Association of Greek Chemists Report to the EuCheMS Division of Chemical Education for 2014-2015

Abstract

The newly elected government is implementing substantial changes in tertiary and secondary education in Greece. Beginning in the school year 2015-16, the reformed program of studies of upper secondary education will be extended to the final twelfth grade, with major changes in the 2016 university entrance examinations. Chemistry will gain in importance from these changes. The in-service science teachers training program on pedagogical use of ICT has switched from traditional to blended learning, supporting the development of Technological Pedagogical Content Knowledge in science teachers. The establishment of the Green Education Centre for primary and secondary school students in the high school of the Anatolia College in Thessaloniki is an educational breakthrough. Finally, a number of successful science and chemistry conferences and events took place in Greece in 2014-15.

1. National educational policy

Because of the change in government after the general elections of January 2015 in Greece, the new minister of education has announced major changes in educational policy, and in some cases the changes have been already implemented. The changes so far affect mainly the tertiary sector, but also the transition from secondary to tertiary education. A new law for tertiary education is under scrutiny, and reforms include new systems of election of higher education authorities (rectors, faculty deans, department chairpersons, etc.), including the abolition of the recently established administration councils.

In secondary education, most of the recently established "Model Experimental Schools" are to be discontinued, with only few traditional model schools continuing. Instead, the practice of experimental schools will be re-established, with the 'model experimental schools' being changed simply into 'experimental schools'. The main difference is the system of selecting the students: through exams for the model schools, through a lottery for the experimental ones.

Beginning in the school year 2015-16, the reformed program of studies of upper secondary education (*lykeion*) will be extended to the final twelfth grade, and this will have as a consequence major changes in the 2016 university entrance examinations. (These examinations are organised centrally each year by the Ministry of Education.) According to the previous practice, tertiary institutions will not be involved in the examinations. The program includes:

- General education courses
- Three groups of *orientation studies*, with five *scientific specialisation fields*.

General education courses will be taught for seventeen (17), 45-minute, periods per week. Each "Orientation Group" includes five courses that will be taught for fifteen (15) periods per week.

The three orientation groups of study are: (1) Humanities, (2) Science, (3) Economics and Information Science. Only the second group of "Science" is of relevance to chemistry. It includes five courses, as follows: streamed mathematics, streamed physics, streamed chemistry, streamed biology, and an information science course entitled "Development of applications in programmed environment".

The five scientific specialisation fields are as follows:

- 1st Scientific Field: Humanities, Law and Social Studies.
- 2nd Scientific Feld: Technological/engineering studies, science and mathematics, and agricultural studies.
- 3rd Scientific Field: Studies in health studies (studies in medicine, pharmaceutics, etc.) and life sciences (including biology).
- 4th Scientific Field: Studies in education (infant and primary education).
- 5th Scientific Field: Studies in economics and information science.

Each orientation group has three (3) common courses that are pre-requisites for any scientific field to which this group has access. The fourth course corresponds to a certain scientific field. The fifth course corresponds to a second scientific field. Therefore, each student follows one out of the three orientation groups, and has the possibility to take examinations in four or in all five of the five streamed courses of his/her group. In the former case (four streamed courses), he/she is able to apply only for one scientific field; in the latter case (five streamed courses) he/she can apply for two scientific fields. For instance, a student of the Science Group (2nd Group), who has taken streamed mathematics, physics, chemistry and "Development of applications in programmed environment" can apply only for the 2nd scientific field. By replacing "Development of applications in programmed environment" with streamed biology, he/she can apply only for the 3rd scientific field. With all five streamed courses, he/she can apply for both the 2nd and 3rd scientific fields.

All students can select one (1) or two (2) out of three (3) scientific fields. Access to the 4th scientific field is possible from all orientation groups. For the calculation of achievement units in the exams, two of the four streamed courses that belong to the corresponding scientific field (e.g. streamed mathematics, physics, chemistry, and biology for the 3rd scientific field) will carry an increased weighting factor.

The problem of the number of chemistry lessons in the Greek secondary education curriculum

Chemistry continues to be "discriminated against" the other science subjects in Greek lower secondary education (*gymnasion*). Since the 1970s, the program of studies includes only two one-period per week chemistry courses in the eighth and ninth grades. Physics had two courses, with a total of four periods per week, while biology has three courses with a total of four periods per week. (Note that geography also enjoys two courses with four periods per week.) A one-period physics course that has been added recently in the seventh grade is dedicated to experimental physics teaching; it includes none chemistry experiment. In this way, physics has now a total of three courses with five periods per week.

The situation appears to be in part improved for chemistry in upper secondary education, where examination in chemistry will be necessary from the 2016 higher education entrance examinations for entrance in engineering, mathematics, science, and agricultural science departments (see above). This will break the long period (it started in the year 2000) of debasement of chemistry, which until this year (2015) was a pre-requisite only for health and life science departments − it was not necessary even for chemistry and chemical engineering departments! Note, however, that chemistry has now been excluded as a streamed course from the eleventh grade.

2. Events in science and chemistry education

- The 1st Greek Conference (with international participation) on *Educational Material in Mathematics and Science* took place with great success in the island of Rhodes on 17 and 18 October 2014. It was organised by the Faculty of Humanities of the *University of the Aegean*. There were 77 oral presentations, 8 poster presentations and 1 symposium. The total number of presentations was 90 (including the plenary lectures and the symposium).
- The 9th Greek Conference on *Science Education and New Technologies in Education* took place with great success in Thessaloniki on 8-10 May 2015. It was organised by the *Association of Education in Science and Technology* (EnEPhET) and the Primary Education Department of the Faculty of Education of the *Aristotle University of Thessaloniki*. It included 4 plenary presentations, 3 symposia with 13 papers, 33 sessions of oral presentations, 2 poster sessions with 14 posters, 1 round table, and 6 workshops. Total number of presentations: 164 (plus 4 plenary lectures).
- A session on chemistry education was included in the *4th Greek Conference in Green Chemistry and Sustainable Development* that was organised by the *Association of Greek Chemists* and the *University of Ioannina* and the *Greek Network of Green Chemistry*, on 30 October − 1 November 2014.
- A session on chemistry education was included in the Greek-Cypriot Chemistry Conference that was organised by the *Association of Greek Chemists* and the *Aristotle University of Thessaloniki* in Thessaloniki on 8-10 May 2015.

3. **In-service science teachers' development of TPACK through a blended training program in Greece**

The teacher training program, known as *second level training*, is supported by the Ministry of Education and implemented by the *Diophantos Institute of Computer Technology*. The training program was established in 2006 and was implemented nation-wide through traditional face-to-face sessions. It has adopted the blended training model, which combines face-to-face sessions and two forms of distance education, synchronous and asynchronous. This blended training program was pilot tried in 2013-2014, followed in 2014-15 by a nation-wide implementation in remote regions in Greece. The aim of this long-term programme is the development of *technological pedagogical content knowledge* (TPACK) of the science teacehrs- a highly desirable competence. More than 3000 science teachers (including chemistry teachers) in the pedagogical use of ICT have already been trained.

4. **A novel lab-based approach towards increasing the environmental awareness of Greek high school students**

The "Green Initiative Programme" is an important tool to raise environmental awareness and can thus have an impact on consumer behaviour and the everyday lifestyle of students. The establishment of the *Green Education Centre* in the *Anatolia College* high school in Thessaloniki, with collaboration and support from chemistry researchers from the *Aristotle University of Thessaloniki,* constitutes an educational breakthrough for Greece. As a matter of fact, never has been established before such a centre in Greece, organised by a high school. The Green Initiative Program will be available for elementary and high school student in the school year 2015-16. This project aims to promote the sustainable development, the protection of human and environment health, and the preservation of natural resources through green chemistry.

5. **Activities of the Association of Greek Chemists**

- The *Chemistry Day* was celebrated in March 2015 throughout Greece, with visits of schools to chemistry departments.
- The Association has continued to exert pressure on the Ministry of Education for chemistry to be given its proper place in the upper secondary school curriculum and the entrance examination for higher education.

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