International Conference on Education in Chemistry ICEC-2014
Abstracts of Invited Talks

Norbert Pienta
Department of Chemistry, University of Georgia, USA

Designing and using self-assessment, testing, and evaluation in undergraduate chemistry teaching and learning

A curricular redesign a decade ago and another currently in progress at two different universities suggest the need for meaningful and relevant ways to test our students' content knowledge and problem-solving abilities but also the means for the students to measure their own progress and for instructors and administrator to evaluate the success of the curriculum. Examples and evidence will be presented related to introductory chemistry courses at the undergraduate level.

The role of the *Journal of Chemical Education* (JCE) in undergraduate teaching and learning

The *Journal of Chemical Education*, currently completing its 91st volume, has endeavored to provide the chemical education community with timely information about innovations, useful material, activities in broadest sense and an archive to help gauge the changes taking place. The presentation uses a historical perspective to describe how teaching and learning have evolved in to current practices and what might be in store as this process continues into the future. The latter will include changes accompanying the world of digital publication and the role technology might have in teaching and learning chemistry.

Richard Moog
Department of Chemistry Franklin & Marshall College, Lancaster, Philadelphia, USA

Process Oriented Guided Inquiry Learning (POGIL): A student-centered approach to science instruction

Research shows that students learn best when they are actively engaged, interacting with their peers, and constructing their own understanding of content. The POGIL classroom environment is based on these ideas, and provides a student-centered, group-learning instructional experience. This presentation will introduce the fundamental principles of POGIL and will provide evidence of the effectiveness of the approach from a variety of settings. A brief discussion of some other pedagogies that promote student engagement and interaction will also be provided.

Argumentation and Participation Patterns in Peer-Led Sessions in General Chemistry

This presentation will describe the use of Toulmin's argumentation framework as a lens to examine group interactions. The study was conducted in a Peer-Led Process Oriented Guided Inquiry Learning (POGIL) setting in a university general chemistry course. Two small groups were video and audio recorded for a semester during weekly peer-led POGIL sessions. Student discourse without peer leader intervention was analyzed for the presence of argumentation, argument strength, and evidence of argument co-construction. This study had three major findings: 1) students did construct arguments and were able to resolve incorrect claims on their own without peer leader intervention; 2) most arguments were co-constructed, although not all students contributed to the construction in the same way; and 3) evidence and explanations were common features of student arguments, but explicit linkages to prior examples and/or fundamental principles were rare.

Pratibha Varma-Nelson
Center for Teaching and Learning
Indiana University-Purdue University Indianapolis, USA

PLTL: A student-faculty partnership for transforming the learning environment

Peer-Led Team Learning (PLTL) was developed as a way for students taking introductory chemistry classes to be more active in their own learning, thus increasing their comprehension, problem solving skills, ability to work on teams and success in introductory science courses. This lecture will present critical elements for successful implementation of the PLTL model of teaching. The lecture will also introduce the theoretical and practical elements of the model and describe how technology can be used to promote cyber-learning through PLTL. Examples of appropriate problems will be provided and training of students to work effectively in this environment will be discussed. Role and responsibilities of the peer leaders to work effectively in PLTL workshops will be discussed as well.

Simon Lancaster
School of Chemistry, University of East Anglia, Norwich, UK

Employing technology to facilitate constructive learning in the lecture theatre

Prof Simon Lancaster will present an interactive presentation on applications of technology that can be used before, during and after contact time to increase the learning opportunities for students of chemistry at every level. Wherever possible the workshop will use the same technologies and pedagogies that he describes. The presentation will begin with an introduction to lecture capture using Screencasting technology. We will discuss the advantages and disadvantages of this approach. Vignettes will be introduced as possible solutions to some of those problems. We will then go on to explore the opportunities presented by the presentation of digital resources to change the way teaching in the classroom can be approached. We will illustrate how audience response apps can make the lecture theatre a more active environment for the student.

What can Massive Open Online Courses teach us about the future of higher education?

In this session, Prof Simon Lancaster will introduce Massive Open Online Courses (MOOCs). The New York Times described 2012 as “The Year of the MOOC” but as invariably happens, MOOCs have failed to meet the wild expectations of the most hype-fuelled predictions. 2014 has been the year MOOCs have come of age and become part of the everyday business of Higher Education. Prof. Lancaster will show how MOOCs exemplify and depend upon many of the teaching innovations in Higher Education from the Open Educational Resource movement to student-led teaching. The lecture shows how we can use MOOCs as a platform to test and improve application for the whole of Higher Education. We will also look at some Chemistry examples!

Sourav Pal
CSIR-National Chemical Laboratory, Pune, India

Integration of Research with Chemistry Education: A Future Perspective

Chemistry education has undergone rapid transformation due to the changing face of chemical research which has become more and more interdisciplinary in nature. Chemistry has also changed from structure driven to function driven and is more about systems than just molecules today. Chemical biology and materials have integrated chemistry with other disciplines of science as well as used border-less chemistry breaking the traditional barriers of discipline based chemistry. Research has become an integral part of chemistry education and thus modern chemistry education has to be interdisciplinary and driven by emerging trends of research.
This talk will highlight the above aspects of chemistry education in a changing environment.

Uday Maitra
Indian Institute of Science, Bangalore, India

Challenges in Organic Chemistry Education at UG and PG levels

As a sub-discipline, Organic chemistry is liked by a majority of undergraduate Chemistry students, and more than 50% of Masters' students in Chemistry eventually specialize in Organic Chemistry. This helps a large number of chemical and pharmaceutical industries (and contract research organizations) in the country for carrying out the much needed bench work for research & development, quality control, etc. A smaller number of students (usually with GATE/NET qualification) join the PhD programmes in various research institutes and Universities. There is now a general perception that our students lack good training both in theory and in laboratory skills. While the theory courses in Organic chemistry have been updated with time, most of the laboratory experiments have remained more or less the same over several decades, both at the UG and PG levels. Some of these experiments have also lost their relevance in the 21st century. It is, therefore, important for us to have a re-look at both the UG and PG curricula and set out a strategy to (1) update the course contents, (2) promote the use of modern technology to enhance classroom teaching/encourage creative teaching and (3) add new and relevant laboratory experiments. Ultimately, Chemistry teaching and learning should be made interesting and relevant to Chemistry in real life.
Some of these issues will be discussed in detail in this lecture.

Arvind Kumar
(Formerly) Homi Bhabha Centre for Science Education, TIFR,
Mumbai, India

History of Science and Science Education

The educational import of History and Philosophy of Science (HPS) is a growing area of science education research globally. HPS can be a useful pedagogic resource to improve science learning in different ways. Carefully prepared historical vignettes on suitable topics can help students confront their alternative conceptions with standard conceptions in science and encourage critical learning of the subject. Besides, HPS based curriculum promotes more mature perspectives on the nature of science than a standard content-driven curriculum.

In this talk we shall advocate HPS informed teaching and illustrate the ideas by two short historical vignettes, one that describes the concepts of force that preceded the Newtonian revolution in physics and the other that describes the ideas on combustion preceding the 'chemical revolution'.

Homi Bhabha Centre for Science Education (HBCSE) Presentations

Swapna Narvekar

Learning from the Chemistry Olympiad Laboratory

The Indian Chemistry Olympiad (INChO) leading to selection of Indian team for International Chemistry Olympiad (IChO), is an established multi-stage programme within the country. The final selection round of INChO programme, that is, Orientation cum Selection Camp (OCSC), is conducted by HBCSE. Here students are tested on experimental areas along with theoretical areas. For the same, we have been developing and standardising experiments in different areas of chemistry for more than a decade. These experimental tasks are unconventional and often present opportunities to look at regular laboratories in novel ways.
In this talk, we will share our learning from this process and also discuss what could be incorporated in regular chemistry laboratories.

Indrani Das Sen

NIUS Chemistry: Towards meaningful learning in Chemistry

The National Initiative on Undergraduate Science (NIUS) Chemistry is part of NIUS programme at Homi Bhabha Centre for Science Education (HBCSE, TIFR), that is aimed at science education at the tertiary level. Open to first year undergraduates, the primary focus of NIUS Chemistry is to catalyse learning in Chemistry by engaging students in research like activities[1]. The talk will discuss the NIUS Chemistry programme in detail: its structure, features, project areas and growth till date.

[1]Goedhart, M.J., Finlayson,O.E., & Lindblom-Ylänne, S. (2009). Research-based teaching in higher level chemistry education. In: I. Eilks & B. Byers (Eds.), *Innovative methods of teaching and learning Chemistry in higher education* (pp. 61-84). Cambridge: RSC

Tejas Joshi

Teaching-learning resources in the Indian context: Yes it's possible!

This talk presents an overview of some learning resources conceptualized and developed as part of a project on the chemical elements and the periodic table at the Homi Bhabha Centre for Science Education. The periodic table and elements being frequently re-visited components in the chemistry syllabus; we took these themes as the starting point to develop print resources at the higher secondary level. Thus, the perspectives these resources aimed to present; important considerations with respect to content; their visual component and qualitative feedback will be discussed. The realization of creating a portal, and the purposes it would serve follows.

All through this discussion, is actually a walkthrough of steps involved in resource development: how exactly do we begin? A head-start on creating resources, deployable media and logistics is thus brought out in the context of this project.

Savita Ladage

Research and Development in Chemistry Education at HBCSE: An Overview

Various research and development activities related to chemistry education are being conducted at Homi Bhabha Centre for Science Education (HBCSE, TIFR). The work done as part of Indian Chemistry Olympiad programme (INChO) and National Initiative on Undergraduate Science (NIUS) Chemistry programme, though developmental is related to some important domains of chemistry education. Involving teachers and students, this work spans across the higher secondary and undergraduate level. Apart from these, there are other chemistry education related activities at the centre. The talk will discuss all these activities, areas they straddle and their pedagogical significance.