



Sigtuna Think Piece 9

Climate Change Education Research: What It Could Be and Why It Matters

Frans Lenglet, Swedish International Centre of Education for Sustainable Development,
Gotland University, Sweden

Abstract

The purpose of this think piece is to situate climate change education research in the context of research traditions, approaches and methods that are common to the social sciences, education being part thereof. At the same time it is meant to give elements for exploring the ways in which climate change education research may be identical to or different from them. This paper deliberates what climate change education research could be and why it matters. The paper argues that for climate change education research within the wider context of Education for Sustainable Development (ESD) to have effect, a research programme should build on the best of different research traditions, while avoiding the pitfalls associated with each of them. In this respect the paper argues for methodological innovation and expansion of existing forms of research. It also sees a research programme in this area has having potential to expand both research and climate change education paradigms and create opportunities for discussion, debate and continuous learning.

Why does Climate Change Education Research Matter?

Climate change education research matters because both climate change education and research matter. For climate change education – within the wider frame of Education for Sustainable Development (ESD) – to be useful, to enhance its utility, to strengthen its effectiveness, and to allow for innovation, new perspectives and continuous learning, its practitioners need to reflect on what they are doing and what is being done and whether the climate change education practice and processes have the intended results. They also need to examine in a systematic way how associated educational results could be improved or enhanced and how the actual educational and pedagogical practice and methods could evolve and innovate, in order to reach larger numbers of people and have a greater and longer lasting impact.

This is where research comes in. In other words, climate change education research should reflect, do justice to and help advance the practice of climate change education and its defining characteristics. It should build on the best from different research traditions, while avoiding the pitfalls associated with each of them. It should be aware of the limitations and the potential of these traditions.

Each research tradition or approach is based on methodological and philosophical framework that circumscribes and privileges the questions to be asked and the methods to be used. Because climate change education is a rather recent addition to ESD and education more broadly, it could be in the forefront of formulating and testing innovative research methods and

approaches. Climate change education research could expand both research and climate change education paradigms and create opportunities for discussion, debate and continuous learning.

What could Climate Change Education Research be?

The purpose of this think piece is to situate climate change education research in the context of research traditions, approaches and methods that are common to the social sciences, education being part thereof. At the same time it is meant to give elements for exploring the ways in which climate change education research may be identical to or different from them.

In this think piece, climate change education is regarded as going beyond education, instruction or learning about climate change, its appearance, its causes and (possible) consequences. These elements are certainly an important part of it. Indicators of climate change, such as global warming, rising sea levels, atmospheric greenhouse gas emission levels and melting ice shelves have become household concepts. Similarly, there is increased understanding of the negative consequences of climate change, if the processes underlying these indicators remain unchecked. However, the science behind all this – drivers, mechanisms, processes and tipping points – is less familiar and less understood. Scientific instruction, thinking and reasoning are therefore more important than ever. However, climate change has a major additional dimension: the human one. It is certain that human activity is having a major impact on climate change and that the consequences of climate change are having a major impact on human activity. Therefore, it is another goal of instruction, training and learning to know about and understand the intricacies of the interaction between climate change, human behaviour and social formations.

For climate change education to be effective, insights into and understanding of climate change in all its dimensions are not sufficient. Climate change education effectiveness is considered to reside in the ‘positive’ outcomes and results of the behaviour, choices, decisions and actions of human beings as a result of having been exposed to climate change education, instruction, training or capacity building. In other words, climate change education effectiveness will only take place if ‘transformation’ and ‘action competence’ are explicitly included in the instructional and learning process. It is this same transformative action competence that is central to ESD.

ESD consists of a wide variety of learning experiences allowing individuals, communities and organizations to acquire competencies, knowledge and predispositions for becoming/being active participants in choices and activities leading to a sustainable future in terms of global and local environmental sustainability, economic equity and social justice (UNESCO, 2005). Action competence¹ refers to the intellectual, practical and life skills of learners to comprehend their world in its complexity and, in the face of uncertainty and adversity, to contribute to the necessary collective and individual action required for transformation and resilience to occur and to be effective.

To the extent that ESD, and by extension associated forms of climate change education, are dealing with the interaction of complex systems and considers human beings and human communities as the agents and actors who affect and are affected by these complexities, it differs from other types of education dealing with comprehending ‘partial’ realities and acquiring

knowledge and instrumental skills, such as physics education, some forms of environmental education or vocational skills training. In the same vein, ESD and climate change education research may differ from research focusing on ‘partial’ or ‘instrumental’ education, instruction and training. For both types of research, the learning process and its outcomes are legitimate objectives of inquiry. Also, the methods of both kinds of research need to adhere to the same general research criteria of being theory-based, and having the characteristics of reliability, validity and reproducibility. However, where ESD and climate change education have a transformative – or some would say ‘emancipatory’ – character, the practice of ESD and climate change education research should reflect this character both in the way it is conceived and is conducted.

Research and research traditions

In his keynote address to the 4th World Environmental Education Congress (Durban, July 2007), Bill Scott presented a similar perspective, more specifically with regards to environmental education research (published in *Environmental Education Research* in 2009). He described the evolution of the thinking about research as a social process: according to the commonly accepted view of scientific research, research is seen as an investigation employing systematic methods to observe and interpret phenomena. ‘Although obviously broadly similar, the modern view is much more open in terms of outcomes, with a change of emphasis from generalisation and modelling, to a focus on knowledge generation and its application’ (Scott, 2009:156), thus transforming research from a mere method or technique to a process, which in terms of ‘... environmental education research concerns developing ... and/or measuring environmental awareness, ecological and issues-related scientific knowledge, issue investigation and decision-making skills, the empowerment of learners as environmental change agents, responsible environmental behavior ...’ (Scott, 2009:156 quoting Marcinkowski & Mrazek, 1996:iv). By extension this process view of research applies equally to research on ESD and on climate change education.

In education, as in the social sciences in general, there are a number of research traditions. These do not necessarily follow each other in time, one building upon the other or one replacing the other. They are traditions *sui generis* with their own strengths. They can and do exist simultaneously. The different research traditions combine a variety of approaches, methods and techniques, depending on research object and purpose, such as: surveys, observations, (quasi-)experiments, case studies (in the anthropological and ethnographic tradition – either stand alone or in a comparative fashion), econometric, psychometric and sociometric methods, longitudinal studies such as cohort and panel analysis, textual and content analysis, rate of return analysis, cost-effectiveness and cost-benefit analysis, etc. The next section will comment on a limited set of these traditions and methods with respect to their applicability and appropriateness in terms of possibilities for climate change education research.

Surveys and focus groups: Surveys of climate change education practices and of understanding, perceptions and beliefs among politicians, decision-makers, teachers, students and the public at large about climate change, its drivers and consequences, are useful tools for gathering

information for determining the ‘lay of the land’ when climate change education initiatives are being proposed and introduced. The data collected also can serve as a baseline against which further climate change education, interventions and impact can be measured and assessed. Usually, opinion polls cover a small number of questions addressed to large numbers of people.² In contrast, the focus group method helps to explore a limited set of issues or questions among selected persons but in greater depth. Thus they can go beyond a mere observation and description of people’s beliefs and explore ways in which people consider that they can make a difference (or not) with respect to the issue under scrutiny.

Comparative and longitudinal studies: Surveys, at any geographical scale, are good for ‘discovery’. The survey method, if used over time and with comparable populations, can produce a rich picture of the ‘status’ of these populations with respect to a small set of variables, and the changes thereof over time. For example, the Organisation for Economic Cooperation and Development’s (OECD) Programme for International Student Assessment (PISA),³ through its surveys of 15-year-olds in the principal industrialised countries, assesses how far students near the end of compulsory education have acquired some of the knowledge and skills essential for full participation in society. Recently, PISA published a study about how 15-year-olds perform in environmental and geoscience in 2006.⁴ Currently, PISA covers a limited number of domains (reading, mathematics, science literacy) but it could be imagined that climate change education components (or a broader set of ESD components) could be included in future PISA editions. To the extent that other countries can participate in PISA or similar studies, the understanding of the ESD and associated climate change competencies of students (and others) across the world could be enhanced. However, surveys of this kind do not say much, if anything, about the conditions, environments and contexts in which the results (i.e. student achievement) have been produced; in other words, the variables that can explain the differences between student scores in different countries. More detailed and context-specific studies (especially in-depth case studies) are required to do that.⁵

While the tools of student achievement testing – whether in the classroom, the school, the school system or the country – are well understood and practiced as far as ‘traditional’ subject matter learning is concerned, it is a challenge to extend and adapt them to learning that goes beyond simple knowledge and skill acquisition. In the environmental education domain Scott and Gough (2003a, 2003b) distinguish three types of learning interventions. Type 1 and Type 2 interventions ‘suppose that what counts as pro-environmental or good citizenship behaviours can be specified, and that, through learning, appropriate skills can be developed that will contribute to bringing about these behaviours’ (Scott, 2003c:2). Traditional testing methods can certainly establish the extent to which these skills have been acquired. Adaptation in testing methods is required, however, when it comes to Type 3 learning interventions, in which, according to Scott (2003c:3), ‘problems have multiple, contested definitions and shifting, contingent solutions where uncertainty about what best to do is the norm.’ Learning in this context encourages critical thinking and open-ended enquiry and recognises uncertainty and its implications. What kinds of testing techniques are appropriate to assess the results of this learning? And would it be feasible to organise an international assessment of ESD and climate

change education in a similar fashion as the large-scale international learning assessment studies such as PISA and TIMMS?

The category of longitudinal studies also includes cohort or panel studies. This kind of research allows, for example, one to follow the ‘performance’ of a particular (natural) group or groups of students as they progress through different stages of education and learning. It is also possible to compare different cohorts or groups that differ on the major variable under scrutiny (see also the section on Randomised Trials below).

Case study: The international discourse on education and learning in general shows a tendency to concentrate around certain key words. ‘Decentralisation’, ‘competencies’, ‘learner-centered pedagogy’ – to just take a few examples – are recurring concepts that are adopted or at least used in highly different contexts and highly different social, cultural and educational systems and traditions. There is a need to subject this phenomenon to further scrutiny. It can be observed, for example, that the languages of climate change education – including concepts that are essential to Type 3 learning interventions (see above) – are increasingly becoming identical in space and over time. However, they are likely to cover and hide different (ideological) realities, perceptions and practices. Detailed case studies that confront actual educational and learning practice with the words and concepts of transnational educational discourse would be of great help in laying bare their ‘accidental’ and ‘essential’ characteristics. In addition, comparison of these case studies could provide insights in how new educational approaches, such as those associated with various forms of climate change education, are disseminated, adopted, adapted and even ‘denatured’ in certain contexts and circumstances. An interesting example of highlighting the dynamics and contradictions in the transnational educational ‘discourse’ is Carney’s (2009) comparison of educational ‘policyscapes’ in Denmark, Nepal and China. It shows that similar concepts of higher educational reform have different (practical) meanings in different contexts, and that over time the meaning of a concept emerging in one context may almost turn into its opposite in the same or a different context.

There is a well-established tradition of anthropological and ethnographic case studies of classroom interaction and dynamics – figuring out what is happening in education’s ‘black box’. Of course, case studies can also be used for describing how (new) educational interventions and approaches are conceived and implemented in their own contexts (see previous paragraph), how they may be perceived and used by the community, the teachers and the learners, and how they may have different consequences, effects and results, depending on a constellation of ‘environmental’ variables. Kendall’s (2007) study of education reform in Malawi is an example of an insightful use of the (ethnographic) case study method. It shows the extent to which the ‘same’ nationwide educational reform produces highly differing outcomes in three different communities, in terms of the genesis and practice of the reform and actual learning outcomes.

Randomised trial and (quasi-)experiment: Education and learning are always and necessarily context-bound; even more so when moving away from knowledge and skill acquisition to higher order learning skills and Type 3 learning interventions (see above). Therefore, they lend themselves very well to qualitative research methods, such as case studies. There are those who

argue that such qualitative research does little for ‘scientifically’ determining which factors or variables determine the effect, success or failure of an (new) educational intervention. For them, the randomised trial or experiment is the ‘gold standard’ of proof. This is premised on the assumption that new educational approaches or methods are analogous to new medicines or drugs: by comparing the difference between the results of ‘administering’ this intervention to one group while withholding it from another but equivalent group except for the intervention, the intervention’s effect can be scientifically measured.⁶

As one can imagine, (quasi-)experimental designs and randomised trials in education are contested.⁷ Apart from the actual difficulty in setting up true experiments (see for example Stufflebeam, 2005), objections have been raised about the possible ethical implications of randomly or arbitrarily allowing certain groups to ‘enjoy’ the intervention and others not. When, for example in the case of climate change education, the intervention’s purpose is closely related to ‘sense-making’ (i.e. critical thinking and open-ended enquiry, while recognizing uncertainty and its implications), an experimental approach may not be that appropriate.

While randomisation of the ‘treatment’ can be highly controversial if not plain unethical, it could be used to one’s advantage in actual situations where new (educational) innovations and interventions reach certain regions or groups of people earlier than others. This creates the condition for a ‘natural experiment’ – comparing the ‘results’ of the ‘reached’ and the ‘non-reached’ groups, although this too has ethically complex undertones. Of course, in order to be regarded as an ‘experiment’, one should assume that there is contextual congruence across sites and across the different time-space configurations involved.

The (quasi-)experimental research method should not be confounded with ‘experimentation’ as in ‘trial and error’, which could be one other method for developing and testing the workings and effects of innovative educational approaches such as climate change education. Experimentation in this sense refers to actively pursuing alternative paths, processes and tools in a search for achieving the transformational potential within climate change education. In order to do so and to be able to derive useful lessons, one should however adhere to the scientific research procedures of systematic observation, analysis and reporting.

Political economic analysis: The introduction of new educational approaches and methods, such as those that may be relevant in climate change education, does not happen in a vacuum. There is no tabula rasa on which the new discourse is being written and the expected new ‘behaviours’ are to be acted out. On the one hand, the intervention meets, clashes with, is rejected, appropriated or absorbed by existing actors, such as teachers, parents, community leaders, learners and school administrators. On the other hand, the new practices and methods are promoted by certain groups of actors and ‘stakeholders’ inside and outside the educational or learning system or environment, each with their own agendas and interests related to maintaining and altering influence, power and control about political, financial and administrative resources. Research in the political economy tradition is a powerful way to uncover the manifest, latent and conflicting interests, ideologies and mechanisms of certain social formations (groups) that may have a significant influence on how the intervention is going to be adopted, rejected or transformed (over time). The Carney and Bista (2009) study of how in Nepal over a 10-year period, the practice

and meaning of 'community education' has been perceived, captured and modified by certain interest groups, fits well into this political economy tradition.

Where climate change education itself has the explicit purpose of empowering learners and enhancing their transformative action competence, not only *vis à vis* bio-physical conditions but also with respect to social formations that enhance or can mitigate the drivers and or (potential) consequences of climate change, understanding of its surrounding political economy must be considered a priority. A recent report by the Commission on Climate Change Development (Christoplos, *et al.*, 2009) stresses the central importance of local and institutional issues with respect to the human dimension of climate adaptation.

Text and content analysis: The content of a text or discourse, in for example textbooks or curricular material, can be subjected to a critical analysis in order to glean its explicit and often implicit meanings that determine its sense and orientation. Not only the structure of the text, but also its references and examples and the ways and social-political context in which it is produced, disseminated and used can be the object of enquiry. Numerous technical tools exist for undertaking a mostly quantitative analysis of the frequency with which certain words, sentences or concepts occur. For interpretative analysis more qualitative tools are available as well. A good recent example of using a variety of research methods and traditions (historical, anthropological, political) for textual analysis is the report by Freedman, *et al.* (2008) about changing the school history curriculum in Rwanda. It contains valuable insights about the array of opportunities and obstacles that people wishing to modify or introduce 'value-laden' education, such as ESD and climate change education, may encounter.

Communication and diffusion of innovations research: Climate change education should be considered an integral part of ESD, which is intended to provide a comprehensive view of and approach to education and learning. Therefore, climate change education is not just another 'adjectival' education, similar to nature education or traffic education. Nevertheless, climate change education is a somewhat new focus within ESD. As such one could determine and assess under what conditions and in what ways its ideas and methods are disseminated, picked up, applied and adopted, and how different groups in a population or society play a role in the acceptance, modification or rejection of this 'innovation'. There is a long and rich tradition of research on the diffusion of innovations (e.g. Rogers & Shoemaker, 1971), elements of which can be used in assessing the extent to which and the ways in which climate change education is adopted.⁸ A recent useful addition to this tradition is the compilation of results of research in the psychology of climate change communication by the Center for Research and Environmental Decisions (2009).

Action research: The key characteristic of action research is that those undertaking the research and those being subject of the research are one and the same person or group. Education action research implies that the educational practitioner, very often together with the learners, is acting as the collector of data, the data analyst, and the interpreter of results. Action research is a well-established research tradition. Although nothing new *per se*, it seems to be particularly

suited for climate change education and ESD in general. It is through social learning, including its particular emphasis on reflexivity and the social construction of meaning that climate change education and ESD can reach their transformative potential. According to Wals (2007), social learning takes learning beyond individual memory work and cognition. It uses social constructivist perspectives to move interactional actions and experiences. By placing a premium on broadening the dimensions of learning and other legitimate ways of knowing, this perspective is a challenge to more traditional educational research and evaluation approaches. Creating space for the social learning perspective requires forms of inquiry and research that allow the researchers and the researched to engage in participatory process.

Future research and scenarios: The further development and evolution of climate change education within the framework of ESD could derive significant benefits from using the approaches of scenario building and future mapping and related techniques. The purpose of futures research methodology is to systematically explore, create and test both possible and desirable futures to improve decisions and learning. Its methods can be quantitative and qualitative. The value of futures research lies less in the accuracy of its forecasting rather than in focusing attention, planning and opening minds to consider new possibilities and changing policy and learning agendas. Because, in this sense, it matches with ESD's transformative nature, it may be particularly useful for climate change education. A didactically well-developed specimen of incorporating futures research and scenario building directly in the educational approach is Brunner's *The Mission* (1996).

Not unlike action research, which can be an powerful tool for social learning (see above), the process of constructing future scenarios and the subsequent backcasting, can open space for understanding complexity and broadening the dimensions of learning – going beyond instrumental knowing and creating opportunities for accentuating agency and responsibility in moving current realities onto a path of sustainability. *The Great Transition* by Raskin, *et al.* (2002) exemplifies this approach.

For scenario building there are special techniques, such as Delphi. It has been around for a long time, but it is cumbersome and time consuming. A recent improvement, made possible by the advent of the Internet, is the 'roundless' Real-Time Delphi (RTD), in which respondents complete – as often as desired – an online questionnaire, the responses to which are recorded instantaneously. This allows for real-time interaction and continuous learning among the participants. The Millennium Project's⁹ *The 2009 State of the Future Report* (Glen, *et al.*, 2009) includes a couple of RTD studies related to environmental or social issues including the futures of water, women, energy and human rights (Chapter 3). Chapter 5 introduces the *Futures Research Methodology Version 3.0*. It contains 'the largest, most comprehensive, internationally peer-reviewed collection of methods to explore the future ever assembled' (Glen, *et al.*, 2009:8).

Conclusion

As for any type of research, good climate change education research and evaluation in the empirical tradition would rest on the formulation and use of good theory, on reliable

observations and valid data and on transparent and reproducible methods of analysis. Climate change education and ESD are manifestations of times and realities that are in crisis. They require innovative ways of sense-making and empowerment. Research on the content, practice and outcomes of ESD and climate change education can make a significant contribution to enhancing their relevance and effectiveness. Research as part of ESD and climate change education practice can do the same. But not any research. Researchers and practitioners should make a careful and reasoned selection of the most appropriate frameworks and methods from among many research traditions and categories. This think piece has discussed a select number of such traditions, especially those that in one way or another have promise or include useful lessons for climate change education research.

Notes on the Contributor

Frans Lenglet is the director of the Swedish International Centre of Education for Sustainable Development (SWEDESSED) at Gotland University, Visby, Sweden (www.swedesd.se). He has a Ph.D. from Stanford University. For more than 35 years he has worked in the domain of education and development in many countries and with many international and national organisations. E-mail: frans.lenglet@hgo.se

Endnotes

- 1 The concept of action competence is originally attributed to the work of Jensen and Schnack (1997), Danish environmental education researchers.
- 2 There are numerous examples of climate change surveys and polls on the web. One of them is the poll conducted on behalf of UNEP among young people in 2008, which found that nearly 90% of young people across the globe think world leaders should do 'whatever it takes' to tackle climate change (http://www.unep.org/pdf/survey_results.pdf).
- 3 See www.pisa.oecd.org.
- 4 OECD (2009).
- 5 Besides OECD's PISA, other international, comparative and longitudinal studies of educational achievement are conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IAE, www.iae.nl): TIMMS – Trends in International Mathematics and Science Study, PIRLS – Progress in International Reading and Listening Study, ICCS – International Civics and Citizenship Education Study, and TEDS – Teacher Education and Development Study in Mathematics.
- 6 The Poverty Action Lab (<http://www.povertyactionlab.org/research/rand.php>) is a main proponent of randomised trials in health and education, especially in developing countries.
- 7 Not only in education, but also in health, environment and international development cooperation. For a view of the appropriateness of randomised trials in real-life settings see, for example, the 2008 IDRC interview with Michael Quinn Patton, http://www.idrc.ca/en/ev-30442-201-1-DO_TOPIC.html.
- 8 Including such concepts as 'innovators' and 'early adopters', 'opinion leaders' and 'change agents'.

- 9 The Millennium Project (<http://www.unmillenniumproject.org/>) ‘was commissioned by the United Nations Secretary-General in 2002 to develop a concrete action plan for the world to achieve the Millennium Development Goals and to reverse the grinding poverty, hunger and disease affecting billions of people.’

References

- Brunner, W. (1996). *The Mission*. Visby: Gotlands Laromedelscentral.
- Carney, S. (2009). Negotiating Policy in an Age of Globalization: Exploring Educational Polycsapes in Denmark, Nepal and China. *Comparative Education Review*, 53(1), 63–88.
- Carney, S. & Bista, M.B. (2009). Community Schooling in Nepal: A Genealogy of Education Reform since 1990. *Comparative Education Review*, 53(2), 189–211.
- Center for Research and Environmental Decisions (2009). *The Psychology of Climate Change Communication. A Guide for Scientists, Journalists, Educators, Political Aides and the Interested Public*. New York.
- Christoplos, I., Anderson, S., Arnold, M., Galaz, V., Hedger, M., Klein, R.T. & Le Goulven, K. (2009). *The Human Dimension of Climate Adaptation: The Importance of Local and Institutional Issues*. Stockholm: Commission on Climate Change and Development.
- Freedman, S.W., Weinstein, H.M., Murphy, K. & Longman, T. (2008). Teaching History after Identity-Based Conflicts: The Rwanda Experience. *Comparative Education Review*, 52(4), 663–690.
- Glenn, J.C., Gordon, T.J. & Florescu, E. (2009). *2009 State of the Future*. New York: The UN Millennium Project.
- Hart, P. (2007). Social Learning as Action Inquiry: Exploring Education for Sustainable Societies. In Wals, A.E.J. (Ed.) *Social Learning towards a Sustainable World*. Wageningen: Wageningen Academic Publishers. pp. 313–330.
- Jensen, B. & Schnack, K. (1997). The Action Competence Approach in Environmental Education. *Environmental Education Research*, 3, 163–178.
- Kendall, N. (2007). Education for All Meets Political Democratization: Free Primary Education and the Neoliberalization of the Malawian School and State. *Comparative Education Review*, 51(3), 281–305.
- Marcinkowski, T. & Mrazek, R. (Eds) (1996). *Research in Environmental Education 1981-1990*. Troy (OH): North American Association of Environmental Education. p. iv.
- NCEER (1981). *Research in Environmental Education 1971-1980*. National Commission of Environmental Education Research, Columbus (OH): ERIC. p. viii.
- OECD (2009). *Green at Fifteen? How 15-Year-Olds Perform in Environmental Science and Geoscience in PISA*. Paris: OECD.
- Raskin, P., Banuri, T., Gallopín, P.G., Hammond, A., Kates, R. & Swart, R. (2002). *The Great Transition – The Promise and Lure of Times Ahead*. Boston: Stockholm Environment Institute.
- Rogers, E.M. & Shoemaker, F. F. (1971). *Communication of Innovations*. New York: The Free Press.

- Scott, W. A. H. & Gough S. R. (2003a). *Sustainable Development and Learning: Framing the Issues*. London/New York: Routledge Falmer.
- Scott, W. A. H. and Gough S. R. (2003b). *Key Issues in Sustainable Development and Learning: A Critical Review*. London/New York: Routledge Falmer.
- Scott, William (2003c) Sustainable Development, Policy and Learning: Exploring Relationships. UK Council for Environmental Education: http://www.bath.ac.uk/cree/resources/SCOTT_CEE_POLICY_Talk_11_03.pdf.
- Scott, William (2009). Environmental Education Research: Thirty Years on from Tbilisi, *Environmental Education Research*, 15 (2): 155-164.
- Stufflebeam, Daniel L. (2005). The Use of Experimental Design in Educational Evaluation, *Journal of Educational Measurement*, 8 (4): 267-274.
- Wals, A.E.J., (Ed.). (2007). *Social Learning – Towards a Sustainable World*. Wageningen: Wageningen Academic Publishers.