



Real Sociedad Española de Química (Spanish Royal Society of Chemistry, RSEQ) Annual Report to the EuCheMS Division of Chemical Education for 2020-2021¹

1. Abstract

From July 2020 to June 2021, the teaching of chemistry in Spain, as in other countries, has been marked by the periods of confinement caused by the COVID19 pandemic. Nevertheless, it has been an opportunity to promote blended learning and several online methodological approaches.

2. National educational policy

For decades, there has been some instability in Spain at the legislative level regarding education. We are currently immersed in the elaboration of an eighth general legislation for secondary education since democracy began in 1977. At the University level, the scope of the University depends on three different ministries.

In turn, the practical application of educational laws falls to the 17 autonomous governments (in which aspects such as education and health are transferred completely), so that in our field, the number of hours dedicated to chemistry is unequal. The heterogeneity of Spain is very large: there are co-official languages in 6 of the 17 autonomous communities, there are large areas with a low population very disseminated, cities with a large population and neighborhoods with very unequal economies and proportions of immigrants. Three educational types coexist for centers of secondary education: public, private and «concertada» (privately run but subsidized by the state).

Regarding the teaching of chemistry, at the university level the standards of the European Higher Education Area are met. At the secondary level, in general, there are few laboratory sessions, depending heavily on the school and the teachers involved.

A peculiarity of the Spanish educational system in secondary education is that the official body of teachers, with exceptions such as Mathematics, and for decades, has been grouped from two to two subjects: Geography and History, Biology and Geology, Physics and Chemistry. Traditionally, physicists choose more places in Mathematics, because in their Bachelor Degree they study less chemistry than chemistry graduates, so Physics and Chemistry teaching positions are more occupied by chemists. Often teachers who are physicists teach chemistry

¹July 2020 - June 2021, all levels of chemistry education: primary, secondary schools, universities, general and vocational education.

in a more limited way, and vice versa. There is only one subject in Chemistry, without Physics, and optionally, in the last year of high school. In previous courses the subject is "Physics and Chemistry". In any case, the teaching of chemistry, with the indicated nuances, is not very different from that of other European countries. We are currently immersed in the competency-based education model, leading to quite a few "headaches" for teachers, especially regarding the evaluation of these competencies.

There are a minority of enthusiastic and innovative teachers, who see little reward for their efforts by the administration. In any case, a small amount of the salary of secondary education teachers is assigned through six-year terms that are received throughout their working life, with a limited number, for tasks of educational innovation (courses received, participation in conferences, innovational projects...). At the level of university faculty, the scientific trajectory is valued much more than educational innovation. However, since the development of the Bologna process, there are educational innovation groups in almost all Spanish universities.

Among the most common problems at national level can be highlighted:

- Lack of job stability for teachers at different educational levels, who are sometimes in a different center each academic year.
- Concern about the amount of school failure and poor results in the successive PISA reports. When these reports are published, authorities and public opinion show the greatest interest in educational matters.

3. Events in chemical education

The RSEQ organized the *National Chemistry Olympics*. After the local phases, the final was developed, online (due to the pandemic), on April 30, 2021 organized by the CEU San Pablo University (Móstoles, Madrid)

As it was pointed out in our last annual report, the confinement during the previous academic year, 2019-2020, caused by the COVID19 pandemic, was an opportunity to promote online teaching: many teachers were fully involved in modern educational methodologies. During the confinement, primary and secondary education teachers and university lectures had been involved in the design and application of a wide range of online didactic tools, teaching strategies and evaluation methods. It should be pointed out that evaluation has been the most discussed issue by educators during the confinement and it is still has been matter of thought for the academic year 2020-2021. During this course, secondary and high school students have generally attended classrooms, with adequate social distance, use of masks, adequate ventilation, etc. According to the educational centers, activities were proposed to the students at home if they could not go to the classroom. Each University proceeded in a way, either completely at a distance or in a blended way.



4. Activities of the National Chemical Society

The “Didactics and History of Physics and Chemistry Specialized Group” (GEDH) is one of the few groups that are common to both the Spanish Royal Societies of Physics and Chemistry. In our case, it belongs to both societies due to the peculiarity of the Physics and Chemistry, who, as indicated before, are twofold. In turn, from the beginning it was considered that history and didactics are two highly intertwined areas.

The GEDH consists of 220 members, 150 from the RSEQ and 70 from the RSEF. Members of the group are professional scholars in science education and/or history of science in different educational levels, including University professors of the Master of Teacher Training (60 ECTS credits, one year long), a compulsory degree to work as a teacher in secondary education in Spain. The GEDH website was recently launched: <https://gedh.rseq.org/>

Perhaps the most emblematic action carried out by our specialized group of RSEQ was the organization of the «Awards to the innovation educational in Physics and Chemistry in times of pandemic», with the participation of teachers from all over Spain. The objectives were to highlight the exemplary task of teachers in a particularly unique historical stage, as well as to disseminate good practices for the future in face-to-face and blended teaching modalities. All this, in the context of the celebration of the 35th anniversary of the creation of the GEDH. Eight prizes were awarded, for works that contemplated various methodologies: gamification, flipped classroom, case-based learning, face-to-face and virtual experiments, *inter alia*.

PREMIOS PARA DOCENTES: “INNOVACIÓN EDUCATIVA EN FÍSICA Y QUÍMICA EN TIEMPOS DE PANDEMIA”

<https://bit.ly/3jiHVvj>

Grupo Especializado de Didáctica e Historia
de la Física y la Química



Real
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Física



Real Sociedad Española de Química



In March 2021, the GEDH of RSEQ resolved the 8th edition of the «Salvador Senent» Award, with the name of the founder of this specialized group 35 years ago, for papers on the didactics or the history of physics or chemistry. It is a much-consolidated activity of the group, after which the publication of works on these issues in the two journals published by our societies (*Anales de Química* by the RSEQ, and *Revista Española de Física* by the RSEF). The awarded work was “En el Bicentenario de la fundación del Museo Nacional del Prado” by José Pastor Villegas and Jesús Francisco Pastor Valle (<https://bit.ly/3w1AnSz>).

Juan Antonio Llorens, board member of the GEDH, participated in in the reverse teaching project (Flip Teaching) of the Polytechnic University of Valencia during the 2019-2020 and 2020-2021 academic years. It was implemented in an introductory course of organic chemistry for Food Science and Technology. <https://docenciainversa.blogs.upv.es/proyecto-clase-inversa-upv/>

Other activities carried out by the RSEQ through the GEDH were:

- Collaboration in the preparation of the 6th International Conference of Science and Technology Teachers, postponed in its day due to the pandemic, was held from April 13 to 16, 2021. The information can be seen at: <https://bit.ly/3w0Hhr1>
- Collaboration in the organization of the 4th Poster Contest «Gender Equality in Science? Experiences of students, teachers and scientists», organized by the Faculty of Teacher Training and Education, *Universidad Autónoma de Madrid*. <https://bit.ly/2Z7r0Av>
- Collaboration in the 1st Contest of Fanzines: «What would the world be like without the work of scientists? » (<https://bit.ly/370MYMB>), convened by the University of *Alcalá*,
- Participation of members of the GEDHFQ in specialized teacher training through Teacher Training Master taught at several Universities.
- Two workshop presentations at the international science festival «*Ciencia en Acción*», Science in Action (Barcelona, online, October 2021).
- A few lectures given online for teachers and/or all the people such as:
 - «Andrés Manuel del Río: the only man from Madrid who has discovered a chemical element. » <https://www.youtube.com/watch?v=-HtwVu1tsNg>
 - «From the thermodynamics of the “botijo” to the popularization of the periodic table: some examples of popularization of science». 3rd Edition of the scientific dissemination contest "Brain Wars: The future is in your hands".
 - «Why study STEM degrees? ». Awards session of the 1st Contest of Fanzines «What would the world be like without the work of scientists?»
 - «Escape room activities for the teaching and dissemination of science. » For teachers of National Autonomous University of Mexico (UNAM).
 - «Resources and practical cases for education in Chemistry and STEM subjects» (3 hours). Online. February 2, 2021.
 - «The laboratory at home: ideas to carry out experimental work with everyday objects». University of Buenos Aires and Center for Research and Support for Scientific Education (CIAEC). Buenos Aires (online). 300 participants from a dozen countries. July 24, 2020. <https://www.youtube.com/watch?v=6P92aML1Yol>
 - The creation of screencasts by students for the development of transversal skills. VI International Congress of Teachers in Science and Technology. April 2021 (online). This contribution is related to Development of transversal competences. Juan A. Llorens-Molina. Screencasts in the Classroom. Design and Assessment. 12th International Technology, Education and Development Conference (INTED 2018). DOI: DOI: 10.21125/inted.2018.0558
 - Participation by Juan A. Llorens-Molina in the reverse teaching project (Flip Teaching) of the Polytechnic University of Valencia during the 2019-20 and 2020-21 academic years. Implementation in an introductory course of organic chemistry for Food Science and Technology. <https://docenciainversa.blogs.upv.es/proyecto-clase-inversa-upv/>
 - Juan A. Llorens-Molina. Introductory Organic Chemistry for Food Science and Technology. 12th International Technology, Education and Development Conference (INTED 2018). DOI: 10.21125/inted.2018.0560

- «Emotional and Social Aspects of Distance Learning». Round Table. International Conference «Teaching Challenges and Evaluation of Knowledge». EDUchallenge. Liubliana, Eslovenia, online. February 10 2021. <https://bit.ly/3rxMXHk>
- «What can science teachers learn from the history of our profession? ». Invited lecture by L. Moreno-Martínez at the 7th Conference on the History of Science for Science Teaching organized by the University of Valencia and the Valencian Regional Ministry of Education. 27. Online. February 27, 2021.
- «History in Chemistry classroom. New perspectives in the history of science research for science teaching. Invited lecture by L. Moreno-Martínez at the History and Epistemology of Chemistry course of the Chemistry Bachelor Degree of the Pedagogical National University of Colombia. Online. March 23, 2021.
- Teaching history of chemistry, learning chemistry through its history. Didactic experiences for promoting history of science in STEM education. Conference paper by L. Moreno-Martínez at the 6th International Conference of Science and Technology Teachers. Online. April 14, 2021.
- «It was not in my Chemistry textbook: A history of a science of spirits, spectrums and hope». Invited lecturer by L. Moreno-Martínez at the History of Science Dissemination Seminar of the Catalan Society for the History of Science and Technology. Barcelona. May 3, 2021.
- The GEDH has supported the online exhibition «Modesto Bargalló. Making science in classroom» organized by L. Moreno-Martínez on the 40th anniversary of the death of this illustrious Spanish science educator. <https://modestobargallo.jimdofree.com/>
- Preparation of two issues of the Group Newsletter (December 2020 and June 2020).

5. Publications

As members of the GEDH, and about different topics of chemical education, we have published among May 2019 and June 2020 the following papers:

- «Los aceites esenciales y su actividad biológica. Una propuesta didáctica». [Spanish] J. A. Llorens-Molina. (2021). *Anales de Química*, 117 (2), pp. 165-170.
- «El Laboratorio en Casa: Ideas para Realizar Trabajos Experimentales con Objetos Cotidianos». [Spanish]. G. Pinto, *Educación en la Química*, Edénlaq, 26(2), 177-192 (2020).
- «Del Río, Descubridor del Eritronio, Hoy Vanadio». [Spanish]. G. Pinto, *Revista Con Ciencias*, 26, 4-25 (2021).
- «El Año Internacional de la Tabla Periódica desde la Filatelia: Implicaciones Didácticas y Divulgativa». [Spanish] G. Pinto, M. Martín y M. Prolongo, *Anales de Química*, 116(3), 164-172 (2020).
- «Experiencias Prácticas para la Enseñanza y el Aprendizaje de las Reacciones Químicas». [Spanish]. G. Pinto, M. Prolongo, *Educación Química*, 27, 49-55 (2020).
- «Un Ejemplo de Actividad de Escape Room sobre Física y Química en Educación Secundaria». [Spanish]. L. Tajuelo, G. Pinto, *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 18(2), 2205 (2021). doi:10.25267/Rev_Eureka_ensen_divulg_cienc.2021.v18.i2.2205
- «Modesto Bargalló in Spain (1894-1939): A biography between the history of education and the history of science [Spanish]. L. Moreno-Martínez. *Historia y Memoria de la Educación*, 13, 635-674 (2021). <http://revistas.uned.es/index.php/HMe/article/view/27491>

- «Naming, defining and shaping: Modesto Bargalló and the chemical terminology (1947-1973) [Spanish]. L. Moreno-Martínez. *Educación Química*, 32(1), 122-132. <http://www.revistas.unam.mx/index.php/req/article/view/75877>
- «Science in classroom». [Spanish]. L. Moreno-Martínez. *Dynamis*, 13, 635-664 (2020). <https://raco.cat/index.php/Dynamis/article/view/374662>
- «The bulletin *Faraday* (1928-29) and the relations between history and didactics of science. [Spanish] *Enseñanza de las ciencias*. L. Moreno-Martínez (2021). In press.
- «Educating in the “scientific habit”: Modesto Bargalló and science in the normal school classrooms in Spain (1912-1939) » [Spanish]. *Dynamis*. L. Moreno-Martínez (2021). In press.
- Review of «Cruzar fronteras. Movilizaciones científicas y relaciones interamericanas en la trayectoria de Manuel Sandoval Vallarta (1917-1942)» by Adriana Minor. [Spanish]. L. Moreno-Martínez. *Asclepio. Revista de Historia de la Medicina y de la Ciencia*, 72(1), 307 (2020). <https://asclepio.revistas.csic.es/index.php/asclepio/article/view/1015/1671>
- «Breaking Bad, but good chemistry». [Spanish] L. Moreno-Martínez, *Principia Magazine* 7(1), 32-35.
- «Tea-Time Chemistry». M. Prolongo, G. Pinto. *Science in School*, 52 (2021). <https://www.scienceinschool.org/content/tea-time-chemistry>

6. Liaison with the chemical industry

RSEQ obtains financing through various sponsorships.

7. International and European initiatives

A few members of the GEDH participate as:

- *Scientix Ambassadors*, in the European project *Scientix* (the community for science education in Europe, <http://www.scientix.eu/>).
- Participants in the festivals *Science on Stage* (<https://www.science-on-stage.eu/>).
- Translators from English into Spanish of papers that are published at the web of the journal *Science in Schools* (<https://www.scienceinschool.org/>).

8. Other events and activities

The GEDH is specially committed with social communication of science. Hence, we have created a Facebook group and a Twitter profile (@GDHFQ) in order to promote activities, resources and publications of interest for chemistry teachers in Spain, Latin-America and other countries.

9. Name of delegate and deputy

Delegate: Gabriel Pinto.

Deputy: Luis Moreno-Martínez.

10. Contact details of delegates.

- Gabriel Pinto: ETS de Ingenieros Industriales, Universidad Politécnica de Madrid (Technical University of Madrid, UPM), Phone: +34 609 13 61 69. Email: gabriel.pinto@upm.es
- Luis Moreno-Martínez: Physics and Chemistry Secondary Education Teacher in Madrid. Phone: +34 717 151 164. Email: luisccq@hotmail.com