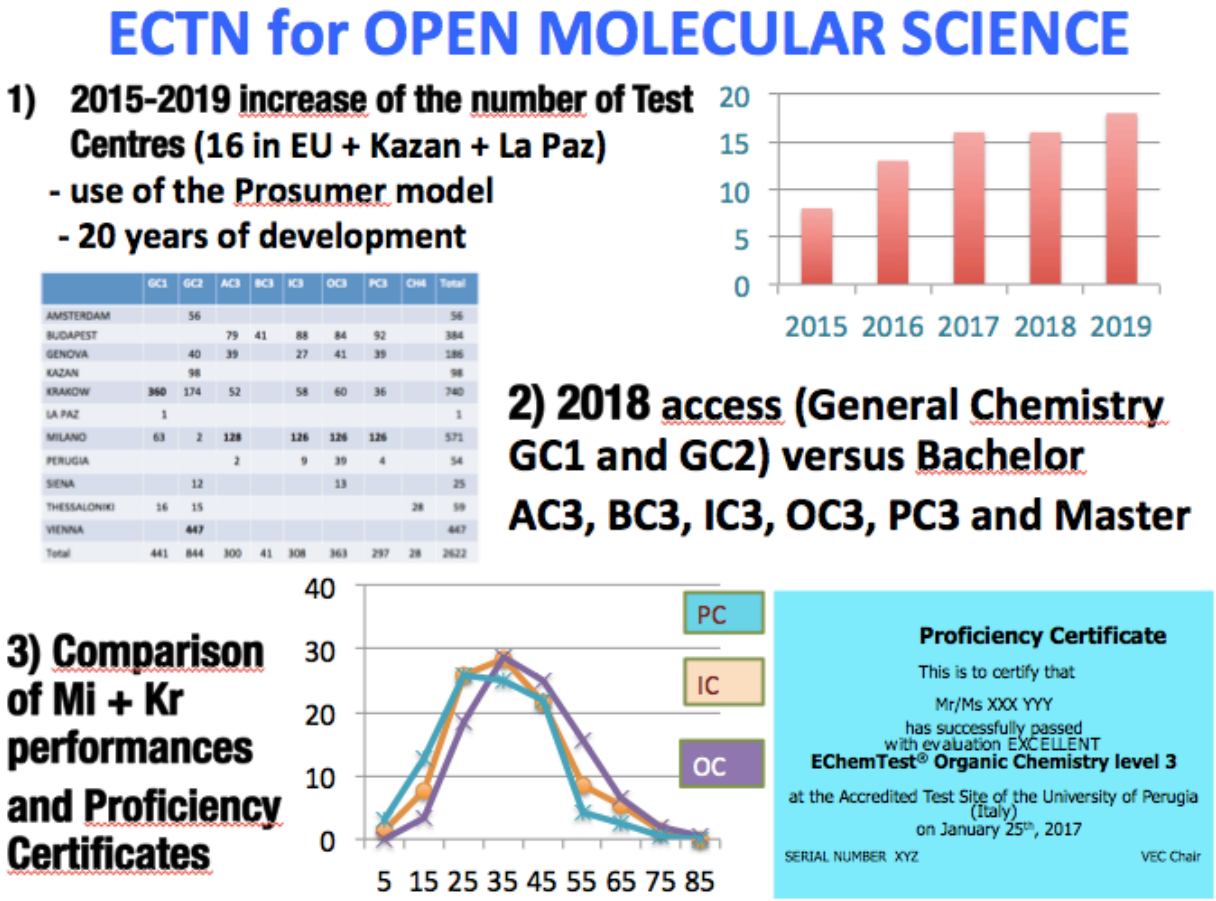
TCs has doubled from 8 to 16 in Europe and now counts also two non EU ones: Kazan (Russia) and La Paz (Bolivia). Thanks to the use of the LibreEOL software developed by *O. Gervasi* (to replace the Question Mark Perception commercial product) and the adoption of the already mentioned Prosumer model, the Universities are able produce further Questions and Answers (Q&A) for the various EChemtest® Libraries and at the same time use them for their own Academic duties. In doing so the Universities gain credits when producing Q&As and running SESs for third bodies while accumulate debits when running SESs for their own Academic activities. This reduces significantly the EChemtest® operational costs (through debits offset by credits) and can produce incomes that ECTN uses for supporting Universities when carrying on VEC activities.
Item (2) of Figure 1 shows that among the over 2600 e-tests run in the year 2018 (with an increase of about 10% over the previous year) General Chemistry level 1 and 2 (University access and first year anti dispersion activities) total about the same number of SESs as the Analytical, Biological, Inorganic, Organic, Physical Chemistry level 3 (Bachelor activities) altogether.
Item (3) of Figure 1 shows that the performances of the students of Krakow and Milano (the two more active Test Centers of EchemTest®) peak clearly between 25% and 35% supporting the use of the following qualifications (Pass>35, Good>50, Excellent>75) for the issuing of the relevant IPCs shown in the rhs screenshot.



	GC1	GC2	AC3	BC3	IC3	OC3	PC3	CH4	Total
AMSTERDAM		56							56
BUDAPEST			79	41	88	84	92		384
GENOVA		40	39		27	41	39		186
KAZAN		98							98
KRAKOW	360	174	52		58	60	36		740
LA PAZ	1								1
MILANO	63	2	128		126	126	126		571
PERUGIA			2		9	39	4		54
SIENA		12				13			25
THESSALONIKI	16	15						28	59
VIENNA		447							447
Total	441	844	300	41	308	363	297	28	2622

FIGURE 1 – *Panel 1: increase in the number of Test Centres in the years 2015-2019; Panel 2: number of Self Evaluation Sessions per Library in the year 2018; Panel 3: (lhs sub-panel) plot of the per cent fraction of the marks in PC, IC and OC Libraries in the year 2018; (rhs sub-panel) Individual Proficiency Certificate model.*

The OMSC Workshop continued with a training activity run by *S. Tasso* (the author of the distributed repository management software G-Lorep) with the participation of *A. Laganà* (the author of the Learning Objects (LO)s relevant to Chemical Reactions used for that purpose) and *M. Alcamì* the Chair of the Erasmus+ Theoretical Chemistry and Computational Modelling (TCCM)

Master. During that event the participants were trained on searching, downloading, modifying and re-using the G-Lorep LOs of the Molecular Science (MS) community.

Next *O. Gervasi* (the author of the used OMSC e-test manager LibreEOL) again with the participation of *A. Laganà* and *M. Alcamì* run another training event during which the participants were taught how to manage the Echemtest® Self Evaluation Sessions (SES)s on a given Test Centre (TC) by defining the e-test takers, choosing the desired library, working out the e-test outcomes, etc.

Finally, *S. Tortorella* (the coordinator of the Italian Chemical Society committee for Chemistry dissemination) showed how to disseminate Chemistry knowledge using Echemtest® sessions on "Chemistry for everyday life" (the above mentioned library developed by *A. Michalack* and *K. Szczeponek* at the University of Krakow).

REFERENCES

1] A. Laganà, O. Gervasi, S. Tasso, D. Perri, F. Franciosa, The ECTN Virtual Education Community prosumer model for promoting and assessing chemical knowledge, Lecture notes in Computer Science 964, 533-548 (2018))

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