

SAUCE Schools at University for Climate and Energy



Cross-country analysis and state of the art review of extracurricular energy education and kids' universities

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About SAUCE – Schools at University for Climate and Energy

For the EU project SAUCE seven European universities and the Berlin Energy Agency have joined forces to develop and promote university programmes for schools as an innovative educational tool aiming to make younger generations adopt intelligent energy behaviour. During the projects duration from Sept 2008 until August 2011, each university offers a series of one-week on-campus education programmes for pupils ages 10-13 on the topics of energy efficient behaviour, renewable energies and climate change in an exciting new learning environment.

The programmes are complemented by activities reaching out to the pupils' teachers. Successful and effective teaching materials and information sources are made available, energy education experts and their teaching approaches are introduced to the teachers, and the exchange of knowledge and ideas between schools, academics and educators is facilitated. SAUCE thus contributes to improving teaching and curriculum on energy efficient behaviour.

SAUCE is supported by the EU Programme Intelligent Energy Europe. This programme aims to promote energy efficiency and renewable energy sources. It helps all of us to produce and use energy in more intelligent ways and to increase the use of renewables.

www.schools-at-university.eu

Contents

1	Introduction	1
2	The international context for SAUCE	3
2.1	Global: UN Decade of Education for Sustainable Development	3
2.2	Europe: EU policy support	5
3	National reviews of energy education: institutions, theory and practice	6
3.1	Austria	6
	Pedagogy/educational theory and practice	6
	Practical examples	8
	Assessment of the state of the art in Austria	11
3.2	Denmark	12
	Pedagogy/educational theory and practice	12
3.3	Germany	16
	Introduction	16
	Formal education	16
	Non-formal education	21
3.4	Latvia	23
	Formal education framework	23
	Official Curriculum requirements	23
	Pedagogical approaches	24
	Development of Environmental Education	25
3.5	Netherlands	28
	Introduction	28
	Pedagogy/educational theory and practice	28
	The Dutch School System	28
	Non-formal education	30
	Dutch Environmental and Nature Education Policy	31
	Dutch Universities	32
	Conclusions	33
3.6	United Kingdom	35
	Introduction	35
	The UK National Curriculum	35
	The Government Office for London	
	- London Sustainable Schools Forum (GOL - LSSF)	37
	London Borough of Islington -	
	Islington Environment Learning Partnership (IELP)	38
4	Conclusions	40

1 Introduction

SAUCE is being conducted in the context of increasing horizontal and vertical integration of energy and climate policy and education across levels of governance and across sectors of government. The sections below address the different ways the SAUCE programme in each country is embedded in international, national and local institutional frameworks and educational policies. Identification of the government departments with a commitment to energy and climate education will help source funding and support in kind for SAUCE programmes, but may also indicate where SAUCE can prompt innovations in governance. A key question here is, to what extent is the energy and climate curriculum institutionalised, and how much discretion do individual schools and teachers have to engage (or, not) in SAUCE-type activities. While full centralisation of the curriculum may constrain teachers' initiative, full freedom to shape delivery may include the freedom not to engage, leaving the field to committed individuals rather than the programmatic approach now required. The rich range of countries engaged in SAUCE will provide a valuable basis for identifying the institutional conditions for transferable best practice.

The SAUCE programme, in identifying **10-13 year-olds as the target constituency**, is working with a younger group than is usually associated either with kids' universities or with energy and climate education, so has the opportunity to provide path-breaking insights here, also. After the **first key question of the institutional context for successful engagement in energy and climate education**, the **second revolves around developmental and pedagogic theory** as it relates to the sustainability skills of 10-13 year-olds. Here, a number of dimensions are important. First, in between the ages of ten to thirteen, children normally go through a key stage in cognitive development, moving from *concrete operational thinking* to *formal operational thinking* (after Piaget). This means that the same materials will not be appropriate to all pupils attending SAUCE programmes. This is compounded by the different rates of development of boys and girls. Second, though, it appears that this **problem is finessed in many examples by addressing the competences, or skills, to be obtained and the changing processes** (e.g. problem- and project-based learning, interdisciplinarity, group-based learning linking with pupils' everyday lives) **used to obtain them**. That is to say, much practice in the field takes place without explicit reference to pedagogic or developmental theory. But rich **experiential learning outside of the regular classroom context** appears a key component of successful environmental, and hence energy and climate, learning.

SAUCE has also developed in the context of commitment by the 'academy', or the partner universities, to reach out and open up to society, and this openness to society is also a necessary part of the schools' commitment. **Energy and climate education includes addressing the curriculum, the campus and the community**, and making a difference to the energy and climate impact of all three. Therefore, the **third key issue is of the nature of local links and partnerships**, both potential ones and those already established. Depending on the institutional architecture for educational policy, national and regional/ provincial/ local government departments, utility companies (private or public), local businesses and NGOs are all potential partners, as are the participating schools and their communities. Hence the **need to identify and compare partnership opportunities** across the SAUCE partner countries.

The **key themes** for SAUCE, then, are: **first, to identify appropriate content for the age group** we have chosen to focus on and, **second, to be able to link this content to the skills and competences** we expect the pupils to develop. This needs to be accomplished against the backdrop of several further considerations: the number of pupils to be addressed by the programme; indicators of behaviour change in schools and communities; the extent to which programmes need to be tailored to local or national contexts, or may be universalized; the link of the SAUCE programmes to ICT and schools outside Europe (e.g. in countries where pupils are experiencing the harsh realities of climate change or energy dependency); and, the changing role of the university in the sustainable development of its community.

The report opens with a brief reminder of the international and historic context in which SAUCE takes place, followed by the national reports.

This is intended as **a living document**, and with the key themes identified above. An integrated bibliography and contact databases will be developed throughout the course of project implementation.

2 The international context for SAUCE

2.1 Global: UN Decade of Education for Sustainable Development

All SAUCE partners are working in the context of policies and agendas developed out of the *United Nations Conference on Environment and Development* (Rio de Janeiro, Brazil, 3-14 June 1992), in particular Chapter 36 of Agenda 21 on promoting education, public awareness and training.

<http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter36.htm>

This was further developed as the work programme on education, public awareness and training at the fourth meeting of the *Commission on Sustainable Development* (CSD) in 1996

<http://daccessdds.un.org/doc/UNDOC/GEN/N96/041/06/PDF/N9604106.pdf?OpenElement>

in Chapter 10, provision 124 of the Plan of Implementation of the *World Summit on Sustainable Development* (“*Johannesburg Plan of Implementation*”) in 2002 :

“124. Support the use of education to promote sustainable development, including through urgent actions at all levels to:

- (a) Integrate information and communications technology in school curriculum development to ensure its access by both rural and urban communities and provide assistance, particularly to developing countries, inter alia, for the establishment of an appropriate enabling environment required for such technology;
- (b) Promote, as appropriate, affordable and increased access to programmes for students, researchers and engineers from developing countries in the universities and research institutions of developed countries in order to promote the exchange of experience and capacity that will benefit all partners;
- (c) Continue to implement the work programme of the Commission on Sustainable Development on education for sustainable development;
- (d) **Recommend to the United Nations General Assembly that it consider adopting a decade of education for sustainable development, starting in 2005.”**

http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter10.htm

The UN Decade of Education for Sustainable Development runs from 1 January 2005 to 31 December 2014. The importance of education was further underscored when the CSD identified it as a cross-cutting issue at its eleventh session.

According to the UNESCO website, as reproduced by [New Zealand], “The overall goal of the UN Decade of Education for Sustainable Development (DESD) is to **integrate the values inherent in sustainable development into all aspects of learning to encourage changes in behaviour that allow for a more sustainable and just society for all.**

The basic vision of the Decade is a world where everyone has the opportunity to benefit from education and *learn the values, behaviour and lifestyles* required for a sustainable future and for positive societal transformation.

The focus of the Decade is *education and related communication, training and capacity-building strategies* for promoting sustainable development — not sustainable development per se.” [emphasis added]

The summary further states that

“[t]he UNESCO Action Plan for the Decade has **four key ESD thrusts**:

1. Promoting and improving basic education, including **literacy and lifelong learning for sustainable livelihoods**, with an emphasis on access, opportunity and quality outcomes for children and youth in schools, out-of-school youth, and adult literacy.
2. **Reorienting existing education programmes at all levels** so that the purpose, content and processes of education promote the social, environmental, cultural and economic knowledge, skills, perspectives and values inherent to sustainability.
3. **Building public awareness** of the need for, and understanding of, the principles of sustainable development, with an **emphasis upon the roles of the media and civil society** in encouraging an informed and active citizenry.
4. **Developing training programmes to ensure that all sectors of society have the skills necessary** to perform their work in a sustainable manner. “ [emphasis added].

These excerpts from the founding documents for the UNDESD provide useful guidance for the SAUCE project, in that they have key points of emphasis that are not traditional, for example those that address skills, livelihoods, values, attitudes and behaviour change. This, as indicated above, **implies and requires that ESD, and therefore ‘education’ (or, human development) for sustainable climate and energy futures, needs to find different styles of delivery.** The SAUCE programme aims to identify and apply the best examples of these.

The halfway-point review meeting of the UNDESD will be held in Bonn, Germany from 31 March to 2 April 2009

<http://www.esd-world-conference-2009.org/en/about-world-conference-on-esd.html> ,

and UNESCO materials for teacher training for ESD can be found at:

<http://www.unesco.org/education/tlsf/>, and include reference to **learning strategies appropriate to ESD: “experiential learning, storytelling, values education, enquiry learning, appropriate assessment, future problem solving, learning outside the classroom and community problem solving”**
http://www.unesco.org/education/tlsf/TLSF/theme_d/uncofrm_d.htm ,

and a set of key links can be found at

http://www.unesco.org/education/tlsf/TLSF/intro/glossary_links/keylinks.htm , with resources at:

http://www.esdtoolkit.org/resources/web_esd.htm.

2.2 Europe: EU policy support

The Intelligent Energy Europe programme includes directories of energy agencies and relevant policy actors against which SAUCE colleagues can check for possible partners, and also to ensure that appropriate potential partners have been identified and approached

<http://www.managenergy.net/energyagencies.html> , and examples of work in the IEE programme on Sustainable Energy Communities can be found at:

http://ec.europa.eu/energy/intelligent/library/doc/ka_reports/sustainable_comm.pdf ,

and examples of materials for 7-11 year olds can be found on the IEE ManagEnergy site at:

<http://www.managenergy.net/kidscorner/en/u11/u11.html>, and for 11-15 year olds at:

<http://www.managenergy.net/kidscorner/en/o11/o11.html> .

These are useful illustrations for SAUCE colleagues to check the materials appropriate to the age groups (10-13 year olds) in our project, and to compare these with the pedagogic underpinnings provided below.

DG Energy lists its previous energy initiatives and provides illustrative case studies of the position of energy education in 'Education on Energy. Teaching tomorrow's energy consumers' (Luxembourg. Office for Official Publications of the European Communities, 2006), found at

<http://www.managenergy.net/download/education2005/05-0001-EN.pdf> .

The work at international level provides the institutional and historic context for SAUCE. The national and sub-national institutional framework is detailed in the national reports, below.

3 National reviews of energy education: institutions, theory and practice

3.1 Austria

Lukas Kranzl, Nanna Sagbauer, EEG, Vienna University of Technology

Pedagogy/educational theory and practice

In Austria, in the 1990s a considerable number of initiatives took place in order to integrate environment and sustainability issues into school education. At the same time, several research groups were established to investigate pedagogical theory with respect to environment and ecology (see literature in annex 1). In this period in particular Peter Posch investigated and developed methods for integrating ESD into a new culture of school learning. In recent years, the competencies required of teachers dealing with ESD have been investigated (e.g. Steiner 2007, University of Salzburg). For example, the University of Klagenfurt carried out a teacher-training course (BINE – Bildung für nachhaltige Entwicklung / Education for sustainable development) in the network UMILE (Umwelt, Innovation, LehrerInnenbildung / Environment, Innovation and Teacher Education) and linked this work to corresponding educational research activities. Greschonig (2002) developed a concept of how to integrate ecology into school learning using drama pedagogy. Piskernik (2007) investigated the impact of educational measures for increasing awareness regarding energy and climate issues in five Austrian schools. This analysis also addressed the relation between knowledge and willingness to take personal action, such as reducing energy consumption.

Regula Kyburz-Graber (e.g. Kyburz-Graber 2004) emphasises that historically, environmental education has been included in science teaching. However, it has to be embedded in social and economic sciences as well. In particular she points out that environmental education is not (only) a matter of facts but to a large extent a matter of how human society deals with environmental issues. In the early days of environmental education, the missionary zeal of individual teachers was the starting point, but environmental education now has its roots in education theory. Schools in general have to deal with current social challenges. The basic idea of Kyburz-Graber is the “socio-ecological” concept, according to which, instead of environmental damages being at the core of environmental education, concrete areas of action are the focus: an enterprise, a school, a block of buildings etc. **The three main components of socio-ecological environmental education thus are: problem orientation, relation to experience and cooperation.**

An important part of Kyburz-Graber’s work relates to the challenges for teachers in environmental education. She addresses the fact that environmental education might challenge the self-concept of teachers. This is crucial with respect to the development of self-competence: teachers have to deal with their own behaviour and interpretation patterns. In addition to **self-competence, social competence, competence regarding scientific content, and competence in methods are important elements for environmental education.**

However, environmental education is regarded as an area that shows characteristics crucial for the general change of education patterns:

- a shift from knowledge transfer to knowledge construction
- problem-oriented, interdisciplinary topics

- critical discussion of social circumstances and the individual and societal shaping of living conditions
- the stress ratio between individuals and society.

Peter Posch and Franz Rauch (Posch and Rauch, 1998) also deal with the challenge of converting the traditional concept of knowledge transfer into knowledge construction, “actively made by each learner as he / she revises the conceptual map he/she uses to interpret the world”. This in particular **requires that teachers take a role in accompanying, supporting and reinforcing learning processes**. Posch developed the concept of action research in environmental education of teachers, and this concept has been integrated into the ENSI project (Environment and School Initiatives). Action research in this context relates to the process by which teachers connect the development of environmental education in their specific school context with research questions relevant for their specific situation and for their own professional development. Not researchers from outside but rather **real stakeholders decide what is important for their specific school situations**. This also leads to a critical reflexion on curricula, the concept of the school, education culture and so on. This process can also contribute to quality improvement and development strategies.

Action research supports the critical reflexion of theory and practice in environmental education. A plausible environmental education is not possible without developing sensitivity for controversial questions and also contradictions in a complex system.

The key references on environmental educational theory are given below:

Regula Kyburz-Grabe (2004) *Welches Wissen welche Bildung? Aktuelle Entwicklungen in der Umweltbildung (What knowledge, which education? Current developments in environmental education.)* Beiträge zur Lehrerbildung 22(1)

Friedrich Palencsar & Kornelia Tischler (n.d.) “Fueps – Interdisciplinary Project Studies. An Example of a Competency Based Module in the Curriculum for Teacher Education in Austria.” Alpen-Adria-University of Klagenfurt, (Institute of Geography and Regional Studies & Institute of Education)

Posch P., Rauch F. (1998) “Developments in Teacher Education through Environmental Education Research.” *International Research in Geographical and Environmental Education*, Vol 7/3.

Franz Rauch, Regina Steiner & Franz Radits (n.d.): “University Course: Education for Sustainable Development – Innovations in Teacher Education (BINE).” Alpen-Adria-University Klagenfurt, (Institute of Instructional and School Development) & FORUM Environmental Education (University of Salzburg)

Regina Steiner (2007) “Kompetenzorientierte LehrerInnenbildung für Bildung für Nachhaltige Entwicklung (Competence oriented teacher training for ESD).“ PhD Thesis, University of Salzburg

Greschonig, Herwig (2002) “Dramapädagogik und Ökologie im Unterricht. (Drama pedagogy and ecology in teaching)“

Practical examples

Formal education

In the Austrian institutional framework for energy and climate education, the primary school is for pupils from 6-10 years. The schools are organized on regional level, i.e. the teachers are employed by one of the nine regional governments in Austria.

After primary school there are two types of secondary schools: the “Gymnasium” and the “Hauptschule”. The first are organized on a national level, with a more academic orientation, the latter on regional level, and more vocationally oriented. However, **curriculum development for all school types is carried out on a national level**. In Austria, **curricula are understood as framework curricula where teachers have a high degree of flexibility** and room for autonomous decisions. Whether or not the topic of sustainable development and energy and climate is included in the curriculum, each teacher has enough space to include them or not, depending on inclination and personal commitment.

The primary school (Volksschule) is charged with imparting basic education for all, as defined in its general educational objectives as follows:

Humanity, solidarity, tolerance, peace, fairness and environmental consciousness – these are the critical values of our society that should guide all our actions. Using these as a foundation, the school should encourage pupils to develop an open mind and an understanding of the existential problems of humankind and their shared responsibility. Education must make an active contribution to a democracy which is committed to human rights and must foster the pupils’ ability to acquire a critical mind and judging, decision-making and action-taking competences.¹

In the curriculum of secondary schools (either Gymnasium or Hauptschule):

Biology:

- Addresses the forest habitat and related matters

Geography:

- The development of nature, concerning human effects on nature and environment
- Effects of climate change on environment
- Responsible treatment of environment
- Consumers’ knowledge about resources, energy production and transport and their uneven allocation around the globe
- Environmental effects of production sites and production processes
- Globalisation and identification of the “one earth”

Physics:

- Dangers in the use of scientific and technical inventions and how to avoid or minimize them
- Gain knowledge about the effects on man and environment of technical inventions and innovations

¹ Austrian Federal Ministry for Education, Arts and Culture
(http://www.bmukk.gv.at/enfr/school/gen_edu/prim.xml, 5 October 2008)

- Influence of physics and technology on economy, ecology and community
- Ecological meaning of energy savings

Chemistry:

- Understanding of the responsible use of resources, recycling and disposal
- Minimization of environmental pollution

The program OEKOLOG (www.oekolog.at) has the objective of increasing the ecological sustainability of schools in Austria. More than 200 eco-schools are currently registered, and the number of schools is steadily increasing. However, financial support for this development is moderate and much work is done by committed teachers in their leisure time. Some of these eco-schools have been awarded the "österreichisches Umweltzeichen (Austrian Environment Logo)" for their efforts in designing and operating the school in a sustainable way.

In 2009, OEKOLOG is planning a joint project with IMST² (Initiative des BMUKK zur Weiterentwicklung des Mathematik-, Naturwissenschafts- und Informatikunterrichts in Österreich) on the topic „energy“. The IMST initiative will probably be more related to the development of (continuing) teacher education in the field of education for sustainable development (ESD). The main role of OEKOLOG is to implement ESD programmes in schools, and it is also trying to promote sustainable technologies and processes in purchasing, schools energy systems etc. Thus OEKOLOG is also targeting awareness and behaviour change and is closely related to the targets of the SAUCE project.

The representatives of this joint OEKOLOG and IMST initiative are interested in cooperating in the SAUCE schools-university programmes. The SAUCE programme will be included in the bundle of projects, seminars, workshops and events that will be carried out within a joint project of OEKOLOG and SAUCE. Moreover, the OEKOLOG network will be used for dissemination of the SAUCE programmes.

Austria is a participant in several international projects and networks such as ENSI (<http://www.ensi.org/>), SEED (http://seed.schule.at/uploads/QC_eng_2web.pdf) and Comenius.

Informal education

„myVision. NACHHALLTIGKEIT Jugendwettbewerb Wissenschaftsjournalismus“ is an initiative of the Austrian Federal Ministry for Education, the Arts and Culture, targeted at 14 to 19 year old teenagers. It is a multimedia journalism contest covering the following topics:

- Climate change, global and local
- Land: the limited resource
- The future of our landscape
- Prosperity and cost-fairness

² German title: Initiative des BMUKK zur Weiterentwicklung des Mathematik-, Naturwissenschafts- und Informatikunterrichts in Österreich;
English: Initiative of the Federal Ministry of Education, Arts and Culture for the development of mathematics, natural science and informatic teaching in Austria

Non-formal education

Several Austrian institutions organize courses and training activities in the field of renewable energy, energy efficiency and in a broader sense on the topic of sustainability. Important institutions in this field are “die Umweltberatung”(Environmental Advice), “Forum Umweltbildung” (Environmental Education Forum) and “Volkshochschulen”. Some of these courses are also targeted at children / pupils. However, up to now we are not aware of any comprehensive education program for sustainable development directed exclusively at children and pupils. Additional education initiatives are also promoted by NGO’s such as Klimabündnis Österreich (Austrian Climate Alliance).

Wilder Wind, originally an initiative of the Austrian Wind Power association (www.wilderwind.at), provides and develops education materials in the field of renewable energy and runs courses and education activities for pupils in the 8-10 years age group.

Vienna Children’s University

The idea of Vienna Children’s University is very close to the objectives of the SAUCE Project. However, the topics are open to all research fields. Energy and climate issues represent only a very small part, with six different lectures directly addressing energy and climate issues, e.g. “How does the climate work?”(University of Natural Resources and Applied Life Sciences, Vienna) and “How to make energy with sun and wind?”(Vienna University of Technology).

During the summer project “Vienna Children’s University”, which has been organised and coordinated by the University’s Children’s Office every year since 2003, the gates of the university open to 3,500 children between the ages of 7 and 12 for two weeks. Initially, Vienna Children’s University was held at the University of Vienna, but in the meantime, the University of Applied Arts, the Medical University of Vienna, and Vienna University of Technology have joined in.

Vienna Children’s University is the first and most comprehensive children’s university in Austria. It has helped in developing other children’s universities, both in Austria and abroad. The special thing about this concept („the Viennese model“) is that children aren’t only able to participate in some of the 350 lectures and workshops, but also have personal contact with researchers and experience the university with all that comes with it: the record of studies, student ID, lunch at the cafeteria, and finally the degree ceremony.

Diversity is one of the main goals of Vienna Children’s University. Diversity shows in the range of disciplines offered (all fields of study are represented, including climate and energy issues), but also in the methods and pedagogical formats, from lectures to workshops, excursions and tutorials. Specific targeting of children who have little access to university is also part of diversity. Vienna Children’s University is a project FOR children and with children. And because Vienna Children’s University is meant to be fun for children and researchers, its motto is still: „We’ll turn university upside down!“ (www.kinderuni.at).

The University of Vienna is also coordinating EUCUNET (European Children’s Universities Network, <http://www.eucu.net/>). There have been exchanges between SAUCE and EUCUNET. However, the details of cooperation are still to be clarified.

Assessment of the state of the art in Austria

Already in the 1990s (and in fact earlier) considerable efforts were taken to integrate ESD into school education. Currently, more than 200 eco-schools are registered. There are some programs to support this development (e.g. OEKOLOG) and to provide effective networking among interested teachers. However, a much work is done by very committed teachers without adequate financial support. Although the number of interested teachers and schools is increasing, the development in the 1990s was more dynamic than it is today. With respect to the training of teachers, in particular the “Forum Umweltbildung” has set important initiatives. There are also several initiatives from NGO’s that are providing teaching materials on environmental and sustainable development topics. Promising experiences have been made regarding children universities, although these were not primarily related to energy and climate.

With respect to the research done in the field of pedagogy for ESD, there are several research groups in Austria. However, our perception is that the current developments cannot keep up with the very ambitious and dynamic developments in the 1990s.

3.2 Denmark

Leif Henriksen and Annette Grunwald, Aalborg University, Department of Development and Planning

Pedagogy/educational theory and practice

Teaching in Danish schools is governed by the national so-called “stage goals” (trinmål) and “final goals” (slutmål). These goals are compulsory for all schools, but how they are fulfilled is determined by the curriculum passed by the politicians in the 98 individual Danish municipalities, and in the end by the individual teacher who is free to teach as she likes as long as she complies with the curriculum, which again has to comply with the national goals. This means that it is very difficult to find out what is taught on climate change and energy as it varies from class to class.

Science is taught from the 1st to the 6th class as the subject “nature/technology” (natur /teknik), after which science is split into physics, biology and geography.

The goals that pupils should attain after the 6th class, and that may include energy and climate change, are:

They should be able to

“explain the use and the conservation of nature locally and globally and the conflicts of interest connected to this” and

“know of environmental problems locally and globally and also give examples of how these problems may be solved”

Evidently, these requirements may be met in many different ways.

Nor is it possible to find out what is taught by looking at the relevant textbooks. A search in the catalogue of the Aalborg, *Regional Center for Educational Materials* (homepage acnord.dk) gives 250 titles relating to the subject nature/technology. But even if it is not possible to tell *what* is taught, we may say something about *how* science is taught.

Until about 25 years ago science was taught in the good old-fashioned way where the pupils were told what to believe and made experiments according to a very detailed recipe. Then, some physicists made an investigation testing pupils’ understanding of fundamental concepts in physics such as force, acceleration, velocity and so on.

The results were appalling: 300 years after Newton most pupils thought in Aristotelean concepts, and pupils can easily use double book-keeping: they know what to answer the teacher in class but outside the classroom they lapse into their everyday thinking. When asked “What is physics?”, 85% of pupils answered “something you have in school”. The results of this investigation and experiences from other countries have slowly changed the way science is taught in schools and in higher education.

The didactic theoretical basis and the methods may be different from school to school or from teacher to teacher, who may use ideas from various theories like the many intelligences, constructivistic learning, developmental psychology, etc. Most science teachers in Denmark (and Scandinavia) adhere to the learning theory called “social constructivism” which is based on the learning theories of Piaget and Vygotsky.

The following is a simple explanation of some key concepts of the kind of constructivism which is the basis of most science teaching in Scandinavia.

Somewhere in their teens many children's way of thinking changes from *concrete operational thinking* to formal *operational thinking*. Concrete operational thinking characterizes the thought processes (Piaget calls them *schemata*) that a child performs on her perceptions. These perceptions may arise from some practical activity but just as well from something read or heard. In this period the child depends less on its perceptions than in the previous period but it still has to base its thinking on concrete situations. It may classify, think reversibly if it makes mistakes and therefore consider several observations. The thinking is bound to concrete objects and concrete activities. The child can only handle a limited number of variables and may describe a situation but not explain it.

In formal operational thinking, the child becomes able to handle statements about objects and events and may use hypotheses, formal premises and conclusions. This capacity for logical thinking is bound up with the fact that the child now may abstract from the concrete basis. A child thinking concrete operational may be able to describe simple food chains and see that the population of one species (ant eaters) is connected to the population of another one (ants). On the other hand it is not able to handle a multivariable ecosystem at all.

The ability to grasp the multivariable dynamic equilibrium in the ecosystem and see that a small change in one variable may have far reaching effects or alternatively be compensated with a change of the equilibrium demands a higher level of thinking - new *schemata*. This also goes for a multivariate system like the climate.

Most theorists agree more or less with Piaget in his ideas of the change in the way of thinking but not in his placing of it on a time scale. But the age group which we deal with in SAUCE probably contains children from either side of the border between concrete and formal thinking and children in the process of crossing the border. This fact makes it difficult to address the children as one group. It makes it difficult to give lectures of a classical kind to say 300 children. The mechanism for developing formal operational thinking is not in any way determined with certainty. Piaget described it as an interaction between the individual and the environment where new stimuli are *assimilated* in the existing *schemata* and the *schemata* is *accommodated* to fit the new stimuli if they do not fit the existing *schemata*.

Assimilation and *accommodation* are coherent and simultaneous processes and form the *adaptation* which governs our cognitive development. Piaget studied the learning of the individual while **Vygotsky** was interested in the interaction among people learning together. In a class it is important that the teacher becomes a *mediator* who facilitates the children in their efforts in acquiring knowledge by getting the child to think out loud, so teacher and child may interact and modify the ideas of the child but the interaction in the class is more important. The children construct knowledge when they question each other about meanings and discuss possible explanations.

Vygotsky is the father of the concept "the zone for proximate development" which describes the difference between the current level of the child's achievement and potential level of development which is the problem-solving of the child depending on the assistance of grown ups or cooperation of its peers.

In turning to practical teaching, it is often very difficult to see which theory of learning the teacher cultivates. Examples from Denmark (and a few from England and India) give an uncomfortable suspicion that teachers teach as they have been taught themselves. It is apparently extremely difficult to close the gap between theory and practice. But in telling 10-13 years old children about climate and energy we must think carefully on how we do this if we want to achieve any essential impact.

Beyond this, the Volksschulen put great emphasis on project and theme-based teaching, where many school classes run a project week for one week in the year and treat one topic on an interdisciplinary basis. In this case of problem-based learning, where the pupils investigate problems themselves and find solutions, and the teacher functions as a kind of adviser and support person.

Constructivism means that the individual constructs their own understanding of the world, which may easily differ from that of the teachers. Therefore, the teacher must try to find out what is inside the pupil's head beforehand, e.g. by using diagnostic tests, and then teach according to these findings and test the pupils' understanding every so often, preferably through their practical work.

The teacher must try to engage the pupils as much as possible. When performing experiments the pupils do not follow a cookbook recipe but the experiments are more open:

Find the most efficient way of transferring solar energy to a plastic bag filled with water, or : How do you keep an ice cube from melting for the longest time possible?

If a pupil expresses a "wrong" understanding of a concept, this should not be rejected at once and the generally accepted perception stated, but rather the teacher should say: "Now that is interesting. How can we find out whether this is a fact?" and then try to involve the whole class in designing an experiment or conducting an investigation which settles the matter. The teacher tries to create cognitive conflicts by putting the pupils in situations where their understanding is in conflict with the result of an experiment.

Through experimenting, the pupils begin to understand the fundamental concepts like variables and their values, variable control, proportionality, classification etc.

Teaching tries to follow Piaget's stages of learning and progress gradually from the concrete operational stage to the formal operational stage. The recognition of the fact that pupils construct their own understanding of the world does not mean that "anything goes".

Group work and project organized teaching

Through discussions with the teacher and most important with their peers pupils may approach a common understanding and it is therefore imperative that the teacher encourages these discussions constantly. This is in accordance with the way much teaching is done in Denmark where group-work, problem-oriented and project-based teaching, and interdisciplinary teaching is quite common.

Even if some constructivism is dominant in the Danish science teaching it is not absolute. It is still possible to find teaching based on other theories (or no theory)

especially in higher education where lectures still play a role.³ One may get an impression of what goes on in science teaching in Scandinavia by studying the proceedings of the 8th Nordic Researcher Symposium on the teaching of science: Lisbeth Bering et al (2006) *Naturfagsdidaktikkens mange facetter* (The Many Facets of Science Didactics), Copenhagen.

Teaching materials

A survey of teaching materials was done (details on the sources are compiled in the Annex). On the basis of the material found we can conclude that

- Either the material found on climate and energy has been developed for an older age group, and now needs to be revised in a way appropriate to the 10-13 year old age group,
- Or, as we have found teaching materials on other themes that are methodologically and pedagogically suited to our age group, and we need to work energy and climate themes into these.

³ The physicist Richard Feynman (Nobel prize 1965) claimed that: “lectures have little or no effect except in the few cases where they are superfluous”.

3.3 Germany

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Introduction

Since the 1970s, education on energy efficiency and energy production issues has been dealt with as part of the broader subjects of health and environment, both on the education policy as well as the practical level. But there had not been developed a comprehensive educational programme on the specific topics revolving around energy technologies or behaviour. The thematic focus was, if at all touched, on technological aspects, discussed in the context of the dispute about nuclear energy on a deliberate basis at secondary level schools.

As the global and political prominence of energy use and climate change issues increased, the topics gradually became relevant at the educational levels. Both formal and non-formal more comprehensive and systematic approaches were developed. Since the early 1990s, formal education policy has become involved with the endeavour to translate the goals of Agenda 21 into school practice; at the same time, non-formal education actors have started to carry new pedagogic and educational ideas and concepts on these topics into individual schools and were actively supported by individual teachers or groups of teachers. The process of capacity building on both the formal and non-formal levels is ongoing.

Formal education

The following notes present the current pedagogical / didactic approach relevant for curriculum teaching in the German Land Berlin. They do not present the path leading to these choices nor can they give a complete picture of theories discussed and teaching practice throughout Germany.

The German school system and recent reform debates

In the aftermath of the PISA studies in the early years of the century, school reforms have received priority attention on the educational agenda in Germany. Debates have revolved around the quality of schooling in Germany, which was intended to be raised through various reform models, deciding in one or the other way on, e.g. 4 or 6 year elementary school, full-time schooling vs. half-time schooling, ten years' common schooling (Gesamtschule) vs. a tripartite school system (Haupt-Real-Gymnasial-Schulen), small group sizes or early differentiation according to pupils' proficiency level (Leistungsniveau), obligatory pre-schooling, yes or no?

While the debate throughout the German Länder was conducted along the same basic lines, school systems continue to differ considerably. With regard to our focus, Berlin is the only Land where common elementary schools cover the levels 1 to 6, but Hamburg's new Green-conservative government has commenced the process of switching from 4 to 6 years of elementary schooling. While both systems can claim arguments in their favour, the second, much more important aspect, receives much less public (electoral) attention: namely, what do we need to do, or more precisely what

does the public need to invest, e.g. for school funding / personnel etc, to raise the quality of teaching, at both levels, elementary and secondary? And, consequently, what kind of leeway do the organisational constraints or conditions leave to the teachers to actually reform teaching itself?

Educational theories in elementary schooling and educational goals at the elementary level (grades 1-6), according to the Berlin curriculum (Rahmenlehrpläne der Unterrichtsfächer).

While schooling 30 years ago was largely characterised by top-down, lecture type methods, in Germany as in many other countries, particularly at the elementary level methods and teaching atmosphere have fundamentally changed, project-oriented and interdisciplinary teaching is regarded as very important and teachers have been given much more freedom in choosing teaching methods. Diversity and creativity have made their way into the classrooms. The development process itself and the underlying concepts cannot be depicted here. The following describes the current theoretical underpinning of the curricula for Berlin elementary schools (which is very similar, if not the same, in other German Länder)

With the new curriculum of 2004, the basic concept of the key competencies approach (Kompetenzansatz) became an explicit basis of the elementary school curriculum (classes 1-6) in Berlin-Brandenburg.⁴ The competencies approach involves the focus on supporting the pupils in developing certain skills:

- factual knowledge that is systematically increased and interrelated (Sachkompetenz)
- methodological learning skills (Methodenkompetenz)
- personal competence (personale Kompetenz)
- social competence (soziale Kompetenz)

The focus is on the development of creativity, personal initiative, cooperation, and systematic learning, and this is regarded as more important than attaining the factual knowledge itself. Quite generally, but particularly also in the context of environmental topics (taught as part of geography lessons), problem-oriented and solution-oriented active learning is recommended. Reference should be made to the pupils' personal experience and perceptions about e.g. social and environmental phenomena; future developments such as changing environmental conditions due to climate change should be discussed using an interdisciplinary approach. (BerlSenBJS 2004, pp. 23/24)

In summary, the survey of curricula for class levels 5-6 shows that new methodological approaches and teaching methods have become mainstream, at least at the programmatic level. Furthermore, the curriculum leaves room to deal with issues like climate change, energy efficiency, energy production, but, at the elementary level, it is not obligatory but largely left up to the teachers' own initiative. And surveys of teaching in practice underline that it is an ongoing process to translate the concept into practice (see also below). In the school subject „science“ (Naturwissenschaften 5/6) there are two major topics (“Sonne, Wetter, Jahreszeiten” and “Umgang mit Stoffen im Alltag”), that match the energy and climate change issue and are often used to introduce these

⁴ Berliner Senatsverwaltung für Bildung, Jugend und Sport, Rahmenlehrplan Grundschule, 2004

themes.

The underlying pedagogical approach has also found its way into the process of formulating educational methods for teaching on energy and climate issues or, from a broader perspective, teaching of the many complex issues related to sustainable development. The theoretical basis for energy education was developed by different and to a large extent independent approaches:

1. The first was developed in the late 1980ies after the nuclear disaster of Chernobyl. It was developed in Berlin and Hamburg and published at the IPN Kiel as a book with the Titel: "ASKA – Eine Schule spart Energie". Out of this methodology in the early 90ies, the scheme of incentives "fifty/fifty" was developed and introduced in Hamburg, Berlin and other German cities.

www.hamburger-bildungserver.de/klima/fifty/, and

<http://www.ufu.de/de/fifty-fifty/fifty-fifty-home.html>

These energy saving projects were first disseminated in the late 1990ies by the SAVE-Project "Energy saving at schools" to other European countries and are continued to be run by the member organizations of the "Bundesverband Schule Energie Bildung", www.schule-energie-bildung.de.

2. A second approach was part of the programmes for education on sustainable development. Energy use behaviour, energy efficiency and climate change issues were taken up by the federal government's educational agenda in the mid-1990s in concert with the goals of Agenda21. Growing from various political and civil society initiatives in support of the goals of the Agenda 21 in the mid-1990s, these topics have since become an integral part of public environmental education programmes, which primarily operate under the title *Bildung für nachhaltige Entwicklung* -- education for sustainable development. A process of formulating new education guidelines set in.

The basis for the new educational guidelines was laid between 1999 and 2004 by the BLK-21, a committee instituted by the Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (Federal and Laender Commission for Education Planning and Research Support). This federal commission of pedagogical researchers and education experts was set up to formulate the theoretical basis as well as test practical recommendations at 200 schools for transferring the goals of the Agenda 21 into formal education.⁵ Besides developing teaching models and materials, the programme's second focus was on defining the comprehensive knowledge and abilities pupils should acquire at school with a view to the goals of sustainable development, which were called "**Gestaltungskompetenzen**" – **key competencies**.⁶

This approach highlights the **output of learning**, i.e. what should the pupils be enabled to do or which problem-solving strategies should they have acquired, which concepts

⁵ The follow-up programme "Transfer-21" disseminated the developed programme modules (materials and activities, advanced education programmes etc) throughout the German Bundesländer in the years 2005-2008. Both programmes have been coordinated at the „Arbeitsbereich erziehungswissenschaftliche Zukunftsforschung“ of the Free University Berlin, (director: G. de Hahn). www.transfer-21.de

⁶ Cf. G. de Hahn, „Politische Bildung für Nachhaltigkeit“ in: *Aus Politik und Zeitgeschichte*, 7 – 8/2004, pp. 39-46.

and competencies for different activities and situations should they have? (**In contrast to this**, traditional teaching is input-oriented by asking which particular **subject matter** the students should learn or know about.) Gestaltungskompetenzen are those **abilities individuals need to actively participate (and not merely react) in shaping economic, ecological and social decisions and conditions in their personal environment**, as members of the polity and in society at large. **Eight sub-competences** have been formulated:

1. The competence to **think ahead**, to deal with uncertainty and future prognoses, expectations and scenarios
2. The competence to **work on an interdisciplinary basis**
3. The competence of a **cosmopolitan awareness**, transcultural understanding and cooperation
4. **Participation** competences
5. **Planning and implementation** competences
6. The capacity for **empathy, sympathy and solidarity**
7. The **competence to motivate** oneself and others
8. The **competence for distanced reflection on individual and cultural role models**.

The list underlines why education for sustainable development in this context has also been characterised as **political or civic education**. Parts of its theoretical basis have been traced back to John Dewey's *Democracy and Education*.

The public debate on the educational value or rather the successful transfer of these concepts into the practice of school became more lively after the results of the first PISA study became public, which shed a devastating light on the German schools system, at least from a German perspective. The demand for "scientific literacy" underlined the teaching standards formulated by the BLK-21/transfer-21 programme and put reforms back on the political agenda. The reform of the Berlin curriculum in the years 2003 to 2006 described above may be seen as a result of this, too. It also became manifest in resolutions like the Berlin Programme "Lokale Agenda 21 – Berlin zukunftsfähig gestalten".⁷

On the practical level, besides the fact that a number of Berlin Schools took part in the Transfer-21 project, the Berlin government has put aside funds to finance the continuing transfer process within Berlin beyond the termination of the national transfer-21 project, the "Programmwerkstatt Transfer 21". The education ministries also put up programmes. At the federal level, national programmes of the Federal Ministry of Education and Research (BMBF) were financed to improve teaching methods in sciences (1998-2003: SINUS; ChiK zur Steigerung der Math.-naturwissenschaftli. Effizienz des Schulunterrichts, seit 2003 SINUS Transfer Progr.; PiKO – Physik im Kontext 2003-2006). The aims here were to **modernise teaching by including: the contexts of the pupils' daily lives, modern technologies, the application of acquired knowledge in daily life situations** and problems.

⁷ Decision of the Berlin Parliament of 8 June 2006 – Drucksache 15/3245.

The characteristics for the new methods developed include:

- they are **interdisciplinary** or address all subjects taught,
- they often involve project-based learning
- they relate to daily lives of the pupils.
- they respond to the defined need to open up the public schools to society (cooperation)
- they intend to raise the quality of teaching and of the teaching environment at the schools.

These programmes were carried out in close cooperation with or under the leadership of university institutes, both from education as well as scientific faculties. As one consequence, many universities have provided continuing programmes for schools or children, e.g. laboratories carrying out experiments, like the PsyLab at the Free University Berlin, or scientists teaching modules at interested schools. The primary target group are pupils 12 years and older, less frequently elementary schools.

The practice of energy education at class level 5 and 6

Practical teaching of renewable energies is confronted with a number of obstacles:⁸

- Lack of funds at schools
- Lack of time
- Large group sizes
- Text books do not cover renewable energies
- Materials are difficult to find, some don't match the organisational constraints of teaching.

Nevertheless, numerous schools have carried out exemplary projects on renewable energy, developed teaching units and invested in materials. They go on field trips, carry out interdisciplinary projects, build their own energy production units and deal with current public debates or events. The following recommendations for future initiatives were derived from interviews with teachers:

- Put more emphasis on science and/or crafts (Arbeitslehre) lessons
- Make more time available for project-oriented teaching units
- Advanced education to include experimental and project modules (particularly for elementary schools)
- Invite external experts into classes
- Develop cooperation partnerships with commercial companies
- Incentives for interdisciplinary teaching
- Increase school funding
- Changes to the curriculum

⁸ Results of a survey done by UfU and IZT „Umweltbildung für Erneuerbare Energien für Kinder und Jugendliche“ BMU FKZ 903 41 113, 2004??.

Non-formal education

In contrast to formal education, non-formal education actors can be said to have taken a learning-by-doing approach to finding educational models teaching energy behaviour, energy technology and the broader context of climate change issues. They have been active for many years, having taken up a number of virulent public debates revolving around the environment, such as air pollution, nuclear energy, noise and waste issues, nature conservation, food production, and also renewable energies, energy efficiency and climate change. The focus has been on practice, so any underlying theory may have been formulated as the work went along, serving primarily to draw lessons from and to improve the individual projects.

The most important actors in non-formal education for energy and climate change are:

- Environmental NGOs
- Youth organisations
- Energy education experts, research and consulting associations
- Energy agencies

Only occasionally do environmental NGOs and youth organisations offer activities for schools, usually in the form of campaigns or public competitions. But there are a number of local initiatives which develop models / projects which - having proven effective - have been transferred into other, larger, longer term, and more professional programmes (e.g. the Klimafrühstück – climate breakfast - which was developed by a small Berlin NGO, and has been adopted by the WWF) .

Some non-formal actors - the research and consultancy associations - have acquired considerable expertise and experience in energy education and have become central players in this field. Some of them have become well-established and professionalised actors in the field: they have attained grounded experience with practical projects, many of which they have developed; they have been in steady exchange with schools and teachers over the last decade at least; they have conducted research projects and surveys. Furthermore, they have developed a tight network with political decision makers, with other education actors and researchers at the local level as well as at the national level, sometimes also the international level. Financially, many of their projects are supported by public funds (European, federal, local), less frequently by private sponsoring.

Examples are the energy efficiency projects for schools, which have become known as 'fifty-fifty' projects in Hamburg or Berlin, and – with different titles - have been carried out in many communities throughout Germany. These projects are implemented in cooperation with local community governments. Teachers and pupils find ways of saving energy in their schools by changing their behaviour or identifying technical solutions. A share of the energy cost savings (e.g. 50%) is provided to the schools to finance special activities / investments.

Regarding the question: Does education matter, can the childrens' behaviour be influenced by energy education? Of interest to educators or anyone wanting to communicate with youth in any context are recent results of the Shell-Jugendstudien (Shell Youth Studies). These show a continuous decline in interest by youth when

asked for direct and “traditional” political involvement in political parties, associations (Vereine) etc. or when asked about their interest in politics (1991: 57% of 12-15 year-olds answered ‘yes’, 2002: 34% ‘yes’). Yet these same youths continue to be socially engaged and interested: in local activities, in their friends’ and families’ well-being, in environmental protection, in the rights of other weaker members of their community. Critical is that they regard these issues to be relevant for their direct personal lives, which does not seem to hold true for politics.

The results of surveys of ‘fifty-fifty’ programmes show measurable energy savings in both the schools (the ten percent range), as well as at their homes. But these need to be repeated periodically to refresh the “new” behaviour pattern. Also individual schools don’t ‘memorize’ the programmes, they depend on individual teachers who periodically need external support to repeat the programme at their schools.

3.4 Latvia

Diana Sulga, Latvia University

Formal education framework

The Education Law adopted in 1998 provides the legal basis for all education in Latvia. The basic level of education is determined by the Cabinet of Ministers regulations about the State Primary Education Standard and standards for particular subjects in primary education and state secondary education standard.

The overall goals of primary education in Latvia are the following:

1. Support learners in acquisition of basic knowledge and skills, necessary for their social and personal life;
2. Provide the basis for learners' further education;
3. Support harmonious development of the learner;
4. Support development of responsible attitudes of learners towards themselves, their families, society, environment and state.

The key targets of the teaching programmes in primary education are:

5. Support the development of concepts and understanding of the main processes in nature, society and sustainable development, as well as moral and ethic values;
6. Provide basic knowledge in language and mathematics;
7. Provide basic learning skills and basic IT using skills;
8. Provide basic knowledge and democratic values necessary for the citizens of Latvia;
9. Provide creativity experience;
10. Develop a basic understanding of cultural heritage of Latvia, Europe and the world;
11. Develop communication and cooperation skills.

Climate change and energy issues on the basic level of education (classes 1 to 9) are addressed according to the National Standard and Subject Curriculum; environmental issues as well as issues of Education for Sustainable Development are cross curricular - integrated into particular subjects.

Official Curriculum requirements

Subject curricula

Teaching in Latvian schools is determined by the official document - Subject or Course Standard. The state standard component defines the main goals and tasks for the subject or course, the compulsory education content, the form and order of assessment. The state educational standard in Latvia is defined by the Cabinet of Ministers' regulations about state primary education standard and state secondary

education standard. The Ministry of Education and Science, Centre for Curriculum Development and Examination is responsible for elaboration of Standards.

Guidelines are normative documents defining subject goals and tasks, compulsory education content, forms and order of assessment. These **goals are compulsory for all schools**, but every **teacher** has rights to **organize teaching** and learning processes, including **choosing among available teaching materials independently**. The teacher is responsible for students' possibilities to acquire education appropriate to the State Standard. The responsibility for the quality of education in schools actually lies only with the teacher. This means that it is very difficult to find out what exactly is taught on energy and climate change as it varies from teacher to teacher, school to school and class to class.

The school level for the SAUCE target group normally covers classes 5 to 8. Climate change and energy issues are addressed according to the subject curricula. Environmental / ESD issues are cross-curricular / integrated into subject curricula and climate change is a part of EE and ESD. At the primary level, integrated science course are taught from the 1st to the 6th class as the subject "natural sciences" (Dabaszinības), thereafter Biology and Geography are taught from the class 7 to 9 and Physics and Chemistry – from 8 to 9.

SAUCE project issues are addressed in the subject curricula of the primary school in the following teaching/learning themes:

Energy: energy concept, resources, renewable/non-renewable resources, energy sources; basis of electricity, electric safety, transformation of energy forms;

Climate: climate formation, its factors and components, importance of clean air

Related topics: composition of lithosphere, use of different resources; ecosystems, human impact on ecosystems, pollution, importance of clean air and water, hazardous waste, recycling; development of positive attitudes for nature, nature values.

Project oriented learning and project days: Project weeks are an obligatory part of curriculum; choice of topics depends on the individual school.

Grade 6: Student scientific work "Environmental pollution".

There are several relevant textbooks officially approved by the Ministry of Education and Science, but teachers can use all other teaching aids and materials they find useful.

Pedagogical approaches

Pedagogical background: Primary school, classes 5 to 9 At this age an intellectual development of adolescents occurs as a shift from the child specific thinking and perception to the adult specific one. This occurs through involvement of adolescents in different activities, actively enquiring about the world, relationships among different natural laws, advancing hypotheses and searching for the evidence; becoming the subjects of societal norms, adolescents develop their individual value system and this is the place where environmental values can be adopted (development theories by Piaget and Allport). But at this age adolescents also consider things in extremes, everything should be divided into right and wrong, black and white, therefore it is important to teach them to look at things in systems, both in nature and society.

Therefore an important role for environmental education at this stage is activities-based learning, fostering development of attitudes through pupils' own individual direct experience, which would contribute to the development of an individual's participatory behaviour in the future.

As described above, at this stage of education, environmental education and its related topics are integrated in the existing curriculum. However, environmental education at this particular schooling stage is the most active and is implemented through traditional lessons and lessons outside the classroom, after-school circles and clubs, projects and student research work.

Development of Environmental Education

Important changes in both curriculum development and in the organization of the education process took place after independence of the Republic of Latvia. Personal development of individuals for self-actualization was adopted as a new aim of education. One of the key tasks to achieve this goal was a shift from regulatory to democratic pedagogy, involving the radical changes in the student-teacher relationship – a shift from the subject-object to the subject-subject relationship in the teaching process, which also required a change in educational content.

Under these circumstances, environmental education was considered as one of the tools for interconnection of various school subjects as well as promotion of awareness of the interdependence of the world among students.

Formal recognition of environmental education in Latvia started in 1994 with elaboration by NGOs of the Environmental Education Concept for General Education Schools in Latvia. This was the first document in Latvia introducing environmental education in schools and it defined environmental education goals, objectives and guiding principles, contents and competences of schools, teachers and other institutions. The concept was based on the guiding principles in environmental education formulated in the final document of the UNESCO Intergovernmental Conference on Environmental Education held in Tbilisi, 1977 (<http://unesdoc.unesco.org/images/0003/000327/032763eo.pdf>).

In 1996, the Curriculum Development and Examination Centre of the Ministry of Education and Science published Guidelines for Environmental Education in Primary School. This document, like subject standards, provides environmental education goals and targets, outlines the contents, and defines the requirements and criteria for the assessment of EE in primary school. It is based on a cross-curricular approach to environmental education, and points out that each teacher is responsible for the introduction of environmental education into their subject. An environmental education coordinator is in charge of the coordination of this work in school. But practice shows that besides schools entirely involved in EE there are also cases where the EE coordinator is the only school teacher doing EE in the school and the support of the school administration is insufficient.

There are three constituent learning goal components well known in pedagogy:

- cognitive - knowledge acquisition,
- psychomotor - skills and skills-building,
- affective - attitudes and certain value system.

This model of complex learning goals emphasizes the importance of all 3 components, besides the role knowledge, which has traditionally been considered as a priority, emphasizing also skills and attitudes, especially important for environmental education in the process of development of an individual's environment-friendly value system and behaviour.

In Latvia, as in other countries, environmental education evolved from natural sciences, therefore most environmental experts have a natural science background. However, in recent years representatives of social sciences and humanities have been involved more broadly.

Recent changes.

Until about 25 years ago science was taught in the good old and well-tested way where the pupils were told how things work, what the laws are and what to believe and to conduct standard experiments according to a very detailed recipe. An international study on what students actually know / have studied in science was carried out in Latvia and its results showed, as in some other countries, that school students know what to answer the teacher in class and know the laws by heart, but fail to use and adapt them to real life situations outside the classroom. As a result of this investigation, subject standards and experiences from other countries have slowly changed the way science is taught in schools and the level of attainment has improved, as international specialist group recently reported.

Current teaching methods

Teaching methods are an important element of the learning process. The didactic basis / **methodology applied broadly varies from teacher to teacher, class to class and school to school.** It should be noted that environmental education has been the one most actively contributing to the development and introduction of new, democratic teaching methods in schools. The Ministry of Education launched the first international project "Baltic Sea Project" in 1989, but in 1991, the University of Latvia Ecological Centre started the second international project in Latvia - "Air Pollution Project Europe". Since the school year 1997/98, the Ministry of Education has introduced a project week in schools. To develop the pedagogical setting in school as well as to foster the teacher and student cooperative model in learning and teacher teamwork within the school and development of new, local community specific teaching materials, University of Latvia, Center for Environmental Science and Management Studies and Vest-Agder county (Norway) Department of Education implemented a joint **project "Environmental Education in Latvia"**, between 1994 and 1997. 16 schools from different regions of Latvia participated.

Participants of the project "Environmental education in Latvia" successfully attained the project goals:

- to create and train a team of different subject teachers in each project school to be able to cooperate on environmental education in the particular school;
- to provide training for working group coordinators in each school to become a teacher of trainers' trainer in the field of environmental project work in schools;
- to develop and implement environmental education projects, rooted in the local cultural, natural and social environment;

- to promote cooperation between different economic sectors (education, environmental protection, energy) to support environmental education.

Group work and projects

For many years much teaching in Latvia has been done using group work, problem-oriented teaching and project work, both subject-based and interdisciplinary. **Project weeks** (usually lasting for 5 school-days) **are an obligatory part of the curriculum** where choice of topics depends on individual school. Students approach educational attainments through work with their peers, individual literature search and other sources, where teachers play the role of facilitator and provide the necessary encouragement. Besides, one may find teaching based on other theories too or no particular theory, especially in pre-school and academic education.

3.5 Netherlands

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Introduction

This section gives an overview of the Dutch approach in Energy and Climate Education (ECE) of young children aged 10-13 years. ECE is part of the formal and non-formal sector in the Netherlands. Most of the relevant programs in both sectors are on nature and nature protection and on environment and sustainable development. Energy and climate is basically considered as one of the relevant topics within these broader themes, but is hardly the topic of specific programs yet. ECE is emerging as a theme in environment and nature programs in the Netherlands, but absolutely no dominant theme yet or *the* theme of any organisation in the formal and non formal sector. There are some initiatives, among others those of two Dutch energy companies, on developing specific programs on energy for young children. The toolkit of nature organisations offers energy and climate activities, but that's it for the moment. Nature and nature protection dominate in the formal and non formal sector. The informal sector is predominantly a niche of certain social groups and lifestyles and not so relevant in this context. Children emerge as a focal group of Dutch universities, but the programs offered are on science and technology and not specifically focused on climate and energy.

What follows below therefore is inspired by and referring to the nature and environment curricula in the formal and non formal sector which serve as the programmatic context for the energy and climate themes in the Netherlands.

Pedagogy/educational theory and practice

In the Netherlands, ECE is primarily organised in the formal and non-formal educational sectors, each of them working with a pedagogy and theory. Both sectors are working together in the sense that the non-formal sector facilitates the teaching programs on energy and climate in the formal sector. We will explain the basic pedagogical ideas behind both sectors separately.

ECE in formal education covers the primary schools in the Netherlands.

The Dutch School System

The Dutch Constitution provides the legal grounds for the Dutch school system based on the freedom to develop, organise and provide teaching and education on the basis of religious or cultural preferences. This fundamental right has given rise to a diverse school system consisting of all kinds of public and private schools at all levels.⁹ At each level children can choose between schools of different religious and cultural orientation. The programs and the requirements at each level are rather comparable; basically the religious and cultural flavours make the difference.

Kids start their educational career at the primary school at the age of five. At that age all Dutch children are obliged to attend educational training at school until the age of

⁹ Public and private schools both are publicly financed. The difference is in the organisation and the cultural and/or religious orientation of schools.

16. Pupils change school for the first time at the age of 12/13. Here they differentiate in pupils continuing in the theoretical track and those continuing in the practical track. The theoretical track is the high school preparing in about 5 years for a bachelor/master track at a university or a bachelor track at a polytech (hogeschool). Pupils changing primary school for the practical track start training in one of the many professions. Some of the professional tracks have different levels (low, middle and high). The highest level is the polytech which can also be reached by continuing primary school in the theoretical track. The final part of the educational career in the theoretical track is the polytech or the university. Quite some students do both starting their bachelor at a polytech and continuing in a master program at the university.

As indicated above the freedom of education is deeply grounded in Dutch society, but variety and differentiation does not affect the curricula at the different levels in the school system. The curricula at each level are comparable and the quality is monitored and assessed periodically. Quality assessment is well integrated in the Dutch school system at all levels. Recently Dutch schools are benchmarked periodically and this information is publicly accessible for parents and students.

Almost all Dutch schools are public schools financed by the Dutch state. Depending on the identity of the school (generally, religiously or culturally oriented), they might be headed either by the municipality (general schools) or a board (religiously or culturally oriented school). Next to the public schools there are private schools who charge fees since they don't have public money.

All primary schools are committed to similar learning targets (kerndoelen) and have an obligation to offer a basic set of courses to their pupils. They do have some freedom in scheduling and offering the courses and in choosing the educational material though. Next to the basic set of courses primary schools have liberty to offer additional courses and programs, allowing them to profile their identity preferences. Both the obliged and the additional part of the curriculum allow schools to participate in the schools@university.

The topic of SAUCE - energy and climate change – is not yet a standard part of the curriculum at primary schools in the Netherlands. The curriculum does cover topics as nature and environment, but this is basically biology oriented. The topic of the SAUCE allows schools to link up with the nature and environment part and with the society oriented part of the curriculum.

The pedagogy of Dutch primary education draws on the idea of primary education as support for the overall cognitive and emotional development of young children, of their social, cultural and physical skills and of their creativity. The curriculum addressing this core idea fulfils three functions:

- 1) Support for individual development of children;
- 2) Transfer of basic societal and cultural values; and
- 3) Preparation for being able to participate as independent citizen in society .

The core idea has been translated into a nation wide set of key learning goals (*kern doelen*), differentiated in and specified for learning areas covered by the primary school curriculum. The key goals act as guidelines and orientation for the focus in and architecture of the school's curriculum. The key goals define the minimal commonality

in the curricula of primary schools in the Netherlands. Schools are free to choose the curriculum to attain the goals in the different areas of learning. ECE is part of the learning area “Individual and society” and “Orientation and reflection on man and society”. The idea of this learning area is to teach children how humans deal with the natural environment and with each other. They learn how society is designed and organised and how the natural environment and resources are used. They learn about the economic, political, social, cultural and technical aspects of designing society and learn about values like sustainable development, and what these values imply for the design and the organisation of society.

The key targets in the learning areas linking up with ECE are:

39¹⁰ Pupils learn how to deal carefully with the environment

40 Pupils learn to identify plants and animals in their natural environment and learn how they live and what their functions are for the natural environment

41 Pupils learn about the architecture of plants, animals and humans and the form and functions of their constituent parts

42 Pupils learn to explore physical phenomena like light, sound, electricity, power, magnetism and temperature

49 Pupils learn about the global differentiation and concentration of populations, religions, climates, energy resources, and natural environmental like volcanoes, deserts, tropical rainforests, mountains and rivers.

These key targets provide the basis and reference for specific activities at school on nature and nature protection, environment and more recently on energy and climate. Schools are free to decide on the topics and programs they want to address. Energy and climate are not obligatory themes, like language and mathematics and gymnastics. Schools decide independently if they want to include energy and climate as themes in the curriculum.

Non-formal education

The Dutch non-formal teaching infrastructure for young children basically consists of what is called in Dutch *Natuur en Milieu Educatie* (Nature and Environment Education). Nature and Environment Education (NME)¹¹ is both a programmatic approach and an infrastructure of organisations. As programmatic approach NME is also offered by environmental and nature oriented NGO's and environmental groups in the Netherlands. Recently private initiatives on the theme of energy and climate emerged, including those of two Dutch energy companies. So the Dutch non-formal sector covers programs in NME offered by a wide range of organisations. In this section we concentrate on major programs that can be considered representative of the non-formal sector in the Netherlands.

The organisational infrastructure of Dutch NME covers a program line of the Dutch government (Ministers for Agriculture, Environment and Education) run and implemented by provincial and municipal organisations. All Dutch provinces are

¹⁰ The numbers refer to the original sequence of the key targets in the documentation

¹¹ We use the Dutch abbreviation in the rest of the text.

covered, but not all Dutch municipalities. NME organisations offer programs for all ages, children and adults, on nature and nature protection and on the environment. Energy and climate *can be part* of these programs and in some parts of the country, energy and climate is offered as a theme. The provincial and municipal NME organisations as NGO's and private companies consider children more and more as an important target group. Children are addressed with all types of educational programs and activities, predominantly on nature and nature protection. This section briefly explains the pedagogy of the NME programmatic approach and the larger environmental NGO's in the Netherlands, IVN and WWF. We also mention the recent initiatives of two Dutch energy companies, Nuon and Essent.

Dutch Environmental and Nature Education Policy

Dutch NME dates back to the beginning of the 20th century.¹² It has its origin in the national association for the protection of the environment (Stichting Natuur e Milieu). Government support for NME dates back to 1988. The first supportive initiatives were meant to build a country-wide infrastructure of organisations offering NME programs for children and adults. In the past 20 years the infrastructure has matured into a dense system of organisations offering a wide variety of nature and environment programs for children and adults.¹³

The core idea of NME was and still is to provide information and knowledge for awareness-raising for environment and nature with the aim of influencing people's habits and behaviours in more environmentally benign directions. By awareness-raising NME aims to contribute to children's and adults' involvement with nature and the environment with the idea to support man's independence in taking environmentally benign decisions in every day life and routines. Children are an important focal group since the youngsters are expected to be open for good practices which they (hopefully) might continue when they are grown up. NME focuses on the ecological component of sustainable development. In this way NME also aims to contributing to sustainable production and consumption, which is one of the goals in the policy program of the current Dutch government.

NME draws on the pedagogical principle of "head, heart and hands" as modes of learning and developing skills. The idea is that experience of and involvement in nature and environment strengthens the learning capacity of children and their respect for nature and environment. Learning should be as close to daily life and daily routines as possible. The knowledge and experience offered should be practical and directly applicable. The idea is to connect experiences with NME to the different daily roles and positions of children as consumer, citizen, traveller, and the like. So NME is assumed to enrich the behavioural alternatives and options of children in their daily routines and lifestyle.

The pedagogy of NME is to engage children and adults in nature, nature protection and the environment. Engagement in this sense means that humans:

¹² The reference to theory and pedagogy in this section is taken from VEN, *Leerlijnen in de NME*, Amsterdam 2006.

¹³ Ministry for Agriculture and Food, Ministry for Education and the Ministry for the Environment, *Choose, Learn and Participate NME 2008-2011* (Kiezen, leren, meedoen, Natuur en Milieu-educatie 2008-2011), The Hague, 2008

- know and respect the crucial function of the natural environment for the overall wellbeing of society;
- are able to balance ecological, private and societal values in decision making;
- are willing to take full personal responsibility for the quality of the natural environment now and later;
- are able to integrate these responsibilities into daily life and routines.

As indicated above the NME track is embedded in a province-based organisational infrastructure supported by professionals with paid jobs. Each Dutch province has an organisation for NME. All provinces do have municipally or community-based local contact points, but this local system has no nation wide coverage.¹⁴

Nature and Environment Education (NME) is the governmentally funded supplier of programs for primary schools. Both children and adults are focal groups of NME. Universities are not involved yet. (We have developed cooperation with the Municipal department of NME in Enschede in the context of SAUCE). NME is basically an interaction between the organisations offering programs and the primary schools. Their interaction is rather straightforward. NME offers programs to schools and schools subscribe to the programs. Programs basically consist of specific activities on specific themes. Energy and climate is one of the themes offered. Schools also can borrow tool kits of NME.

NME organisations cooperate in developing new ideas and program activities. Cooperation is organized on a province basis. There is no systematic involvement of and interaction with universities. NME Enschede involvement in SAUCE activities is considered as a promising new activity.

Dutch Universities

Dutch universities are discovering children of primary school age as a new target group. Some universities run programs for children and others are in the process of starting up. The focal point of the programs is science and technology in general and not energy and climate. The Universities of Maastricht, Tilburg and Amsterdam offer a Children's University on general themes. The University of Twente is developing a pre-university college for children in primary school. SAUCE probably will become a pilot in this initiative. The Department of Physics also offers a nice website with experiments for children. (www.proefjes.nl)

The Dutch teacher universities also run an initiative on sustainable development. In 2007 a group of Dutch teacher universities initiated a program aiming at integrating the theme of sustainable development into the curriculum of the teacher university. The idea is to bring sustainable development to the attention of new generations of primary school teachers to motivate them to integrate the theme into the primary school curriculum.

SAUCE adds a new dimension to the educational part of the university's societal engagement. The initiative expands the role of the university to a new target group, the

¹⁴ For instance the larger cities in my environment have an own NME organisation whereas the smaller cities haven't.

youngsters in the final classes of the primary school. The initiative expands the societal responsibility of the university by opening the minds of the children for the highly relevant and urgent topic of energy and climate change. Bringing these societally urgent topics to the minds of children in an academic environment which children might perceive as highly fascinating, will clearly help open their minds for such a relevant topic. Being addressed by 'real professors' in their own understandable language, will complete the imaginary fascination children will experience at the university campus. This will provide a fertile ground for SAUCE. Children will share their experience and knowledge with other children, their parents, family and neighbours and this will add to the spread of the recognition of the climate change problem and the need to take action.

Twente university, for instance, organizes a so-called Twente Academy offering high school students support in certain disciplines like mathematics and physics on campus. The idea behind it is to motivate the youngsters for the University of Twente. The youngsters stay on campus and experience a bit of student life during a couple of days. It serves as a kind of appetizer for them. With the same idea Twente organizes so-called technology days every year, again for high school students. The idea here is to show the high school student the fascinating world of technology (Twente is also a technical university) with the idea to develop his interest for our university.

Next to these activities addressing high school students, several Dutch universities offer so-called children's universities, with primary school children as focus group. The children's university is a periodic lecture on a scientific theme. The idea behind it is to introduce children into the world of science and develop their interest in knowledge and learning. This activity will probably diffuse to all Dutch universities. It is motivated by the changing role of the university in Dutch society. Universities should engage more in society and societal problems and focusing on children is a way to do that. That is why we may expect an increase in children activities of universities.

Another driver in the university focus on children is quality improvement of primary school teaching, which is considered as too low. One of the causes is bad training of primary school teachers and the professional expertise of the teachers. Stronger engagement of universities in the training and education of primary school teachers is currently considered in the Netherlands. So this too is a driver of a stronger child focus of universities. SAUCE could benefit from these developments. At Twente for instance, we find enthusiasm about SAUCE because we are doing what others are considering. SAUCE therefore could act as a pilot in exploring the ins and outs of a stronger university focus on primary school children. SAUCE is a first mover in this respect, and this argument can be used to interest people for SAUCE.

Conclusions

The Dutch non formal NME sector is well organised and structured. As indicated above it has a country-wide coverage at the provincial level. The sector has some 1000 paid jobs and a tremendous reservoir of volunteers all working on a wide variety of themes and topics in predominantly nature and nature protection and environment. The non formal sector offers products and services to the formal sector. Above we have explained that NME is taken up in the primary school curriculum in several learning areas. In general the organisational infrastructure of NME is well developed in the

Netherlands. There is a relatively high degree of professionalism and a rich supply of themes, products and services.

On the content side, energy and climate is an emerging theme, but clearly not a dominant one in NME. This holds for the formal and the non-formal sector. However, energy and climate is becoming more important. For instance, the larger Dutch environmental organisations present energy and climate as a separate theme in their activities, but only a few have developed kids' programs on the theme. So, in terms of content there is room for more energy and climate activities in both the formal and the non-formal sector.

Above, we also mentioned some initiatives at Dutch universities. Almost all Dutch universities offer programs for high school students, but only a few focus on primary school pupils, offering a children's university. At Twente, high school students are still the most important target group for the extra-curricular activities, but primary school is present in the background.

The first conclusion is that there is growth potential for the theme of energy and climate in the formal and the non-formal sectors and in the children's programs of Dutch universities. The second is that the review did not find any initiative or program covering intercontinental communication or interaction on themes such as sustainable development or energy and climate. SAUCE could include intercontinental communication for the Caribbean area, with Twente covering the Netherlands Antilles. We could consider holding a live video conference on energy and climate at some point with children from different continents.

3.6 United Kingdom

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Introduction

The activities of individual teachers in UK schools may be thought of as 'nested' in multiple layers of policy and governance. First, comes the UNESCO Decade of Education for Sustainable Development (out of Rio, 1992 Agenda 21, see Introduction, above) and EU policy support (e.g. Intelligent Energy Europe programme and projects, see above). In the context of these international level developments, the national curriculum strategy (UK Department of Children, Schools and Families DCSF, see also Department of Environment, Food and Rural Affairs Defra and the new Department of Energy and Climate Change DECC) works mainly out of the DCSF but with reference to Defra, while the new Department of Energy and Climate Change (October 2008) may be expected to play a key role in future.

The UK, and in particular the SAUCE programme, located in London, benefits from the commitment of regional agencies to programmes of energy and climate change education to promote both awareness and behaviour change. Behaviour change programmes are also supported by research funded by the Economic and Social Research Council (ESRC) in partnership with Defra. The key regional agency for SAUCE, in the first instance, is the Government Office for London's London Sustainable Schools Forum – LSSF, which is a SAUCE programme partner.

At Local Authority level, the London Borough of Islington's Sustainability Department and the Islington Environment Learning Partnership [IELP] are supportive of SAUCE, with IELP a programme partner.

The UK National Curriculum

In 1998, the Prime Minister set up a review body to address all aspects of ESD in the UK, in the context of a lifelong learning approach. This was a partnership, an example of policy integration, between Defra and the predecessor to DCSF, the Department for Education and Skills (DfES):

<http://www.defra.gov.uk/sustainable/defra/educpanel/index.htm>

The Department for Children, Schools and Families (DCSF)'s strategy for sustainable schools can be found at:

<http://www.teachernet.gov.uk/sustainableschools/>, with the sustainability requirements laid out according to stages at

http://www.teachernet.gov.uk/sustainableschools/teaching/teaching_info_detail.cfm?id=13

and primary energy materials at:

http://publications.teachernet.gov.uk/eOrderingDownload/3676%e2%80%a2SSSTR_EnergyBoost_PRI.pdf,

with climate issues covered at:

<http://publications.teachernet.gov.uk/default.aspx?PageFunction=searchresults&ft=climate+change+film+pack&pn=1&rpp=1&ShowHide=4&Area=1> ,

a site that shows links to Defra and also the result of a challenge to provision of the climate materials in the UK! Defra held a climate change youth competition for 11-18 year olds in 2007 (although the winners were all 13 years old, or older):

<http://www.defra.gov.uk/news/2008/080220a.htm>

who can communicate their experiences on

<http://www.footprintfriends.com/> , a website dedicated to climate engagement for 11-18 year olds, itself linked to the Children in a Changing Climate initiative:

<http://www.childreninachangingclimate.org/> , one that we may all wish children attending SAUCE programmes to sign up for. This will address the requirements of global citizenship education as well as climate change, and could support our plans to include partnerships with schools in developing countries severely affected by climate change. A more 'fun' site dedicated to younger audiences is provided by OneWorld at:

http://tiki.oneworld.net/global_warming/climate_home.html?qclid=CP3YyLSJg5gCFRk_awodJAPSYg .

Ten to thirteen year-olds bridge two key stages across primary and secondary education in the UK, with Key Stage 2 running from 7-11, the later stage of primary school, or 'junior school' in some countries, and Key Stage 3 from 11-14, the early stage of secondary school. This means that the SAUCE programme will probably need to include occasional days appropriate to classes from secondary schools.

Fortunately, the primary curriculum has just been revised to focus on skills and competences, which will provide a much more favourable context for SAUCE. According to the National Curriculum, "Children learn a wide range of specific skills in each subject. They will also learn broader skills which can help them in any area of school, work or life. These **key skills** are□

- **communication**
- **application of number**
- **information technology**
- **working with others**
- **improving own learning and performance**
- **problem solving**

The key skills are taught across the National Curriculum subjects. For example, in a science project, children might work together as a group, using communication and problem-solving skills as well as learning to work with each other. Children will also be taught thinking skills across all subjects.

Schools must also promote children's spiritual, moral, social and cultural development. This will be done across all the subject areas. For example, in a geography project where children compare two contrasting cities, they will learn about the cultures of the different people who live in those cities.

Spiritual, moral, social and cultural development may also be covered more specifically in your child's school during religious education, collective worship, personal, social and health education (PSHE) and lessons in citizenship.” (From http://www.bbc.co.uk/schools/parents/work/curriculum_guide/national_curriculum.shtml)

SAUCE will also need to address the definition of skills appropriate to sustainable development. General skills for young people are addressed at:

http://curriculum.qca.org.uk/uploads/PLTS_framework_tcm8-1811.pdf?return=/key-stages-3-and-4/skills/plts/index.aspx%3Freturn%3D/key-stages-3-and-4/skills/index.aspx

and the skills needed for a low carbon economy are addressed at:

<http://skills4lowcarboneyconomy.co.uk/reports.aspx> .

Given the emphasis on novel pedagogic approaches, the SAUCE programme will present an opportunity to match the development of required, or desirable, skills to the learning context (e.g., in the community, or volunteering, or working in small teams) in which these skills are to be acquired.

At the national level, two other institutions committed to ESD should be mentioned:

The National Association for Environmental Education (www.naee.org.uk); the University of Bath Centre for Research in Education and the Environment (<http://www.bath.ac.uk/cree/>), a potential SAUCE partner and the UK's leading team for research into ESD; Eco Drama (<http://www.ecodrama.co.uk/index.php>), a Scottish troupe 'bringing eco issues to life', but unfortunately something of a lone figure in the potential eco-dramatist/ eco-theatre landscape.

Awards are a prominent feature of government policy to encourage sustainability in the UK, and can be found in the Eco-Schools programme (<http://www.ecoschools.org.uk/about/>). The private sector is also involved in partnerships with schools, as in the example of British Gas's Generation Green initiative (<http://www.generationgreen.co.uk/>). The role of the private sector, and the potential for partnerships with SAUCE national programmes, deserves consideration by the consortium.

The Government Office for London - London Sustainable Schools Forum (GOL - LSSF)

The GOL LSSF is a SAUCE project partner, and has developed an approach to ESD that addresses curriculum, campus and community through eight 'doorways':

Food and drink

Energy and water

Purchasing and waste

Traffic and travel

Buildings and grounds

Inclusion and participation

Local well-being

Global dimension.

While energy is specified, climate is self-evidently a pervasive, or cross-cutting aspect of all eight dimensions. With this in mind, the UK SAUCE programme may work in substantial part through an LSSF-type programme. The food and drink doorway takes us into the relationship between climate and food security, as well as the contentious field of food miles (contentious in relation to the vegetables and flowers flown into the UK from, for example, Kenya, where the total carbon budget for a flower in a London florist from Kenya is argued to be less than the equivalent 'hot-housed' flower from the Netherlands or UK.), as well as the potential for a 'climate breakfast'. Aspects of the other themes also lend themselves to inclusion of climate considerations.

The 'process' doorways (inclusion and participation, and, possibly, local well-being and global dimension) also favour inclusion of equity and social justice dimensions of climate and energy issues, as well as identification of relevant skills.

The LSSF has recently published its report 'Towards Whole School Sustainability: A View from London Schools. Ideas to move from lone enthusiast to whole school participation' (London: Government Office for London, October 2008), a handbook that guides the user through the various stages of developing a whole school approach, and avoiding over-reliance on one or two committed teachers. The report also includes resources for each of the doorways, and can be found at:

http://www.gos.gov.uk/497417/docs/199952/605390/Towards_Whole_School_Sustai1.pdf

Its partner document "Creating Sustainable Schools in London: A Case Study Guide" is at :

http://www.gos.gov.uk/497417/docs/199952/605390/Creating_Sustainable_School1.pdf ,

providing examples from London schools that have tackled themes behind the doorways.

E-bulletins and workshop reports from the LSSF can be found at:

http://www.gos.gov.uk/gol/Children_youngpeople/Sustainable_schools/

London Borough of Islington - Islington Environment Learning Partnership (IELP)

The IELP, also a partner in the SAUCE project, is one of London's leading local authority initiatives supporting ESD and climate and energy education in particular. The IELP won the 'Golden Apple', London's premier award for sustainability education, in 2007 and 2008, and is a partnership of council officers and community groups¹⁵. The council officers are from energy conservation, recycling, nature conservation, the library service and the road safety team, and the community group partners are Groundwork, a leading organisation promoting green spaces and sustainable living; Freightliners City Farm, an urban farm working on sustainable principles; EC1New Deal, an urban renewal agency; Healthy Schools (<http://www.healthyschools.gov.uk/>) (Healthy Schools covers four themes: "personal, social and health education including Sex and Relationship Education (SRE) and Drug Education (including alcohol, tobacco and volatile substance abuse); healthy activity; physical activity, and emotional health

¹⁵ Presentation by Miranda Pennington to Islington Environment Forum, 17 April 2007.

and well-being” (<http://www.healthyschools.gov.uk/Themes/Themes.aspx?theme=4>), and CEA (Cambridge Education), the private sector body that runs schools in Islington.

IELP’s aims are to “achieve sustainable practice and healthier school communities; to embed the Council’s ‘cleaner, greener, safer’ agenda in schools; to be a point of contact for schools, other officers and local authorities on environmental topics in schools, and to share information and work in partnership in the pursuit of environmental improvement in schools.” *ibid.* The IELP draws on materials from the World Wild Fund for Nature (WWF) and CEA; runs an annual ‘Earth Summit’ for schools, and a training programme with teachers. The IELP is also partnered with the Islington Environment Forum, a Local Agenda 21 group, which provides links to a further range of projects and groups in the borough dealing with ESD, energy and climate issues, and co-chaired by the UK project principal.

As can be seen from the above, the UK SAUCE project is rooted in a supportive and active national, regional and local policy framework with strong partners. This does mean there is some crowding of the institutional space, which could mean competition for teachers’ and schools’ time for the SAUCE programme, but may also provide some pointers and ideas for colleagues in other SAUCE countries.

What the UK lacks, though, is experience with ‘Kids’ Universities’, and we will look elsewhere for a review of these.

4 Conclusions

Returning to themes mentioned at the outset, we have various levels of coverage of these issues in the sections above, some of which may be usefully updated as SAUCE progresses, and as project partners compare their experience and comments with those of others.

On pedagogy and development theory, there appears to be a consensus that Piaget and Vygotsky provide such foundations as there are in ESD in practice, but that the emphasis is more on process with theoretical and conceptual contributions implicit rather than explicit. It may be worth discussing the extent to which this needs teasing out more, or not.

As far as the institutional context is concerned, again we find different degrees of engagement by government, NGO's and public utilities, though all of these are implicitly legitimized by the international commitments all governments have engaged in. Two key differences appear to emerge. The first is the extent of engagement of local and regional government in direct support for ESD and energy and climate initiatives, which appears most clearly in the UK account, though this may be a product of the UK's chosen emphasis rather than the absence of such engagement across the board. Second comes the role of the energy utilities, for example in the Dutch case, which appears to signal the value of continuing public ownership of the utilities, if they are to engage proactively in energy and climate education – although we should not rule out the possibility of a state regulatory regime of privately owned utilities achieving the same objectives over time.

The report has, as far as possible, included weblinks so that partners can access materials and examples of different initiatives while reading the document.

One obvious gap in some accounts is evidence of what is really going on in energy and climate education in some countries. By definition, where the individual schools and teachers have wide discretion regarding the context of teaching and learning materials for energy and climate, an evaluation of the state of the art is a research project in its own right. However, it would be helpful to at least have qualitative feedback on a small sample of schools in each country if there is no systematic evidence base. This could then, in collaboration with teacher education departments and institutes, form the basis of a short research project that could be completed during the course of the SAUCE programme.