Scientific committee:

Dr. Muhamad Hugerat – Conference Chairman

Professor Avi Hofestin – Scientific advisor

Dr. Naim Najami

Dr. Ahmad Basheer – Scientific Coordinator

Dr. Eisam Zoubi

Dr. Naji Kortam

Dr. Fadeel Jobran

Dr. Riam Abu-Much

Dr. Ali Zghair

Mr. Salem Saker

Advocate Tayseer Hasson – Administration Coordinator

Graphic Design: **Shady Tobia**

"Science Education and Green Chemistry for a Sustainable Future"

December 2-3, 2015

Wednesday the 2nd of December

Chair: Professor Avi Hofstein

9.30-10.00: **Professor Salman Elian**, Head of the college: **Welcoming.**

10.00-10.30**: Professor Cathy Middlecamp**, University of Wisconsin, Madison, USA: **Sustainability: What, How, and Why Now, for our Chemistry Students?**

10.30-11.00: **Professor Ronny Neuman**, Deaprtment of Chemistry, Weizmann Institute of Science, Rehovot, Israel: **Green Oxidation: Practice and Dreams.**

11.00-11.30: **Coffee Break.**

Chair: Dr. Thomas Waitz

11.30-12.00: **Professor Kurt Winkelman**, Florida State University, USA: **An Experiment to Demonstrate the Effects of Different Silver Nanoparticles on the Respiration of Yeast.**

12.00- 12.30: **Dr. Ron Blonder**, Department of Science Teaching, Weizmann Institute of Science, Israel:
Responsible Research and Innovation in Science Education: Under what conditions would we agree to have-perovskite based photovoltaic cells installed on the windows of our school?

12.30-13.00: **Dr. Riam Abu-Much,** the Academic Arabic College, Haifa. Israel: **Modern prospects in teaching nano materials**.

13.00-14.00: **Lunch**

Thursday the 3rd of December

Chair: Dr Naji Kortam: Department of Sinece Education; The Arabic Academic College, Haifa.

10.00 -10.30: **Professor Ingo Eilks,** Department of Chemistry and Biology, University of Bremen, Germany:
Chemistry: Relevant Education for Sustainability.

10.30-11.00: **Dr. Rachel Mamlok-Naaman,** Department of Science Teaching, Weizmann Institute of Science, Israel: **Learning about Sustainable Developments in Socio-scientific Issue-based Chemistry Lessons on: Fuels and Bio-plastics.**

11.00-11.30: **Professor Thomas Weitz,** Department of Chemistry, University of Gottingen, Germany. Nano Scaled Semiconducting Metal-Oxides in School Chemistry Education.

11.30-12.00: **Coffee Break**

Chair: Ms. Sawsan Elabony

12.00-12.30: **Dr. Silvija Markic**, Department of Chemistry and Biology, University of Bremen, Germany. **Promoting Sustainable education for all learners in Non-Formal Chemistry Laboratories.**

12.30 -.13.00: **Professor Marika Kapandaze,** Faculty of Science, Ilia State University, Tbilisi, Georgia. **Science Education for Sustainable Future in Georgia.**

13.00 -13.30 **Professor Franz Rauch,** Alpen-Adria University, Klagenfurt, Austria**.**
Education for Sustainable Developments: Models and Competences.

13.30-14.00**: Lunch Break**

Addressing the International Scientific Conference by the College President

Advocate Zaki Kamal

Scientific research is an essential standard for the development of human society as a whole. It is through scientific research that nations are perceived as developed countries that allow their populations to benefit from such a scientific accomplishment. We have witnessed how human progress and advancement transformed this globe into a more industrialized and technological place.

It is imperative to state that populations will not be able to progress without science and knowledge just as history teaches us. Namely, those who did not keep up with the pace of the scientific development got marginalized and weakened in this civil and human revolution.

Currently, we live in this small global village where interests, ambitions and information exchange are interconnected and tangled. Large distances are not posing an obstacle anymore for those who seek knowledge and for exchanging information. It is through realizing these facts that we have become focused and devoted to our utmost resources at the Academic Arab College for Education for conducting scientific research and for holding scientific conferences at our academic institute. We believe that such activities will be a lever and a major pillar for exchanging information and experiences and for strengthening academic relationships.

For the past 10 years we, at the Academic Arab College for Education, have consistently aspired to organize and hold equable international scientific conferences in order to stay abreast and keep up with the tremendous amount of generated information in our world. Through these activities, the college enables the faculty to publish their research findings and attend international conferences.

It is not surprising, thus, that a scientific meeting entitled "Green Chemistry and Teaching Sciences for Sustainability" will be soon held at our college. This is done with the aim of strengthening the culture of keeping the environment safe; particularly since different types of pollution are reaching undesired and dangerous levels. Therefore, the need to deal with this issue is urgent as it negatively affects our social behavior, health and economy.

This conference is the result of our educational and academic effort as well as our interest to demonstrate our involvement in issues of global interest to humanity and to our environment in different places; regardless of our country of origin or race.

I wish the organizing committee all the success. I would also like to wish all of the participants and their communities' institutions a collaborative and insightful academic experience. Finally, I would like to underscore the role of the researchers who came from different parts of the world in making this conference a success.

Professor Salman Ilaiyan

Head of the College

The Academic Arab College for Education in Israel – Haifa

The Academic Arab College for Education in Israel - Haifa is the oldest and largest Arab college in Israel. It serves the Arab sector since the establishment of the state with the goal of developing the Arab education in higher education system.

The college student enrolment is over 2,000 in the undergraduate and graduate levels including all disciplines taught in Arab schools in Israel - ranging from languages, early childhood and special education to science education in primary and post-primary levels.

The Department of Science Education at the college went through significant change in infrastructure and laboratories, as well as the teaching and research faculty members in physics, chemistry, biology, computer science and mathematics.

The science education staff has more than 35 faculty members with Ph.D. degree and post-doctorate research, working on developing learning materials and research, and their studies are published in local and international journals.

The college encourages and supports lecturers participating in international conferences. From here, the idea of developing a curriculum for Science Education MA degree was derived, which includes three fields: material science, life science and mathematics for primary and post-primary education.

This is the place to announce that the professional committee of the Council for Higher Education (CHE) recommended to the subcommittee and plenary CHE to give the program full recognition. The CHE Committees adopted and approved the recommendation.

I take this opportunity to congratulate the technical committee entrusted with the preparation of the conference, and I welcome the participants, our guests from Israel and abroad for their active participation and wish them all academic enrichment

Professor Bernard Pinchuk

Head of the Academic Council

The Academic Arab College for Education in Israel – Haifa

The State of Israel is a leading country in investing in research and development. This stems from recognizing the importance of research in the development of economy and technology and the belief that it will lead to a modern society and educated citizens who can deal with the challenges of our ever-renewed world. In the last decade, this small country has been a factory for Nobel Prize laureates in Chemistry indicating the concerns and investment in research and science in general. Any academic institution seeking to advance and succeed must promote and invest in research, in general, and in scientific research in particular.

There is no doubt that the subject of sustainability is a major issue nowadays. A basic and essential component of sustainability is the field of green chemistry, which gained a great momentum in recent years (from the 90's). Many institutions and researchers are pleased to investigate this important subject, among which, our institution stands "The Academic Arab College for Education in Israel- Haifa ". For the field of green chemistry, two main emphases were put forward:

- *Development of new processes that contain no hazardous substances and do not create environmental pollution.*
- *Finding new ways (not through classical chemistry) for the production of known materials that lead to hazards and pollution reduction based on the existing substance in nature.*

In this manner, chemists can have a major impact on human health and the environment. Production of such materials should be economic, in addition to being ecologically suitable. Many solvents are used every day in a variety of reaction in the manufacturing processes as solvents and thinners. One of the goals of green chemistry is to minimize the use of these solvents and reduce chemical waste accumulated in the industry and research institutions worldwide. Another goal is to give access to chemistry students in science teaching institutions and schools through waste reduction and reduction of risks associated with using solvents and toxic substances in relatively large quantities.

The conference will expose participants and teacher trainees to innovative research, and industrial applications and will highlight environmental and health aspects and implications for instructional educational field in Israel and abroad. The research that began in the College discusses the importance of sustainability and green chemistry teacher trainees, teachers and students in post-primary schools.

One of the main goal for organizing this conference is to make the subject of green chemistry and sustainability in teacher training colleges as an integral part of school programs. All this in the hope of reducing the negative effects of the existing level of risk in classical chemistry. For this reason, we will work together with scientists from universities in the United States and Europe.

Dr. Muhamad Hugerat

Conference Chairman

Arab Academic College for Education in Israel – Haifa

1988-1993 Ph.D. in Physical Chemistry, The Hebrew University, Jerusalem.
1986-1988 M.Sc. in Physical Chemistry, The Hebrew University, Jerusalem.
1983-1986 B.Sc. in Chemistry, The Hebrew University, Jerusalem.

Current Position and Title in the Academic Arab College for Education:

Vice – President, Chairman of Continuing Education Department.
Head of *SALiS* (Student Active Learning in Science) Center.

Lecturer in Science education

Research Interests:

1. Science Education in all level ages.
2. Micro scale electrochemistry.
3. Teaching science through research.
4. New experimental demonstration in chemical education.
5. History and philosophy of science.

He published several articles in different international journal. He wrote many teaching books in science education. He has been involved in organising and speaking at many national and international conferences.

Science Education and Green Chemistry for a Sustainable Future

International Conference

Muhamad Hugerat

Vice President and Chair of the Conference

The Academic Arab College for Education in Israel - Haifa

Rationale for the symposium

In recent years, the debate on the challenge regarding sustainable developments for our future added an important and relevant dimension to science education for all students. This is aligned with the UN decade for education for sustainable development (DESD). Clearly, green chemistry is one of the key components in the components of the idea of sustainability. There is no doubt that in an era in which science educators and professional development providers make a great effort to make the learning of the sciences more relevant to the learners, including green chemistry in the formal curricula and educating for sustainability should not be overlooked.

The main goal of the proposed symposium is to discuss issue related to the inclusion of these two key topics (sustainability and green chemistry) in the science curricula in the Israeli educational system.

About 15 lecturers from Israel, Germany, USA, Austria, Georgia were invited to give plenary talks focusing on (among others) the following key issues:

- Sustainable development and science education
- Green Chemistry and sustainability
- Innovations in science education through education for sustainable development
- Green chemistry: Research and development
- Using sustainability education to make science learning more relevant
- Models for incorporating sustainability into the chemistry curriculum
- In-service and pre-service professional development of science teachers to apply ESD in the classroom.

Professor Ronny Neumann

Nationality: Israeli
Date of birth: September 24, 1953
URL for web site:
http://wws.weizmann.ac.il/Organic_Chemistry/neumann/

EDUCATION

Ph.D. in Catalysis, Applied Chemistry, The Hebrew University of Jerusalem, 1982-1985.
M.Sc. in Applied Chemistry, The Hebrew University of Jerusalem, 1979-1981.
B.Sc. in Chemistry and Biochemistry, The Hebrew University of Jerusalem, 1972-1976.

ACADEMIC POSITIONS

Professor, Department of Organic Chemistry, Weizmann Institute of Science (2002-present)
Associate Professor, Department of Organic Chemistry, Weizmann Institute of Science (1999-2002)
Associate Professor, The Hebrew University of Jerusalem (1996-1999)
Senior Lecturer with tenure, The Hebrew University of Jerusalem (1992-1996)
Research Associate (post-doc) with Professor John Groves, Princeton University (1985-1987)

AWARDS, HONORS AND FELLOWSHIPS

2014 – Israel Chemistry Society Outstanding Scientist Award
2013 – Elected Member of the Academia Europae (Academy of Europe)
2010 – Visiting Professor, University of Paris VI, France
2005 – Visiting Professor, University of Versailles, France
2002 – Appointed to the Rebecca and Israel Sieff Professorial Chair of Organic Chemistry
1992 – Israel Chemical Society Prize for Excellence (Young Scientist Award)

PUBLICATIONS

Total Number Peer Reviewed Publications -210; Invited publications, book chapters – 20; Books – 1
Patents – 5 plus 4 pending; Invited International Symposium Presentations > 100.

RESEARCH INTERESTS AND HIGHLIGHTS

• An original design and study by our group of a novel mechanism for homogeneous oxidation catalysis termed by us as an *electron transfer – oxygen transfer mechanism* for oxygenation. Generic reactions are initiated by electron transfer from the substrate to the catalyst, which upon reduction, transfer oxygen to the organic substrates. Novel transformations have been carried out, e.g., carbon-carbon σ bond cleavage of primary alcohols, insertion of oxygen atoms into metal-carbon (M-alkyl) bonds to yield primary alcohols, and selective hydroxylation of alkyl arenes. This research has culminated in a conceptually novel method for biomass to fuel conversion through the quantitative conversion of carbohydrates from biomass to

synthesis gas. The research has also included other novel transformations and very comprehensive mechanistic studies using both experimental, e.g spectroscopic, and computational techniques.

• The rarely observed dioxygenase activation of O_2 has been demonstrated in Ru-polyoxometalate and Ru-bipyridine complexes with phenyl-selenium tethers towards the long-standing goal of aerobic epoxidation. Recently, using Co- and Cu-substituted polyoxometalates *aerobic* C=C bond cleavage for the selective formation of aldehydes has been invented. This is the first such reaction reported showing reactivity previously only known with highly reactive ozone.

• Novel concepts of organic chemistry in water have been demonstrated with reactions occurring in aqueous biphasic media allowing simple catalyst separation. The concept of lipophiloselectivity has been introduced and unique chemoselectivity has been observed.

• New methods for preparation of polyoxometalate – metal organic hybrid compounds have been introduced culminating in the demonstration of the aerobic oxidation of methane to methanol and acetaldehyde, an efficient Wacker type reaction using for the first time N_2O as oxidant and the photochemical reduction of CO_2 with H_2 to CO at room temperature.

• Extensive research was carried out using polyoxometalates as highly active catalysts for oxidation with H_2O_2, especially the epoxidation of alkenes. Recently we have observed that introduction of a Lewis base into the polyoxometalate leads to an umpolung and a complete change in chemoselectivity. Uniquely selective oxidations using sulfoxides, N_2O and peroxides as oxidants have been reported for the first time.

Green Oxidations - Practice and Dreams

Ronny Neumann

Department of Organic Chemistry,

Weizmann Institute of Science, Israel

Historically synthetic organic chemistry to make ever more complicated molecules developed separately from catalysis that was particularly the domain of petrochemicals. Synthetic organic chemistry is largely based on use of stoichiometric reagents where such reactions produce copious amounts of waste that is often toxic. Especially in the field of oxidation chemistry, the divide between petrochemical transformations using O_2 and synthetic chemistry using reagents chromium oxide, permanganate is especially large. Although considerable advances have been made in recent years using hydrogen peroxide as a green oxidant, the substrate scope is limited so that the majority of transformations involve addition of an oxygen atom to a nucleophile. On the other hand, the use of O_2 freely available from air remains a grand challenge. Solutions that would allow important transformations such as hydroxylation of C-H bonds remain elusive. In this talk I will describe new concepts developed in our research group that can be used for selective C-H bond activation and C-C bond cleavage reactions that are important in applications ranging from the synthesis of fine chemicals to the conversion of biomass to transportation fuels.

Professor Kurt Winkelmann

Department of Chemistry
kwinkel@fit.edu
Florida Institute of Technology

Professional Appointments

Faculty, Florida Institute of Technology	2002 – present
Postdoctoral Researcher, Northwestern University	2000 – 2001
Visiting Instructor, Auburn University	2000

Education

Ph.D. Chemistry, Auburn University	2000
Dissertation: Photoinitiated Reactions on Semiconductor Particles	
B.S. Chemistry with minor in English, Virginia Tech	1995

Research

- Study learning outcomes and attitudes of students performing virtual chemistry experiments
- Create and implement nanomaterial synthesis and characterization laboratory experiments
- Design and measure outcomes of research-inspired experiments in general chemistry
- Introduce hydrogen and alternative energy-themed experiments in general chemistry and measure student attitudes and learning
- Study catalyzed decomposition of environmental contaminants initiated by visible light
- Synthesize novel nanoparticles for use in human space flight applications
- Develop visible light-sensitive actinometry methods

Teaching

- General Chemistry 1 and 2
- Physical Chemistry 1 and 2
- Introduction to Nanoscience and Technology Laboratory
- Computer Applications for Chemists

Administration

General Chemistry Coordinator, Florida Institute of Technology	2010 – present
Online Learning Science Chair, Florida Institute of Technology	2014 – present
Co-Director of TA Training Seminar, Florida Institute of Technology	2012 – 2014

Awards and Honors

Florida Tech Kerry Bruce Clark Award for Excellence in Teaching	2013
Florida Tech Andrew W. Revay Jr. Award for Excellence in Service	2009

Service

Editor-in-Chief of the *Journal of Nano Education*	2010 – present
Activity leader for Florida Tech Engineering Camp	2012 – present
Co-Director of Camp Nanotech summer high school day-camp	2008 – 2009

An experiment to demonstrate the effects of different silver nanoparticles on the respiration of yeast

Kurt Winkelmann, Leonard Bernas, Katherine Stewart, Jean Rose and Carolyn Chabuz

Department of Chemistry

Florida Institute of Technology

Melbourne, Florida, USA

Nanotechnology will have a significant impact on the global economy and our everyday lives. Nanotechnology offers many real and potential benefits but its potential environmental impact is less understood. In order to contribute constructively to the growth of nanotechnology, students should learn about this new field of science and engineering using hands-on activities that can spark discussions about both its benefits and risks. In one such experiment, students synthesize silver nanoparticles then add them to a solution of baker's yeast. Students observe the conditions under which the nanoparticles alter the normal respiration of the yeast, as measured by the volume of carbon dioxide produced throughout a thirty minute period. This leads to a discussion of what silver nanoparticles might do to other organisms. The authors have found that different silver nanoparticle preparation methods affect the behavior of the silver nanoparticles in the yeast suspension. The authors are testing other commonly used nanomaterials to determine how they affect simple organisms like yeast. This presentation will provide a description of this experiment as well as the most recent results of studies involving other nanomaterials on baker's yeast.

Prof. Dr. Franz Rauch

Head of the Institute of Instructional and School Development (IUS)

The Alpen-Adria University Klagenfurt, Austria.

Head of the Institute of Instructional and School Development (IUS) at the Alpen-Adria University Klagenfurt (Austria). He holds a master's degree in Natural Sciences (teaching certification) and Ph.D. in Education and a Habilitation in Education (with a focus in Environmental Education). He worked as science teacher at vocational schools for several years. Since 1991 he is involved in research and development projects. He was a research fellow at the University of Northumbria in Newcastle upon Tyne, England and Fulbright Scholar at the University of Missouri - St. Louis, USA. He is inter alia member of the leading team of the project "Innovations in Mathematics, Science and Technology Teaching" (IMST) in Austria as well as of a university course on ESD in Teacher Education. He was and is involved in some FP 7 Projects (i.e. FIBONACCI, PROFILES, PARRISE). He serves as an editor of the Educational Action Research Journal and as a consulting editor of The Journal of Environmental Education. His areas of research and publication are education for sustainable development/environmental education, networks in education, school development, science education, continuing education for teachers and action research. http://ius.uni-klu.ac.at/franzrauch.

Selected examples of publications:

Rauch, F. (2015). Education for Sustainable Development and Chemistry Education. In V. Zuin & L. Mammino (Eds.) Worldwide Trends in Green Chemistry Education. Royal Society of Chemistry: Cambridge.

Sjöström, J., Rauch, F., & Eilks, I. (2015). Chemistry education for sustainability. In I. Eilks & A. Hofstein (Eds.), Relevant chemistry education – From theory to practice (S. 163-184). Rotterdam: Sense

Rauch, F. Rauch, F. & Pfaffenwimmer, G. (2014). Education for Sustainable Development in Austria. Networking for Education. In R. Mathar & R. Jucker (Eds.) In Schooling for Sustainable Development: A Focus on Europe (S. 157-176). Springer: Dortrecht.

Rauch, F., Zehetmeier, S. & Erlacher, W. (2014). 30 Years of educational reform through action research: Traces in the Austrian school system. In T. Stern, A.Townsend, F. Rauch & A. Schuster (Eds.), *Action Research Innovation and Change: International and Interdisciplinary Perspectives* (S.27-42). Routledge: London & New York.

Hübner, R., Rauch, F. & Dulle, M. (2014). Implementing an Interfaculty Elective "Sustainable Development": An Intervention into a University's Culture between Organized Scientific Rationality and Normative Claim. In K.D. Thomas & H.E. Muga (Eds.), *Handbook of Research on Pedagogical Innovations for Sustainable Development* (S. 510-522). Hershey: IGI Global.

Rauch, F. (2013). Regional networks in education: a case study of an Austrian project.*Cambridge Journal of Education*, 43(3), 313-324.

Rauch, F. & Steiner, R. (2013). Competences for Education for Sustainable Development in Teacher Education. *CEPS-Journal (Centre for Educational Policy Studies Journal),* Jg. 3, Heft 1, S. 9-24
Burmeister, M., Rauch, F. & Eilks, I. (2012). Education for Sustainable Development (ESD) and chemistry education. *Chemistry Education Research and Practice*, Jg. 13, Heft 2, S.59-68.

Education for Sustainable Development: Models and Competences

Franz Rauch

Head of the Institute of Instructional and School Development (IUS)

The Alpen-Adria University Klagenfurt

Austria

Education for Sustainable Development (ESD's) intended purpose is to promote and more thoroughly focus education as a crucial tool, preparing young people to be responsible future citizens, so that our future generations can shape society in a sustainable manner. All educational levels and domains are to be involved in contributing to Education for Sustainable Development (ESD), including Chemistry. The presentation discusses the meaning of Sustainable Development and Education for Sustainable Development and will also focus on competences for ESD. Competences are intensively discussed internationally in the context of cross-curricular themes, such as Sustainable Development and Education for Sustainable Development (ESD). Competence models for ESD will be described and illustrated with examples.

Dr. Ron Blonder

Department of Science Teaching

Weizmann Institute of Science

is a senior researcher in the Department of Science Teaching in the Weizmann Institute of Science
She completed her PhD studies in chemistry in the Hebrew University in Jerusalem and then decided to study chemistry between people and not just the chemistry of matter
She was the coordinator of the "Young thinker" program in Brancoweiss institute where she guided teachers and taught elementary school children.
She was the chemistry coordinator and the manager of the Belmonte laboratories in the Hebrew university and developed inquiry experiments based on advanced instrumentation for high school students
For 9 years she is faculty member in the Weizmann Institute of Science working on chemistry teacher professional development in Israel and in the World.
She is concerned about two central dimensions in chemistry education: First, currently school chemistry content often does not present contemporary chemistry and does not reflect an authentic process of chemistry knowledge utilized in modern research labs. Second, much of the pedagogy underlying chemistry teaching is not congruent with the ways young people learn today in the era of social networks.

Responsible Research and Innovation in Science Education: Under what conditions would we agree to have-perovskite based photovoltaic cells installed on the windows of our school?

Ron Blonder

Department of Science Teaching

Weizmann Institute of Science

Responsible Research and Innovation (RRI) has been the focus of the program Science in Society since 2010. The development of a framework for RRI asks for a close cooperation between society and research. The project Irresistible focuses on the design of activities that foster the involvement of students and the public in the process of responsible research and innovation. In my talk I will describe the module which was developed by the Weizmann Institute team. The module is aimed at fostering positive attitudes towards RRI by both teachers and students, by focusing on the development of perovskite-based photovoltaic cells, which may provide an alternative energy solution to the energy crisis.

Dr. Rachel Mamlok-Naaman

Department of Science Teaching

Weizmann Institute of Science, Rehovot, 76100, Israel

Dr. Rachel Mamlok-Naaman earned her BSc in chemistry from the Hebrew University in Jerusalem (1966), her MSc and PhD in Science Education from Bar Ilan (1992 and 1998 respectively). After conducting her postdoctoral research at the University in Michigan (2000) she joined the Weizmann Institute of Science in the Department of Science Teaching, where she is the head of the National Center for Chemistry Teachers, and the coordinator of the chemistry group at the Department of Science Teaching.

Dr. Mamlok-Naaman is engaged in development, implementation, and evaluation of new curricular materials, and research on students' perceptions of chemistry concepts and professional development of chemistry teachers. She also focuses on production of publications in the areas of teachers' professional development, cognitive aspects of students' learning, assessment and curriculum development. In her work, she uses the experience which she gained as a chemistry teacher who taughed high school students for 26 years. She is the coordinator of chemistry teachers' programs in the framework of the Rothschild-Weizmann MSc program for science teachers, and of projects in the framework of the European Union (the FP7 programs) in Israel - PROFILES (which ended July 2015), and TEMI. In addition, she is the formal representative of the Israel Chemical Society to the various international organizations of Chemistry Education, including the IUPAC CCE and the EuCheMS DivCED, and a member of editorial and advisory boards of journals and organizations of science education.

Learning about Sustainable Development in Socio-scientific Issues-based Chemistry Lessons on Fuels and Bio-plastics

Rachel Mamlok-Naaman

Department of Science Teaching

Weizmann Institute of Science, Rehovot, 76100, Israel

This presentation will deal with the application of socio-scientific issues (SSI)-based science education in the secondary chemistry classroom. Issues of sustainable development are suggested to contextualize chemistry learning. If this is operated in an SSI-based approach controversial issues from the sustainability debate are used to motivate chemistry learning under thorough inclusion of a societal perspective. Aside chemistry content learning the lessons focus an understanding about how society is dealing with developments in chemistry and technology. Examples will be presented from secondary chemistry teaching in Israel and Germany. Alternative fuels and bio-plastics will serve as examples. The discussion will show that a combination of SSI-based science teaching with issues of sustainable development offers a fruitful approach to motivate chemistry learning and contribute the development of general educational skills.

Professor Thomas Waitz

Georg-August-University of Göttingen

Germany

Thomas Waitz (*1979) is Professor for Chemistry Education at the Georg-August-University of Göttingen (Germany).
After graduating in chemistry and sport sciences from the Justus-Liebig-University of Gießen in 2005, he started his in-service teacher training and finished his 2nd state examination in 2007.
From 2007 to 2009, he worked as a teacher and parallel to his work at school, he received his PhD in 2009 in the group of Prof. Dr. Michael Tiemann concerning mesoporous semiconducting metal oxides.
In 2009, he was delegated to the Institute of Chemistry Education at the University of Gießen. In 2010, he accepted a position as Assistant Professor at the University of Göttingen.
His main areas of work concern the didactic reconstruction of socially relevant developments from various scientific and technical domains of chemistry for school chemistry education. In this respect, special focus of his work is placed on cross-linking scientific findings with curricular innovations and standards as well as on content and methodological adaptions of teacher training at university level.
In a variety of projects, he focuses on conceptualization of the topic ‘Nanotechnology’ in the context of sustainable education. In this respect he is especially interested in the development of experiments with new (nano)materials in the areas of sensing, energy conversion and energy storage for school chemistry education, school laboratories and teacher education.
Thomas Waitz is involved in different projects concerning the development of public outreach activities e.g. for Collaborative Research Centre (CRC) 803 and the CRC 1073 which aim to bring Science into school.
Areas of expertise: nanotechnology, higher education, school education, chemistry teaching, public outreach activities

Nanoscaled Semiconducting Metal-Oxides in School Chemistry Education

Thomas Waitz

Department of Chemistry Education, Tammannstraße 4, D-37077 Göttingen, Germany

twaitz@gwdg.de

The fabrication and control of nanometer-scaled materials has enabled the development of a great variety of economically significant technologies, which have become essential for our day-to-day life. These include, for example, scratch resistant coatings (for displays), functional textiles, pigments as well as additives for drugs and food products. Despite their relevance for everyday life, technology and economy, the topic ‘Nano’ only plays a minor role in German school chemistry education. This is also confirmed by the fact that the term ‘Nano’ can only rarely be found in German science school books or curricula of teacher training institutions like universities and ‘Studienseminar’ (second phase of teacher education in Germany). From the chemical didactic perspective, the topic 'nano' offers versatile opportunities to connect chemical and physical school knowledge with relevant and current issues such as sustainable energy supply and pollution control. With the example of simple semiconducting nanoscaled metal oxides like TiO2 and ZnO, we present an experimental approach to the topic 'nano in school'. This includes the isolation and analysis of TiO2 from everyday products like sunscreen, tooth paste, wall paint, or cosmetics, demonstrating students the ubiquity of nanomaterials in everyday life. Based on these isolated materials we further present experiments on photocatalysis, the fabrication of a solar cell (Grätzel cell), or the fabrication of a gas sensor which can be understood through fundamental chemical concepts like the 'donator-acceptor principle'. Finally, it will be shown how these topics can provide student insight into current research and as a consequence thereof, enhance collaboration between schools and university.

Prof. Dr. Ingo Eilks FRSC

University of Bremen - Department of Biology and Chemistry, Institute for Science Education (IDN) - Chemistry Education

Bremen, Germany

Prof. Dr. rer. nat. habil. Ingo Eilks FRSC studied chemistry, mathematics, philosophy and education at the University of Oldenburg. He is a full trained grammar school teacher, having a PhD and the Habilitation in chemistry education. Since 2004 he is professor (chair) in the didactics of chemistry at the Institute of Science Education (IDN) at the University of Bremen.

His research interests encompass various areas. One area is research-based curriculum development, founded on the application of Participatory Action Research to science education. Foci of corresponding projects deal with understanding the particulate nature of matter, cooperative learning, ICT in science education, promoting scientific and media literacy, Education for Sustainable Development, or the socio-critical and problem-oriented approach to science teaching. A second major domain of research focuses science teachers‘ cognition and learning. Different studies are carried out about science teachers‘ beliefs, pedagogical content knowledge, and continuous professional development. A third domain focuses innovations in higher chemistry education.

Ingo Eilks is the organizer of the biannual international symposia on science education at the universities of Dortmund and Bremen. He was leader of different working groups within the European Chemistry Thematic Network (ECTN) and is member of different boards of national and international journals in science education. Up to now, he published about 500 publications in a broad range from refereed international journals, via book chapters and teacher journals, towards textbooks for German lower secondary chemistry education. Currently he is the Editor-in-Chief of Chemistry Education Research and Practice, the highest ranked chemistry education journal in the world.

Ingo Eilks received different awards for his scientific work and teaching, among them the Johann-Friedrich-Gmelin-Award 2003 of the division of chemistry education within the German Chemical Society (GDCh), the Berninghausen-Award 2006 for excellence in teaching and its innovation, the 2014 STEM for Tomorrow School Award, or in 2015 the Senior Fellowship in the Kolleg Didaktik:digital to support innovations in science education based on the use of ICT. In the field of sustainability and green chemistry, he was recently selected for the 2016 ACS-CEI Award for Incorporating Sustainability into Chemistry Education and won three times the award for projects being recognized as official projects of the United Nations World Decade of Education for Sustainable Development (DESD).

A third vision of scientific literacy? - Focusing Bildung, sustainability and societal eco-reflexivity in science learning

Ingo Eilks

University of Bremen - Department of Biology and Chemistry

Institute for Science Education (IDN) - Chemistry Education

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Scientific literacy is one of the generally accepted terms when it comes to the aims of modern science education. However, there are different visions of what scientific literacy means. Most often cited are two visions outlined by Doug Roberts. Roberts' Vision I focuses science learning to understand the applicability of science in technology or industry. His second Vision II describes science teaching starting from everyday contexts for meaningful learning. Anyhow, based on different theories of education, e.g. the concept of Bildung, there is currently a debate to whether there needs to be a third Vision III for societal oriented science learning. The claim concerns to clearly differentiate meaningful contexts for science learning from science education thoroughly based on controversial, hot-type socio-scientific issues – many of them focus ecological concerns, issues of sustainable development, or questions of missing eco-reflexivity. This paper provides insights into some theoretical justification for a third vision of scientific literacy. It presents an organizer of how to reflect corresponding issues for their use in class. It also presents a curriculum model of how to operate socio-scientific issues based science education in lower secondary classes. The curriculum model will be illustrated by a teaching example on learning about and reflecting conventional and alternative plastics in terms of education for sustainable development.

Marika Kapanadze

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(Prof. Dr.) - research interests are teacher professional development, science curriculum development and investigation of teachers' attitudes and students' interest in science after implementation of IBSE. She is one of the authors of National Curricula in Physics and Science in Georgia. She is engaged in development, implementation and evaluation of curricula and new curricular materials. She develops materials for science teachers for inquiry at science laboratories. She was the coordinator of the TEMPUS project SALiS, successfully implemented in Europe in 2010-2012. She coordinated the implementation of FP7 project PROFILES in Georgia. She is a head of science education research center SALiS and science teacher professional development programs at the university. Currently she coordinates FP7 project Chain Reaction and Tempus project LeAGUe at ISU. She is actively involved in pre- and in-service teacher-training courses. She develops the courses about inquiry based learning and active learning methods in Physics and Science. She is a co-author of methodological books in education and in science education.

Science Education for a Sustainable Future - Implementation of Pupils Research Briefs in Georgia

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Project Chain Reaction is a three-year (2013-2016) project funded by the FP7 program of European Commission. Chain Reaction aims to develop Inquiry Based Science Education (IBSE) across twelve partner countries. The project provides interactive and engaging IBSE professional development to teacher education professionals from each participating country using tried and tested inquiry based science resources. Ilia State University is a consortium member of the project and implements the project activities in Georgia.

The Chain Reaction project offers 11 of the original Pupil Research Briefs (PRBs), which are based around "The Earth and the Universe" topic areas.

How the implementation of Chain Reaction modules (PRBs) helps to strengthen Education for Sustainable Development through inquiry-based approaches will be reported. The feedback of the teachers after implementation of the project in Georgia, about the development of their IBSE competences and the results of the study of Georgian science teachers' constructs of IBSE will be presented as well.

Dr. Silvija Markic

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Worked as a high school teacher in chemistry and mathematics before she became a senior researcher and lecturer in chemistry education at the University of Bremen (Germany). Her research interests focus on curriculum development in chemistry and science education, language and the learning of science, linguistic heterogeneity and cultural diversity in science education, teachers' beliefs and knowledge base, and action research in science education.

Promoting sustainability education for all learners in non-formal chemistry laboratories

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In many countries, the informal and non-formal educational sectors gained more and more attention in science and technological education in recent years. They became valuable and well recognized add-ons to the traditional educational system. In Germany, a special form of non-formal student laboratories emerged in recent years to promote primary and secondary practical science learning, so-called Schülerlabor. The talk presents an initiative of operating Schülerlabor in chemistry education to promote education for sustainability for all learners. New Schülerlabor learning environments are developed under consideration of a thorough model of differentiation in different dimensions of diversity. The aim is creating non-formal learning environments that allow all learners learning about and for sustainability, including also lower achieving learners and students with disadvantaged educational biographies. The project initiative, an example from the classroom and first data and implications from the accompanying evaluation are discussed.

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EDUCATION

B.A. Cornell University
Chemistry major, Distinction in all subjects
1968-1972

Ph.D. University of Wisconsin-Madison
Inorganic Chemistry
1972–1976

M.S. University of Wisconsin-Madison Counseling Psychology and Counselor Education 1985–1989

POSITIONS HELD (UW-Madison)

2015 – present Interim Co-director, Office of Sustainability
2013 – present Professor, Nelson Institute for Environmental Studies
2011 – present Affiliate, Department of Chemistry
2011 – 2013 Howe Bascom Professor, Integrated Liberal Studies Program
2011 – 2013 Associate Professor, Nelson Institute for Environmental Studies
2009 – 2011 Chair, Integrated Liberal Studies Program
2000 – 2011 Distinguished Faculty Associate, Department of Chemistry
1988 – 2011 Director, Chemistry Learning Center

HONORS and AWARDS (recent)

2006 2006 Award for Encouraging Women into Careers in the Chemical Sciences American Chemical Society
2009 Fellow (inaugural class)
American Chemical Society
2009 Phi Beta Kappa Teaching Excellence Award
University of Wisconsin-Madison
2010 Award for Incorporating Sustainability into Chemistry ducation
Committee for Environmental Improvement, American Chemical society
2011 William E. Bennett Award for Extraordinary Contributions to Citizen Science Science Education for New Civic Engagements and Responsibilities (SENCER)
2015 2015 Award for Encouraging Disadvantaged Students into Careers in the Chemical Sciences, American Chemical Society

JOURNAL ARTICLES (recent)

Catherine Middlecamp, Learning Chemistry for an Exciting (and Uncertain) Future, *J. Chem. Educ.*, 90, 395-397 (2013).

John Perkins, Catherine Middlecamp, David Blockstein, Jennifer Rivers Cole, Robert H. Knapp, Kathleen M. Saul, and Shirley Vincent, Energy education and the dilemma of mitigating climate change, *J Environ Stud Sci,* 12 October 2014.

David Blockstein, Catherine Middlecamp, John Perkins, Energy Education: Easy, Difficult, or Both? *J. Sustainability Educ*, Vol 8, January 2015.

Timothy Lindstrom, Faramarz Vakili, and Catherine Middlecamp, Light Bulbs: A Bright Idea for Teaching and Learning Sustainability, *Sustainability: J of Record*, Volume 8(2) April 2015.

Catherine Middlecamp, Encouraging disadvantaged students in chemistry: Four-part harmony (or disharmony), Awards Address, *J. Chem. Educ.* XX, XXX-XXX (2015).

BOOKS and BOOK CHAPTERS (recent)

Catherine Middlecamp, Steve Keller, Karen Anderson, Anne Bentley, Michael Cann, Jamie Ellis, Chemistry in Context, 7th edition, McGraw–Hill, Dubuque, IA, 2011.

Catherine Middlecamp and Andrew Jorgensen, Eds. Sustainability in the Chemistry Curriculum, ACS Symposium Series 1087, American Chemical Society, Washington, DC, 2011.

Catherine Middlecamp, Michael Mury, Karen Anderson, Anne Bentley, Michael Cann, Jamie Ellis, Katie Purvis-Roberts, Chemistry in Context, 8th edition, McGraw–Hill, Dubuque, IA, 2015.

Catherine Middlecamp, *Chemistry Education That Makes Connections: Promoting Sustainability*, in Chemistry Education: Best Practices, Opportunities, and Trends, Javier Garcia-Martinez, Elena Serrano-Torregrosa, Eds., Wiley-VCH, Verlag GmbH & Co. KGaA, 2015.

Irv Levy and Catherine Middlecamp, Eds. Teaching and Learning About Sustainability, ACS Symposium Series 1205, American Chemical Society, Washington, DC, 2016. (in publication)

INVITED TALKS (recent)

Learning Science by Making Connections: Energy, Food, and Trash, 2014 Cottrell Scholars Conference, Tucson, AZ, July 9-11, 2014

Learning Science by Making Connections: Energy, Food, and Trash, Purdue University, West Lafayette, IN, October 22, 2014.

Sustainability, What, How, and Why Now? Version 2.0, Systematic Transformation through Evidence-based Reforms, University of South Florida, October 21, 2015.

Every Number Has a Story, 98th Canadian Chemistry Conference and Exhibition, Ottawa, ON, June 13-17, 2015.

Sustainabililty! What, How, and Why Now for Our Chemistry Students

Catherine H. Middlecamp

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What: For many of us who teach chemistry, the "what" of sustainability means learning a new body of knowledge. I will speak to the learning curve, having climbed it as the editor-in-chief of Chemistry in Context, a project of the American Chemical Society. I also will discuss the definition of the term itself, sustainability. Finally, I will describe how making connections is of key importance as students learn about sustainability. Just as they make connections in the sub-microscopic world of atoms and molecules, our chemistry students also need to make connections in the real world around them.

How: The "how" also has a learning curve. Our expertise lies in teaching chemistry problems that have answers in the back of the book. Teaching sustainability involves envisioning solutions to complex problems that are difficult to describe and challenging to remedy. The answers to such problems are not in the back of the book.

Why Now: This one is easier. The time is now because our students (and future citizens) need it, welcome it, and ask for it. So does our professional societies. “Chemistry for a Sustainable World" is a four-way win: for our students, for our discipline, for our communities, and for our planet.

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Education, Certificates, and Degrees

2007-2009 Post-Doc, Bar-Ilan University, Nano-science & Energy
2004-2007 Ph.D, Bar-Ilan University, Nano-Materials
2001-2003 M.Sc, Hebrew University, Jerusalem, Nano-Materials
1997-2001 B.Sc, Hebrew University of Jerusalem.

Academic Administrative Positions Held

2010-2011 Bar-Ilan University, Scientific Researcher
2009-2012 Alqasemi Academic of Education, Lecturer
2008- Academic arab college of Education, Haifa, Lecturer & Scientific Researcher
2003-2007 Bar-Ilan University, Department of chemistry, Teaching Assistant

She published several articles in different international journals, and was involved in organizing and speaking at many national and international conferences.

Nanomaterials in Schools: Lab Activities for the implementation of nano-science in schools

Todays, in teaching science, less particular focus on the issue of nanotechnology and it is hardly found its way into school. In this lecture, I will present lab activities that aim in the implementation of nano-science into school chemistry education.

In the first, I will show the use of filter extrusion Mini-Extruder apparatus, for minimizing the size of "micellar-like" structures to selected emulsion solutions, which enable the students to realize the amazing transparency appearances of the solutions as a function of size.

Secondly, I will present a lab activity aimed at demonstrating the importance of nano-scale materials using a unique point of view. Electrical conductive films made of silver nanoparticles are fabricated. The silver nanoparticles are protected against aggregation by using electrical conductive polypyrrole, which acts also as conductive bridge between them. The experiments show a simpler way for fabricating conductive thin film than the much more complicated and costly conventional method.