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Education for Sustainable Development in Compulsory School Technology Education: A problem inventory

*Inga-Britt Skogh, Lena Gumaelius, Lars Geschwind
KTH, Royal Institute of Technology, Stockholm, Sweden*

Abstract

Awareness of sustainability issues is increasingly demanded in society. Education for Sustainable Development (ESD) is a requirement stated in the Swedish curriculum. Findings (Schools Inspectorate, 2012) indicate considerable variations in how teachers in Sweden work with value related issues. It is also found that schools/teachers commonly lack a holistic approach and a common stance in this assignment. Reportedly ESD seems dependent on the personal interests and abilities of individual teachers (*ibid.*). In order to develop teaching about sustainable development within the Technology subject we need knowledge about how ESD is carried out today (content and work methods). We also need to know how the concept of sustainability is interpreted by concerned key actors in schools (teachers and principals). During the spring of 2013 a pilot study focusing technology teachers' work with sustainable development within their technology classes is being performed. Based on interviews (teachers and principals) we analyze what are perceived to be the main difficulties associated with the integration of sustainability into technology education. Findings confirm previous research stating that knowledge about sustainability is vague among teachers. Most teachers and principals in the study are primarily (in some cases only) aware of the environmental/ecological aspect of sustainability. The study also points to a discrepancy between perceived and actual need for improving teachers' competence in ESD. Since ESD is not well defined, fully understood and established among those responsible for the actual teaching there is an evident risk of ESD being treated as 'one further requirement' rather than as the asset it actually represents to technology education. It is suggested is that the planning, organization and implementation of future ESD efforts must be coordinated carefully with all concerned parties in advance and be supported more substantially than previous efforts.

Key words: Education for Sustainable Development (ESD), Technology Education, Compulsory School, Teachers, Principals

1. Introduction

In the current compulsory school curriculum introduced in Sweden in 2011 (Curriculum for the Compulsory School, Preschool class and the Leisure-time Centre, 2011) sustainable development is highlighted in the Fundamental values and tasks statement (*ibid* p. 9). These fundamental values should be reflected in all syllabuses. Sustainable development is accordingly mentioned directly or indirectly in most subject syllabuses. In the Technology syllabus (*ibid* p. 254) sustainable development is e.g. mentioned in the section describing the aim of the subject:

... teaching should give pupils the preconditions to develop confidence in their own ability to assess technical solutions and relate these to questions concerning aesthetics, ethics, gender roles, the economy and sustainable development (*ibid* p. 254)

A recent study (Skolinspektionen/Schools Inspectorate, 2012) shows considerable variations in how teachers in general work with education about value related issues. Findings indicate that schools/ teachers commonly lack a holistic approach and a common stance in this assignment. This is, according to the report, reflected in how teachers design their teaching which mainly seems dependent on the personal interests and abilities of the individual teachers (c.f. Pavlova, 2009, 2012; Pitt & Lubben, 2009). In order to develop ESD within the Technology subject, in line with the visions of the curricula (e.g. *ibid* p. 254), we need to know how ESD is carried out today (content and work methods).

The pilot study presented here is part of a research project that aims at increasing our knowledge and understanding about how future technology education (school) and engineering education (university) should be designed in order to secure the inclusion of the various dimensions of sustainability presented in the so called Bruntland-report (WCED, 1987), as effectively as possible.

Based on interviews with teachers and principals in compulsory schools with a technology profile (licenced Boost for Technology Schoolsⁱ), we explore how compulsory teachers/schools work with ESD from the following questions: (1) How is the concept of sustainability interpreted/defined (2) How is sustainability taught (learning objectives, teaching methods, pedagogical strategies/tools)?,and (3) What resources (e.g. training efforts, material/tools, etc.) are (according to the informants) required in order to strengthen ESD in general and in technology education in particular.

2. Background

2.1. The concept of sustainability

In the Brundtland report (WCED, 1987) it is stated that development in society need to meet ecological as well as economic and social demands. Today, there is broad consensus that in order to achieve ecological sustainability societies must develop in such a way that the regenerative capacity of biological systems is maintained over time. However, there is significantly less agreement on what it means for development to be ecologically, socially and economically sustainable (Vallance *et al.*, 2011). From the literature it is clear that at present there is no single agreed-on definition of sustainability.

2.2. Sustainability in compulsory school education

The present curriculum was introduced in 2011. It contains three parts (Fundamental values and tasks of the school, Overall goals and guidelines for education and Syllabuses for all school subjects). In the fundamental values and tasks section, the concept of sustainability is mentioned only once. On the other hand the importance of a sustainable approach is highlighted already in the first paragraph;

Each and every one working in the school should also encourage respect for the intrinsic value of each person and the environment we all share (National Agency of Education, 2011, p.11).

Four perspectives are to be highlighted in all educational (historical, environmental, international and ethical). Regarding the environmental perspective it is stated that;

Teaching should illuminate how the functions of society and our ways of living and working can best be adapted to create sustainable development (ibid. p. 12).

In total sixteen (16) overall goals are presented in the curriculum. Three (3) of these goals include sustainability or/and a sustainable approach. The most obvious one reads:

The school is responsible for ensuring that each pupil on completing compulsory school has obtained knowledge about the prerequisites for a good environment and sustainable development (ibid. p. 16).

Sustainable development is explicitly written out as an important part in in eight (8) syllabuses (home and consumer studies, biology, physics, chemistry, geography, social studies, crafts and technology). In e.g. the Technology syllabus (ibid p. 254) sustainable development is mentioned in the section describing the aim of the subject:

... teaching should give pupils the preconditions to develop confidence in their own ability to assess technical solutions and relate these to questions concerning aesthetics, ethics, gender roles, the economy and sustainable development (ibid p. 254).

3. Related research

In a study of Canadian (Ontario) schools, Elshof (2005) set out to identify which facets of sustainable development technology teachers deem to be the most significant, from a personal, collegial and student interest perspective. It was found that there is a great need

for professional development of teachers, to break up traditional disciplinary boundaries and to create new discursive spaces.

According to Pavlova (2009) the current co-existence of environmental education (EE) and education for sustainable development (ESD) has created a concern regarding overlap and duplication of goals and programs in EE and ESD. This lack of clarity is pointed out as a contributing factor to the inefficiencies in achieving goals and development in educational initiatives/activities. Pavlova (ibid.) also argues that emphases on the social dimension of design for ESD need to be strengthened in order to align technology education with global developments. In line with this McGarr (2010) argues that the integration of ESD needs to move beyond awareness rising, particularly in relation to raising awareness of environmental issues.

The challenge ahead lies in exploring ways in which a much more critical dimension can be added, one which challenges both teachers' and students' beliefs and perceptions about technology, and in doing so, illuminates a range of issues pertinent to ESD (McGarr 2010, p 330).

Across disciplines, there are great challenges regarding how to integrate ESD in the curriculum. Different stakeholders are competing for priority in influencing curriculum design (Layton 1994). This combined with the continuous changes in the political landscape is making the development of ESD in schools a sometimes difficult balancing act.

4. Theoretical considerations and methods used

This is primarily a descriptive study however; the question of how to explain and understand the findings is, to some extent, also addressed. The starting point of our study is the requirement that sustainability should be included in education. In order to understand how different actors respond to this requirement, the intermediate process, i.e., the question of how education about sustainability dimensions is organized planned and implemented needs to be addressed. In this study, the Frame factor theory thinking model (FFTT) is used as a tool for understanding the informants' different ways of responding to the listed requirements. FFTT was introduced by Dahllöf (1967, 1999) in the 1960s and was initially referred to as Frame factor theory thinking by Gustafsson (1994).

The aim of this pilot study is to, in a small scale, try-out tentative interview questions and methods/tools of analysis. Data collection and analysis is therefore limited to statements from four teachers and three principals. The selection of schools is based on the fact that these schools have participated in the previous mentioned Boost for Technology Initiative.

Semi-structured interviews with principals and teachers were conducted in June and July 2013. All interviews lasted 25-35 minutes and followed the same interview template consisting of questions sorted into five focus areas: the interviewee's background, the concept of social sustainability, learning objectives, curriculum integration and opportunities/difficulties. At the time of the interviews, the teachers (three women and one man) had been teaching for between 6-25 years. The principals (all women) had been principals for 4-21 years. None of the informants were currently or had been involved in work/research directly related to sustainable development. Collected data has been transcribed, systemized and analyzed through repeated readings of statements.

5. Results

Both principals and teachers have been actively involved in the integration of sustainable development in their classes/schools (teachers directly as they are responsible for the actual teaching and principals indirectly by being originators/promoters and facilitators of time and

resources). Most of them say that they feel fairly comfortable discussing sustainability issues in school education. Examples of their thoughts and views are accounted for below.

5.1. The concept of sustainability (Q1)

The challenge to define the concept of sustainable development is met with considerable confidence by the informants. The concept is perceived as familiar but, at the same time elusive. Several of the teachers directly associate to their own teaching practice. The link to the environmental aspects is strikingly frequent in informants' responses.

When we work with it in the school it mainly concerns environmental issues...about recycling ... That's the very theme we worked with!

Only one of the informants is familiar with the fact that the concept of sustainable development has been divided into three different dimensions.

My understanding of the concept is that I as a citizen should feel confident that everyone in the community takes their decisions based on the three keynotes, ecological, economic, and social sustainability - to ensure that everyone is safe.

When presented to, and asked about social and economic sustainability the notions in most cases are vague. Some informants indicate that it is the first time they have encountered these dimensions in relation to sustainability in general and in relation to school education in particular. This is in particular true in the case of economic sustainability.

It is really difficult to work with it when you do not know what it is.

Both principals and teachers are well aware of the requirements stated in the curricula (National Agency of Education, 2011) regarding the integration of sustainability dimensions into compulsory school education. Their knowledge about how ESD is projected in the different syllabuses is generally more general and unspecific. There are some examples of statements in the data (answers that could be described as cautious) showing traces of guilt of not being fully updated (being ignorant and untutored) about the different aspects of the sustainability concept.

5.2. How is sustainability taught in the selected schools/classes? (Q2)

Sustainability (as understood by the informants) is integrated in the education in various degrees. Environmental aspects are in particular highlighted (pollution, recycling of packaging, and energy issues). The importance of linking education to students' needs and questions is emphasized. Most informants do recognise social dimensions as being implied in their teaching and therefore dealt with (in various degree) within their school/classes. Social dimensions are however explicitly specified as a learning objective by only one teacher and one principal (however under another heading). Issues concerning economic sustainability are not specifically addressed by the teachers.

According to the informants, ESD should be included in all school subjects. When asked in what subject matters sustainability ESD could/should be taught the informants mention Geography, the Natural Sciences, the Social Sciences, Craft, Food Technology and Technology. Reportedly ESD education is, commonly performed in the form of projects, thematic work, study visits or by inviting experts (preferably active in the vicinity of the school).

Statements expressing that sustainability issues (ESD) have been addressed prior to the introduction of this concept in the curricula are found in the data.

Actually, we have always worked with this, but we didn't call it Sustainable Development.

5.3. What resources are required in order to support ESD? (Q3)

Most of the informants are fairly content with how they work with ESD. Resources available as well as content knowledge and pedagogical competence among the teachers is not seen as a problem by two of the three principals. Several teachers seem to agree:

You learn when you work with it ... and we can search on the internet

However some do request opportunities for betterment (preferably shorter courses during 1-3 days). Guidelines, good examples and most of all a precise definition to relate to are other requests mentioned. The policy documents are, according to the informants, perceived to be helpful although no one exemplifies how they have used these documents in their teaching (except to 'tick off' elements to be included).

6. Discussion and conclusions

The aim of this study has been to investigate how sustainability is perceived, interpreted and taught in Swedish Technology education. The analysis is based on documentary studies and interviews of teachers and principals. Earlier research has shown that ESD in schools is still fragmented and rather unsatisfactory. This study, albeit based on a small sample, confirms that knowledge about sustainability in technology education is vague and that teachers and principals mainly are aware of the environmental/ecological aspect of sustainability. The study also points to a discrepancy between perceived and (as we understand it) actual need for improving teachers' competence in ESD. In line with earlier research our results show that the social aspects, and to an even greater extend, the economic aspects of ESD, are less familiar and therefore in general not dealt with. We do need to move beyond this limited approach to sustainability and prepare pupils and students for all aspects of technology in society. The suggested basis for this is the foundation of integrated critical thinking at all educational levels and more focus laid on aspect of sustainability relevant to young student's needs and wants.

We have also investigated which kind of resources that are needed in order to enhance awareness and increase knowledge about all aspects of sustainability. Although demands for ESD competence development are raised by the informants these demands are very moderate (occasional lectures and/or training days). There may be reason for us to consider why the complexity of the field is not fully reflected in the demands presented by the informants. Looking at this from a Frame factor theory thinking perspective (FFTT) (Dahllöf, 1967, 1999), these findings are logical and understandable. Decisions and directives concerning sustainability education in school has been taken at the organizational level with few opportunities for principals and teachers to influence the what, when and why's of ESD. The problem is not ESD itself. All informants fully share the visions and goals stated on the executive level. The problem rather lies in the implementation process. When/if the aims and goals of ESD is not well defined, fully understood and established among those responsible for the actual teaching there is an evident risk of ESD being treated as 'one further requirement' rather than as the asset it actually represents to technology education. Our suggested conclusion is that the planning, organization and implementation of future ESD efforts must be coordinated carefully with all concerned parties in advance and be supported more substantially than previous efforts.

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ⁱ The Boost for Technology Initiative is a two-year training project (ended 2013) for technology teachers in elementary school in the County of Stockholm. The aim of the initiative is to improve teachers' skills (content knowledge and pedagogical methods). The project is led by the House of Science/KTH and funded by the European Social Fund.