

AN EXTENSION OF THE ECTN VIRTUAL EDUCATION COMMUNITY ECHEMTEST PROSUMER MODEL TO HIGH SCHOOLS

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ABSTRACT – The completion of the ECHEMTEST⁺ project of the VEC (Virtual Education Community) of the ECTN (European Chemistry Thematic Network) Association, has stimulated, among other initiatives, new efforts to extend the activity of the EChemTest[®] e-tests to Schools. In this paper we discuss in some detail the motivations and the background of such a move by referring to the Italian situation in which, thanks to the catalytic action of the Division of Chemical Education (DCE) of the Italian Chemical Society (SCI), such extension is being implemented. In particular, details are given about the synergy being activated between the Test Centre (TC) of the University of Perugia and the Technical Institute of Crotone aimed at establishing the first examples of both the Local ECTN Advisor (LEA) and the School based Accredited Test site (ATS-School).

AN INTRODUCTION TO THE ECHEMTEST⁺ PROJECT

ECTN, the European Chemistry Thematic Network (<http://ectn.eu/>) was launched in 1996 by A.K. Smith as a network of over 130 chemistry departments from all Member States of the European Union, Norway, Iceland, Switzerland, Bulgaria, Romania following the outcomes and recommendations of the Erasmus Congress “Chemistry in Europe” held in Lyon, in March 1995. Among the various activities carried out with success by ECTN since then [1], there was the development and the centralized use (coordinated by P. Mimero in Lyon with the side support of C. Manuali in Perugia) of the EchemTest[®] electronic tests at a few University Test Sites (TS) for various areas and levels of the European ECTN core chemistry knowledge [2]. About 20 years later it became apparent that the EU funding to Thematic Networks was about to end. For this reason, the ECTN Association (an Association established a few years earlier with the aim to carry out some of the activities of the network and already used to manage the evaluation and award of quality Eurolabels in Chemistry) discussed a position paper during the year 2014 at its General Assembly (GA) and Administrative Council (AC) held in Madrid and Krakow. The paper, proposed by the Virtual Education Community (VEC) committee, designed a sustainability plan for running EchemTest[®] at autonomous Test Centres (TC)s. Such plan was finally approved during the year 2015 as a project (called ECHEMTEST⁺) when wrapping up the EC2E2N2 (the latest at that time European project of the ECTN series) at the GA and AC meetings in Brussels, Ljubljana and Prague. At that time the situation of EchemTest[®] was looking quite critical: a switch had to be rapidly made from an academic (only) centrally managed system running e-tests at a few passive test sites paid on funds going to be terminated soon to a distributed

one able to offer an “in principle” unlimited number of self-sustained local TCs running a large number of Self Evaluation Sessions (SES)s. The mission of such TCs was to support autonomously both the selection of applicants to register to the first year and the admission of candidates to pass the final evaluation of the EuroBachelor® and Euromaster® studies. This effort showed to be extremely difficult to afford especially when trying to extend the scheme to non member Universities. As a matter of fact, according to the approved business plan, the consolidated flow of activities of EchemTest® were based on assets worth about 2 M€; the yearly cost for maintaining a central coordination centre holding the licence, managing the central server, curing the maintainance of the English Q&A master libraries, coordinating the runs of the SESs would amount to about 40 k€. At the same time the corresponding yearly cost of running each individual TC would amount to about 10 k€ minimum. On top of that one should add the cost of new Q&As creation, update and translations. In total the running costs would easily amount to more than a quarter of a million euros. For this reason it was necessary to develop and approve (2015, April 26) an alternative collaborative scheme to launch the special project ECHEMTEST+ in which the VEC committee engaged itself in reorganizing the EchemTest® activities by sharing the duties and related costs among the partners. The partners were chosen to be ECTN member Institutions (possibly bearing at least one Eurolabel) committed to act as the country (or linguistic area) TC (and/or Accredited Test Site (ATS)) which signed the related Memorandum of Understanding (MoU). In addition, a new Open Source e-testing software LibreEOL developed in Perugia [3,4] was adopted to replace the previously used e-test software (Question Mark – Perception (QM)) based on proprietary tools which was making it difficult to reuse edited material.

ECHEMTEST+ AND THE PROSUMER SCHEME

The adoption of the above-mentioned collaborative model, however, in the education sector meant much more than costs saving. The distinctive feature of knowledge is, in fact, its increase (with no limits both in quantity and in sharing) through learning processes. For this reason, modern economies are evolving rapidly towards “learning economies” in which the various steps involved in the elaboration and usage of both tacit and explicit technological knowledge as a common good are understood as a means for achieving innovation. It is one of the main, if not the most important, driver of economic growth, especially in the most developed economies [5]. As a matter of fact, the dynamism of learning economies is largely based on the education mechanisms enhancing a fruitful participation of knowledge users to its production according to the so-called **prosumer** model [6]. The prosumer scheme is, indeed, the model on which the VEC committee of ECTN has built its European system of TCs located at some member Universities aimed at promoting and assessing chemical knowledge [7]. In such scheme the TCs, after signing the relevant ad hoc agreement, can act not only as **users** of the EchemTest® SESs (to evaluate students to admit, reduce dispersion, assign research tasks, etc.) for their home University, but also as **producers** of such services on behalf of ECTN or other members and third parties. At the same time, ECTN itself can act not only as users of the EchemTest® SESs when relying on TCs to carry out dissemination and advertising activities as well as when using TC experts for

building libraries, but also as producers when coordinating and supporting central and TC activities. Finally Agencies and ATS act mainly as producers when procuring customers. Such combination of producer and consumer functions means also a richer attention to the production. The active role of the TCs enhances their involvement in activities aimed at correcting the Q&A database and the collaborative production of new ones and Learning Objects to support the interactive learning use of the e-tests. The second part of the year 2015 and the first part of the year 2016 was spent to implement the existing EChemTest[®] English libraries. The most difficult task was the reconstructing of the Q&As of some libraries out of paper document and unofficial copies. Then, in the second part of the year 2016, the first training event on the use of the LibreEOL and of the recovered version of the Q&As was held (starting in presence on September 16 and continued afterward with on line continued tutoring). From then, however, training events were held once or twice during each of the following years. During the next period of three years (2017-2019) the number of TCs doubled and various dissemination initiatives were delivered. Of particular importance was the reiterated use of the Chemistry for Everyday Life for students' contests in addition to the regular use of the EChemTest[®] libraries. At the end of the three year trial period, the evaluation of the sustainability of EChemTest[®] was highly positive and its scale up to a larger number of TCs was definitely established at the ECTN AC of Rome on Dec 6, 2019. Incidentally, this was the subject of an open meeting held last February 21, 2020 at the Milano Statale University arranged by its coordinator M. Ceotto. According to the figures of the year 2019, the Milano TC is the top user of EChemTest[®] SESs; they are systematically used (786, of which 711 declared as regularly completed) for selecting the students to accept for registering at their Chemistry EuroMaster course. The other big users of the EChemTest[®] SESs for selecting students to register are the TCs of Budapest, Vienna, Krakow, Kazan totalling respectively 401, 368, 246, 117 SESs run for their own purposes (with Budapest and Krakow totalling other 201 and 342 SES for dissemination purposes). At the meeting the discussion was lively and touched several aspects of the use of the SES. In particular it was made clear the fact that the EChemTest[®] SESs are not meant to evaluate the students with respect to their suitability to register at a given curriculum offered by the local University, because it is designed to evaluate the students with respect to the European Core Chemistry curriculum. The discussion concerned also the possibility of running the recently become available remote on line version of LibreEOL. Yet, the presence run was considered to be preferred because it allows a more complete evaluation of the candidates and, more specifically, the possibility of better detecting a possible misuse of the SES. It, indeed, gives little room to the fact that on line SESs (if properly managed) would be very useful in the cases of reduced mobility. As a curiosity it is worth pointing out here that the above mentioned day of the Milano meeting (February 21, 2020) was that in which the first case of COVID 19 was spotted in Milano and changed the point of view of many people on the on line use of the EChemTest[®] SESs.

ECTN-SCI COLLABORATION FOR ON LINE SES OFFER TO SCHOOLS

The sudden expansion of the COVID 19 pandemic did actually impact the ECTN activities much more than expected. This led first to the postponement of the 2020 GA

of ECTN (that was going to be held in presence at Perugia) to the first week of October when it was finally held on line. Among the issues brought to the attention of the member of the GA and largely accepted there was the possibility of giving high priority to the implementation of the on line version of the EChemTest[®] SESs. Another important novelty was the support given by the President of the Società Chimica Italiana (SCI), G. Guerra, and the Chair of the Division of Chemical Education (DCE), M. Venturi. The matter was, in fact, brought to the attention of the DCE Board that agreed to promote and support the on-line certification of chemistry competences developed by the ECTN Association and its more than 100 Chemistry Departments of the European Universities. The DCE supports the EChemTest[®] European standard procedures for the evaluation of chemistry competences through either a presence SES (attended at an ECTN TC) or an on-line remote one (through either a TC or an agency, a public institution, a company, or even at home). The EChemTest[®] evaluation provides the certification of the admissibility of a candidate to the courses of EU Universities (including the Italian ones), or application to a job of equivalent level of competence. The mentioned EChemTest[®] evaluation (which does not preclude the possibility of participating in the assessment procedures activated by a single university) is believed to offer a proper quality based selection of the applicants for the admission to:

- the University entrance (eurobachelor) level through the EChemTest[®] SES on Q&A libraries for General Chemistry 1 (GC1) and General Chemistry 2 (GC2) subjects.
- the University specialist (euromaster) level through the EChemTest[®] SESs on Q&A libraries for Analytical Chemistry (AC3), Biological Chemistry (BC3), Inorganic Chemistry (IC3), Organic Chemistry (OC3) and Physical Chemistry 3 (PC3) subjects.

The used assessment software LibreEOL (<https://www.libreeol.org>), either in Italian or in English (for admission to non Italian Universities the English version needs to be used) is considered to be suited for running SESs either in presence or remotely whose Demo sessions can be downloaded from <http://www.chem-learn.com/demo-libraries-request/> as pdf files (after registering for a SES the candidates can access interactive demos).

The whole procedure leads, if passed, to the possibility of purchasing an Individual Proficiency Certificate (IPC) at different levels (pass, good and excellent) and the mentioned agreement gives also the possibility to the Schools to play an active role by setting their own infrastructure to serve the local territory. DCE favours the application of Italian Universities wishing to become members of ECTN as well as the application of the Schools to become ATS-School by signing an ad hoc MoU which assigns them (for the purpose of carrying out EChemTest[®] SESs) some of the ATS prerogatives. The DCE encourages the Schools to participate in the EChemTest[®] activities because it is a great opportunity to be inserted in a European context; furthermore the number of students gaining the certification can be considered as a flagship of the School testifying the value of the educational path adopted.

SCHOOLS AS CASE STUDIES

The smoothest solution to the problem of opening the activities of EChemTest® to the Schools is to allow their students access individually the SESs through an existing TC. In that case it is sufficient that the School acts like an Agency and channels to the chosen TC the names and the coordinates of the test takers. Among the Schools having expressed their interest to be considered for the project let us consider an Industrial Technical Institute from Italy. Accordingly, the TC of Perugia has been considered as the reference one. To this end the coordinator of the TC has already set the dates of the two next SESs (January 20th and March 31st) and a maximum of 20 test takers. As already mentioned, the student can register for the SES either directly by getting in contact with the TC individually, or through an Agency (the cost of a SES including the issuing of the IPC is 60 € with 1/3 of the net gain assigned as credit both to the TC and to the LEA for EChemTest related activities). In the latter case the School may act as an agency by agreeing with the VEC a LEA via the signature of an ad hoc MoU (signed also by the appointed teacher) valid for an initial period starting at the date of signature and automatically renewed on January 1 next year for an additional one-year term unless terminated by the Parties in writing 60 days prior to renewal date. Thanks to her/his closeness to the students of the School the LEA is expected to:

- properly assist them in selecting the type of contents and Libraries they may wish to address during the SES
- not influence by any means the performance of the test takers during the SES
- make the best use of the outcomes of the SES for the School internal purposes
- orient the practices of the school to the EchemTest contents.

In the signed MoU the LEA appointed by the School:

- acknowledges the ownership of ECTN both for the set of libraries of Q&A used in chemistry knowledge self assessment and certification with registered trademarks and for the developed procedures of their awarding
- expresses the desire to support for both academic and non-academic use the on-line delivery of the EChemTest® SES in English and in its national language and the award of related EChemTest® IPCs through the ECTN TCs
- agrees to keep permanent links with the TC and use criteria and procedures defined by ECTN to award EChemTest® based IPCs and to promote EChemTest® SESs
- commits her/himself to attend the ECTN on-line training activities on the use of EChemTest®, not incur any Intellectual Property violation, liability or trademark/patent infringement claims and deal in any activities which compete with EChemTest® without the prior written consent of ECTN. In the event of a material breach of the agreement either party may give six-month notice requiring compliance and in the event of non-compliance, may terminate the agreement.

THE STEP FORWARD TO SIGN AN ATS-SCHOOL MoU

In the case of the Industrial Technical Institute of Crotona the documentation already received shows that there is already a candidate to act as LEA determined to single out the students who can be encouraged to profitably undertake an EChemTest® SES and

assist them in singling out the difficulties occurring when undertaking higher level tests on chemistry competences. In addition, the Institute seems to be well equipped to provide higher level support to the establishing of an ATS-School spanning its activities at regional level. In this regard the Institute counts on 10 teachers in Chemistry with appropriate scientific curricula and awards. The step forward to consider in this case is, therefore, to evaluate the sustainability of the activities that the institute can undertake. It is therefore important to carry out with the potential LEA and the Direction of the Institute a detailed analysis of the typical MoU to be signed in such case. To this end the content of the ANNEX to the ATS MoU dealing with debits and credits (and related offsetting rules) is shown in [8].

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