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Conference paper

Alejandra G. Suárez*

Education and engagement: key elements to achieve and maintain a world free of chemical weapons

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Abstract: Education and outreach are long term strategic tools for the implementation of the Chemical Weapons Convention (CWC) that actively promote the peaceful use of chemistry. Thousands of new chemicals are reported every day; which can render enormous benefits for the common good. However, as with any science, there is always the possibility that chemistry may be misused as it has been done in the past. This work will refer to preliminary initiatives undertaken to address awareness-raising about the multiple uses of chemical substances and the potential dual -use of scientific knowledge which are being implemented in different levels of chemistry education and public outreach programs. The OPCW has placed a priority on education and engagement with the development of tools and materials relevant to the Convention; we will describe these tools and the regional and national meetings that were organized to highlight the incorporation of the CWC's issues into the chemical curricula in South America. The paper will give special consideration to The Hague Ethical Guidelines, another initiative to support a culture of responsibility in the chemical sciences and to guard against the misuse of chemistry. These guidelines were recently formulated by an international group of chemistry practitioners and serve as a set of elements to engage scientists in the ethical dimensions of their work. Education and outreach to future generations to promote the peaceful uses of chemistry is an essential part of achieving the goal of a world free of chemical weapons.

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Keywords: chemical weapons; Chemical Weapons Convention; education; engagement; Organisation for the Prohibition of Chemical Weapons; outreach; 2016 Spring ConfChem.

Introduction

Chemistry, the discoveries of chemistry, and chemical products are vital and beneficial to daily life. Chemicals, both natural and synthetic, are all around us. They are also within us, part of the fundamental structures of living systems. Chemicals can be designed to serve specific purposes, such as in medicine or in a wide array of industrial applications.

In most cases, chemistry is used to improve the quality of life for humans; however, although chemicals supply with a vast array of benefits, they also present the potential for misuse. Important industrial chemicals can be used to create chemical warfare agents, some of the world's most terrible weapons. Despite the screening of thousands of chemicals only few of them satisfied the appropriate physical, chemical and

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Article note: A collection of invited papers based on presentations at the Open Access Online Conference "Science, Disarmament, and Diplomacy in Chemical Education: The Example of the Organisation for the Prohibition of Chemical Weapons", which was held from 2nd May till 20th June 2016.

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toxicological properties to enable their use as chemical warfare agents. These types of chemicals have been created with the purpose to kill or injure humans, which have been used through history in several regional wars and conflicts.

During World War I, the first large scale attack with chemical weapons [1] took place at Ieper, Belgium, on 22 April 1915. Since this event extensive efforts were undertaken in many countries to develop chemical weapons as well as defense countermeasures.

Throughout history there were several international attempts to codify the ban on chemical weapons, but those agreements did not prevent their use and their production. Finally, in 1993 the countries of the world finalized the Chemical Weapons Convention (CWC) [2, 3], the first disarmament treaty to include a time frame for the elimination of an entire class of weapons of mass destruction, but also the first multilateral arms control treaty to incorporate an extensive verification regime.

The full name of the CWC is the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons, and on Their Destruction. In 1997 it came into force after 65 nations had ratified it, and subsequently that number has risen to 192 States Parties, representing about 98% of the global population, as well as 98% of the worldwide chemical industry.

The Organisation for the Prohibition of Chemical Weapons (OPCW) [4] is the implementing body of the CWC, with the mission to verify the destruction of all existing chemical weapons; to prevent their re-emergence in any member State; to provide protection and assistance to the States Parties against chemical threats; to encourage international cooperation to strengthen implementation of the Convention and promote the peaceful uses of chemistry.

The OPCW Headquarters is located in The Hague, Netherlands. In 2013, in recognition of its extensive efforts to eliminate chemical weapons, the OPCW was awarded the Nobel Peace Prize [5]. While the elimination of Syrian chemical weapons was the most visible demonstration of these efforts; the real success has been the verified destruction of over 90% of the world's declared chemical weapons [6].

Everyone engaged in the use of chemicals and chemical technology should understand the intent of the CWC – to recognize what aspects of chemicals it prohibits and to appreciate the much broader applications of chemistry that it not only allows but encourages. Chemicals per se are not good or bad but even chemicals and technologies intended for the best of purposes could be misused.

Education and outreach at the OPCW

Education and outreach are strategic tools for the implementation of the CWC and the peaceful use of chemistry. They are also key elements in raising awareness of the Convention among the broad community of relevant professionals who should be aware of it, including students, educators, the global scientific community and the chemical industry; and educating future generations of the societal benefits of upholding a world free of chemical weapons and the need to prevent their re-emergence.

For this reason, the Scientific Advisory Board (SAB) [7–9], a subsidiary body of the OPCW, at its Seventeenth SAB meeting in November 2011 recommended the establishment of a Temporary Working Group (TWG) on Education and Outreach on Science and Technology Relevant to the Convention [10]. The Director-General endorsed this recommendation and established the TWG [11], which met from 2012 to 2014. Based on the findings and activities carried out by the group during this period, the TWG produced a final report [12] that contained seven main recommendations regarding the sustainability of OPCW education and outreach efforts. Among them, the following can be mentioned:

- "Education and outreach with respect to the responsible use of science, particularly as it is relevant to the Chemical Weapons Convention, should remain a core activity of the OPCW, so as to achieve and maintain a world free of chemical weapons".
- "An ongoing expert advisory group on education and outreach with respect to the responsible use of science, particularly as it is relevant to the CWC, should be established to help OPCW fulfill its mandate for education and outreach".

Recently, the Conference of States Parties [13] at its twentieth session adopted a decision on the establishment of an Advisory Board on Education and Outreach (ABEO) [14]. This new body met for its First Session on April 2016 [15]. The Advisory Board will offer practical advice and proposals on education and outreach strategies, approaches and tools, and develop a portfolio of activities in line with global trends.

Education and outreach has become a core activity of the OPCW, supported by its Member States. Whereas education and outreach was earlier seen in the limited sense of raising awareness among particular groups of society about the provisions of the CWC, today it is seen in a much broader and more substantive sense as an important element of national implementation and as a foundation for preventing the re-emergence of chemical weapons.

To facilitate awareness raising about chemical disarmament and chemical safety and security issues the OPCW engages in social media and makes a number of publications intended to be accessible to broader audiences:

- Fact Sheets that cover historical, procedural, and some technical aspects of the work of the OPCW [16],
- OPCW Today is an in-house periodical with articles contributed by OPCW staff and outside experts [17],
- OPCW Science and Technology Monitor, a science focused newsletter [18].
- The OPCW website also hosts other links to resources for students and teachers interested in topics relevant to the CWC [19], which includes:
- E-learning modules about the OPCW and online training tools for those involved in CWC related activities [20];
- Materials from the conference "Education for Peace: New Pathways for Securing Chemical Disarmament" held from 22 to 23 September 2014 at the OPCW Headquarters that brought together stakeholders to discuss best practices for raising awareness on disarmament and non-proliferation issues in educational institutions [21];
- "Fires" project [22], a series of short films exploring personnel stories with chemical weapons related dimensions. Fires stories include the ethical dilemma raised by the use of one's chemistry training to produce weapons (e.g. Fritz Haber) [23] and the story of a man who as a child survived a 1988 mustard agent attack in Halabja [22].
- "Chemistry in Conflict" is an educational module for high school students, designed to introduce students to chemical weapons, the Chemical Weapons Convention, and ethics in science [24].

The OPCW supports projects by science educators, a recent example being the IUPAC "Multiple Uses of Chemicals" project, to develop an interactive online tool that explores the beneficial uses, misuses, and abuses of multi-use chemicals, both historically and presently; the website is designed to be informative for students, educators and policymakers [25–27].

The Hague Ethical Guidelines

Awareness of the CWC could be placed in a broader educational context of ethical concerns in chemistry. As a way of promoting a culture of responsible conduct in the chemical sciences and to guard against the misuse of chemistry, the OPCW facilitated two workshops involving a group of more than 30 scientists and chemistry professionals from over 20 countries, including all regional groups. The objective of these events was to discuss and draft possible ethical guidelines for the practice of chemistry under the norms of the Convention. The workshops took place at OPCW Headquarters in The Hague.

The first workshop on Ethical Guidelines for the Practice of Chemistry under the Norms of the CWC was held from 10 to 11 March 2015 [28] and included eighteen participants representing academia, industry and chemical societies. Key elements of CWC-relevant ethical guidelines, principles and best practices for drafting guidelines, and synergy with other current initiatives were discussed. A report from this workshop is available on the OPCW public website [28].

The second workshop took place on 17–18 September 2015 [29], with the attendance of thirty-three participants, chemistry practitioners from all regional groups, including fifteen of the original eighteen participants of the first workshop. The workshop arrived at a consensus text, The Hague Ethical Guidelines, which was endorsed by participants from both workshops held in March and September, and is posted on the OPCW public website [30].

The Hague Ethical Guidelines is intended to serve as elements for ethical codes and discussion points for ethical issues related to the practice of chemistry under the Convention. The core element of the guidelines, which draw on many existing elements, is based on the premise that "achievements in the field of chemistry should be used to benefit humankind and the environment". The guidelines provide a useful framework for debating the vital dimension of ethics in relation to chemical disarmament and non-proliferation [31].

The workshop participants discussed the best way to promote and disseminate The Hague Ethical Guidelines, and recommended that the document could be usefully shared with all National Authorities of the CWC, education ministries in CWC States Parties, government agencies and ministries responsible for the practice of chemistry, scientific societies and professional associations, among other relevant stakeholders.

The International Union of Pure and Applied Chemistry (IUPAC) endorsed The Hague Ethical Guidelines in April 2016 [32]. A Global Chemists' Code of Ethics was recently developed, which is the first international code to be developed using the key elements outlined in the Hague Ethical Guidelines [33].

Argentina, an example of effective national education and outreach

Many chemists have limited or no exposure to the ethical norms and to the aims of the CWC during their careers. On the other hand, new developments in science and technology that are paving the way for a multitude of opportunities beneficial to humankind could also open the door to unforeseen challenges and abuses. Today, for example, scientific literature and technical information is widely accessible and can be searched quickly and thoroughly with adequate computer facilities [34]. The availability of information and materials makes it evident that awareness-raising about the multiple uses of chemical substances and the dual use nature of scientific knowledge is an urgent need, in particular in the field of chemical education.

This scenario motivated different debates in the academic and scientific community in our Institution, Facultad de Ciencias Bioquímicas y Farmacéuticas – Universidad Nacional de Rosario. A general consensus was reached that chemistry educators have a duty to prevent the misuse of chemistry and the need to educate people about chemical safety, waste disposal, and the responsible use of chemistry. This approach represented a new challenge for educators, scientists and decision makers. During the debates, one of the main questions that rose was:

How to address awareness-raising about the multiple uses of chemicals and the CWC in higher education?

Some professors were not aware about the need to introduce these subjects into the chemical curricula and for the ones who considered it important, it was not evident for them how these concepts can be introduced. On the other hand, there was a widely-held view that doing so would require the creation of new subjects in the already crowded curricula. A general consensus was that awareness raising about the multiple uses of chemicals and the potential dual use of the scientific knowledge need a multidisciplinary approach, including from chemists, teachers, specialists in e-learning and ethics, among others. The new objective was focused on the consideration of issues of ethics, responsibility and the CWC in the chemistry curriculum at all levels of education. After a deep debate and taking advantage of the design of a new curricula for the Degree in Chemistry in our Institution, it was decided to include these topics in the core curriculum, elective courses and complementary activities.

Within the core curriculum, seminars for undergraduate students of the first and second years of the career, which usually approach different topics related to the students' future professional activities, were reformulated to emphasize the achievements of chemistry and its contribution to humankind, examples of the misuse of chemistry (waste disposal, chemical accidents, and chemical weapons), the history of chemical weapons, the objectives of the CWC and the achievements of the OPCW. In the second year, exercises on

specific topics include case studies regarding problems that arise from inappropriate waste disposal. Other subjects include "Epistemology and Methodology of Research", in which the responsible use of the scientific knowledge is discussed; "Legislation, Hygiene and Safety", in which particular aspects of the CWC are considered. Among the elective courses, "Green Chemistry", "Bioethics" and "Education for sustainability" all cover the responsible use of science.

The students are also invited to participate in all complementary activities that were developed. The first of them was a pilot workshop entitled "Chemistry for Peace: ethics and professional responsibility in education", which was held in Rosario, Argentina, on 27 and 28 June 2013 [35].

The participants were academics, scientists, and representatives of professional and scientific associations, from all over the country. The objectives of the workshop were to provide an opportunity to exchange experiences, and to develop proposals for chemical education related to the prevention of the misuse of toxic chemicals; to facilitate chemical safety and chemical security; to build skills and capabilities in areas related to the peaceful uses of chemistry; to raise awareness of the CWC among the broad community of relevant professionals who should be aware of it; and to build networks in chemical education.

The workshop included two round tables: one on institutional policies, and one on strategies in chemical education. The round table panels were made up of representatives of the Ministry of Education, the Ministry of Science and Technology, the National Research Council, Professional and Scientific Associations, and the Forum of Deans from Schools related to chemistry.

The topics of general discussion were:

- How can undergraduate and postgraduate education programs address the ethical and practical aspects of preventing the misuse of chemistry?
- How can we encourage universities to reflect the issues of the CWC in their curricula?
- What information should be provided?
- Strategies for implementation
- Teaching material for professors

The main conclusion from the workshop was a complete general consensus on the urgent need to address the subject of professional ethics and responsibility at different levels during the careers of the future professionals. The OPCW contributed to the participation of international experts who belonged to the OPWC's TWG on Education and Outreach. The workshop received broad attention and the results were reflected by radio interviews and articles in newspapers to the general public. This workshop was the first academic activity in Argentina regarding E&O relevant to the CWC, which was a catalyst to generate different educational programs and other initiatives in other universities, supported today by the Argentine National Project on Education on the Responsible and Safe Use of Chemical Science and Technologies, carried out jointly by the National Authority and the Ministry of Education [36, 37].

Another activity that was organized devoted to teachers and professors in chemistry as well as graduates and undergraduates students from our institution was the workshop "The challenge to educate in Chemistry" (November, 2014) [38]. Thanks to the support of the OPCW, it was possible to have the participation of Mr. Chretien Schouteten, a retired chemistry teacher from the Netherlands who spent most of his career being concerned about chemists´ responsibilities towards society [39]. Among the different activities develop during the workshop, undergraduate students interpreted an extract from "The Chemist" a moving play written by Mr. Schouteten about the tragic life of Fritz Haber and his family. This activity was used as a starting point for a general debate among the participants to create awareness about the potential misuse of chemistry and challenging them to imagine what they would do if their knowledge were demanded not for noble causes, but for evil purposes.

22 April 2015 was the centenary of the first massive use of chemical weapons [40], which was a paramount opportunity to promote the objectives of the CWC and the achievements of the OPCW as well as the responsible use of chemical substances and the scientific knowledge among chemistry educators and students. For this reason, a commemorative event was organized, focusing on raising awareness about the OPCW and its activities, and on promoting responsible science. There were different presentations about

the history of chemical weapons, the purpose of the CWC and description of the main achievements of the OPCW.

"Chemistry Week" is an activity devoted to teachers and high school students which is carried out annually [41]. It is a great opportunity for youth to get connected with the wonders of chemistry and to appreciate the positive aspects of chemistry through hands-on experiments, games, demonstrations, lectures, exhibitions and more. Teachers are encouraged to explore with their students the impacts of the chemistry involved in everyday life. Taking advantage of this event we introduce topics of the responsible use of chemical substances and the scientific knowledge by the conference "Chemistry for Peace".

Although our Institution was able to make good progress in our objective towards including relevant educational issues related to the CWC in the chemical curricula, some aspects are still being implemented, and the project is constantly under review. We are devoted to the design of tools to evaluate the impacts of the new curricula in order to make the necessary modifications to achieve our objectives [42].

In April 2014 the First Regional Meeting on Education in the Responsible Application of Knowledge of Dual-Use Chemicals for the Latin America and the Caribbean region took place in Buenos Aires, Argentina. The OPCW Director-General, Ambassador Ahmet Üzümcü, delivered an opening statement to the regional meeting, in which he mentioned that education and outreach are opening "a new front" in the OPCW's efforts to guard against chemical weapons, a front that "must bring together a well-integrated community of scientists and researchers working proactively for chemistry that benefits, and never harms, humankind" [43]. This workshop was a result of the need to disseminate the topics and issues contained in the Convention among professionals of the chemical, industrial, and academic areas, and society in general [44].

Final comments

Education and outreach efforts should be tailored to different types of audiences (such as: age, profession, educational background, country and region). Educational programs should be addressed to primary and high school students and teachers, university undergraduate and graduate students and faculty, professionals, trainers, scientists, journalists, lawmakers, and diplomats. The important role of partnerships between national and international scientific organizations, national academies of sciences, and other international organizations should allow increasing cooperation to maximize efficiencies and avoid duplication of efforts. The challenge is to cover holistically all disarmament and non-proliferation issues including chemical-, biological-, and nuclear-focused organizations.

CWC education and outreach is not only something that must be done by the OPCW, but also all of its States Parties. Argentina's experience shows that with committed people and a multi-stakeholder approach, national education and outreach on the CWC can be successfully carried out and can truly complement existing educational programs. The next challenge will be to ensure that CWC States Parties can share such experiences with each other.

Only with a focus on the long-term of education and outreach to future generations will we come closer to the goal of a world free of chemical weapons and ensure that chemistry will always be at the service of humankind.

References

Q4: Please supply access date for the following refs. [5, 15, 19, 21–23, 25, 32, 33, 38, 41, 43, 44].

[1] "What is a Chemical Weapon?" https://www.opcw.org/fileadmin/OPCW/Fact_Sheets/Fact_Sheet_4_-_CW_types.pdf.
[2] "The Chemical Weapons Convention: A Synopsis of the Text". https://www.opcw.org/fileadmin/OPCW/Fact_Sheets/Fact_Sheet_2_-_CWC.pdf. Full text available at: https://www.opcw.org/chemical-weapons-convention/.
[3] "Origins of the Chemical Weapons Convention and the OPCW". https://www.opcw.org/fileadmin/OPCW/Fact_Sheets/Fact_Sheet_1_-_History.pdf.
[4] "The Structure of the OPCW". https://www.opcw.org/fileadmin/OPCW/Fact_Sheets/Fact_Sheet_3_-_OPCW_Structure.pdf.
[5] https://www.opcw.org/special-sections/nobel-peace-prize-2013/.

[6] To be informed about the updated statistics of the OPCW visit: https://www.opcw.org/.
[7] The Scientific Advisory Board (SAB) is formed by 25 members from different States Parties that renders specialized advice to the Director General in the areas of science and technology relevant to the Convention. SAB members serve in their individual capacity as independent experts. This board meets once or twice a year at the headquarters of the OPCW in The Hague. The SAB reports are publically available on the SAB website at: https://www.opcw.org/about-opcw/subsidiary-bodies/scientific-advisory-board/.
[8] A. G. Suárez. The Scientific Advisory Board. *OPCW Today*, **3**, 6 (2014).
[9] More information about the SAB: "Scientific Advisory Board". https://www.opcw.org/fileadmin/OPCW/Fact_Sheets/Fact_Sheet_11_-_SAB.pdf.
[10] Subparagraph 16.6 of SAB-17/1, dated 23 November 2011, available at https://www.opcw.org/fileadmin/OPCW/SAB/en/sab-17-01_e__2.pdf.
[11] Temporary Working Group on Education and Outreach in Science and Technology Relevant to the Convention. The TWG was chaired by Professor Djafer Benachour and comprised 14 international individuals with expertise in: education and outreach in science and technology, perspectives from chemical industry, representatives from relevant international organizations, professional associations and scientific unions.
[12] *Education and Engagement: Promoting a Culture of Responsible Chemistry;* Organisation for the Prohibition of Chemical Weapons, November 2014, and references cited therein. Full document available at: https://www.opcw.org/fileadmin/OPCW/SAB/en/Education_and_Engagement-v2.pdf.
[13] The Conference of the States Parties is the plenary organ consisting of all members of the OPCW. It is the principal organ of the Organisation, and has the general power to oversee the implementation of the Convention, and to act in order to promote the object and purpose of the Convention. More information can be found at: https://www.opcw.org/about-opcw/conference-of-the-states-parties/.
[14] (C-20/DEC.9, dated 3 December 2015).23.1 https://www.opcw.org/fileadmin/OPCW/CSP/C-20/en/c2005_e_.pdf.
[15] https://www.opcw.org/about-opcw/subsidiary-bodies/advisory-board-on-education-and-outreach/.
[16] *Fact sheets*. Available at: https://www.opcw.org/documents-reports/fact-sheets/.
[17] *OPCW Today*. Available at: https://www.opcw.org/documents-reports/opcw-today/.
[18] *OPCW Science and Technology Monitor.* Available at: https://www.opcw.org/special-sections/science-technology/science-technology-monitor/.
[19] See https://www.opcw.org/special-sections/education/.
[20] OPCW e-learning tools can be found at: https://www.opcw.org/special-sections/education/e-learning/.
[21] https://www.opcw.org/special-sections/education/education-for-peace/
[22] *Fires* project. http://www.thefiresproject.com/.
[23] *Fires: A Teachers Mission*; https://www.opcw.org/special-sections/education/fires/.
[24] *Chemistry in Conflict.* L. Juurlink. Chemistry in conflict: Spreading the word to high school students. *OPCW Today*, **2**, 24 (2013). This book is currently under revision, and it is expected to be ready soon.
[25] Multiple Uses of Chemicals. http://multiple.kcvs.ca/site/index.html.
[26] P. Mahaffy, J. Zondervan, A. Hay, D. Feakes, J. Forman. Multiple Uses of Chemicals – IUPAC and OPCW Working Together Toward Responsible Science. *Chemistry International*. September –October **2014**, 9–13.
[27] A. Hay, P. Mahaffy. Multiple Uses of Chemicals: Choices for Chemists and the Public. *OPCW Today*, **2**, 23 (2013).
[28] *Report of the First Workshop on Ethical Guidelines for the Practice of Chemistry under the Norms of the CWC*. https://www.opcw.org/fileadmin/OPCW/SAB/en/March_2015_Ethical_Codes_Workshop-Report.pdf.
[29] *Report of the Second Workshop on Ethical Guidelines for the Practice of Chemistry under the Norms of the CWC*. https://www.opcw.org/fileadmin/OPCW/SAB/en/Hague_Ethical_Guidelines_2nd_Workshop_Report.pdf.
[30] The complete text of "The Hague Ethical Guidelines", preamble, key elements and endorsement, in the official languages of the OPCW can be found at: https://www.opcw.org/special-sections/science-technology/the-hague-ethical-guidelines/.
[31] J. L. Husbands, A. G. Suárez. The Hague Ethical Guidelines: Applying the norms of the practice of chemistry to support the Chemical Weapons Convention. *Toxicol. Environ. Chem.* **98**, 1110 (2016). Online: http://www.tandfonline.com/doi/full/10.1080/02772248.2016.1172074
[32] https://www.opcw.org/news/article/iupac-endorses-the-hague-ethical-guidelines/.
[33] https://www.opcw.org/news/article/opcw-ethical-guidelines-inspire-global-chemists-code/; and https://www.acs.org/content/dam/acsorg/global/international/scifreedom/global-chemists-code-of-ethics-fi-2016.pdf.
[34] L. K. Sydnes.Update the Chemical Weapons Convention. *Nature* **496**, 25 (2013).
[35] A. G. Suárez, R. A. Spanevello. Projects in Education and Outreach Relevant to the CWC: A Pilot Activity in Argentina. *OPCW Today*, **2013**, *2*, 25–27.
[36] More information about the National Project in Education at: www.mrecic.gov.ar/proyecto-nacional-de-educacion.
[37] National Authority: Each State Party of the OPCW is obliged to designate or establish a representative called National Authority to ensure that the Convention is implemented effectively. More information at: https://www.opcw.org/about-opcw/member-states/national-authorities/.
[38] More information at: http://www.unr.edu.ar/noticia/8770/taller-quotel-desafio-de-educar-en-quimicaquot.

[39] C. Schouteten.Chemistry and Ethics in Secondary Education: 25 years of experience with classroom teaching on chemical weapons. *OPCW Today* **2**, 30 (2013).
[40] S. Everts.When Chemicals Became Weapons of War. *Chem. Eng. News*. **93**, 9 (2015).
[41] Press release: http://www.unr.edu.ar/noticia/8406/entrevista-con-organizadores-de-la-semana-de-la-quimica-acercando-facultad-y-escuelas.
[42] Research Projects: "Química en contexto: estrategias para el mejoramiento de su enseñanza en el marco de la responsabilidad social" (Ref. 2010-148-14). Secretaría de Estado de Ciencia, Tecnología e Innovación de la Provincia de Santa Fe, Argentina, and "Responsabilidad social en la formación en química para la promoción del desarrollo sustentable" (Ref. 1BIO505). Universidad Nacional de Rosario. Argentina.
[43] More information at: https://www.opcw.org/news/article/director-general-meets-senior-government-officials-in-argentina-opens-1st-regional-meeting-on-educa/.
[44] http://www.dgmn.cl/wp-content/uploads/2014/09/INFORME-Final-XV-GRULAC-ingl%C3%A9s.pdf.