

Chemical Education in India

Three Decades of IUPAC Initiatives

by N.K. Uberoi and K.V. Sané

As undergraduate science students at Delhi University (DU), we became familiar with IUPAC's role in pure and applied chemistry in the early 1950s. While pursuing graduate studies at Princeton University in the late 1950s, the junior author (KVS) was mesmerized by the chemical demonstrations of the legendary showman, Hubert N. Alyea, who invariably got a standing ovation. Those demonstrations inspired a lifelong affair with the hands-on component of chemical education. Starting in August 1977 as a plenary speaker at the Third International Conference on Chemical Education (ICCE) in Ljubljana, the involvement of KVS with the erstwhile Committee of Teaching of Chemistry (CTC) evolved from an observer status (1977–1980) to serving as India's national representative (1981–1985), to serving as CTC Secretary (1986–1990) and then as CTC Chairman (1991–1995).

The First Decade

When the CTC—under C.N.R. Rao (chairman) and David Waddington (secretary)—realized the urgent need to upgrade student laboratories in developing countries, an action plan was formulated in 1979. Its implementation began at DU under the title, "Locally Produced Low-Cost Equipment (LPLCE) for Teaching of Chemistry." The R&D part was based on local materials and local know-how (see *C*, 1982, Issue 1, pp.7–12). The field-testing part of the project, catalyzed by generous support from UNESCO, made spectacular progress beginning in the late 1980s. The senior author (NKU) organized the teacher-training component under the auspices of the Center for Professional Development in Higher Education established at DU by the Indian University Grants Commission (UGC). Nearly 100 hands-on workshops were conducted all over the world, in which nearly 6 000 LPLCE items were fabricated by teachers and taken back for use in student laboratories. Complete documentation for the LPLCE project is available in two monographs distributed by UNESCO, the Commonwealth of Learning, the Federation of Asian Chemical Societies (FACS), and other agencies to college/university libraries all over the world.¹

Assembling and distribution of LPLCE items was entrusted to SWAVLAMBAN (Sanskrit for self-reliance)—a unit managed by a physically challenged young man. BBC Open University made a documentary on the social dimension of the DU project under its series *Survival*, telecast in the United Kingdom and continental Europe.

The Second Decade

The African program initiated in the mid-1990s was one of our more satisfying experiences. Thanks to the cooperation of John Bradley, several workshops were conducted in Southern Africa. The Soil and Plant Analytical Laboratory Network of Africa (SPALNA) carried out a thorough evaluation of LPLCE published under a Belgian Development Assistance program.

After our retirement from DU, we continued our collaboration by providing new inputs to the LPLCE philosophy. To start, LPLCE was christened "Cost-Effective Science Education." The new label provided the multidisciplinary orientation necessary for hands-on environmental education—an emerging area in the 1990s. KVS strengthened the formal aspects of the teacher-training program during his tenure (1996–1998) as the UNESCO-Nehru Professor for Science Capacity Building at the Jawaharlal Nehru Center for Advanced Scientific Research founded in Bangalore by C.N.R. Rao. NKU shifted his attention to the professional development of schoolteachers under the auspices of the DAV College Management Committee with a network of more than 600 schools all over India.

The Third Decade

Thanks to the partnership with Charles Fogliani, the highly successful Royal Australian Chemistry Quiz was tried in DAV schools in 2003. The Indian adaptation, titled RASAYANIKA (Sanskrit for chemistry), was introduced in 2004.² The award was chaired by the reputed Indian industrialist G.H. Singhanian, who was made an IUPAC fellow in 2006. The award function was held during Chemical Education Week in January 2005, with Peter W. Atkins and Ram S. Lamba as the chief guests. The duo delivered popular lectures for students and held some workshops for teachers. Atkins also inaugurated the Science Education Center, located at one of the DAV schools in East Delhi. The visit of Atkins and Lamba revived the link with the Committee on Chemistry Education (CCE)—the rein-



carnation of CTC—and was coordinated under the IUPAC umbrella of the CCE Flying Chemist Program³ (see side column).

At DU, IUPAC initiatives have attracted support at all levels. International agencies like the ICSU CTS, UNESCO, British Council and (British) Commonwealth agencies, World Bank, IDRC, UNIFEM, and UN APCTT have supported part of our activities; as did regional agencies like the FACS and COSTED; and national agencies like the Indian UGC, Indian DST and their counterparts in South Asia, and several other developing countries.

Earlier events of the ICCE series—especially in Dublin (1979), Maryland (1981), Lyon (1983), Tokyo (1985), Sao Paulo (1987), Waterloo (1989), York (1991), Bangkok (1992), and Puerto Rico (1994)—provided a platform for dissemination of the LPLCE philosophy and its relevance to the teaching of pure and applied chemistry. Likewise, the many awards received also attest to the global appreciation of the project. These include the Commonwealth Foundation Award (1983), UNESCO's Einstein Silver medal (1994), the Brasted Memorial Award of the Chemical Education Division of ACS (1994), the Rome-based Global Junior Challenge Award (2000), and FACS Citation (Hanoi, 2003).

Conclusion

Any education project remains unfinished until it is able to influence the teaching and learning process at the grassroots level. Educational changes have very high activation energy; therefore, our effort should be regarded as the first lap of a (marathon) relay race in which individuals of one generation hand the baton to the next generation. The authors have succeeded in identifying some enthusiastic chemistry teachers who are willing to take over, and look forward to seeing wonderful results from them in the future. 🏆

Notes and References

1. For any LPLCE documents like the two LPLCE monographs, the SPALNA evaluation report, or the BBC Open University CD, please contact <sitah@bol.net.in>.
2. IUPAC Project 2005-003-2-050; Jan-Feb 2006 *CI*, p. 22.
3. IUPAC Project 2005-004-1-050; Jan-Feb 2006 *CI*, p. 24; or <www.iupac.org/standing/cce/FCP.html>.

Krishna V. Sane <sitah@bol.net.in> and N. K. Uberoi <coordinator@mitramandal.org> became IUPAC fellows in 2005.

Goals and Outcomes of the Flying Chemist Program

The aim of the Flying Chemist Program (FCP) is to help emerging countries improve the teaching and learning of chemistry at all levels. In India in 2005, some of FCP's predetermined goals have translated into tangible outcomes:

Goal 1. Assist in the development of curricula and help develop or recommend new assessment tools.

- The manuscript titled "Assessment Techniques and Tools—Recent Advances" was completed for circulation amongst chemistry teachers.

Goal 2. Help develop different approaches to the teaching of chemistry, including hands-on experiences.

- The first round of the e-Quiz competition was held April–September 2006. The second round was held July–November 2007 and included an online component.
- The two FCP workshops ("Ten Great Ideas of Science" by Atkins) and ("Discovery Approach for Student Labs" by Lamba) were a great hit with the audience. To assist teachers in acquiring multidisciplinary skills, two interactive multimedia sample packages are ready for field-testing.
- A prototype mobile table with built-in 12VDC supply and a mini-LPG cylinder has been fabricated. The table should facilitate the task of lecture-demonstrations in schools. The collection of demonstrations (and associated kits) should constitute another publication.
- The booklet *Small is Beautiful*—a comprehensive review of the microscale approach, authored by Peter Towse a decade ago—has been updated describing some recent developments. Also, a home-kit has been designed to accompany the booklet.

Goal 3. Help develop and implement teacher-training programs.

- A vigorous teacher-training program has been launched through a teacher creativity competition in 2006–2007. The e-Quiz competition for students is also underway, as in 2006.