Report to Bureau Committee on Chemistry Education Mei-Hung Chiu, Chair April 10, 2013

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1. Report of the Project Group of CCE for the CCE Report to Bureau (March 21, 2013)

Prepared by Prof. Mustafa Sözbilir (Turkey) – *Project Coordinator* Prof. Tina Overton (UK) Prof. Richard Hartshorn (New Zealand) Prof. Morton Z. Hoffman (USA) Prof. Masahiro Kamata (Japan) Dr. Erica Steenberg (South Africa)

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- Previous Report: submitted at the CCE Meeting in Roma during 22. ICCECRICE in July 15-20, 2012.

1. Membership of the Project Group

Prof. Mustafa Sözbilir (Turkey) – Project Coordinator Prof. Tina Overton (UK) Prof. Richard Hartshorn (New Zealand) Prof. Morton Z. Hoffman (USA) Prof. Masahiro Kamata (Japan) Dr. Erica Steenberg (South Africa)

2. Review Procedure of Proposals in IUPAC

- Step 1. Receipt at the Secretariat
- Step 2. Internal evaluation and identification of outside reviewers
- Step 3. Distribution to the outside reviewers and gathering of the reviews
- Step 4. Communication of the reviews to the Division(s) or Standing Committee(s) for final decision or recommendation to the Project Committee
- Step 5. Consideration and action by the Project Committee (when applicable)
- Step 6. Notification of IUPAC's decision to the submitter
- Step 7. Responsibility for project management

Review Procedure of Proposals in the Project Group, CCE (Step 2 in above)

- Step 1. FM (Dr. Fabienne Mayer) sends the proposals to the members of Project Group.
- Step 2. Each member sends his (her) opinion to FM
- Step 3. FM sends the opinion of the members to Project Coordinator (PC).
- Step 4. PC summarizes and sends the collective opinion to Chairman of CCE and FM

3. Project Budget

USD 20,000 per two years

4. Current Projects

4.1 CCE Projects (from the most new)

(1) Project No: 2011-003-3-050

Title: Best Practices in the use of Learning Outcomes in Chemistry Education
Chair: Maja Elmgren
Members: Eva Å kesson, Christiane S. Reiners, Marcy Towns, Siegbert Schmid, Ilka
Parchmann, Jan H. Apotheker, Nina Aremo, Pascal Mimero, Hilmi Namli.
Start Date: 08 June 2012
Planned End Date: June 2014
Budget in USD: 8.160
Web Page: http://www.iupac.org/web/ins/2012-003-3-050

(2) Project No: 2012-014-2-050 (Final Report Pending) Title: A Virtual Colloquium to Sustain and Celebrate IYC 2011 Initiatives in Global Chemical Education Chair: Robert E. Belford Members: Mustafa SOZBILIR, Liberato Cardellini, Fabienne Meyers Start Date: 10 May 2012 Planned End Date: July 2013 Budget in USD: 3.020 Web Page: http://www.iupac.org/web/ins/2012-014-2-050

(3) Project No: 2011-054-1-050 (Final Report Pending) Title: Flying Chemists Program in Mexico and Panama Chair: Cecilia BERRIOS, Jorge IBANEZ Members: Juan Pérez Hernández, Héctor Cárdenas Lara, Mei-Hung Chiu, Abdiel Aponte, Cristina Rueda, Start Date: 01 January 2012 Planned End Date: July 2013 Budget in USD: 5.465 Web Page: <u>http://www.iupac.org/web/ins/2011-054-1-050</u>

(4) Project No: Project No: 2008-042-1-050 (Final Report Pending) Title: Development of a framework of priorities for IUPAC Committee on Chemistry Education Chair: Dr. Tony Ashmore Members: Akesson, Eva; Chiu, Mei-Hung; Kirchhoff, Mary; Lamba, Ram S. Start Date: 01-May-2009 Planned End Date: 31 August 2012 Budget in USD: 7.880 Web Page: <u>http://www.iupac.org/web/ins/2008-042-2-050</u>

Update: This project has been moved to the Mei-Hung CHIU as the Chair of CCE to deal with.

(5) Project No: 2007-005-2-050 (Final Report Pending) Title: Research-based evaluation of the Young Ambassadors for Chemistry Chair: Dr. Lida Schoen Members: Mei-Hung Chiu, Ponnadurai Ramasami, Erica Steenberg, and Natalia Tarasova Start Date: 01 January 2008 Planned End Date: 31 December 2012 Budget in USD: 11.070 Web Page: <u>http://www.iupac.org/web/ins/2007-005-2-050</u>

Update: A report published in Chemistry International, 34(5), 7-9, 2012.

4.2. Interdivisional Projects (Joint Projects with Other Inter-Division /Standing Committees projects)

 Project No: 2007-032-1-100 (Final Report Pending) (Joined with Div-I: Physical and Biophysical Chemistry Division) Title: Green Book - Abridged Version Chair: Marquardt, Roberto Members: Brett, Christopher M. A.; Cvitas, Tomislav; Frey, Jeremy G.; Hinde, Robert J.; Holmström, Bertil; Kuroda, Yutaka; Pavese, Franco; Quack, Martin; Smith, Sean; Stohner, Jürgen; Thor, Anders J Start Date: 27 November 2007 Planned End Date: 31 December 2012 Budget in USD: 12.500 Web Page: http://www.iupac.org/web/ins/2007-032-1-100

5. Projects Under Consideration

Currently there is no project from CCE under considerations. New projects are welcome.

6. Completed Projects

- Project No: 2007-038-3-200

 (Joined with Div-II: Inorganic Chemistry Division)
 Title: Development of an isotopic periodic table for the educational community
 Chair: Holden, Norman E.
 Members: Böhlke, John Karl; Coplen, Tyler B.; Mahaffy, Peter G.; Vocke, Robert D.;
 Walczyk, Thomas R..; Wieser, Michael; Yoneda, Shigekazu; de Laeter, John R.
 Start Date: 01 April 2008
 Planned End Date: Completed
 Budget in USD: 11.000
 Web Page: http://www.iupac.org/web/ins/2007-038-3-200
 (A feature titled 'Atomic Weights No Longer Constants on Nature' published in Chemistry International March-April 2011, by Tyler B. Coplen and Norman E. Holden. It could be read at http:///old.iupac.org/publications/ci/2011/3302/2_coplen.html). For more information please also visit http://www.ciaaw.org.
- 2. Update: The Periodic Table of the Isotopes have been updated and final updated version is available at the http://www.ciaaw.org. A new extension project submitted to the IUPAC is under review entitled "Extension 2007-038-3-200 - Development of an Isotopic Periodic Table for the Educational Community (2012-016-12) with 20.650 USD budget" Project No: 2010-031-2-050 (IYC 2011 Activity) Title: Chemistry as a Cultural Enterprise Chair: Prof. Christiane S. REINERS & Dr. Lida SCHOEN Members: Boshra M. AWAD, Liberato CARDELLINI, Mei-Hung CHIU, Mary J. GARSON, Morton, Z. HOFFMAN, Rachel MAMLOK-NAAMAN, Liliana MAMMINO, Daniel RABINOVICH & Thomas R TRITTON Start Date: 01 September 2010 Planned End Date: Completed Budget in USD: 1.735 Web Page: http://www.iupac.org/web/ins/2010-031-2-050 IYC 2011 Activity Page: http://www.chemistry2011.org/participate/activities/show?id=110
- Project No: 2010-025-1-050
 Title: Enhancing the capacity to provide quality chemistry education at secondary and tertiary levels in Ethiopia
 Chair: Prof. Temechegn ENGIDA

Members: Yonas CHEBUDE, Mei-Hung CHIU, Peter G. MAHAFFY, Ahmed MUSTEFA Start Date: 01 September 2010 Planned End Date: Completed Budget in USD: 5.500

4. Project No: 2010-011-1-050 (Joined with Div V: Analytical Chemistry) (IYC 2011 Activity)

Title: Global Chemistry Experiment for the International Year of Chemistry – Design and Development
Chair: Garc ía-Mart ínez, Javier; Wright, Anthony (Tony) H.
Members: Camões, Maria Filomena; Cesa, Mark C.; Hasler, Julia; Humphris, Colin J.; Joyce, Alexa; Kamata, Masahiro; Steenberg, Erica
Start Date: 01 January 2010
Planned End Date: Completed
Budget in USD: 15.000
Web Page: <u>http://www.iupac.org/web/ins/2010-011-1-050</u>
IYC 2011 Activity Page: <u>http://www.chemistry2011.org/participate/activities/show?id=92</u>
IYC 2011 Activity Page: <u>http://water.chemistry2011.org</u>

A report can be read at <u>http://www.iupac.org/publications/ci/2012/3403/3_martinez.html</u>

5. Project No: 2009-055-1-050

Title: Toward Higher Quality of Chemistry Teacher In-service Training in Croatia Chair: Judaš, Nenad; Vladušić, Roko Members: Bucat, Robert B.; Chiu, Mei-Hung; Luetić, Marina; Šunjić, Vitomir Start Date: 01-05-2010 Planned End Date: Completed Budget in USD: 5.000 Web Page: <u>http://www.iupac.org/web/ins/2009-055-1-050</u>

- 6. Project No: 2009-037-3-050 (IYC 2011 Activity) Title: Developing Toolkits for National Chemistry Weeks during IYC Chair: Prof. Mustafa SOZBILIR Members: Choon Ho DO, Morton HOFFMAN, Ram S. LAMBA, Jan H. APOTHEKER Start Date: 1 August 2010 Planned End Date: Completed Budget in USD: 3.300 Web Page: <u>http://www.iupac.org/web/ins/2009-037-3-050</u> IYC 2011 Activity Page: http://www.chemistry2011.org/participate/activities/show?id=61
- Project No: 2008-043-1-050
 Title: Visualizing and understanding the science of climate change
 Chair: Prof. Peter Mahaffy

Members: Chiu, Mei-Hung; Engida, Temechegn; Hasler, Julia; Kirchhoff, Mary; Martin, Brian; Osborne, Colin; Tarasova, Natalia P. Start Date: 01-Feb-2009 Planned End Date: Completed Budget in USD: 8.400 Web Page: <u>http://www.iupac.org/web/ins/2008-043-1-050</u>

The set of peer-reviewed, interactive, web-based materials has been released at <u>http://www.explainingclimatechange.ca</u>.

8. Project No: 2006-050-3-100

(Jointed with Div-I: Physical and Biophysical Chemistry) **Title:** Wet surface vibrational spectroscopy experiments **Chair:** James McQuillan **Members:** Masatoshi Osawa, Derek Peak, Bin Ren, Zhong-Qun Tian, and Thomas Wandlowski **Start:** 14 March, 2007 **End:** Completed **Budget in USD:** 8.200 **Web Page:** <u>http://www.iupac.org/web/ins/2006-050-3-100</u>

(9) Project No: 2004-045-1-700

(Jointed with Div-VII: Chemistry and Human Health) **Title:** Training of school children on pesticides and health - "Toxicology in the classroom" **Chair:** Temple, Wayne A. **Members:** Awang, Rahmat; Besbelli, Nida; Duffus, John H.; Heinzow, Birger; Makalinao, Irma Omar, Maizurah; Binti Rexilius, Lutz; Schweinsberg, Fritz **Start:** 01 March, 2005 **End:** Completed **Budget in USD:** 6.007 **Web Page:** <u>http://www.iupac.org/web/ins/2004-045-1-700</u> **Update:** (November 2009 - feature published in Chem. Int. Nov-Dec 2009. Please visit <u>http://www.iupac.org/publications/ci/2009/3106/4_omar.html</u>) In addition an amended version of the Toxiclaro multimedia package is now been developed which can be found at www.prn2.usm.my/toxicology2009.

(10) Project No: 2004-037-1-400

(Jointed with Div-IV: Polymer) **Title:** Design of polymer education material for French speaking countries **Chair:** Gerard Froyer **Members:** Djafer Benachour, Philippe Dubois, Jean-Pascal Eloundou, Dhanjay Jhurry, Hamid Kaddami, Armand Soldera, and Françoise Winnik **Start:** 01 April 2005 **End:** Completed **Budget in USD:** 5.000 **Web Page:** http://www.iupac.org/web/ins/2004-037-1-400 (June 2011 - project completed - a collection of 400 ppt slides is available via the IUPAC Polymer Education Website portal

(<u>http://www.iupac.org/polyedu/page36/page38/page38.html</u>). The slides illustrate different chapters of Polymer Science and are grouped together into 6 chapters forming an expanded introduction to polymers: Introduction to polymer science, Polymer chemistry, Polymer solid state, Simulation of polymer chains, Rheology and processing, Electrical and optical properties of polymers.

The project continues under French Polymer Group whose website (<u>http://www.gfp.asso.fr</u>) provides additional resources and references. Additional topics will cover physical chemistry, mechanical properties, and biopolymers.)

4. Future Projects

IUPAC operates using a project-driven system. This is done to ensure by selection that only high quality projects bear the IUPAC label, and to encourage participation by the worldwide chemistry community. Therefore you are encouraged to produce more projects and submit.

5. Information about IUPAC & Projects

For information about IUPAC Organisation structure please visit <u>http://www.iupac.org/home/about.html</u>

For information about IUPAC projects and project submission and review process please visit

http://www.iupac.org/home/projects.html

For CCE Projects please visit

http://www.iupac.org/nc/home/projects/projects-by-divisions/project-list-fordivision.html?tx_wfqbe_pi1%5Bdivision%5D=Committee%20on%20Chemistry%20 Education

6. Acknowledgements

Most of data in this report was obtained from the website of IUPAC. We appreciate very much for Dr. Fabienne Meyers and Linda Tapp's excellent documentation in the web site. We also thank many internal and external reviewers for their efforts to screening and identifying excellent projects.

2. IUPAC Proposal 2012-014-1: "A Virtual Colloquium to Sustain and Celebrate IYC 2011 Initiatives in Global Chemical Education" Prepared by Robert E. Belford

The 2012 online ConfChem conference, A Virtual Colloquium to Sustain and Celebrate IYC 2011 Initiatives in Global Chemical Education, was a collaborative effort between the IUPAC Committee on Chemical Education (CCE) and the ACS Division of Chemical Education Committee on Computers in Chemical Education (CCCE). This project evolved out of discussions of the 2011 CCE meeting in San Juan pertaining to the importance of sustaining IYC initiatives beyond 2011. The chair of the CCCE, Professor Bob Belford, was a guest of the meeting and suggested the CCCE may be able to devote the Spring 2012 ConfChem to IYC 2011. Through email interactions during the Fall of 2011 the project took on its final shape with three distinct components.

- Run the Spring 2012 ConfChem on IYC 2011 as a preconference virtual colloquium to the 22nd ICCE- 12th ECRICE conference in Rome.
- 2. Run a IYC 2011 symposium during the ICCE-ECRICE conference and give a 30 minute presentation on the virtual colloquium.
- 3. Publish a series of Communications by the authors of the IYC 2011 Virtual Colloquium papers in the Journal of Chemical Education.

The Virtual Colloquium organizing committee reflected these objectives and consisted of Bob Belford (ACS-CCCE), Mustafa SOZBILIR (IUPAC-CCE), Fabienne Meyers (IUPAC) and Liberato Cardellini (ICCE-ECRICE). The virtual colloquium was held from May 18 - June 29, 2012 using the CCCE ConfChem conference management system that allowed participants to discuss papers through emails and comment features. During this time 824 people were registered to the email list and the virtual papers received 11,616 hits and 155 comments, and as of March 18, 2013 the number of hits has grown to 30,893. Many of the comments were extensive, for example the nine page paper on the IUPAC periodic table of the isotopes (paper 6) had 25 pages of comments.

Funds from this project supported Bob Belford and Mustafa SOZBILIR in attending the ICCE-ECRICE conference where Bob Belford gave presentations to both the CCE meeting held prior to the conference and the IYC 2011 session chaired by Jan Apotheker. Funds had also been sought to enable a remote presentation into the IYC 2011 session but we were unable to synchronize these with the facilities on the ground in Rome. It should be noted that 3 weeks later this technology was successfully used at the 22nd BCCE at Penn State (USA) where Peter Murray-Rust was able to present from Cambridge University (UK) into a session chaired by Belford, and although we had the equipment, we did not feel comfortable charging

IUPAC for it. But if there is an interest in future conferences, we have the ability to provide remote presentations in symposia sessions as outlined in this proposal.

The third aspect of this project is still ongoing. Recognizing the ephemeral nature of the internet Belford had made an arrangement with the Norb Pienta, editor of the Journal of Chemical Education to allow ConfChem authors to submit a series of communications for peer reviewed publication. The Journal would allow them to upload the original ConfChem papers and discussions as supporting documents, and bundle all the papers into a section of the printed journal. The authors of ten of the twelve papers opted into this, the communications are currently under review and should be published within the year.

The true merit of this project lies in the collaborations across several chemical societies and the merging of different forms of scientific communications. The CCCE ConfChems are the oldest ongoing online conference in the chemical sciences and have evolved from pre World Wide Web ASCII text files being FTP'd and uploaded over gopher servers to online conferences employing modern social semantic web technologies. In twenty years of ConfChem this is the first time the CCCE has collaborated with another chemical society and run a ConfChem as a preconference virtual colloquium. Although there is much about this project that can be considered a success, especially with respect to the objective of promoting and sustaining IYC initiatives beyond 2011, there were also some serious shortcomings. In many ways this project involved the interaction of three chemical societies, IUPAC/CCE with respect to IYC2011, ACS/CCCE with respect to hosting the Virtual Colloquium and the Italian Chemical Society with respect to hosting the ICCE-ECRICE. To maximize the benefits of a preconference virtual colloquium there needs to be better communication across the involved societies. In many ways it seemed that many of the members of the involved societies did not even know the virtual colloquium was happening until it was over.

This project did succeed in the manifest goals of promoting and sustaining IYC initiatives beyond 2011 and has real tangibles to show like a very successful and interactive virtual colloquium that is archived in both an open access website and a peer reviewed journal. In a less tangible way, this project has brought about an increased awareness for many of the stakeholders on new modes for scientific communications that could potentially lead to more effective future projects.

3.Young Ambassadors for Chemistry in Panama and Mexico in 2012

REPORT YAC CANCÚN, MÉXICO

The course for the global project Young Ambassadors for Chemistry of the Committee on Chemistry Education (CCE) of the International Union of Pure and Applied Chemistry (IUPAC) was successfully held during 30° Congreso Latinomericano de Química (CLAQ 2012) in Cancún, México, on October 26 and 28, 2012.

Local organiser Jorge G. Ibañez-Cornejo invited us and Sociedad Química de México (SQM) hosted and facilitated the YAC course and



event. The YAC event took place in front of the town hall Benito Juarez of Cancún, a spatial square. Our activities were carried out amidst a 3D Periodic Table with a lot of public around.

15 volunteers and many (young) students and public, participated in the programme, that was organised together with the ACS's outreach programme Festival de Química.

Friday October 26, 2012

Héctor Alejandro Cárdenas Lara (Secretar ía General de SQM) starts us off with the YAC training workshop. During the workshop (10h-13h) and (16h-19h) we train invited chemistry and medical students instead of teachers. Before the afternoon session the chemistry students help a lot to provide us with droppers and other simple 'equipment'. We train them to run the YAC event on Sunday (16h-19h). Nobody can tell us how many students to expect and where they will come from, but we end with appointing volunteers as co-ordinators for chemicals, packaging, stationary, etc.

Saturday October 27, 2012

Jorge G. Ibañez-Cornejo is very helpful to design a banner and is able to pick up 3 printed banners later.

Sunday October 28, 2012

To promote the YAC event we find



good locations for our YAC banner: above the poster stands and in an empty stand opposite the auditorium. Fortunato Sevilla from the Philippines (present for the concurrent CCE Flying Chemists Programme) acts as a member of the YAC team during the whole event.



Promoting the YAC event in the conference centre

The 3D Periodical Table in front of the Town hall

We leave 15h for the town hall to set up the YAC event. The square in front of the town hall is covered with a complete 3D Periodical Table. Carlos Rius Alfonso (with Jorge another Spanish speaking helper!) and 8 strong men carry our tent to the front of the square. We fix the banner and cover pairs of elements, so the hard top can be used as a table for practical work.



YAC banner in front of our tent

One of our University students demonstrates how to produce an emulsion



Youngest Ambassador for Chemistry

Students and public even stay in the dark!

Our volunteers drip in together with an unstructured group of students. It's hardly possible to form groups, our volunteers do what they can, but regularly the situation is quite chaotic with a lot of students and public around. Everybody works enthusiastically and we are proud to welcome Cecilia Berríos (president SQM), Nicole Moreau (past president IUPAC), Kazuyuki Tatsumi (president IUPAC), Javier García-Martínez (AM CCE, IUPAC Bureau) and Miranda Wu (president ACS). From 18h30 on it's pretty dark in our tent, but our volunteers cope. With still many visiting students and public at 18h45 everybody is happy, presentations are impossible, so our great volunteers get the 'prizes': the end of another successful different YAC!

Mei-Hung Chíu and Lida Schoen

(Part of) local reports:

http://www.yocancun.com/jovenes-cancunenses-difunden-conocimientos-de-quimica-a-la-poblacion/

http://www.quequi.com.mx/2091_benito-juarez/1803625_celebran-festival-latinoamericanode-quimica.html

29 de Octubre del 2012.- El día de ayer domingo se llevó a cabo en Plaza de la Reforma del palacio municipal de Benito Juárez, con apoyo de la Secretaría de Desarrollo Social y Económico, a cargo de Julián Lara Maldonado...

El festival fue impulsado por "Young Ambarssadors for Chemistry" (Jóvenes Embajadores de la Química), quien cada dos años realiza el congreso latinoamericano de Química y que en esta ocasión se desarrolla en el Ayuntamiento de Benito Juárez presidido por el presidente municipal, Julián Ricalde Magaña.

Por ello, al evento asistieron maestros, científicos, especialistas, estudiantes y ciudadanos quienes denotaron un intercambio de ideas sobre aspectos académicos, productivos y económicos referentes a la misma materia, la química. Entre ellos representantes de la Unión Internacional de Química como Mej-Hung Chiu (Taiwan), Lidia Schoen (Holanda) y Jorge Ibáñez (México), quienes destacaron que la juventud es el futuro de la especialidad y que el reto es vencer el miedo de la población a los asuntos químicos, que en realidad están involucrados en todos los aspectos de nuestra vida.

Reflections

Comparison ACS 'Festival de Química' - YAC

- 1. The ACS festival programme trains volunteers (suppose it aims at chemistry students?) for tutoring students to carry out selected experiments to show to the public (?).
- Money involved ACS is 'rich', YAC (CCE) is 'poor', completely obvious during the training and event in Mexico, Cancún. ACS offers 'goodies' to give away, materials, banners, etc.. Probably ACS sends all needed materials before the training/activity;
- 3. YAC trains teachers for **1-3 (optimum) days** with the aim the trained teachers can repeat ideas, methodology and the public event with students and public (sustainability!);
- 4. YAC **aims** for the course (teachers) and event (students, public): YAC programme:
 - a. teaches teachers about new **content** ('modern' research and use of 'chemical' products in daily life);
 - b. makes teachers aware of **local examples**: local chemistry of and procedures in obtaining local useful products;
 - c. offers examples of 'new' **methodology** (e.g. group work, group discussions and reports, polls, competition), dependent on local state of art;
 - d. teaches teachers about practical work within reach of local schools. Chemistry is about producing and analysing 'products'. For **public** (and **students**) producing is more transparent (so useful) than analysing (often complex and expensive);
 - e. stresses the relationship between chemistry and other disciplines (geography, art, communication): daily life 'chemistry'
 - f. makes **teachers**, **students** and the **public** aware of the **impact of chemistry** by showing examples (<u>www.iupac.org/publications/ci/2012/3405/2_schoen.html</u>) and <u>www.youtube.com/watch?v=V_ptrpD1840&feature=youtu.be;</u>
 - g. prepares teachers to organise and run a public awareness YAC event with students (as **Young Ambassadors for Chemistry**) in a public place (students carry out practical work in groups, group reports in public, competition between groups), not as helpers of the organisers, but independently, to secure optimal sustainability. We also stimulate finding local sponsorship for the organising costs of the event (successful in e.g. Philippines);

5. YAC sustainability

Sometimes it is difficult to find the right **raw materials** for the practical work locally, because of 'ignorance' of the local organisers or problems with local suppliers (if any). We always bring an emergency supply, because sometimes organisers only have to get familiar with the ideas, but also to show examples of current improvements based on current research for new raw materials (dependent on sponsorship of our involved

multinationals). Anyway we always train the teachers to find their own local products. Good YAC examples from Taiwan and Cyprus.

6. Summary

		ACS	YAC
1.	Budget	Large	Small
2.	Model	Trainer - volunteers (students) -	Trainers—teachersstudents
		public	public
3.	Course	3-hour workshop + On-site	1-3 day workshop + on-site
		event	event
4.	Participants	Volunteers (students)+ public	Teachers + (students & public)
5.	Chemicals	ACS	Local and CCE as example
6.	Evaluation	No?	Yes
7.	Sustainable	Less	More equipped teachers

Prepared by Lida Schoen

Appendices: Photos of YAC taken in front of Ministry of Education, Panama.



Figure 1: Chemistry teachers guided students Figure 2: The students were involved in the to do cosmetic products in Panama city. YAC activiti4es in Panama city.

4. Flying Chemists Programs (FCP) (4-1) Panama and Mexico

The 2012 FCPs have been carried out in three countries, Panama, Mexico, and Croatia. Among them, the first two was in conjunction with Latin America Chemistry SQEPCLAQ 2012-Domingo 28 de Octubre, 2012

FCP Report: Panama City + Cancun, México (M. H. Chiu, & J. G. Ibanez)

On October, 2012 the Flying Chemists Program (FCP) of the Committee on Chemistry Education (CCE) of the International Union of Pure and Applied Chemistry (IUPAC) sprang a successful regional initiative for offering learning and networking opportunities in Latin America. FCP took advantage of their geographical proximity and for the first time it linked visits to two countries in a single trip (Panama and Mexico).

PANAMA CITY

- Firstly, on October 20-24, 2012 the Ministry of Education of Panama and the Universidad de Panama hosted Dr. Mei Hung Chiu (Taiwan Normal University), Chair of the IUPAC Committee on Chemistry Education; Dr. Fortunato Sevilla (Universidad de Santo Tomas, Philippines), and Dr. Lida Schoen, IUPAC 's Young Ambassadors for Chemistry leader.
- M. H. Chiu and F. Sevilla offered four workshops to high school and college teachers on Pedagogical Insights for the Learning of Chemistry, and Microscale Analytical Chemistry, while L. Schoen organized Young Ambassadors for Chemistry (YAC) workshops and a public event for communicating Chemistry through Cosmetic Chemistry activities in front of the Ministry of Education offices. Over 100 participants joined the event.

Local organizers included: Marisa Talavera and Ilsa Austin (Ministry of Education), and Abdiel Aponte and his group (Universidad de Panama).

CANCUN, MEXICO

- The group then flew to Cancun, Mexico in connection with the 30 Congreso Latinoamericano de Quimica (CLAQ 2012), where the Sociedad Quimica de Mexico (SQM) and the Federacion Latinoamericana de Sociedades de Quimica (FLAQ) hosted and facilitated the FCP workshops and an education symposium.
- Peter Mahaffy (Kings College, Canada), Past Chair of the CCE-IUPAC, joined the group in Cancun to offer the following **workshops** on Saturday, October 27, 2012:
- Nonstandard Ways of Assessing and Developing Student Understanding in Chemistry (Mei Hung Chiu)

- Visualization of Chemistry and Climate Change Science A Hands on Workshop (Peter Mahaffy)
- Microscale Analytical Chemistry Experiments Based on Low-Cost Instrumentation (Fortunato Sevilla).

The workshops were attended by high school and college teachers from throughout Latin America (at an average of 20 participants in each) and were **inaugurated by**:

Kazuyuki Tatsumi (President, IUPAC), Cecilia Anaya (President, SQM), and Héctor Cárdenas (General Secretary, SQM).

The local organizer was Jorge G. Ibanez (Universidad Iberoamericana-Mexico City and SQM) who was greatly aided by:

- Carlos Rius Alonso, from the Universidad Nacional Autonoma de Mexico (UNAM/SQM) who provided and set up the computers for Mahaffy 's workshop
- Juan Pérez (President, PROVITEC- glass company), who provided complementary financial aid for the FCP activities
- Norberto Farfán and Margarita Romero Á vila from UNAM/SQM, who helped F. Sevilla 's workshop
- Alejandro Zepeda and Manolo Barceló from UADY, who provided reagents and solutions for F. Sevilla 's workshop
- José Manuel Méndez Estivalet from UNAM/SQM, who helped M. H. Chiu´s workshop

Lastly, on Sunday, October 28, 2012 the group participated in the **Symposium on Chemistry Education** (approximate attendance = 100 people) also organized by Jorge Ibanez as follows:

- Alternative Diagnostic Assessment in Chemistry Education. Mei-Hung Chiu
- Using the Rich Context of Climate Science to Teach Chemistry. Peter Mahaffy
- Communicating Chemistry. Lida Schoen
- Analytical Chemistry Experiments in Microscale. Fortunato Sevilla III
- Teaching Environmental Chemistry through Experiments. Jorge G. Ibanez

The same day, the group participated in the YAC event at the City Hall where several hundred people benefited from the outreach activities.

Below are photos taken during the FCP and YAC activities. Our president, Kazuyuki Tatsumi, actively participated in these activities.



(Note: also see the flier of the workshops and events in Appendices A & B)

(4-2) Croatia-Follow up activity in 2012: Toward Higher Quality of Chemistry Teacher In-service Training in Croatia

The 2nd Croatian Workshop on Chemical Education (2CWCE) was held in November 2012. in Split, Croatia (See **Fig. 1**). It came as a follow-up event to the 1st Croatian Workshop on Chemical Education (1CWCE) that was also held in Split, Croatia, in November 2010 (IUPAC Project No. 2009-055-1-050).



Figure 1. Participants of the 2CWCE. A snapshot taken between workshoping sessions on Nov. 10th 2012.

CWCE events started by a jointed effort of *Croatian Chemical Society* (CCS), *Faculty of Science University of Split* (FoSci UniSt) and *Croatian Education and Teacher Training Agency* (ETTA).

The need for such events is based on the following fact: Croatia is a *country-intransition* facing various social and political changes and paralley facing the reform of its educational system. Because the process of upgrading the chemistry education in Croatia should be further continued and the learner-centered approaches further implemented in chemistry classroom at the secondary level the parties agreed to come up with a relevant project that would bring together domestic and foreign experts in the field of chemical education. As the time of the global-crisis seriously affects general economical situation, the IUPAC came out as the best and most logical international partner because its *Flying Chemist Program* serves as an international source of experts in the field of chemical education.

Correspondingly, the project was proposed to the IUPAC and titled *Toward Higher Quality of Chemistry Teacher In-service Training in Croatia*. The central idea of the project is to organize a continuing series of conferences/workshops that will be held in Croatia in biennial phases. Eight basic goals of the project were defined:

- to provide international support to the on-going modernization of chemistry teaching/learning strategies at the primary and secondary education level in Croatia,
- to promote incorporation of the inquiry learning, particularly the discovery-based small-group learning method and thus enhance the opportunities for students to learn chemistry in a meaningful way,
- to promote the needed awareness of action research,
- to give a necessary needed support to the institutionalization process of the graduate study *PhD in Science Education* at the Faculty of Science of the University of Split,
- to create a dynamic and challenging atmosphere that will impel career development of young chemistry teachers,
- to enhance social-networking of the chemistry teachers in Croatia as well as in the geopolitical Region and correspondingly enable further dissemination of good teaching practices, classroom activities and teaching experiences,
- to help National Chemical Societies in the Region to coordinate exchange of the information and to reduce the differences in chemistry teaching caused by different social and political environment.
- to enlarge the number of experts trained to use inquiry learning strategy in the classroom and capable of training others.

To realise these goals the support of the IUPAC's Flying Chemist Program was vital.

Despite having a pronounced national prefix, the CWCE are organized for an international audience of teachers to primarily discuss problems being regularly encountered in learning and teaching of chemistry at all levels of education.

As learning and teaching of chemistry at all levels of education inevitably comprises the problems of learning and teaching a broad range of subjects across the natural sciences the CWCE cover the following topics:

• **Teaching Chemistry** Guided-inquiry and student-oriented learning

- **Communication** The "professional language" *vs.* the mind of non-expert
- **Research in Chemical Education** What to research in chemical education and why?
- The Interdisciplinary Attack To the mathematics, physics, biology... and back
- Microscale and Green Chemistry Implementation into the classroom

The CWCE are organized as three day events and are led by a three-membered organizing team (Nenad Judaš, Marina Luetić and Roko Vladušić). Both events were attended by approximately 130 participants, mostly Croatian primary and secondary school chemistry teachers. But, some 20 % of the attendees were students - the pre-service training chemistry teachers, 15 % were academics and experts from governmental institutions and 10 % were experts from neighbouring countries and Europe. The program of the 2CWCE consisted of 9 plenary lectures, 7 workshops and 15 short oral presentations.

The first day of the 2CWCE was focused on plenary lectures. The second day morning sessions were devoted to short oral presentations and in the afternoon the workshoping part started and was continued during the third day.

In order to enable the participants to attend maximal number of workshops, participants were divided into three groups and workshops were held in five series of three parallel workshops. In this way each participant was able to attend **five of seven** different workshops. This fact highlights the CWCE and distinguish them from other events. One workshoping session lasts for 90 minutes and is usually designed as guided-inquiry based lesson with hands-on activities (See **Fig. 2**).



Figure 2. Typical atmosphere during the workshoping sessions on CWCE events.

For 2CWCE plenary lectures and workshops were given by Bob Bucat and Mauro Mocerino (Australia), Onno De Jong (Netherlands), Thomas J. Greenbowe and Marian DeWane (USA), Metodija Najdoski (Republic of Macedonia), Marina Luetić, Roko Vladušić, Krešimir Molčanov and Franka Miriam Brueckler (Croatia). Comparing to the 1CWCE the 2CWCE succedeed to gather even more foriegn experts having contributions from Russian Federation, Ireland, Poland and Bosnia and Herzegovina.

CWCE are friendly events, full of positive energy and characterized by great synergy between attendees and plenary lecturers (See **Fig. 3**). Although most of the participants are not fluent in English special care was taken to overcome this problem. Plenary lectures were simuntaneously translated by dr. sc. Vladimir Stilinović and dr. sc. Krešimir Molčanov whose effective translation results not just from the fact that they are fluent English speakers but also excellent chemists and chemical educators. During the workshoping part, each workshop leader had an assistant to enhance *English-to-Croatian-and-back* communication. Participants also helped on this matter by organizing themselves into small groups having at least one fluent *English-to-Croatian-and-back* communicator.



Figure 3. A great sinergy between participants and plenary lecturers and workshop leaders enhances the exchange of the ideas and experience and adds to the CWCE profile.

The breakage of the language barriers was completed when Russian colleague Denis Zhilin gave his *first-in-life* chemistry talk in Croatian. The message was easily transmited and audience aplauded. Bob Bucat gave an excellent talk titled Language Issues in the Teaching and Learning of Chemistry using mix of Croatian and English languages.

All in all, the CWCE events are successful (See Fig. 4), invoke warm reflections and breed new ideas (See Fig. 5), tighten companionship (See Fig. 6) and enhance the enthusiasm that surely will affect the classroom practice (See Fig. 7).



Figure 4. Bob Bucat celebrates the organizing Figure 5. Denis Zhilin (Russian Federation) and Team (left to right: Roko Vladušić, Marina Luetić, Bob Bucat and Nenad Judaš).

Jagoda Oplanić (Croatia) exchange ideas to solve a problem.



Figure 6. Thomas Greenbowe and Marian DeWane Figure 7. Simple, cheap, easy-to-do microscale tightly bonded by a topological problem during hands-on-activities to upgrade the learning a session on The Interdisciplinary Attack. and teaching of chemistry.

But although the Croatian team was able to rise funds the 2CWCE would hardly be a successful event without a great help and devotion of Bob Bucat, Thomas Greenbowe, Marian DeWane and Mauro Mocerino. We thank them most sincerely.

Now we are running towards the 3CWCE which should bring us more foreign friends, more new ideas and help us to further disseminate knowledge, expertise and experience in inquiry based learning in Croatia but also in the neighbouring Region.

We may say that the main goals of the project are accomplished, but as teachers, we know that all achievements should be further developed. Thus we hope that IUPAC FCP support might continue in future not only for CWCE but for the rest of the world as well.

Nenad Judaš

Note:



FCPs have been launched in seven countries (including India, Sri Lanka, the Philippines, Croatia, Ethiopia, Panama, and Mexico, across four continents since 2005.

5. Report on project 2011-003-3-050_Best practices in the use of learning outcomes in chemistry education

Learning outcome driven chemistry education is increasingly practiced, providing new opportunities for international comparisons. We will develop a method for learning by sharing and comparing best practice of the use of these outcomes, to enhance learner-centered chemistry education both in the developed and developing world. The project builds on and extends task group members' experiences from national and international projects.

Accomplishments so far

During 2012 we compared learning outcomes and guidelines for chemistry education in Europe, North America and Australia.

In a meeting before the ICCE conference in Italy, the comparisons were discussed. Awareness of varying circumstances is needed for this project to be useful for both developed and developing countries. The possibilities to gain information about how these learning outcomes are aligned with learning activities and assessment in courses and modules at universities around the world were discussed. The work during the year and on the coming workshop in Istanbul 2013 was planned. Almost all project group members and a couple of external interested chemists attended the workshop and actively engaged in the discussions.

With insights from the workshop guidelines including a self-reflection matrix was written (see sample in Appendix C). The tool for the self-analysis was designed to facilitate the work and to make the various documents more comparable. In focus were chemistry specific and transferable skills. We started with the three overarching documents from USA, Australia and Europe. They were compared and ordered in accordance with the American headlines. In each section there is room to write something concerning learning outcomes, assessment and learning activities for the bachelor as a whole and for courses or modules.

The guidelines were sent to the task group members for comments and feed-back, resulting in some small changes.

ongoing work

All task group members are supposed to make self-analyses with reflection on the use of learning outcomes for the chemistry bachelor. For the work to be feasible, cooperation with colleagues at the task group members universities is encouraged.

Workshop in Istanbul

2013: At a workshop at the GA in Turkey, the self-analyses will be compared and the task group members will exchange feedback. Other GA-members will also be invited to give feedback and learn from the experience.

Maja Elmgren (2013-03-18)

6. Summary

CCE continuously support projects that are promoting chemistry education worldwide (such as YACs and FCPs for emerging countries) as well as linking divisions and committees of IUPAC and other international associations with CCE. We have been successfully put some research into practice and to provide supports for local needs in teaching and learning chemistry. However, with limited budget, we, the CCE, still need supports from IUPAC Project Committee and others to support promising and sustainable projects in order to plant seeds of chemistry education deeply across countries. We understand that the extension of impact of CCE should be spread out to other societies (such as ICSU and UNESCO) and active participation in outreaching activities/programs. CCE is looking forward to explore the collaboration across IUPAC and other unions.



Appendix A. Young Ambassadors for Chemistry in Mexico



Appendix B. Flying Chemistry Program in Mexico

PROGRAMA PROPUESTO: SIMPOSIO

SOBRE EDUCACIÓ N QUÍMICA

HORA	TÍTULO	PONENTE	INSTITUCIÓ N	
11:30-	Alternative Diagnostic	Mei-Hung Chiu	Chair, IUPAC Committee on	
11:55	Assessment in		Chemistry Education. Professor,	
	Chemistry Education		National Taiwan Normal	
			University.	
11:55-	Using the Rich	Peter Mahaffy	Past-Chair, IUPAC Committee on	
12:20	Context of Climate		Chemistry Education. Professor and Co-director of the King's	
	Science to Teach			
	Chemistry		Centre for Visualization in	
			Science, Canada.	
12:20-	Communicating	Lida Schoen	Past Titular Member of IUPAC	
12:45	Chemistry		Committee on Chemistry	
			Education. Amsterdam, The	
			Netherlands.	
12:45-	Analytical Chemistry	Fortunato	Professor, University of Santo	
13:10	Experiments in	Sevilla III	Tomas, Manila, Phillippines.	
	Microscale			
13:10-	Teaching Through	Jorge G. Ibanez	Professor and Chair. Dept.	
13:30	Experiments: The		Chemical Engineering and	
	Case of		Sciences. Universidad	
	Environmental		Iberoamericana. Mexico.	
	Chemistry			

CLAQ 2012-Domingo 28 de Octubre, 11:30 AM - 1:30 PM

1. Alternative Diagnostic Assessment in Chemistry Education

Mei-Hung Chiu. Chair, IUPAC Committee on Chemistry Education. Professor, National Taiwan Normal University. Graduate Institute of Science Education. mhchiu@ntnu.edu.tw

Numerous studies have shown that students have difficulty learning the concepts associated with diffusion of particles due to the abstract nature and microscopically complex mechanisms behind this scientific phenomenon that cannot be observed through other macroscopic events. However, the methods used in these studies included traditional formats with multiple-choice questions. In this presentation, I introduce a National Science Concept Learning Study that adapted two-tier test items to diagnose students' alternative conceptions in chemistry. The results of this study revealed that although junior and high school students demonstrated cognitive development around chemical concepts, they still held alternative conceptions that did not align with the scientific concepts taught in their classrooms. In addition, the results showed that the use of two-tier test item design increased our understanding of how students consider a concept or phenomenon during learning. From here, we designed a Web-based Mental Model Diagnostic (WMMD) system to investigate students' mental models of gas diffusion. The results revealed that although sixth, ninth, and twelfth graders still had difficulty understanding how gas particles move randomly when two gases are mixed in the same container, the students' progression paths showed their increasing gains by grade and by type of mental model held by students. Some modeling activities, designed to improve students' understanding of gas particles and other chemistry concepts, will be discussed.

2. Using the Rich Context of Climate Science to Teach Chemistry

Peter Mahaffy, Past-Chair, IUPAC Committee on Chemistry Education. Professor of Chemistry and Co-director of the King's Centre for Visualization in Science; Chemistry Department, The King's University College, 9125 50th St., Edmonton, AB, Canada, T6B 2H3, peter.mahaffy@kingsu.ca

Understanding and responding to the fundamental changes to earth's atmosphere and oceans since the industrial revolution is one of the defining challenges facing our modern world. Despite the fact that much of the underlying science builds so heavily on fundamental chemistry and physics, chemistry educators have taken little ownership for helping students visualize and understand the science and connect it to conceptual understanding in chemistry courses. We introduce (a) our NSF-funded VC3 project, Visualizing the Chemistry of Climate Change, in which we develop strategies to teach a set of core chemistry concepts through the rich contexts of climate science and (b) a newly completed IYC-2011 legacy project carried out in partnership with IUPAC, UNESCO, RSC and ACS to create a set of interactive web resources for global dissemination, that make connections between climate literacy and the teaching of concepts in chemistry <u>www.explainingclimatechange.com</u>.

3. Communicating Chemistry

Lida Schoen, Past Titular Member of IUPAC Committee on Chemistry Education. Amsterdam, The Netherlands, amschoen@xs4all.nl

Teaching (chemistry) is the most difficult job in the world! The teacher has to: master the subject (repertoire); know the ('foreign') language; be an excellent communicator; demonstrate professionally; be an experienced classroom manager (group work, discussions, (hands on) experiments, computer use); be aware of new developments and introduce them in the classroom; know how to deal with the public (popular media) and promote chemistry. In this talk we will concentrate on the communication with students and the public.

4. Analytical Chemistry Experiments in Microscale

Fortunato Sevilla III. Professor, University of Santo Tomas, Espana Blvd., Manila 1008, Phillippines. <u>fbsevilla@mnl.ust.edu.ph</u>

Analytical chemistry experiments present to the students methods for the determination of the composition of a matter. These experiments demonstrate to the students how chemical principles are applied to measure the amount of substances in a material. Conducting these experiments in microscale enables the teaching and learning of chemical analysis at a reduced expense and at a low risks. In this manner, chemical analysis experiments can be done in high schools and in the general chemistry course. Most microscale experiments on analytical chemistry include qualitative analysis and the classical methods of quantitative analysis, both gravimetric and volumetric. A number of volumetric analysis experiments present variations of the design of a buret using pipettes, syringes and stopcocks. A limited number of microscale experiments have focused on instrumental methods of chemical analysis. Small scale and inexpensive designs of photometers and experiments have been presented to enable optical methods of chemical analysis. Innovations in the instrumentation for potentiometry and conductimetry have led to low-cost microscale experiments on electrochemical analysis. A recent exciting development is the involvement of electronic gadgets, such as the digital camera and iphone, in the chemical analysis systems.

Teaching Through Experiments: The Case of Environmental Chemistry Jorge G. Ibanez. Professor and Chair. Department of Chemical Engineering and Sciences. Universidad Iberoamericana. Prol. Reforma 880, 01219 Mexico, D.F. Mexico. jorge.ibanez@ibero.mx

Laboratory experience is a key ingredient in the learning process of future Chemistry professionals. We developed a set of introductory Environmental Chemistry experiments, mostly at the microscale level (sometimes also called small-scale), that include a pedagogically-oriented set of questions and problems as follows: a) Water characterization: pH, conductivity, chloride concentration (Mohr), sulfate concentration (turbidity), total hardness, Ca and Mg, dissolved oxygen, alkalinity and buffering capacity, carbonate equilibria and water corrosiveness. b) Environmentally-relevant properties and phenomena: The point of zero charge of oxides, E vs. pH (or Pourbaix) diagrams, air oxidation of metal ions, natural photolysis of metal complexes and nitrates, anionic detergents and o-phosphates in water, halogenated hydrocarbons and the ozone layer depletion, acid mine (or acid rock) drainage, the greenhouse effect. c) Remediation strategies and disinfectant production: Electrochemical treatment of gas pollutants, liquid wastes, and soils, removal of nitric oxide by complex formation, photocatalytic transformation of pollutants, chemical mineralization (Fenton), production and analysis of disinfectants (chloramines, ozone, ferrate, and chlorine dioxide). d) Recovery and reuse: Green Chemistry: The recovery and reuse of sulfur dioxide, the electrochemical recovery of components from pollutants and from treatment residues, metal ion cementation. e) Biological aspects: Microorganisms in soil, water and air, toxicity assay using bacterial growth, wastewater disinfection.

Appendix C. Matrix for self-reflection: Comparing Learning Outcomes – Skills

Problem-Solving Skills								
USA	Australia	Eurobachelor						
Problem-Solving Skills.	Investigate and solve qualitative and	1.2 Ability to apply such knowledge and understanding to						
Students should be able to define	quantitative problems in the chemical	the solution of qualitative and quantitative problems of						
problems clearly, develop testable	sciences, both individually and in teams,	familiar nature.						
hypotheses, design and execute	by:	1.3 Competences in the evaluation, interpretation and						
experiments, analyze data using	• formulating hypotheses, proposals and	synthesis of chemical information and data.						
appropriate statistical methods, and draw	predictions and designing and	1.4 Ability to recognise and implement good measurement						
appropriate conclusions.	undertaking experiments in a safe and	science and practice.						
In this process, students should apply	responsible manner	1.6 Computational and data-processing skills, relating to						
their understanding of all chemistry	 applying recognised methods and 	chemical information and data.						
subdisciplines.	appropriate practical techniques and	2.3 Skills in the monitoring, by observation and						
Students should use appropriate	tools, and being able to adapt these	measurement, of chemical properties, events or changes,						
laboratory skills and instrumentation to	techniques when necessary	and the systematic and reliable recording and						
solve problems, while understanding the	• collecting, recording and interpreting	documentation thereof.						
fundamental uncertainties in	data and incorporating qualitative and	2.4 Ability to interpret data derived from laboratory						
experimental measurements.	quantitative evidence into scientific cally	observations and measurements in terms of their						
	defensible arguments	significance and relate them to appropriate theory.						
	• synthesising and evaluating	3.1 The capacity to apply knowledge in practice, in						
	information from a range of sources,	particular problem-solving competences, relating to						
	including traditional and emerging	both qualitative and quantitative information.						
	information technologies and methods.	3.2 Numeracy and calculation skills, including such aspects						
		as error analysis, order-of-magnitude estimations, and						
		correct use of units.						
		3.4 Ability to analyse material and synthesize concepts.						

Write your overarching local learning outcomes for the bachelor concerning problem-solving skills, if existing.

Shortly describe final assessments of problem-solving skills for the bachelor, if existing.

Shortly describe learning activities of problem-solving skills, continuous through the bachelor program, not linked to specified courses or modules, if existing.

Fill in examples of courses or modules where problem-solving skills are in focus!

Course/Module	Learning outcome	Learning activity	Assessment

Reflection

What are the strengths with your work with problem-solving skills in your bachelor education?

What would you like to develop further? How?