

THE STATE OF EDUCATION AND OUTREACH ACTIVITIES IN AFRICA IN RELATION TO THE CHEMICAL WEAPONS CONVENTION²

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ABSTRACT

This study reports the state of education and outreach activities in Africa with particular reference to the chemical weapons convention (CWC) of the Organization for the Prohibition of Chemical Weapons (OPCW) that was established in 1997 and based in The Hague, The Netherlands. The study employed various approaches like administering tests to chemistry students, secondary school chemistry teachers and chemistry lecturers in a selected university. The findings suggest that a lot has to be done in order to fully and effectively promote the ideals of the CWS among the various stakeholders. [*African Journal of Chemical Education—AJCE 5(1), January 2015*]

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INTRODUCTION

Education and outreach (E&O) refers to activities that support formal or classroom-based education, as well as informal education that occurs outside the classroom. E&O campaigns provide educational experiences for young people in classrooms, libraries, after-school programs, community-based organizations, museums, etc., as well as supporting the professional development of the professionals and paraprofessionals who work with them.

The why of education and outreach in relation to CWC is discussed elsewhere [1] so it is sufficient to say that whereas chemists played a formative role in the development of chemical warfare and the CWC aims to prevent any recurrence of this activity, unfortunately very few chemists know much about the CWC and what it covers, and few chemistry students realize that beneficial substances can be misused to produce chemical weapons.

The issue here is that if chemists and chemistry educators agree that education and outreach in relation to the CWC is a necessary part of their professional obligations, then they need to devise strategies that accomplish these obligations. Existing educational materials for school science and university chemistry students are written mostly for a specialist audience, or have dealt only marginally with the topics central to chemical weapons or the CWC in general. On the other hand, revising or updating the existing chemistry education materials to address and deal with the CWC may not be realistic in the near future, particularly in African countries, mainly because of the financial, institutional and human requirements.

The purposes of this report are three fold: first to validate whether the above claims are still there, to explore the challenges in greater detail in the African context and suggest plausible recommendations as seen from the stakeholders' perspectives.

METHODOLOGY

Various approaches were used to collect data for this work, some of which were the following. I made a brief look at the Ethiopian secondary school and the undergraduate harmonized Chemistry curricula contents in relation to multiple uses of chemicals and the work of OPCW. I also administered a brief Test on the same issues (prepared by myself) in selected senior secondary schools and a University in Ethiopia. The test consisted of eight questions, some in true-false and others in multiple choice formats. The questions were asking whether a single chemical can be useful or dangerous depending on its use, whether chemists played an influential role in the development of chemical warfare, what CWC stands for, etc. A sample of 52 senior secondary school students, 5 secondary school chemistry teachers (BSc degree Holders) and 11 University Lecturers (MSc degree holders) participated in answering the test. These samples were selected on availability and willingness basis.

I also facilitated, upon request by OPCW, the E&O group at the Twelfth Regional Meeting of National Authorities (NAs) of States Parties (SPs) in Africa, from 4 to 6 June 2014 in Nairobi, Kenya. I posed certain questions and issues to guide them through the discussion process. Some of these were:

- Could professional societies like national chemical societies, continental federations, and international unions be in a position to take the burden? How feasible is this in your country? Why?
- Is there any hope that States Parties in Africa can be the major players in this regard? Do you have specific experiences in your country? What are the challenges and opportunities?

- What are the most feasible strategies to convince education policy makers and curriculum developers to integrate issues related to CWC in already ‘crowded’ curricula in African/your education systems?
- Given the fact that that ‘one size fits all’ kind of educational material cannot work here, what are the most plausible and yet cost-effective approaches to address the various stakeholders (science and technology/education policy-makers and shapers-- including politicians and the media, diplomats, senior military personnel, researchers and students of Chemistry/Science)?

That occasion gave me the opportunity to get the views and opinions of representatives of the participating African countries. In particular the participants expressed the challenges they faced in their respective countries in relation to the CWC’s education and outreach activities. They also suggested the way forward.

RESULTS AND DISCUSSION

Ethiopia’s recently developed secondary school chemistry curriculum and the harmonized undergraduate chemistry curriculum do not seem to have been influenced by developments in the area of multiple uses of chemicals. Neither the objectives nor the content areas of the curricula make any reference to the ideals of the CWC. As a consequence, perhaps, the University instructors (MSc holders) attained only as high as 5 out of 8 (only 2 teachers) and as low as 2 out of 8 (5 teachers).

The question here is: Can we assume that these university instructors (the majority of whom scored about 20% on a test prepared for high school students) are ready to teach

secondary school chemistry teachers in relation to the concepts investigated? In fact, some of the secondary school chemistry teachers scored lower than their students in the test.

We can thus safely say that our university instructors, high school chemistry teachers, students and their corresponding curricula are not ready for multiple uses of chemistry concepts or not ready to contribute meaningfully to the ideals of the CWC.

Some of the participants of the 12th regional meeting of the African national authorities (NAs) stated that they already started E&O activities in their respective countries with varied depth and strategies. They have, however, highlighted a number of challenges, some of which are the following:

- Lack of capacity (human, materials and finance). The required added expertise on education and outreach like knowledge of educational/pedagogical principles, and the skills for proper training may not be available at national level within the NAs
- The issue of chemical weapons (CW) not being a priority for African State Parties
- Strategies for engaging various stakeholders with multiple/varied needs
- The burden to conduct large scale training of relevant stakeholders

These challenges in Africa, and perhaps anywhere in the world, tell us that there is a long way to go in relation to educating the various stakeholders by way of making them aware of the ideals and strategies of the CWC. It is good that OPCW started working on E&O as one of its activities. This initiative must continue, as recommended by the temporary working group (TWG) on E&O of OPCW, to reach the wider relevant community through various means.

SUGGESTIONS/RECOMMENDATIONS

The findings require us to do a lot of things at various levels. As expressed by the TWG of OPCE [2] education and outreach is a core component of national implementation of the Convention. Engagement with stakeholders in the chemical industry, the scientific community, academia and the public at large contributes to promoting and expanding a culture of responsible science. More specifically, the following need to be taken into account:

- Convincing key stakeholders like policy makers and university professionals in the value of knowledge and skills about issues related to CWC. Start with issues relevant to them and at the same time related to the CWC, maybe chemical safety and security.
- Use social media with key messages and professional moderators. Capitalize on the availability of mobile (smart) phones in the hands of the African youth.
- In collaboration with IUPAC, consider launching International Day of Chemistry that could help the world to be aware of the use and misuse of chemistry (multiple uses of chemicals)
- At national level encourage NAs to hold Open Day (Competitions) on CWC/OPCW/Multiple Uses of Chemicals
- Target different stakeholders (public, students, teachers, industry professionals, policy makers, parliamentarians, etc)
- Provide intensive training in the form of training of trainers (TOT) so that the approach can be cascaded at national/local level to ensure larger groups are reached, ownership and sustainability ensured

- Use multimedia approach in developing the content to address learning styles/preferences. Some prefer movies, others hardcopy brochures with images and targeted messages, etc.
- Approach sub-regional and regional economic communities of the African Union (AU) by way of conducting side events related to the CWC. Examples are EAC, SADC, COMESSA, ECOWAS, Ministerial Forums on Science, Technology, Education, the African Academy of Sciences, the Federation of African Societies of Chemistry, etc
- OPCW and NAs need to engage the relevant stakeholders starting from the planning stage through implementation and then evaluation. OPCW and NAs could progressively withdraw as the stakeholders own the activities. The planning, Implementation and evaluation (PIE) approach is discussed in the ensuing pages.
- OPCW needs to empower the NAs as they should be the key players. This could be in terms of staffing (numbers), expertise and skills
- To address the issue of CWs not being the priority of African States, the OPCW needs to articulate the benefits to African SPs and develop key message on that to be communicated to the NAs. Perhaps one can start with a more relevant issue like Chemical Safety and Security and then go from that to the target issue
- OPCW needs to stress in its support to sponsored professionals who attend conferences that they do E&O activities as part of their respective presentations/speeches to the science professionals they communicate.

It is my belief that ultimately all these need to rest on one particular issue: **INVESTING HEAVILY ON CHEMISTRY TEACHERS DEVELOPMENT (BOTH PRESERVICE AND INSERVICE) IN A SYSTEMATIC WAY!** A mere reliance on developing new chemistry

content and making them available for teachers to read could take us nowhere. Similarly, training chemistry teachers in just general pedagogical strategies would not be effective. So what should be done? Address it through the (T)PCK ([technological] pedagogical content knowledge) approach as such an approach integrates the relevant content with the appropriate pedagogy and technology.

I also believe that NAs need to engage themselves on E&O activities in a systematic way. One approach to systematization is the UNESCO's [3] PIE model (in relation to peace education) discussed and depicted below.

- E&O program development should follow a systematic framework such as the iterative process PIE (planning—implementation—evaluation) to be successful.
- *Planning* involves identifying goals and objectives, audiences, and educational strategies.
- *Implementation* concerns the operation of activities.
- Monitoring and *evaluation* of the results help identify successful activities as well as components in need of improvement.

This iterative process—PIE—leads to an education and outreach program that avoids common problems, such as targeting the wrong audience or using an inappropriate message or medium. The following are PIE-questions to guide the design of an education and outreach program:

Planning

- What is the problem or issue you want to address?
- What are your goals and objectives?
- What audiences or stakeholders are involved in the issues to be communicated?
- What are their backgrounds, needs, interests, and actions?

- For each audience, what changes or actions are desired?
- How can audience members be involved in the planning process?
- What constraints and resources are there?
- What messages must be sent?
- What channels and activities will most efficiently result in the desired changes in knowledge, attitudes, or behaviors?

Implementation

- What modifications are indicated by pilot tests of activities and materials?
- Is scheduling, funding, and staffing adequate and efficient?

Evaluation

- How will you know if the strategy worked?
- What are the outputs and outcomes of the program?
- Have you assessed key indicators of success, such as changes in the environment or in audience knowledge levels, attitudes, or behaviors?

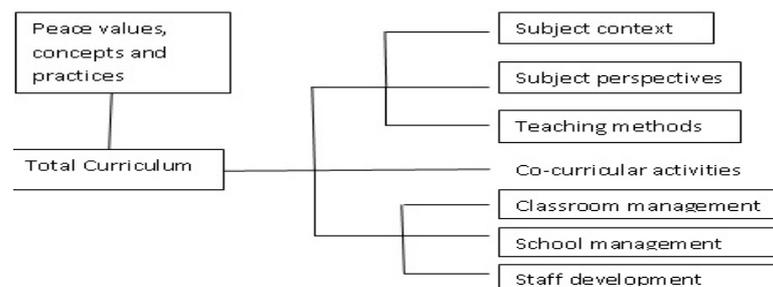


Fig. Model of integration of peace values into school curriculum [3]

One last but not least recommendation is in relation to who should be doing these. My suggestions are the following:

- Under the umbrella of NAs, National Chemical Societies need to take the lead as they will have easy access to the academia and relevant ministries in their respective countries
- Regional federations of chemistry like FASC should play a catalytic role in terms liaising with African chemical societies, other chemical societies in the world and regional and international professional societies maybe through FASC's Committee on Chemistry Education in Africa--CCEA. CCEA is entrusted in handling the African Conference on Research in Chemistry Education (ACRICE). ACRICE-1 was held in Addis Ababa/Ethiopia in December 2013, whereas ACRICE-2 is planned to take place in South Africa in November 2015.
- Development partners that promote science education for sustainable development agenda need to be convinced that, ultimately, it is the investment on the youths' science education that determines the attainment of the sustainability agenda.

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