Supporting and promoting science education internationally

The ICASE Newsletter November 2010

Newsletter of the International Council of Associations for Science Education.

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1. ICASE News

The Tartu Declaration

This document, stemming from the World Conference held June 28 - July 2, 2010 in Estonia on the theme - **Innovation in Science and Technology Education: research, policy, practice and endorsed by the participants,** presents the major ICASE direction as seen by the ICASE Executive Committee. However it does present a dilemma for ICASE. The ICASE constitution indicates that member organisations (which are the actual ICASE) promote what role ICASE is expected to portray to the rest of the world.

It is thus important that all ICASE member organisations (NOT individuals as they are members only by virtue of being a member of their own national associations/organisation) consider the Tartu declaration and raise any concerns they may have. This applies to the very big organisations (such as NSTA) to the very small (there are many in this category but perhaps I can use SLASME – the Sri Lanka Association for Science and Mathematics Education – as one example).

To be aware what the declaration is about and the aspects included, please see section 3 of this newsletter. Member organisations are more than welcome to react, and are specifically requested to put this before their own appropriate committee so that the ICASE Executive Committee can seek endorsement.

2. Science Activities

These following activities are from a collection built up by ICASE through its former primary science newsletter (STEP) and other sources. They are put forward to bring attention to small activities which can be carried out in the science classroom with minimal equipment.

A STEP ACTIVITY

STEP ACTIVITY

Soils and water absorption

Contributed by S P Ariyawathie, Sri Lanka

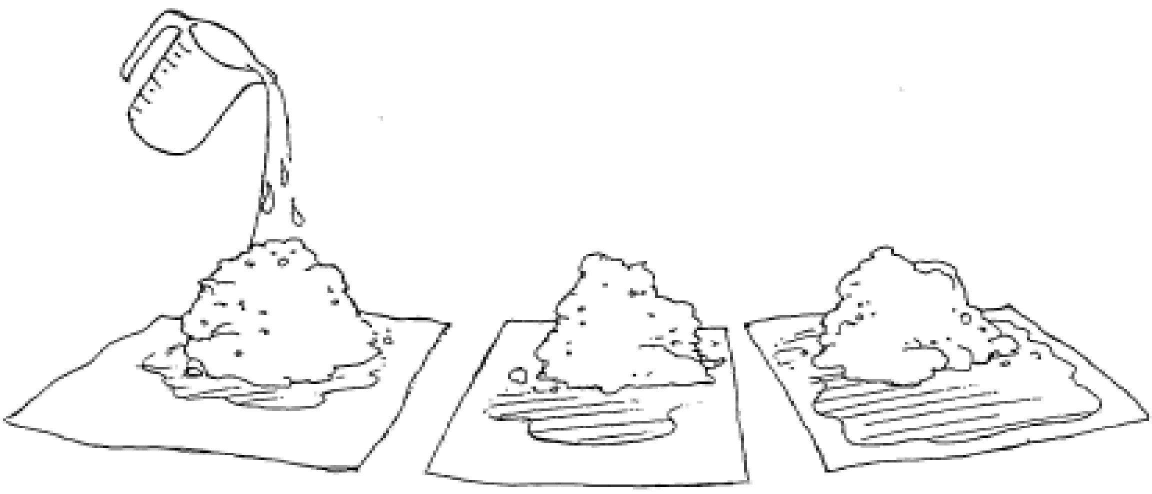
Challenge: How can you measure the amount of water absorbed by different soils?

What you need

- different soil samples
- 2 measuring jugs (one could be a syringe)
- absorbent paper such as newspaper or kitchen paper towel

What to do

Measure identical sample amounts of soil. Place each sample on an absorbent piece of paper – these should be the same type and size. Add the same amount of water to each soil sample and observe what happens. Measure the area of dampness around each mound of soil.



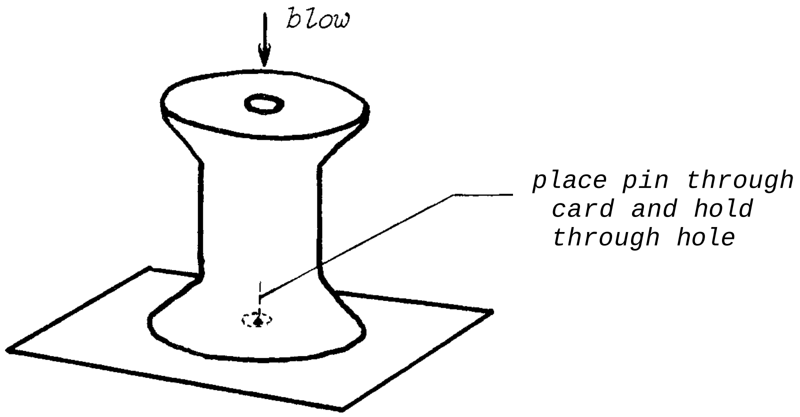
More to do

- How can you make the soil hold more water? Design and test you ideas. Why is this knowledge important?

B) ADDITIONAL SCIENCE ACTIVITY

THE FLOATING CARD

Materials: 1. A paper card (3 x 5").
2. A thread spool and a pin.



Procedure:

1. Hold the card up close to the mouth and blow against it. What do you observe? What did the card do?
2. Now push the pin through the center of the card
3. Hold the card against the spool with the pin sticking in the hole of the spool. Ask: "What would you expect the card to do when I blow through the hole of the spool?" (Anticipated answer: 'blow away').
4. Now blow through the hole of the spool and let go of the card (card should stick against the spool).

Questions:

1. What did you observe when blowing against the card without the spool?
2. What did you observe when blowing through the hole of the spool against the card?
3. Where was the faster flow of air created?
4. What is different about the air above the card as compared to the air under the card (while blowing through the spool hole)?
5. What is keeping the card against the spool?

Explanation:

By blowing in the hole of the spool, we are creating a faster flow of air above the card, thus creating a partial vacuum at this spot: between the card and the spool. The relatively slower moving air, which is surrounding the card, exerts a higher pressure compared to the air between the card and the spool. This makes the card stay close to the spool. As soon as we stop blowing through the spool, the card drops, because the pressure above and below the card is equalized.

C) USING EXPERIMENTAL IDEAS IN SCIENCE TEACHING

This newsletter contains two experimental ideas. It is hoped that these are of interest. But how to use these experiments in teaching? Teachers need to be free to include experimentation as they feel best, but given below is ICASE thinking in putting forward the experiments in this newsletter. Teachers and science educators are welcome to comment.

1. Who does the experiment ?

Clearly these experiments can be undertaken as a teacher demonstration. However, the intention is that the students are involved, either working individually, or more likely, in small groups. The apparatus is kept as simple as possible and can often be brought from home, or made by the students themselves.

Why is student involvement preferred ? We note the old Confucius saying – I hear and I forget; I see and I remember; I do and I understand. The belief is that the more students are engaged, the more they learn. Teacher demonstrations, or large group experiments, limit student involvement and are thus not preferred.

2. Should instructions be given to students ?

The sections *'What to do'* and/or *'Procedure'* clearly spell out how to undertake the experiment. But it is not intended that the experiment must be used in this way. By following instructions, a *'cookbook,'* or *'follow a recipe'* situation is created. This highlights the **doing,** but **probably not** the understanding. Where instructions are provided, the student learning can be expected to be the explanation that follows. And the teacher is then focusing on students' explanatory skills. The questions have been added to the first experiment to encourage moves away from a 'cookbook' or 'do-and-forget' approach and towards a more exploratory approach. In the second experiment the questions seek understanding which can lead to modifications of the experiments for more novel effects. It will a pity if the teacher is the person who answers these questions. In fact it would be interesting to learn of situations where the students, themselves, are both asking and then answering the questions.

3. Inquiry learning

Can the experiments be used in an inquiry approach, whereby the students ***raise questions*** and **suggest the *purpose* and *procedure themselves* ?** This is very much an ICASE recommended approach. It means students put forward the investigatory question, plus the procedure to follow. It promotes science as the seeking of explanations to questions put forward rather than to a 'wondering why' approach, although perhaps this is appropriate for the younger students.

So what would be the investigatory questions for these experiments ?

This is a challenge left for you to consider.

3. The ICASE Tartu Declaration

Jack Holbrook, ICASE President

Do you support the Tartu Declaration ?

If you do, then the next question areas- how do we promote the various components ?

One aspect put forward for consideration by ICASE member organisations is encouraging the students to be innovative. If you, as an individual, wish to play a role then please help by asking the national STAs to consider the following:

Students need to be involved in learning to be innovative. Students cannot learning to be innovative if they are not given opportunities to develop such attributes. In the pre-primary and primary school innovative approaches are often strongly encouraged, allowing the students to explore, to try things, to develop materials, operation and ideas. We need students to be innovative beyond the primary school also. Being innovative is seen as a key, essential component of education at all levels. Students' learning to be innovative is put forward as an essential part of science teaching.

To promote innovation, students must be allowed to learn how to be innovative. For this they need to be

1. **Actively involved (listening to the teacher is unlikely to promote innovation). It means** (see declaration given on the next page)
   - Students are involved in developing and applying scientific conceptual understanding to make sense of contexts in their evolving world.
   - Students are involved in inter-disciplinary learning in relevant contexts, to reflect the nature of science and to allow teachers to build on students' interests and questions;
   - Students are involved in making decisions about their own STE learning ;
   - Students are involved in an inquiry approach, where students are guided (by the teacher) to learn to formulate scientific and technological questions, learn how they can be the planner and determiner of how to investigate those questions and then the student learn to be able to build and apply conceptual understandings;

Actively involved does NOT mean – read the textbook. The textbook is a source of information, not to be used as an excuse for learning in science because teaching innovation is too difficult !

Actively involved does not mean - listening to the teacher. Listening to the teacher as a major classroom activity so that the teacher can show how clever they are, needs to be banned from the science classroom. Whatever is taken in to the memory is simply forgotten after leaving school. What is the point ? It is a waste of time and a poor use of the teacher as a professional.

Actively involved does not mean – undertaking group work where the student does not have to participate intellectually. Group work is so that students can learn from one another, support one another, interact meaningfully with one another and to develop leadership skills. It can be a major approach to develop innovative thinking, innovative ways to interact, to develop and to respond. But putting students into groups without a clear learning target, without students willing to participate, without students being on-task (maybe talking about what they will do after school) is not active learning. It is time wasting and useless.

Actively involved does not mean – guiding students to pass a memory-based examination. The target is active learning and through active learning the students illustrates their gains acquired through the learning, one of which is intended as being innovative.

This is one key aspect declaration put forward in the declaratin. Are you supportive? If so, then stop seeing the textbook as a panacea for science learning. That learning is so as to forget it afterwards. It is not real learning. It is a behaviourist approach to learning which research has shown to be inappropriate and fails to recognise that students **construct knowledge –** they do not take it ready-made.

The Tartu declaration

The conference participants call upon all involved in research, policy development and practice in STE to implement this Declaration in their regions of the world, acknowledging the key roles of teachers.

We resolve that:

- innovative STE is of fundamental importance throughout life commencing at the earliest years;
- major goals for STE are active, ethical citizenship; responsible, evidence-based decision-making; and high levels of satisfaction in STE;
- STE involves students developing and applying scientific conceptual understanding to make sense of contexts in their evolving world;
- an integrated approach to STE needs to be implemented, because science and technology are inseparable as we move into the future;
- an inquiry approach is central to STE, where students formulate scientific and technological questions, investigate those questions and build and apply conceptual understandings;
- assessment policies and practices that improve students' learning need to be implemented;
- high-quality teacher preparation and continuous professional learning support are essential in order for teachers to create rich, relevant, interesting, current and timely STE;
- STE policy and practices should be informed by evidence-based research findings and research in STE encouraged and supported.

4. SAFE SCI: Be Protected!!

By Dr. Ken Roy
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THE DIRTY SAFETY DOZEN REVISITED!

I. The Winds of Change

The need for more scientifically/technologically literate citizens, changing student enrolments, major economic issues, emphasis on hands-on laboratory science, acceleration of master teachers retiring and neophyte teachers entering service, and aging buildings/lab facilities, continues to increase as major issues/factors that are affecting science in our schools today worldwide.

The purpose of this article is to simply update those safety problems called the "dirty dozen!" This information will help science teachers to educate and work with their supervisors and administrators. The hope is that leadership can then be advocates for change, leading to improvements in the science laboratory.

II. What Are the Dirty Dozen?

1. Air quality – including ventilation, fume/exhaust hoods, bio-aerosols, radon gas, etc. This is applicable at all levels where hazardous chemicals are being used – primary and secondary levels. Not only is this still an issue but scheduled preventative maintenance per manufacturer's recommendations tend to be put off, resulting from cuts in budgets. Instead of yearly inspections, recommended by most manufacturers, anecdotal evidence indicates that inspections are being put off for five years or more!

2. Water quality – including radon gas, lead, copper, nitrates, methane gas, eyewash/shower drains, etc. As facilities get older, the chance for poorer water quality increases with inappropriately grounded wires on plumbing and more.

3. Electricity – including ground fault interrupters (GFI), EMF's, etc. In laboratories or classrooms where water and electricity are being used in close proximity, there is danger of shock or electrocution. There is a need for GFIs in order to protect employees and students! If there are aquariums, wave tanks, and other equipment using both water and electricity – there is a need for GFI protected circuits! Remember – circuit breakers protect the physical structure or building – not the occupants as GFI protected circuits do.

4. Heavy Metals - including mercury thermometers, florescent bulbs, barometers, manometers, sphygmomanometers, elemental mercury, etc. Mercury needs to be removed and environmentally disposed of. After all of the fanfare about heavy metals like mercury – there are still an unacceptable amount of the mercury being found in labs. The bottom-line is – get it out – appropriately!

5. Asbestos – including floor/ceiling tiles, burners, laboratory table tops, walls, etc. Friable asbestos is dangerous and still found in many schools. Asbestos needs to be either

6. Chemical Management – including improper storage, use, and disposal. Many schools have hazardous chemicals which are unlabelled, not dated, improperly stored and incorrectly disposed. Although chemical management seems to have been improved, there are still an unacceptable number of academic labs using poor chemical management and making for an unsafe workplace – both for teachers and students. Much progress has been made but still more needs to be done.

7. Personal Protective Equipment (PPE) – Schools need to adopt regulatory standards and best professional practices for use of eye protection, hand and body protection as required. If the appropriate PPE is not available, the activity should not be done! Some science teachers still do not know the difference between safety glasses, directly vented and indirectly vented chemical splash goggles. Make it a point of knowing, adopting and enforcing. Don't give liability and negligence a place to roost!

8. Engineering Controls - Appropriate engineering controls such as fire suppression equipment, master energy controls, fume hoods, ventilation systems, and more are the safe guards for employees and students. Laboratories using hazardous chemicals should not be operated without appropriate engineering controls. It is not only use but again appropriate preventative maintenance necessary to make sure the engineering controls function correctly when needed. Make sure regulatory requirements and the manufacturer's recommendations are followed.

9. Radiation – including ionizing (radioactive materials) and non-ionizing (UV, lasers) radiation - Safe guards including appropriate levels, signage, use policies need to be addressed. The use of radioactive materials for instruction seems to be waning in some schools, especially gamma type sources. Health and safety concerns seem to be fostering these concerns.

10. Biohazards – including microbes, mold spores, bloodborne pathogens, etc. – MRSA, AIDS, H1N1 and other microbes are more of an issue than ever before. Most schools have been adopting policies and practices to reduce exposure; e.g. no human blood typing, no fresh cheek cell labs, limited general survey bacteria culturing, etc.

11. Occupancy Loads – This is new on the list, though an issue with a long history. With limited funds, reduced teaching faculty and shortages of laboratories, numbers of occupants in labs seems to be increasing. Remember that laboratories are designed and built to hold a prescribed number of occupants (students and teacher) for safety operation and emergency egress. Know the load factor for the lab! Occupants' lives depend on it.

12. Personnel – including unsafe practices, unskilled, insufficient knowledge, etc. – Annual safety training is absolutely critical for faculty teaching science at any level! Topics like chemical management, bloodborne pathogens and more should be included.

III. Insuring A Safe Working Environment

Professional science teachers need be aware of the dirty dozen and also work toward addressing them. Using the process "AAA" –Awareness, Assessment and Action, each of the dirty dozen can be addressed in earnest.

"Live Long and Prosper, Using Safety!"

5. Modified Herron Model for classifying inquiry learning

Herron developed a model which classified inquiries on a scale of 0 (Confirmation/Verification) to 3 (Open Inquiry) depending on how much teacher structure is supplied and whether there is an already existing solution to the problem or question. I like this model because it ties in with my beliefs about the need for scaffolded/guided inquiry when students (of any age) are new to inquiry.

The following table is adapted from one on: http://edweb.sdsu.edu/wip/four_levels.htm

Level of Inquiry	Teacher supplied **problem**?	Teacher prescribed **procedure**?	**Solution** known in advance?
0 Confirmation/Verification	✓	✓	✓
1 Structured	✓	✓	-
2 Guided	✓	-	-
3 Open	-	-	-

Modified Model 2007 Jan-Marie Kellow

I have made some modification to Herron's model (see table below). Firstly I have renumbered the levels as I feel that naming it 0 implies it is not inquiry. It is certainly very low-level inquiry but I believe it is still has a place at times. Secondly, I have restructured the table to make the desired outcome clearer i.e. ticks for student designed/owned elements rather than for teacher designed/owned elements.

I have changed the second level (Herron's level 1) to allow for **either** a student-generated question to which there is a pre-existing solution (not known to the students) **or** for an unknown solution to a teacher-generated question. This is because student-generated questions can often have pre-existing solutions. If we include among our definitions of inquiry: "Inquiry" is defined as "a seeking for truth, information, or knowledge - seeking information by questioning." (www.thirteen.org/edonline/concept2class/inquiry/), "Inquiry is a systematic investigation or study into a worthy question, issue, problem or idea." (www.galileo.org/inquiry-what.html) and especially: "Through the process of inquiry, individuals construct much of their understanding of the natural and human-designed worlds." (www.thirteen.org/edonline/concept2class/inquiry/), then we must allow for that fact that some student-generated inquiries will have a pre-existing solution.

I have also changed the third level (Herron's level 2) to include either a student-generated problem or student- designed/selected procedure. This is because I feel that students are often able to generate their own problems before they are ready to independently design and/or select all the procedures they will use and that students, I believe, having an either/or situation more actually reflects what can happen in classrooms. I have renamed the final level Independent Inquiry as I feel this more accurately describes the level.

Level of Inquiry	**Problem is student-generated?**	**Procedure student-designed/selected?**	**Solution is not already existing/known?**
1. Confirmation	-	-	-
2. Structured Inquiry	Either ✓	-	Or ✓
3. Guided Inquiry	Either ✓	Or ✓	✓
4. Independent Inquiry	✓	✓	✓

Explanation

1. Confirmation - students answer a teacher-presented question through a prescribed procedure when the results are known in advance to the teacher but not necessarily the students.

2. Structured Inquiry - students investigate through a prescribed procedure and EITHER there is a teacher-presented question (usually open-ended) but the answer is not known in advance and could vary from student to student OR there is a student-generated question where the results are known in advance to the teacher but not to the students.

3. Guided Inquiry - The solution is not already existing/known in advance and could vary from student to student. Students EITHER investigate a teacher-presented question (usually open-ended) using student designed/selected procedures OR investigate questions that are student formulated (usually open-ended) through a prescribed procedure (some parts of the procedure may be student designed/selected).

4. Independent Inquiry - students investigate questions that are student formulated (usually open-ended) through student designed/selected procedures. The solution is not known in advance and could vary from student to student. Ownership of all aspects of the inquiry belongs to the student.

Adapted from: Herron, M.D. (1971). The nature of scientific enquiry. *School Review, 79*(2), 171- 212.

6. Calendar of Events

The 23rd Asian Association for Biology Education will be held in Singapore, from 18-20 Oct, 2010, at the National Institute of Education, Singapore. The theme of the conference is: **Biology Education for Social and Sustainable Development**. The 3-day conference will have 6 plenary speakers, oral and poster presentations, country reports, a workshop on Problem Based Learning in Biology, and mid-and post-conference tours.

The conference is jointly organized by, the National Institute of Education, the Asian Association for Biology Education, Singapore Institute of Biology, and Science Teachers Association for Singapore.

The website for the conference is http://www.nsse.nie.edu.sg/aabe2010/

IOSTE

International Organization for Science and Technology Education

Mini-symposium, Reading, UK

20-21 June 2011 (welcome reception on 19th)

Contemporary Issues in Science and Technology Education

The symposium is open to all working in the field of science and technology education, including established researchers, Masters and Doctoral students, and practising teachers in schools.

We invite papers on completed empirical research and theoretical issues in science and technology education.

In the first instance, send a 1000 word abstract in Word format to the coordinator, John Oversby (j.p.oversby@reading.ac.uk) including the frame for the research, the research questions, methodology, outline data, analysis, interpretation, implications, and selected references, for empirical papers and parallel areas for theoretical papers by December 31st 2010. Abstracts will be blind reviewed and invitations for full papers up to 12 pages sent to successful authors by January 30th 2011, to be received by March 30th 2011. We intend to seek a publisher for presented papers.

Oral papers at the symposium will have 20 minutes followed by 10 minutes discussion. If there is sufficient response, we will also accept posters for a special session.

Reading is close to Heathrow and Gatwick airports by frequent public transport, and easily accessible from budget airline Stansted and Luton airports.

IOSTE home page: www.ioste.org. Symposium home page www.IOSTE-NWE
The registration fee and other details will be available by October 2010

Welcome to Science Singapore 2011

The Future of Science Education

22-24 July 2011

Blending traditional conference formats with 21st century technology, Science Singapore 2011 will be a unique meeting where the latest research and best practice in science education come together, presented by educators from around the world. There will also be multiple opportunities for social gatherings and sightseeing in this fascinating city and surrounding countries!

Features of Science Singapore 2011:
Three parallel presentation strands consisting of
Keynote speakers in science education, web-based technology, and inspiring lives;
Continuous short (20 minute) talks—two per hour with breaks,
45 minute presentations, and 90 minute double sessions for interactive, practical workshops.

Session strands scheduled as one block and repeated during the conference for more attendance opportunities;

- Internet networking to promote the conference via Twitter, Facebook. Google, and Email;
- Long distance interaction with breakout groups via internet chats;
- Forums via Skype;
- Live online streaming of sessions;
- Technology mentors for participants;
- Download session videos;
- One half day devoted to “un-conference” format of posted topics, participant voting and flexible scheduling of most popular choices;
- Electronic and traditional message boards;
- “Viewing party” prospects for distance discussions in small local groups;
- Live and eight-hour delay broadcasts of sessions.

Coordinators: John Stiles, Bangkok, Science Educator and Consultant; and Rob Newberry, Singapore, Educational Technology Consultant who organized the first TEDx conference in Bangkok. Conference information: http://sites.google.com/site/scisg2011/

6th SCIENCE CENTRE WORLD CONGRESS
4 - 8 SEPTEMBER 2011
CAPE TOWN, SOUTH AFRICA
Science Across Cultures

Namkelekile e Afrika   You are welcome in Africa

Science Across Cultures
The 6th Science Centre World Congress will be held in Cape Town, South Africa, 4-8 September 2011. Enjoy stimulating congress sessions, challenging workshops and lively debates. And enjoy all that Cape Town and South Africa have to offer - whale watching, wine tasting, a unique floral kingdom, big game safaris, beautiful beaches, unparalleled scenic beauty, and a friendly and diverse culture.

With the theme "Science Across Cultures", the 6th Science Centre World Congress will encourage reconciliation between different cultures and a greater appreciation of the role that science centres can play in highlighting each culture's unique contributions to science, technology and science education.

Registration Fees and Information
Registration for 6SCWC will be opening in September 2010.

Congress Registration Fees

Registration – Early (until 3 June 2011)	ZAR 5,525.00
Registration – Standard (until 19 August 2011)	ZAR 6,525.00
Registration – Late	ZAR 7,525.00
*Registration - Discounted (until 3 June 2011)	ZAR 4,250.00

** Residents of low-GNI (gross national income) countries are eligible for a discounted registration fee.*

Accommodation Rates
The 6SCWC Congress Secretariat has selected a range of hotels for delegates to choose from and has negotiated guaranteed rates. Delegates can reserve accommodation at one of the designated congress hotels when completing the registration form..

If you would like to make your own accommodation arrangements at a B&B, hostel or guesthouse, the 6SCWC Congress Secretariat recommends www.capestay.co.za. Please note that the Congress Secretariat can only make bookings at the designated congress hotels and cannot be responsible for accommodation booked independently by delegates.

Rates quoted are per room, per night, including breakfast, including 14% VAT, excluding a compulsory 1% Government Tourism Levy.

More details from the website www.6scwc.org

Keynote Speakers

Peter Posch   Herbert Altrichter   Ingo Eilks   Katherine Froggatt

Indicative Themes

- AR for unity and diversity
- AR for coping with the challenges of a knowledge society
- AR and workplace cultures
- AR in teacher education and professional development
- AR in palliative care and in nursing homes
- AR in health promotion
- AR and community development
- AR methodology and methods
- AR and Participatory Research in fields of social work
- AR in science education, environmental education/education for sustainable development
- AR in curriculum development, school development, networking and system intervention

Indicative Dates

30th April 2011 deadline to send a proposal
20th June 2011 answer for the approval of a proposal
1st July 2011 deadline for early bird registration

Call for papers and posters end of January 2011. Participative workshops are particularly welcome.

7. ICASE Executive Committee 2008-2011

Based on the ICASE constitution, the ICASE Management committee as well as Regional Representatives are elected by member organisations. These elected members, in turn, nominate chairs of relevant standing committees. Together these persons form the ICASE Executive Committee and are the persons who make decisions on behalf of the ICASE Governing Body. The ICASE Governing Body is the **ICASE member organisations**.

***The Executive Committee* (the decision making body working under the Governing Body)**

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