

## Item 11.4: Future Strategy in Chemistry Education

*During the last two years, the future role of IUPAC in chemistry education has been the subject of intense analysis. This report summarizes the results of the studies and presents a framework for discussion of this subject by the Bureau and Council.*

**Background.** Following the General Assembly in 1999, President Jortner appointed an Education Strategy Development Committee [ESDC] to review the Union's activities in education, recommend areas to which IUPAC might usefully contribute to chemistry education and the public appreciation of chemistry, and recommend organizational and operational changes needed to accomplish the desired objectives. The ESDC, chaired by the distinguished educator and textbook author, Prof. Peter Atkins, was constituted to bring together a wide variety of expertise and perspective; it included members from ten countries.

A detailed report was issued by the ESDC in August, 2000. The report was distributed to all NAOs, to many national chemical societies and to other interested organizations. It was also posted on the IUPAC web site. The report was endorsed by the Bureau in September, 2000. The Bureau noted that some of the report's 21 recommendations could be implemented easily, while others required major decisions on policy and resource allocation. Accordingly, a small Working Party on Education Proposals [WPEP] was set up to categorize the recommendations and to propose specific plans for their implementation. The WPEP [Joshua Jortner (chairman), Leiv Sydnnes, Edwin D. Becker, and John W. Jost] sought comments from all NAOs and most national chemical societies and received a number of thoughtful views. The WPEP reported to the Executive Committee in March 2001. After discussion and modification of some details, the recommendations of the WPEP were endorsed by the EC for presentation to the Bureau and Council.

**General Scope of IUPAC's Efforts in Chemistry Education.** Several responses from NAOs and national chemical societies commented favorably on the need for IUPAC to broaden its current efforts in the teaching of chemistry and to supply guidance to smaller countries in their quest for improved science education. At the same time, a number of responses cautioned that IUPAC should carefully marshal its limited resources and not attempt to duplicate programs that are being conducted by much larger organizations. The need for tailoring programs to national requirements was also emphasized. The WPEP accepted the view that the Union's efforts should be broadened but recognized that they must be carefully crafted to be synergistic with those of other organizations. In general, IUPAC can best serve as a coordinating body and a source of information to national organizations. The further recommendations of the WPEP follow this overall philosophy.

**Curriculum Development.** Probably no subject was more contentious in discussions by the ESDC and in comments received from various bodies than IUPAC's role in development of chemistry curricula. Several individuals and smaller chemical societies argued that IUPAC-recommended curricula could be helpful in raising standards and in helping chemistry graduates in developing countries move into the mainstream of current international practice. Others pointed out that development of curricula is an enormous task and that no agreement exists, even within individual countries, on the best approach. Many textbooks advocate very different approaches in virtually every chemistry specialty.

Taking into account the recommendations of the ESDC for a measured approach and the collective comments received, the WPEP believes that IUPAC should not attempt to develop curricula or to recommend particular curricula. However, IUPAC may be able to provide a

## Item 11.4: Future Strategy in Chemistry Education

valuable service in collecting and disseminating information on curricula via its web site, as discussed in a later section. Also, IUPAC may be able to develop and disseminate more limited educational materials in particular areas and to develop general standards for the B.S. or Ph.D. degree, based in part on criteria already available. Under the project system, a variety of initiatives can be considered and those that appear to be cost effective accepted and funded.

**Public Appreciation of Chemistry.** The ESDC recommended that IUPAC should broaden the scope of its efforts in education to include the public appreciation of chemistry. Comments received universally recognized the importance of enhancing the public understanding of science and the scientific method and of better alerting both students and the general public to the past, present and likely future accomplishments of chemistry. Once more, the question is how IUPAC can best assist in these activities. The WPEP endorsed the view that IUPAC's role must be in support of national organizations. The Union has no contact with the "public", but it can facilitate exchange among national organizations of resource material and information on various approaches developed in individual countries. Details on implementation are given in a later section.

**Low-Cost Equipment.** At various times, the Committee on Teaching of Chemistry has been interested in the provision of low-cost equipment and apparatus, primarily in developing countries. While recognizing the importance of this endeavor, the ESDC recommended that IUPAC should not attempt to develop, manufacture or distribute low-cost equipment. However, the ESDC felt that workshops and training sessions designed to help potential users of such equipment may well be within the capability of IUPAC. The WPEP endorsed the ESDC recommendations but noted that costs of such workshops are usually beyond IUPAC's resources. Fortunately UNESCO and other organizations frequently are interested in and able to support such workshops.

**Staff Resources.** The ESDC recognized that an expansion of IUPAC's activities in chemistry education will require additional staff support. The ESDC recommended strongly that the Secretariat employ a full-time Director of Education and argued forcefully that such a dedicated position is needed to mount a broad program. The ESDC suggested that such an individual might be able to develop proposals for outside support of educational programs, hence partially offset the additional direct salary costs.

The WPEP accepts the need for additional staff support for education activities, but it has had to take a broader view of the allocation of resources. Almost every major activity within IUPAC has proposed [with considerable justification] that it would benefit strongly from full-time staff support. The Union does not have the resources to provide the magnitude of staff support that is desired. Moreover, IUPAC is by design an organization of volunteers, who are expected to carry out much of the actual work. With improvement in the efficiency of handling administrative matters, the Secretariat is now able to devote increased staff resources to direct support of IUPAC bodies and IUPAC programs. However, this is intended as *support* of volunteer efforts, not as a self-contained, staff-driven operation.

The WPEP concluded that the programs envisioned in exchanging information and in evaluating approaches in curricula, in ways to enhance the public appreciation of chemistry, and in many other aspects of chemistry education can best be handled through efforts initiated by the responsible Standing Committee [see next section] and the Divisions but in a manner organized and facilitated through the Secretariat. For example, information on chemistry curricula, on TV programs about chemistry, on educational materials on green chemistry, on standards for B.S. and Ph.D. degrees, etc. that is developed in one country or region should be made widely

## Item 11.4: Future Strategy in Chemistry Education

available through IUPAC. The IUPAC web site should become a primary source of information on chemistry education. The proposal by the ESDC that IUPAC “should be willing to provide curriculum planning expertise at the request of NAOs ...” can be implemented in terms of an information directory but not in terms of developing material in response to individual requests.

The Executive Director has committed the Secretariat to provide the necessary staff to carry out these activities at the level required by volunteer-driven initiatives. Thus the magnitude of IUPAC’s program in education, as in all other areas, will depend heavily on the programs developed within the appropriate Divisions and Committees and on projects generated partially by those bodies.

**Organization and Operations.** The Committee on Teaching of Chemistry [CTC] has long been the focal point for education within IUPAC, with efforts in specific areas often initiated also by individual Divisions. The ESDC recognized the outstanding accomplishments over many years by CTC, particularly in assistance to developing countries, which has been the primary interest of the Committee. The ESDC also recognized that CTC has been largely self-contained [as has been true of most IUPAC Commissions and other bodies], and that very few people have been responsible for most of the work. The ESDC recommended a broadening of the mission of the Committee, a new name, and a structure that could better draw in wide participation and could more effectively manage the expanded programs.

The WPEP endorsed the basic thrust of these ESDC recommendations but proposed some changes in organization. The WPEP recommends that the CTC continue as an Operational Standing Committee but be renamed the *Committee on Chemistry Education* with terms of reference proposed by the ESDC:

- (1) To advise the President and the Executive Committee on matters relating to chemistry education, including the public appreciation of chemistry.
- (2) To maintain a portfolio of educational projects and to coordinate the educational activities of IUPAC.
- (3) To monitor chemistry education activities throughout the world and to disseminate information relating to chemical education, including the public appreciation of chemistry.
- (4) To develop liaisons with international organizations such as UNESCO, national and regional chemical societies, chemical education committees, and organizations concerned with the public appreciation of science.

The Terms of Reference define CCE’s role as an operational committee in developing programs and maintaining a portfolio of projects but also recognize its responsibility to coordinate educational activities throughout IUPAC. The ESDC pointed out the importance of continuing and expanding such activities within the Divisions while retaining CCE as the focal point for education. In fact, the ESDC rejected the idea of a separate *Division* of Chemistry Education since it felt that responsibility for education should permeate IUPAC.

The WPEP recommended the following structure for CCE:

- 8 Titular Members, including a Chairman and a Secretary

## Item 11.4: Future Strategy in Chemistry Education

- One Associate Member from each Division, with the proviso that the AM be a Titular Member of the Division Committee who is interested in and able to contribute to educational matters
- An unlimited number of National Representatives, appointed in accordance with the requirements of Bylaw 4.305

The Terms of Reference and composition of CCE will be established formally by the Executive Committee through Standing Orders.

The WPEP drew particular attention to the importance of appointing Associate Members who have the necessary stature and support within their Divisions to ensure close collaboration with CCE. It also emphasized the responsibility of National Representatives to be able and willing to participate actively in CCE work, especially in providing information to CCE that can be disseminated through the Secretariat and in assisting in dissemination of information in their countries. Moreover, the WPEP pointed out the need for the officers of CCE to make every effort to ensure such active participation by National Representatives.

The WPEP also recommended that CCE establish two subcommittees, each chaired preferably by a TM of CCE:

- Subcommittee on Public Appreciation of Chemistry
- Subcommittee on Chemistry Education in Developing Countries

As is customary, members of the subcommittees may also be members of CCE but in general can be drawn from a broader worldwide pool. In WPEP's view, these are two important areas that require a critical mass of expertise beyond that likely to be available in CCE itself. WPEP believes that this organizational arrangement will be easier to implement and probably more effective than the larger CCE with two deputy chairman, as proposed by the ESDC.

The ESDC made several additional recommendations for handling projects, coordinating programs, disseminating information, and strengthening relations with UNESCO. The WPEP concurred in the recommendations and noted that these recommendations are being implemented as part of the project system and other operational changes that are underway. The ESDC also recommended that IUPAC attempt to obtain better coordination of three series of international conferences on chemical education, a matter that is being addressed.

Finally, the ESDC and the WPEP noted that there are many charitable foundations and other granting organizations with a strong interest in scientific education. If IUPAC develops a strong program in chemistry education, particularly with innovative approaches, there may well be sources of funds to augment the Union's contributions. Cooperation between CCE members and Secretariat staff will be required to identify such potential sources and to prepare convincing proposals.