22nd Symposium on Chemistry and Science Education

Science Education Research and Education for Sustainable Development (ESD)

University of Bremen, 19-21 June 2014

Program, Abstracts and Information
(Lasfe minute changes 15 June 2014)

http://www.chemiedidaktik.uni-bremen.de/symp2014/index.html
Rationale

The 22nd Symposium on Chemistry and Science Education taking place at the University of Bremen in June 2014 continues a long tradition of symposia stretching back to 1981. In 2014, the symposium will coincide the end of the United Nations worldwide Decade of Education for Sustainable Development (DESD) spanning from 2005-2014.

Already in the past, the Dortmund-Bremen-symposia on science education focused the question of how science education research can help to improve chemistry and science teaching and learning, and also which are the objectives to be followed. In recent years, debate on the challenge of the sustainable development of our future added another dimension towards this discussion. This additional focus and the coincidence with the end of the DESD provoked the organizers of the symposium to entitle the 2014 symposium: “Science Education Research and Education for Sustainable Development (ESD)”.

This title simultaneously maintains and further develops many topics of the past symposia from 2002-2012, in which we discussed the orientations and directions of science education research, questions of contemporary and successful science learning, and the role of research on science teacher education for it. The symposium in June 2014 will reveal and evaluate all these aspects even more in connection to a goals and strategies focusing Education for Sustainable Development within science education.

The main questions addressed will include:

- What does science education research revealed about students’ and teachers understanding of sustainability issues and ESD?
- Which curricula and pedagogies are available to strengthen ESD in science education on secondary and tertiary level and what do we know about their effects?
- What do we know from research about fostering and hindering factors concerning the implementation of science education operated by an ESD approach?
- What do we know about attitudes, motivation and PCK of practicing teachers concerning sustainability issues and ESD in science teaching?
- How is science teacher training for ESD (pre- and in-service) operated and what do we know about the development of teachers’ competencies in successfully applying ESD in science classes?
- Which research-based strategies do we have for implementing ESD thoroughly into to chemistry and science teaching by fostering science concepts simultaneously?
- What consequences does the interdisciplinary nature of most sustainability issues has for chemistry and science education?
Program

Thursday, 19/06/14

10:00-10:30 Welcome, addresses, intentions of the symposium
Bernd Ralle (Dortmund/ Germany)
Thomas Hoffmeister (Bremen/Germ.)

Morning session

Chair Bernd Ralle

10:30-11:15 The question of the relevance of science education and Education for Sustainable Development
Ingo Eilks (Bremen/Germany) & Avi Hofstein (Rehovot/Israel)

11:15-12:00 Innovations in science education through Education for Sustainable Development?
Franz Rauch (Klagenfurt/ Austria)

Lunch break

Afternoon session I

Chair Avi Hofstein

13:00-13:45 "... to help make decisions": Challenges to science education research in the 21st century
Susanne Bögeholz & Jan Barkmann (Göttingen/Germany)

13:45-14:30 Educating for critical citizenship and global sustainability: Chemical education as a case
Jesper Sjöström (Malmö/ Sweden)

14:30-15:15 The effectiveness of the geospatial curriculum approach on urban middle level students’ climate change understandings
Alec Bodzin (Bethlehem/PA, USA)

Coffee break

Chair Shu-Nu Chang Rundgren

15:45-16:30 Conducting Didactical Design Research to enhance students’ understanding of atmospheric phenomena
Thomas Roßbegalle & Bernd Ralle (Dortmund/Germany)

16:30-17:15 Climate change education at a crossroads
John Oversby & Jane Fieldsend (Reading/United Kingdom)

19:30 Welcome evening at the ‘Paulaner an der Schlachte’

Friday, 20/06/14

Morning session I

Chair Rolf Hempelmann

9:00-10:00 Introduction: The German Schülerlabor: Development – position today - impact
Rolf Hempelmann (Saarbrücken/ Germany)

Sustainability and chemistry in non-formal student laboratories: A project to support learning about sustainability
Nicole Garner, Antje Siol, Johannes Huwer, Rolf Hempelmann & Ingo Eilks (Bremen and Saarbrücken/Germany)

The Agnes-Pockels Student Lab at the ‘Technische Universität Braunschweig’ - a place to support chemical education outside school
Petra Mischnick & Beate Faustmann (Braunschweig/Germany)

Learning sustainability in an outdoor chemistry lab
Martin Gröger, Daniela Krischer & Philipp Spitzer (Siegen, Germany)

10.00-10:45 NEW: Sustainability - what does it mean to 8th graders? An analysis of science fair projects and posters
Gabriela Jonas-Ahrend (Dortmund, Germany), Yehudit Judy Dori, Hagit Refaeli Mishkin, Niva Wengrowicz (Haifa, Israel)
## 22nd Symposium on Chemistry and Science Education – Final program

**Coffee break**

**Morning session II**  
Chair Rachel Mamlok-Naaman  
11:15-12:00 The role of values in chemistry education  
Debbie Corrigan, Rebecca Cooper & Stephen Keast (Melbourne/Australia)  
12:00-12:45 Current Green Chemistry and sustainability teaching activities at Canadian universities  
Andrew P. Dicks, Barbora Morra, Laura Hoch, Melanie Mastronardi & John Andaos (Toronto, Canada)

**Lunch break**

**Afternoon session I**  
Chair Silvija Markic  
13:45-14:45 Oral bits/short communications  
e.g. Subrata Das (India), Amal Krishna Banik (Bangladesh), Griet Ceuelemans (Belgium), Patricia Esteve (Spain), Nurma Y. Indriyanti (Indonesia), Bahhatin Deniz Altunoğlu and Bahhatinin Aydînli (Turkey), Supreshkumer. Manthiryappan (South Korea), Ines Nuic (Bosnia-Herzegovina) or Marika Kapanadze (Georgia)

15:00-15:30 Postersession with coffee

**Afternoon session II**  
Chair Vania Gomes Zuin  
15:30-16:15 Green Chemistry and Sustainability Education in the U.S.  
George Bodner (West Lafayette/USA)  
16:15-17:00 Route to sustainability using Green Chemistry: Experiences from Malaysia  
Mageswary Karpudewan & Zurida Ismail (Sains/Malaysia)  
18:00 Sightseeing and Conference Dinner at the ‘Hofbräu’

Saturday, 21/06/14

**Morning session**  
Chair George Bodner  
9:00-9:45 Models for incorporating sustainability and chemistry education  
Yael Shwartz (Rehovot/Israel)  
9:45-10:30 Sustainable development, Green Chemistry and environmental education in Brazil  
Vania Gomes Zuin (Sao Carlos/Brazil)

**Coffee break**  
Chair Franz. Rauch  
11:00-11:45 SSI pedagogic discourse: embracing scientific media literacy and ESD to face the multimedia world  
Shu-Nu Chang Rundgren & Carl-Johan Rundgren (Karlstad/ Sweden)  
11:45-12:30 On the educational goals of innovation and employability  
Jan Nielsen & Henriette Tolstrup Holmegaard (Copenhagen/Denmark)  
12:30-13:15 A reform in science education in Tanzania  
Rachel Mamlok-Naaman (Rehovot/Israel)  
13:15-14:00 Closing – Reflections from the symposium  
Ingo Eilks (Bremen/DE)
Abstracts

The question of the relevance of science education and Education for Sustainable Development

Ingo Eilks (Bremen, Germany) and Avi Hofstein (Rehovot, Israel)

An often used term in the rhetoric of science education reform is ‘relevance’. Science educators are asked to make their teaching ‘more relevant.’ However, the term ‘relevance’ in the science education literature is used often with uncertainty and ambiguity. This talk will present a model for understanding the potential meanings and dimensions of relevance of science education. Further, the model will be reflected in the foreground of the philosophy of Education for Sustainable Development. Major curriculum orientations will be discussed to whether they are having potential for contributing ESD in science education and thus making science teaching more relevant.

Innovations in science education through Education for Sustainable Development?

Franz Rauch (Klagenfurt, Austria)

Does the interdisciplinary nature as well as the present and future relevance of the sustainability debate, with all its inherent dilemmas and uncertainties, constitute a fertile ground for innovations in science education? What is the potential to link the regulative idea of sustainable development and education for sustainable development (ESD) with teaching and learning in the sciences as well as school development? In how far support the characteristics of ESD (like interdisciplinary and holistic character; values orientation, critical thinking and problem solving, participatory decision-making, local and global relevance) innovations in science education? These questions will be elaborated and reflected on as well as illustrated by practical examples found in projects like IMST (Innovations in Mathematics, Science and Technology Teaching (http://imst.ac.at), the ENSI (Environment and School Initiatives) and CoDeS (Collaboration of Schools and Communities for Sustainable Development) Networks (http://ensi.org) or the FP 7 project PROFILES (http://www.profiles-project.eu/).

"... to help make decisions": Challenges to science education research in the 21st century

Susanne Bögeholz and Jan Barkmann (Göttingen, Germany)

Many private, professional and public decision-making tasks of the 21st century are beset with a bewildering level of factual and normative uncertainty and complexity. Without appropriate intellectual tools at hand, learners and adults are not able to respond systematically to these tasks. Although being a core component of scientific literacy concepts and of competence definitions with respect to socio-scientific issues, substantial challenges to science education and science education research remain. Focusing on decision-making tasks related to Sustainable Development, we relate these challenges to current research on socio-scientific reasoning and socio-scientific decision-making. Substantial gaps in Education for Sustainable Development become apparent. One such gap consists in insufficient attention paid to providing learners with procedural knowledge to solve complex decision-making tasks including the ability to assess the socio-economic impacts of differing decision-making options. Knowledge as provided by environmental and institutional economics remains largely under-utilised in the respective educational contexts although hardly dispersible.


Educating for critical citizenship and global sustainability: Chemical education as a case

*Jesper Sjöström (Malmö, Sweden)*

We live in a risk society, characterized by increasing complexity and unpredictable consequences of techno-scientific innovations and production. One example is the “chemicalisation” of our society. The risk society needs educated citizens who are able to understand the world and make informed decisions – in both their private and professional lives, and as citizens engaged in democratic processes and sustainability issues. (Allgemein-)Bildung is an educational ideal for the citizens and it is according to Wimmer (2003) “the central critical concept of modern pedagogy”. In the area of chemistry the ideal is covered by the term “critical chemical literacy”. Except for scientific concepts and models, which is in focus in “normal” chemistry, scientific processes and societal contexts are also emphasized in Bildung-oriented chemical education. Examples of alternative practices, which will be highlighted and problematized in the presentation, include the sub-discipline green chemistry, thematic chemistry videos available online and education based on socio-chemical issues. It is argued that Bildung-oriented chemistry should be influenced by research fields/areas such as ESD research, risk education research, science and technology studies, cultural studies of science, and philosophy of chemistry.

The effectiveness of the geospatial curriculum approach on urban middle level students’ climate change understandings

*Alec Bodzin (Bethlehem/PA, USA)*

Climate change science is a challenging topic for student learning. This quantitative study examined the effectiveness of a geospatial curriculum approach to promote climate change science understandings in an urban school district with eighth grade students and investigated whether teacher- and student-level factors accounted for students’ climate change knowledge achievement. The participants included 12 science teachers and 956 eighth-grade students. Data included a pre- and posttest climate change assessment measures for both teachers and students and a teacher measure of geospatial science-technological pedagogical content knowledge. Paired-sample t tests revealed statistically significant gains from pretest to posttest on their climate change knowledge (p < .001; effect sizes being large on multiple-choice items and medium on the open-ended response assessment). Both ordinary least squares (OLS) multiple regression and 2-level hierarchical linear modeling (HLM) found that student initial climate change knowledge and gender were significant predictors for students’ posttest scores, p < .05. Students’ pretest scores was the strongest significant predictor of the posttest scores, p < .001. Neither the teachers’ climate change knowledge nor their geospatial science-technological pedagogical content knowledge had significant association with the student posttest scores. Teaching years was a significant predictor for student posttest scores in OLS regression (p < .001). The findings provide support that a geospatial curriculum approach is an effective science curriculum approach for learners in urban middle level education.
Conducting Didactical Design Research to enhance students’ understanding of atmospheric phenomena

*Thomas Roßbegalle and Bernd Ralle* (Dortmund, Germany)

Global change phenomena may have far-reaching impacts for humanity in the 21st century. Due to anthropogenic influence to atmospheric phenomena (e.g., an intensified greenhouse effect as a result of emissions of greenhouse gases), the United Nations declared the concept of sustainable development. The resultant concept of education for sustainable development aims at promoting “Gestaltungskompetenz” (shaping competence) which relies on vital, complex and interdisciplinary knowledge. However, many studies show that students lack adequate understanding of the underlying scientific processes of global change phenomena. Consequently, the project Atmosphere in Chemistry Lesson (AIR) deals with developing and evaluating learning designs that support a more sophisticated and more scientific understanding of the greenhouse effect, acid rain and the depletion of stratospheric ozone. The presentation will give an insight into the research strategy, which follows the Didactical Design Research in the Dortmund Model and into the development of teaching-learning arrangements. After that we discuss results from the empirical evaluation, bringing students’ learning processes and obstacles into focus.

Climate change education at a crossroads

*John Oversby and Jane Fieldsend* (Reading, United Kingdom)

Climate change education (CCE) occupies a special position in education. In relation to science education, it provides an excellent case study for extending thinking about the Nature of Science, including issues of data kinds, modelling, visualization and reliability. CCE also challenges the fragmented model of subjects in the curriculum, where parts of the subject are scattered throughout separated disciplines. In addition, there are key points in learning where the knowledge becomes troublesome, that is, where there may be specific barriers to learning that need to be overcome (teachers’ scientific subject knowledge; complex nature of CCE; Nature of Climate Science as a Science; CCE as context for controversy; CCE focused solely on alternative energy). These outcomes give valuable pointers for change.

Sustainability and chemistry in non-formal student laboratories: A project to support learning about sustainability

*Nicole Garner, Antje Siol, Johannes Huwer, Rolf Hempelmann and Ingo Eilks* (Bremen and Saarbrücken, Germany)

Addressing issues of sustainability in school is the key towards a change of attitude. But, there is too little focus on sustainability in schooling contexts. Unavailable teaching materials, experiments, and general conditions at school may be reasons for this. And this is precisely where Sustainability and chemistry in non-formal student laboratories would lie to offer assistance. Universities of Bremen and Saarbrücken initiated this project to develop half- and full-day non-formal laboratory-based learning environments on issues of sustainability in chemistry related contexts. The core element of the project is the linkage between non-formal and formal learning. Therefore, all modules are following the national science education standards and materials for pre- and post-processing
in school are offered. The modules are created to support a learner-centred and inquiry-based learning. The project, a specific example, and the experiences gained with the project are presented on the poster. This project is supported by the Deutsche Bundesstiftung Umwelt (DBU).

The Agnes-Pockels Student Lab at the 'Technische Universität Braunschweig' - a place to support chemical education outside school

Petra Mischnick and Beate Faustmann (Braunschweig, Germany)

Chemical education at German schools is usually characterized by a tight time schedule, limited equipment and a pupil : teacher ratio of about 30 : 1. Under these conditions, experimental work is necessarily restricted. Thus, student labs e.g. at universities or exploratories, have gained increasing importance during the last decade to complement the education of children and young people in science. In the field of sustainability and environmental matters the Agnes-Pockels-Lab together with the Realschule Maschstraße in Braunschweig has developed sets of experiments dealing with catalysis, cycles of matter and heat storage. Pupils can till example experience chemical and biocatalysis, study the CO2/O2 cycle, work with phase change materials or perform forms of recycling. This project was supported by the Deutsche Bundesstiftung Umwelt (DBU).

Learning sustainability in an outdoor chemistry lab

Martin Gröger, Daniela Krischer and Philipp Spitzer (Siegen, Germany)

We have set up an “open air laboratory with experimental field” (FLEX), a learning environment close to nature, located outside a small village near a forest. There amongst others we have a large meadow, springs, a pond, numerous plants, and a shed, which was remodeled into a room for experiments (“laboratory”) and equipped with extensive experimental material. We believe that through out-of-school learning of chemical phenomena in this natural setting both interest in and popularity of the subject chemistry can be increased. Furthermore, long-term attitudes towards chemistry and sustainability shall thus be influenced positively. Nature-related contexts in which basic chemical concepts and aspects of sustainability can be introduced are, for example, “From the benefits and harms of CO2”, “From the plant to the drug”, or “Environmental analysis”. First projects are evaluated with respect to environmental attitudes. This project was supported by the Deutsche Bundesstiftung Umwelt (DBU).

Sustainability - what does it mean to 8th graders? An analysis of science fair projects and posters

Gabriela Jonas-Ahrend (Dortmund, Germany), Yehudit Judy Dori, Hagit Refaeli Mishkin, Niva Wengrowicz (Haifa, Israel)

Last minute change to oral presentation.
Current Green Chemistry and Sustainability Teaching Activities at Canadian Universities

Andrew P. Dicks, Barbora Morra, Laura Hoch, Melanie Mastronardi and John Andraos (Toronto, Canada)

This presentation focuses on the nature of contemporary green chemistry instruction and outreach at post-secondary institutions in Canada. An overview of work at a regional scale will firstly be discussed, along with instructor and student perspectives gained from detailed surveys. Time will then be spent outlining more specific activities incorporated into the undergraduate curriculum at the University of Toronto. These include lecture and laboratory exercises embedded in second- and third-year organic chemistry courses, some of which involve problem-solving and decision-making on an individualized basis. A novel and successful capstone course focusing on principles and applications of catalysis within the realm of synthetic chemistry will be described. Finally, the role of a graduate student-run organization (the University of Toronto Green Chemistry Initiative: www.chem.utoronto.ca/green/chemistry.htm) will be highlighted, in terms of educating the university population about application of the twelve principles of Green Chemistry.

The role of values in chemistry education.

Deborah Corrigan, Rebecca Cooper and Stephen Keast (Melbourne, Australia)

Values are central to the teaching and learning process. As Hildebrand (2007) asserts no science curriculum is value-free and to develop life-long scientific capability we need to ‘design ways in which diverse value positions – of scientists, science educators, teachers and students – can be embedded in our curriculum’. This chapter will explore how what roles values play in chemistry education. More specifically values that underpin chemistry as a discipline, as a curriculum area and how such values are manifested in chemistry teacher practice and influence how students learn chemistry will be examined. Values also play a role in the assessment of student learning and examples of different assessment practices will be highlighted.

Green Chemistry and Sustainability Education in the U.S.

George Bodner (West Lafayette, USA)

The American Chemical Society has been a strong proponent of green chemistry for many years. There are many reasons for the growth of green chemistry movement, not the least being the convictions among leaders of the global chemical enterprise that the design of products and chemical processes that might be described as “green” is a fundamental building block in efforts to create a sustainable economy. In this paper, the author will take advantage of his perspective as a member of the ACS Board of Directors to describe some of the efforts to bring green chemistry and sustainability education into the curriculum in the U.S.
Route to sustainability using Green Chemistry: Experiences from Malaysia

Mageswary Karpudewan and Zurida Ismail (Penang, Malaysia)

Green chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. Green chemistry is used to address major areas like energy, global change, resource depletion, food supply and toxics in the environment. Incorporating green chemistry principles into the chemistry curriculum is an approach that focuses towards teaching science concepts simultaneously educates our students about their responsibilities and obligations as environmental stewards. This approach also provides opportunities to shape positive perceptions about the role chemistry in society and to address the need to discover and develop sustainable chemistry for the future. In this paper detail illustrations on how green chemistry has been integrated into chemistry teaching methods course and secondary school curriculum will be provided. Additionally, the assessment of the impact of the integration will be discussed as well.

Models for Incorporating Sustainability and Chemistry Education

Yael Shwartz (Rehovot, Israel)

Chemistry education aims not only at preparing students for an academic career, but also at helping them to become responsible citizens. Dealing with environmental issues is crucial for human been survival. Recently the awareness to environmental issues is increasing, and the need to deal with them in an intellectual manner also increases. Thus, it is important to incorporate sustainability issues into science education in general, and chemistry education in particular. In this talk we will introduce research and development of 3 different models: (1) Integrating Green Chemistry into high-school chemistry curriculum via a web-based texts, (2) Establishing an interdisciplinary course of environmental studies with a strong emphasis on scientific knowledge and skills, and (3) Informal project-based competition for non-majors in chemistry.

Sustainable development, Green Chemistry and environmental education in Brazil

Vania Gomes Zuin (Sao Carlos, Brazil)

In 2014 the Decade of Education for Sustainable Development established by the United Nations General Assembly, through its Resolution 57/254, will be concluded. One of its main objectives is to allow “every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future” which requires “methods that motivate and empower learners to change their behavior and take action for sustainable development”. In this context, a reflection considering the core of sustainable development and Green Chemistry philosophy and their relation to the field of Environmental Education in Brazil over the 14 last years will be discussed in this contribution. Special attention will be given to the most recent pieces of research, initiatives and approaches related to Green Chemistry Education towards a socio-environmental sustainability, taking into account the Brazilian publications divulged in the Brazilian Chemical Society vehicles.
SSI pedagogic discourse: embracing scientific media literacy and ESD to face the multimedia world

Shu-Nu Chang Rundgren (Karlstad, Sweden) and Carl-Johan Rundgren (Stockholm, Sweden)

In this science and technology dominated society, the complex interrelationship of science, technology, environment and society has been noticed during the past 30 years. In line with this phenomenon, socio-scientific issues (SSI) are not only emerging in the research field of science/environmental education, but also discussed in our everyday multimedia world. This year is the last year of the UN Education for Sustainable Development (ESD) decade (year 2005 to 2014), it is time to reflect upon what we have done and how we ought to continue in the next step. Therefore, in this presentation, firstly, I will address the important relationship of science media literacy (SML), ESD and SSI in the modern society. Secondly, based on the aforementioned important relationship of SML, ESD and SSI, a model of SSI pedagogical discourse is presented to contribute to school education. The implications to ESD, media, science and citizen education are delineated.

On the educational goals of innovation and employability

Jan Alexis Nielsen and Henriette Tolstrup Holmegaard (Copenhagen, Denmark)

During the past 20 years the use of the concepts innovation and employability have gained more and more traction in the educational field. These trends in general educational policy, we assess, will have notable consequences for the field of science education in the near future. In this talk, we explore the origin of the two concepts and the various ways they are applied. Further, we present an analysis of how the concepts – treated as curricular goals – can contribute to the development of students’ science competences to meet the requirements of the 21 century.

A reform in Science Education in Tanzania

Rachel Mamlok-Naaman (Rehovot, Israel)

The following paper deals with a project, regarding the development, implementation and evaluation of a new science technology-based curriculum which was launched in 2012: A Joint Engineers-Educators Project for Enabling Science Learning in Rural High Schools in Tanzania. The project involved scientists from EPFL Swiss Federal Institute of Technology in Lausanne, from the Weizmann Institute of Science in Israel, and from the University of Dodoma in Tanzania. The main goal of the project was to strengthen the science education in order to enhance the economic development, and referring to ecological and societal sustainability, in a country in which the technological infrastructure science and health facilities are poor. The project consisted of the development of a new technology-based science curriculum, and of a coaching program for the teachers, accompanied by an evaluation study. The findings revealed that the project served as an appropriate educational model which could be adopted for sustainable development in order to maintain a healthy and prosperous society.
Oral bits/Short communications

(1) Rolf Hempelmann (Saarbrücken, Germany)
The German Schülerlabor: Development – position today – impact

(2) Nicole Garner, Antje Siol, Johannes Huwer, Rolf Hempelmann and Ingo Eilks (Bremen and Saarbrücken, Germany)
Sustainability and chemistry in non-formal student laboratories: A project to support learning about sustainability

(3) Petra Mischnick and Beate Faustmann (Braunschweig, Germany)
The Agnes-Pockels Student Lab at the ‘Technische Universität Braunschweig’ - a place to support chemical education outside school

(4) Martin Gröger, Daniela Krischer and Philipp Spitzer (Siegen, Germany)
Learning sustainability in an outdoor chemistry lab

(5) Subhadip Roy, Rupak Banik, Subrata Das (Agartala, India)
Chemical education and research to achieve goals of sustainable development: Bio-surfactant as a case study (Cancelled)

(6) Amal Krishna Banik (Dhaka, Bangladesh)
Developing a science course for non-science students

(7) Doris Elster, Tanja Barendziak, Frederike Haskamp und Lena Kastenholz (Bremen, Germany)
Pre-service teacher education for a sustainable future: Insights into the INQUIRE course Bremen

(8) Griet Ceulemanns (Leuven, Belgium) and Ingo Eilks (Bremen, Germany)
The understanding of sustainability and education for sustainable development among experienced Flemish chemistry teachers and Flemish teacher trainees of chemistry and geography

(9) Franz Radits, Christine Heidinger & Manfred Bardy Durchhalter (Vienna, Austria)
Authentic Inquiry learning meets education for sustainable development

(10) Gebrekidan Tesfamariam (Mekelle, Ethiopia), Annette Lykknes and Lise Kvittingen (Trondheim, Norway)
Perceptions of secondary school chemistry teachers towards small-scale chemistry experimentation approach

(11) Michael Coffey and Daniel. Rawlins (Nottingham, United Kingdom)
Introduce sustainability to chemistry higher education students using an interactive board-game: Green Chemistry

(12) Sandra Hubricht and Bernd Ralle (Dortmund, Germany)
How to encourage scientifically interested students in informal learning environments

(13) Patricia Esteve, Mercedes Jaén and Antonio De Pro (Murcia, Spain).
How can we teach the value of biodiversity? A methodological proposal to future primary teachers

(14) Tuszie Widhiyanti, David Treagust, Mauro Mocerino (Perth, Australia)
The power beyond its simplicity: Effectiveness of POE strategy to enhance pre-service teacher understanding about intermolecular spacing in matter

(15) Nurma Yunita Indriyanti (Surakarta, Indonesia) and Hans-Dieter Barke (Münster, Germany)
Teaching the mole through experiential learning for a sustainable future
(16) Anne-Katrin Holfelder and Ulrich Gebhard (Hamburg, Germany)
Students’ perception of Sustainable Development

(17) Bahattin Deniz Altunoğlu (Kastamonu, Turkey) and Esin Atav (Ankara, Turkey)
An analysis of high school students’ perceptions about environmental risks based on demographical characteristics and their approach towards environment

(18) Bahattin Aydinli (Kastamonu, Turkey)
The emerging concept “sustainability” in science education curriculum of Turkey

(19) Ilse Bartosch and Roswitha Avalos Ortiz (Vienna, Austria)
Teaching sustainable energy management in a blended learning environment – First evaluation results

(20) Gabriela Jonas-Ahrend (Dortmund, Germany), Yehudit Judy Dori, Hagit Refaeli Mishkin, Niva Wengrowicz (Haifa, Israel)
Sustainability - what does it mean to 8th graders? An analysis of science fair projects and posters (Changed to oral presentation)

(21) Laura E. Rice, Odilla E. Finlayson, Kieran Nolan (Dublin/IE)
Enabling Green Chemistry: Understanding structures of organic molecules

(22) Meliha Zejinagic-Hajric, Maida Haskic and Ines Nuic (Sarajevo, Bosnia-Herzegovina)
Sustainable Development in Bosnia and Herzegovina – Current environmental situation and possibilities

(23) Louise Bindel & Martin Lindner (Halle, Germany)
Hands on climate change - Design and evaluation of an interdisciplinary workshop about the science behind climate change

(24) Marika Kapanadze and Ekaterine Slovinsky (Tbilisi, Georgia)
Science education for sustainable development and the project Chain Reaction in Georgia

(25) Sonja Pullen (Uppsala, Sweden) and Katharina Brinkert (London/UK)
With a multidisciplinary course concept towards a sustainable education in chemistry

(26) Christian Bertsch, Heidemarie Pirker, Christian Vogl, Elisabeth Klingbacher, and Theresa Markut (Vienna, Austria)
McKioto – Climate impact of young people’s eating behavior

(27) Sabine Mälzer and Dörte Ostersehlt (Bremen, Germany)
Effects of an experimental exploration of a moor environment promoting the evaluation and judgment skills of school students

(28) Sureshkumar Manthiriyappan (Suwon, South Korea)
Smartphone as an educational tool for sustainable development (Cancelled)
**Conference chair and contact**

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**Symposiums Website**

www.chemiedidaktik.uni-bremen.de/Symp2014/index.html

**Information about the University of Bremen**

www.uni-bremen.de

**How to get to the University of Bremen, flights, low fare connections**

www.chemiedidaktik.uni-bremen.de/Symp2014/index.html

**Information about Bremen**

http://www.bremen-tourism.de

**Accommodation**

http://www.bremen-tourism.de

**Bremen Campus Map**
Social Program

Early Arrivals, Wednesday, 18 June 2014, 19:30

For those who already arrived on Tuesday we will make a reservation at 19:30 in the restaurant "Becks in’n Schnoor" in the centre of Bremen (‘3’ on the map, address Schnoor 34, tram station ‘Domshiede’). Dinner is served à la carte. All costs are on the participants.

To allow planning please register for this evening with the registration form up to May 15, 2014.

Welcome Evening, Thursday, 19 June 2014, 19:30

The welcome evening will take part on Wednesday at 19:30 in a restaurant at the river bank of the Weser. The restaurant is the Paulaner an der Schlachte (‘4’ on the map, address Schlachte 30, tram station ‘Am Brill’). On this evening, dinner will be offered a la carte. All costs of this evening are on the participants. A pre-order of meals shall be made during the morning session of June 19, 2014.

To allow planning please register for this evening with the registration form up to May 15, 2014.

Sight Seeing and Conference Dinner, Friday, 20 June 2014, 18:00

The conference evening will start with a guided sightseeing in the historical city centre of Bremen (tram station ‘Domshiede’, meeting point is the statue of the Roland and on Old Bremen Market Square, ‘5’ on the map).

The Bremen Rathaus (Major House) was built between 1405-1410. The Rathaus is acknowledged as one of the masterpieces of the Weser renaissance. It is part on the ensemble of the old Bremen market. The Bremen market with the Major House, Cathedral, Roland and Chamber of Commerce became monuments of UNESCO world cultural heritage in 2004 (www.unesco-welterbe.de/en).

After the sightseeing the conference dinner will take place at the Ratskeller from 19:30 (‘6’ on the map).

The price including guided tour and dinner is 40 €. A reduced price of 30 € is offered to students and doctoral students with half a salary or less. Please add a respective attestation to your registration. Costs for drinks have to be paid individually.

Registration for this evening is obligatory with the registration form not later than May 15, 2014.
1: Bremen Main Station; 2: Hotel Star Inn Columbus

3: Early Arrivals Evening „Becks in’n Schnoor”, Schnoor34

4: Welcome Evening “Paulaner an der Schlachte”, Schlachte 30

5: Conference Evening Sightseeing, meet at the ‘Roland’

6: Conference Dinner “Ratskeller”
Scimnce Education and Education and Sustainable Development

22nd Symposium on Chemistry and Science Education in Bremen, 19th - 21st June 2014

Registration Form

The Symposium is free of charge. To allow better planning all persons interested to come are asked to register up to June 01, 2014.

Name: __________________________________________
Affiliation: _______________________________________
___________________________________________
Email: ___________________________________________

I will participate: YES ☐ NO ☐

I’m interested in the book of proceedings: YES ☐ NO ☐
The book of proceedings will be published in late summer 2014 by Shaker Publishers Aachen. The book will be 25 Euro (p&p included). Order can be given at the conference office or via fax (+49 421 218 63288).

For the social events registration is requested not later than May 15, 2014.

I will participate on the early arrivals evening and dinner on Thursday, 18 June 2014
(On this evening all costs are on the participants. Registration is just to allow planning for the restaurant.)

I will participate on the welcome evening and dinner on Thursday, 19 June 2014
(On this evening all costs are on the participants. Registration is just to allow planning for the restaurant.)

I will participate in the conference evening at the Bremer Ratskeller on Friday, 20 June 2014
Total costs are € 40. The price includes a sightseeing tour and the buffet. Drinks are not included. Registration is required up to May 15, 2014. Please pay until May 15, 2014, to Uni Bremen, Bank: Bremer Landesbank, BIC BRLADE22, IBAN DE20 2905 0000 1070 5000 22. Note on the transfer your name and “Fonds 40200509-Sommersymposium 2014”. Participants from outside the EU may pay at the conference office.

Student, co-worker with not more than half a salary
A reduced price of € 30 is offered for the conference dinner to students or scientific co-workers with less than half a salary. Please send a respective attestation together with your registration. Number of reduced tickets is limited. Bank account, see above.

Please send this form by email to rfofana@uni-bremen.de
or via fax to +49 421 218 63288
Notes
The symposium is supported by

Nolting-Hauff-Stiftung

DBU

Deutsche Bundesstiftung Umwelt

www.dbu.de

Universität Bremen

VCI nord