

Education for sustainable development: a challenge for biology teachers

Regula Kyburz-Graber

SUMMARY

Sustainable development is a prior task for societies in the 21st century. As a demanding societal transformation process it is understood as both a bottom-up and a top-down process where individual and structural developments interact and interfere. Within those processes the role of schools has to be newly examined.

Within the research framework of the Swiss Priority Program Environment case studies were conducted in four upper secondary and tertiary schools asking the question if and how schools can become active partners in sustainable development processes. Fears, hesitations, lack of knowledge concerning sustainable development, insecurity concerning the disciplinary and pedagogical aims, weakness in coaching open-ended and participatory processes, self-imposed boundaries but not so much structural problems emerged in the case studies. Based upon those data and outcomes this paper explores the question what sustainable development in education means specifically for biology education and biology teachers: What may promote, what is hindering innovative developments and why? Results are discussed with respect to biology teacher education.

KEY WORDS: sustainable development, social change, environmental education, education for sustainable development, case studies, biology teacher education , interdisciplinary teacher education

Prof. Dr. Regula Kyburz-Graber
Universität Zürich
Höheres Lehramt Mittelschulen
Postfach
CH 8033 Zürich 6
e-mail: kyburz@hlm.unizh.ch

Introduction

Sustainable development is widely recognized as a prior task for societies in the 21st century. Following the tradition of environmental education which was thought as a main instrument for solving environmental problems and which is seen as a precursor of education for sustainable development, education once again seems to serve as a prior vehicle to reach the ambitious goals of sustainability. If it is presumed that education can neither solve social problems in a political sense nor that it can be naive by not caring about social problems the question has to be raised what the role of education realistically can be regarding the demanding societal transformation processes envisioned for sustainable development. In a research project within the framework of a national priority research program "environment" which was run over several years we tried to get answers to that question analyzing cases of interdisciplinary teaching-learning settings. In this paper I am exploring the question what our research outcomes mean for biology teachers and biology teacher education.

Environmental problems and sustainable development

Environmental problems are changes in the natural environment which are directly or indirectly caused by human activities and are judged as negative. Environmental problems can not simply be considered as scientifically and technically measurable effects on the environment. The facts must be interpreted and judged. Individual interpretations can vary considerably and opinions on solutions differ greatly. Even when environmental damage is more or less undoubted there are different opinions on adequate reactions and solutions.

The same can be said for the term sustainable development. It has become popular since the Brundtland Report in 1987¹ and the United Nations Conference on Environment and Development in 1992. Sustainable development means considering environmental, social and economic aspects for the solution of problems. It means development which gives future generations the same opportunities as the present generation to meet their own needs. Sustainable development is a guide-line and contains a normative decision: the norm for social justice regarding equal opportunities for future generations.

Sustainable development is not a final goal which can be reached definitely. Just like, for instance, justice: it is a guide-line, a background for reflection which can guide the focus of attention in a certain direction but does not determine concrete solutions. Sustainable development is a social process of searching, learning and development. It is a bottom-up as well as a top-down process in the sense as Anthony Giddens, the sociologist, describes social change: acting individuals are constantly changing conditions of acting (Giddens 1992)².

Environmental problems and sustainable development as social constructions

Individuals and social groups perceive and interpret changes in the environment in different ways depending on their own experience. A person who considers air traffic as an economic necessity and personally enjoys flying to distant holiday resorts perceives and interprets the noise caused by airplanes in quite a different way than someone who sees air traffic as an increasingly negative impact on the environment.

¹ World Commission on Environment and Development (WCED), *Our Common Future*, Oxford, University Press, 1987.

² Anthony Giddens, *Die Konstitution der Gesellschaft. Grundzüge einer Theorie der Strukturierung*, Frankfurt

Scientists often contend that their exact and objective data portray reality and that they are therefore to be considered as true statements on environmental conditions. But there are at least two major objections to this position:

- Different experts use different methods for data collection depending on their premises and preconditions. This can lead to different results.
- Results are interpreted in different ways depending on reference systems and expectations.

Many environmental changes cannot be directly perceived because they are extremely slow, for example climate change, or they cannot be detected with our human senses, such as radioactivity or ultra-violet radiation. We receive most of our information on environmental changes through the media, which influence our opinions. We filter out that information and those interpretations which fit in with our own personal views.

Much the same is true for the concept sustainable development. What is considered as sustainable depends on the appraisal of individuals or social groups. Where the boundary of sustainable and not sustainable should be drawn must be decided by considering all the facts in a specific context. It is self-evident that prior experience, values, interests, needs and the visions of those involved play an important role in such decisions.

This shows that environmental problems and sustainable development cannot be considered without looking at the social context. They must be understood as social constructions, for which there are different perceptions, ideas and judgements (see Kyburz-Graber et al. 2000)³. Assuming that every individual constructs his or her own perspective on environmental problems, individuals must learn to recognize and to reflect their own perspectives as well as those of others. This is the only way to reach a common understanding of environmental problems. Solutions must be reached by negotiations in a democratic process.

Ecology, society and economy as sources of conflicting interests

The concept of sustainability can be described as a triangle with the three corners standing for ecology, society and economy. This concept states that ecological, social and economic aspects are relevant for meeting human needs and that these three variables are interdependent. However, often they may be contradictory. Conflicting interests and goals are the key problem regarding sustainable development. Activities in one domain can cause undesirable side effects in another domain. Therefore sustainable development means not only the increase of positive effects, but especially the reduction of undesirable side effects. The major challenge consists in questioning norms and value judgements and finding generally accepted solutions in a democratic process.

We can draw four essential conclusions regarding the process of sustainable development:

- Sustainable development cannot be controlled by a central authority
- Sustainable development cannot be planned and implemented systematically and rationally
- Sustainable development cannot be realized overnight
- Changes cannot be realized through individual action alone.

³ Regula Kyburz-Graber, Dominique Hoegger & Arnold Wyrsh, *Sozio-oekologische Umweltbildung in der*

Changes in individual action are necessary for sustainable development, but the political task is also to find ways of changing collective action. Sustainable development is a social and political process of learning, searching and negotiating.

Education and sustainable development

In a rapidly changing world it is a prominent goal to enable students to participate in the societal process of sustainable development. It is essential that students be given the opportunity to develop competencies for reflecting and cooperating with each other. Furthermore, consequences for school organization and for the education system as a whole have to be discussed.

We postulate four criteria for an adequate approach to environmental education and education for sustainable development, focussing on sustainable development as a guide-line⁴:

- Sustainable development is a guide-line, not a school subject. School subjects aimed at dealing with sustainable development have to be based on real concrete social issues (problem orientation)
- The topic contains ecological, social and economic aspects which are interrelated in a complex and controversial way
- Sustainable development as a guide-line is not adequately interpreted if problem solving is reduced to standard solutions and to changing individual action
- Understanding the meaning of sustainable development as a guide-line has to be developed in a reflective learning process.

These four criteria are based on the features of sustainable development as a guide-line. They express high demands, and they cannot be strictly operationalized and implemented. They have the function of serving as a basis for reflection.

Problem orientation emerged as one of the main didactic features in an educational process in the light of sustainable development. It concerns both the selection of a relevant topic and the method of working on it and, in fact, problem orientation is not exclusively a feature of working on aspects of sustainable development but also on other socially relevant issues. Problem orientation means: Handling complex situations, examining conflicts regarding different goals, dealing with unsolved problems. By studying such topics, students will learn that constructive contributions are necessary for dealing with problems which are relevant to today's society. If the studied topic is a concrete field of action, students can gain personal experience with personal initiative and responsible action. The essential goal is to enable them to develop competencies in judging complex problem situations.

Case studies on education for sustainable development and problem-oriented teaching and learning

In four case studies⁵ (two schools of upper secondary level, two schools of tertiary level) we investigated experience and judgements of school heads, teachers and students with respect to sustainable development and problem orientation. Another big issue concerns

⁴ Regula Kyburz-Graber, Dominique Hoegger & Arnold Wyrsh, *Sozio-oekologische Umweltbildung in der Praxis. Hindernisse, Bedingungen, Potentiale*, Zürich, Universitaet, Hoeheres Lehramt, 2000.

cooperation and decision making during the teaching/ learning processes. In this paper we will not refer to those outcomes. The table below shows the procedure of data collection.

Table 1: Function and number of interviewed subjects in the four examined schools

	gymnasium A	gymnasium B	teacher education college	professional college
head of the school	principal	principal	principal	head of the department
teachers	6	6	4	5
students	5	3	4	4

Every interview partner was confronted with a set of questions which covered the following topics: interdisciplinary classes, procedure in general, choice of topics, starting phase, cooperation, sustainable development in the context of the school. The set of questions for each of the topics was:

- Experience: What has been done?
- Preconditions: How did this come about?
- Goals/ effects: What were the results?
- Evaluation: How good were the results?

Barriers for working on sustainable development as a guide-line

Sustainable development as a guide-line and the corresponding criteria for environmental education set exceptionally high demands on teachers and students. In the various interviews we conducted, it became directly or indirectly evident what difficulties are encountered working on the topic in class.

1. Sustainable development as a guide-line is complex, contradictory and extensive.

What does this mean for teachers? They can either feel overcharged by the demanding task or underestimate the demand; for some of them sustainable development is unknown or they interpret it in a different or personal way. Some have no interest.

What does this mean for students? They are not used to reflective learning processes, they might not be keen and patient enough to deal with the complex issue or they might even have no interest.

2. Sustainable development as a guide-line concerns individual behavior and social conditions.

Both teachers and students seem to have a tendency to take a defensive position towards sustainable development, either because they reduce the issue to the mere aim of changing individual behavior and moral categories or because they are confronted with their own behavior anyway while dealing with questions of sustainable development.

3. The learning objectives cannot be achieved in a short time.

Teachers and students are used to visible and measurable effects as a result of teaching and learning processes. Concerning environmental problems they seem to specifically expect visible changes either in their individual behavior or in their environment. This expectation

might hinder them to adequately get involved in complex issues. Effects might be either too simplistic answers or resignation.

4. It is too difficult to achieve a reflective learning process on sustainable development.

Teachers and students are not used to reflecting together on learning processes and specifically not on learning about sustainable development. Methods which could be used are not known. Reflection seems to have a touch of boring discussions and unproductiveness. Lacking reflections seem to reduce the highly demanding task either to an arbitrary event or to a simple input-output thinking.

5. The boundaries of school make it difficult to work on sustainable development as a guide-line.

Boundaries set by school contexts are the lack of time in class, the priority of other school subjects, the curriculum, other goals of the school, the overload of other special topics and the habits of daily practice.

Biology education and sustainable development

In our case studies we did not specifically relate the teachers' thoughts and arguments to their disciplines and their experience as discipline teachers. Some of the teachers were science teachers and a few of them biology teachers. There is no reason to presume that biology teachers differ in a more specific way from the findings described above than others except the fact that they might be better informed about sustainable development as a term including ecological, social and economic aspects. Whether they conceive sustainable development as a normative guide-line as outlined above or as a scientifically defined prescription cannot be referred to our findings. However it can be assumed that they as science teachers are more likely to believe that sustainable development is a scientifically evident fact than a guide-line for a socially constructive process in the sense of an ongoing democratic discourse and progress. >From another research project, a representative survey among lower and upper secondary teachers of social and natural science teachers concerning environmental education⁶ we can draw evidence that natural science teachers differ considerably from social science teachers with respect to their understanding the importance of social and ecological aspects of environmental problems. This leads us to the assumption that it might be an even bigger challenge to science teachers (and especially biology teachers who consider themselves as having the main responsibility for environmental questions) to deal with open-ended reflective educational processes. To accept that defined solutions cannot be found neither in school nor in society and that sustainable development must remain a guide-line which will never really be reached is probably more frustrating to biology teachers than to others, especially for those who are personally strongly concerned about future developments in nature.

In order to promote a multidimensional educational process on questions of sustainable development it can be concluded that

- At least two teachers from social and natural science have to cooperate (e.g. as "tandems", an approved form of collegial cooperation)
- The educational process has to start from real social issues and not from environmental problems. This will encourage teachers to explore value questions right from the beginning. Examples: Can a supermarket contribute to sustainable consumption? Can a

⁶ Regula Kyburz-Graber, Ueli Halder, Anton Huegli & Markus Ritter unter Mitarbeit von Kirsten Schlueter,

small shop contribute to sustainable consumption? Air traffic is growing all over the world: can this development meet aspects of sustainable development and how?

- Normative questions and value judgements have to get a prominent position within the educational process
- The teachers involved ought to develop instruments for reflection on the educational process, on aims and cooperation and support each other in conducting the reflection process as a highly relevant learning process. Action research as a means for improving teaching/learning processes has been approved to substantively promote new approaches (OECD-CERI 1995)⁷.
- The teachers involved rather have to learn to ask relevant questions than give too simple and reductive answers.

For biology teacher education these conclusions mean that teacher students have to experience a form of collaborative interdisciplinary reflective inquiry concerning sustainable development at least once during their education. By that experience they will learn to cope with the tension and complexity of questions concerning sustainable development.