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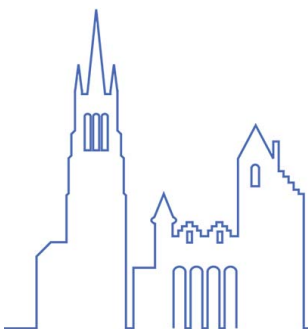
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Integration of Sustainable Development in Education – Motivating a Change

E. Strömberg, T. Sandberg, E-D. Egan and G. Finnveden

KTH Royal Institute of Technology, Stockholm, Sweden.

emmast@kth.se

Abstract

As part of a strategic initiative at KTH to increase focus on environment and sustainable development (ESD), a university-wide project on “Integration of ESD in the Educational Programs at KTH” was initiated in 2012. To ensure continuous work with integration of sustainability in all educational programs, the project has focused on two complementary strategies: evaluation of the programmes’ efforts and providing tools and support for all Program directors and teaching staff to achieve the set goals. The evaluation process was conducted in several steps, from schools’ self-assessment of the fulfilment of the learning outcomes on ESD stated in the Swedish Higher Education Ordinance, to the creation of action plans (by all schools) for the development and integration of ESD objectives in all educational programmes, and finally a follow-up of the programmes’ progress within the area.

To support the process, several tools and inspirational activities have been conducted. The Swedish Higher Education Ordinance’s learning outcomes are considered broad and difficult to interpret by the majority of the teaching staff and therefore a clarification of the overall learning outcomes was developed for implementation on both the course- and programme levels. Also, a toolbox containing definitions and good examples of learning activities for integration of sustainable development in higher education was developed and launched as an open website. The project has been involved in the development/support of three course modules that can be implemented in all educational programmes and several events have been organized on teaching activities with inspiring talks by teachers from KTH and colleagues from other universities. In order to facilitate further education of the teaching staff, a pedagogical course on “Learning for Sustainable Development” was developed as an effort of two schools at the university in collaboration with the project leaders. Throughout the process, the Program directors and teaching staff involved in course design have been continuously in contact with the project leaders regarding any ideas or for support in introducing or integrating ESD in the curriculum.

This presentation will focus on the results from the follow-up and the tools that were provided to support Program directors and teaching staff during the process of integration of ESD in the educational programmes at KTH. The results show that several programmes have improved their integration of ESD suggesting that the combined strategy of support and evaluation has been successful.

1 Introduction

1.1 Background

One of the most important factors in modern higher education is to assure that graduates have deeper knowledge about present and future challenges as well as the necessary tools they need to be able to contribute to a sustainable society. KTH's (Royal Institute of Technology) long-term strategy, Vision 2027 (KTH, 2011), stresses that the engineers and architects that graduate from the university must have a distinct focus on sustainability. This is also in accordance with the overall learning outcomes set by the Swedish Higher Education Ordinance, that has prescribed a number of learning outcomes for engineering and architect educational programs including two with clear relevance for environment and sustainable development (ESD).

In 2011, the university performed a self-initiated Education Assessment Exercise, where panels of external experts were invited to review all of the educational programs at the university. The results of the evaluation pointed out the necessity of a higher degree of integration of sustainable development on the program levels. In 2012, the "Integration of Environment and Sustainable Development in the Educational Programs at KTH" project was initiated to launch and facilitate activities within the educational programs on the overall level. The aim of this paper is to describe the project's and other related activities, and progress to date concerning the integration of sustainable development in educational programs at the university.

1.2 The management structure, leadership and organisation

KTH is Sweden's oldest and largest technical university. The university is organized in ten different schools that are divided into departments and divisions. The schools are responsible for the educational programs.

The project "Integration of Environment and Sustainable Development in the Educational Programs at KTH" is part of a larger project, KTH-Sustainability, which was established in 2011 (Finnveden et al, 2016). The main project plan was approved by the President of the university and a Vice President for Sustainable Development was assigned as the leader of the overall project. A steering group for the project called the KTH-Sustainability council was also appointed. The council, chaired by the Vice President for Sustainable Development consisted of six teacher representatives appointed by the Faculty Council, two student representatives appointed by the student union, and the environmental manager. The focus of the overall project is on the core activities at the university, containing goals and activities to be undertaken in education, research and collaboration, and the work is overarching and includes all schools. The project is closely connected to the environmental management system, providing a feedback system of continuous achievements and improvements (c.f. Holm, T. et al, 2015; Staniskis, J.K. and Katiliute E., 2016).

As a part of the environmental management system, the university established environmental goals for the period of 2013-2015 and sustainable development goals for the period of 2016-2020. The environmental goals for education were:

- KTH shall work actively to increase teachers' and students' knowledge of and involvement in issues relating to the environment and sustainable development.
- All of KTH's educational programmes should report on how they integrate and develop environment and sustainable development in education in accordance with the Swedish Higher Education Ordinance

The new sustainable development goals for education are:

- KTH shall increase all employees' and students' knowledge of and involvement in issues relating to sustainable development.
- Sustainable development shall be integrated into all educational programs at all levels so that students can contribute to the sustainable development of society after graduation

The goal of the above mentioned project is to support these goals.

1.3 Strategic approach

Early on, top management decided that sustainable development should be integrated in educational programs. However, how this integration should occur was not prescribed. It was the responsibility of the schools and Program Directors to choose the best course of action. In other words, no decisions for a minimum number of credits or specific courses were made. Instead, this has been addressed through dialogues with Program directors and teaching staff without providing any uniform solutions, such as specific courses, to assure that integration of sustainable development is linked to subjects that are essential within the specific program and provide relevance for the future application of the skills. This has resulted in different solutions being developed at different educational programs.

The approach to assure integration of ESD in educational programs has focused on two complementary strategies: evaluation of the progress of integration of sustainable development on the program level and providing tools and support for Program directors and teaching staff to achieve the goals set by the university. The support is provided through a number of different activities, for example as “coaching” on individual or group levels as well as communicating contact information on teacher resources and expertise available that could facilitate the relevant approach for that specific course or program. It was recognized that some of the teaching staff were troubled with interpretation of the overall learning outcomes set by the Swedish Higher Education Ordinance, therefore one of the first activities within the project was to develop specified learning outcomes as a proposed interpretation relevant to all of the educational programs at the university and as valuable tools for evaluation of the progress of integration of ESD on both program and course levels. Some of the barriers to integration of the ESD were identified as limited teacher qualifications and a problem to extend an overcrowded curriculum. These findings are in accordance to challenges identified at several universities (Læssøe, J. et al, 2009). Therefore, several tools were developed and proposed to the Program directors to facilitate the fulfilment of the goals set by the university.

2 Evaluation process

The evaluation process was designed to continuously promote and verify the progress of integration of environment and sustainable development in all engineering and architect programs. In 2012, all programs were given the assignment to conduct a self-assessment of fulfilment of the ESD learning outcomes stated in the Swedish Higher Education Ordinance as a preparatory exercise prior to the evaluation by the Swedish Higher Education Authority. In the self-evaluation the schools were asked to describe the program's learning outcomes related to ESD, which courses support the learning outcomes of the programs, examples of examination, the level of progression etc. The schools were also asked to specify the need of further support that could be provided to the different programmes to improve the fulfilment of the learning outcomes. The self-assessment resulted in deep analysis of the ESD content in the different programs and provided a starting point for continual discussions about the implementation of ESD related topics in education.

The self-evaluation reports were used as basis for discussions in the following dialogue with the Deans of the Schools and the Directors of First and Second cycle education at all schools. These discussions resulted in setting up of action plans for integration of ESD objectives in the educational programs at each school. The original action plans were set for 2013-2015; some schools revised their plans during 2014. The action plans are part of the environmental management system at the university and thus followed up yearly.

During 2015, a follow-up on the progress in fulfilment of the learning outcomes on ESD stated in the Swedish Higher Education Ordinance, goals set in the action plans as well as the overall environmental goals set by the university (2013-2015) was conducted as a three step procedure. First, all engineering and architecture programs turned in a survey containing courses in the programs that contribute to different learning outcomes, then the survey was evaluated and interviews with the Program directors were performed based on the information in the surveys. Thereafter all of the information was summarized in a short report and submitted to the Directors of First and Second cycle education at each school. The interviews were conducted as a dialogue where both the current level of integration and future development needs were discussed.

3 Tools for integration of environment and sustainable development

3.1 Specified learning outcomes

Early during the evaluation process and discussions with teaching staff it became apparent that the learning outcomes related to environment and sustainable development stated in the Swedish Higher Education Ordinance are sometimes perceived as rather general and difficult to apply, especially on the course level. Therefore, in 2012, a proposal defining the overall learning outcomes as ten specified learning outcomes was presented to the Faculty Council which decided that they should be seen as advisory on the university level (Finnveden & Strömberg, 2013). The learning outcomes were thereafter evaluated in discussions with the Program directors and during the self-evaluation in 2012. The received feedback resulted in development of a revised version containing eight specified learning outcomes that were in 2015 decided to be advisory clarifications for program and course development by the Faculty Council. The proposal is meant to be general and relevant to all engineering programs and is a valuable tool in the evaluation process on the program level. The revised version has also been discussed during the follow-up interviews in 2015 giving further insight in the usefulness of the specifications.

3.2 Pedagogical course

One of the recurrent themes that arose in dialogues with Program directors and teaching staff is that there is a high need for further education of the teaching staff and educational leaders on how to teach topics related to ESD. An initiative was taken to develop a new pedagogical course for university teachers; "Learning for Sustainable Development (4.5 ECTS)". The aim of the course is that teachers, based on their own subject, should be able to integrate questions on sustainable development in their teaching so that the students, during and after their education include their integrated knowledge and reflections in the subject sustainable development. The course was developed in 2012 as a joint effort between two schools, the School of Industrial Engineering and Management and the School of Education and Communication in Engineering Science. This course was further developed in 2013 with support and co-financing from KTH-Sustainability. So far, approximately 80 teachers have attended the course during the 5 occasions it has been offered. As a direct result from the ideas

developed and discussed during the pedagogical course, at least three educational programs at different schools have implemented integration of ESD on the program level.

3.3 Toolbox

In order to provide tools for both the teaching staff and the students to integrate and work with issues related to sustainable development in education, a toolbox for integration of sustainable development in higher education was developed (Toolbox – Learning for Sustainable Development, 2013). The toolbox is published as an open website; this has resulted in attention from other national universities, and has initiated discussions and suggestions for further development of the tools. The design of the toolbox builds on the philosophy of constructive alignment (Biggs and Tang, 2007), aiming at illustrating good examples of how to set up learning outcomes, teaching activities and different methods of examination in relation to sustainable development. The idea behind the toolbox is to provide inspiration and examples of best-practice from within the university and beyond to facilitate teaching ESD on all levels of higher education. The contents and design of the toolbox have been revised during 2013-2015 and new content and literature are continuously added.

3.4 Meetings and seminars

Several seminars and events on integration of sustainability in education with national and international guests have been organized to create inspiring environments that promote discussions and exchange of experiences. Seminars on social and economic sustainability were arranged due to an expressed need by Program directors for deeper understanding of the definitions of social and economic sustainability. In 2014 and 2015 a KTH-Sustainability Education Day was organised, during which the teaching staff addressed possible ways of integrating sustainable development both at course and program levels. Inspiring talks were held by teachers from the university, invited colleagues from other universities (Chalmers University of Technology and UPC Barcelona Tech) and by companies that could correlate the engineering education to the needs of the society. The participants shared their experiences and ideas with others and found possibilities for future collaborations. Several events are also planned for 2016 as many have expressed a wish to participate in meeting/discussion arenas on different levels and with a focus of various topics

3.5 Course modules

In order to assist integration of ESD in education, two different modules were developed and one was supported. These modules (1-1.5 ECTS) can be implemented directly in existing courses, either as they are or after modifications, assuring relevance for the specific core subject.

A course module focusing on environmentally driven business development was developed in collaboration with a technical consultant company (ÅF). This module is comprised of lectures, group discussions and a hand-in assignment. One of the most appreciated features of this module is that the students spend part of the time at the consultant company, being introduced to the real issues companies are facing. The course module is currently implemented in seven educational programs at different schools.

The teaching staffs have expressed a concern on difficulties to integrate social sustainability on course- and program levels (Björnberg et al, 2015). Therefore, a course module focusing on social sustainability was developed during 2014. The module consists of two parts: a generic part that could be included in any programme and a more subject specific part, which is of high relevance for a specific programme/course. The module is comprised of lectures, seminars and an examination

assignment. The module is implemented in three courses, but during the follow-up interviews a demand from several additional programs was expressed.

A course module on introduction to sustainable development was developed independently from KTH-Sustainability (Dahlin et al, 2013), and has over the years received substantial support and promotion. The module is implemented in several engineering programmes and consists of innovative teaching activities, such as interactive large theatre lecturing and the use of board games (which include preparatory quiz questions and peer-discussion). The course content is largely connected to a new textbook (Dahlin, 2014), yet the module is adjusted to each program and is integrated in different ways in collaboration with the course responsible teachers.

4 Results from the evaluation

The results from the 2015 follow-up clearly showed that progress has been made. Significant changes have been made in the majority of programs or concrete plans are in place for development. Currently there are no programs that completely lack integration of sustainable development. Several programs have developed additional action plans on further development of ESD aspects relevant to the programs' core subjects. A few programs have gone through (or are in the process of) a complete reconstruction and sustainability aspects have been integrated in several courses. New courses with relevance to ESD have evolved and new educational activities have been developed in existing courses at several schools. One of the remaining big challenges is assuring the progression throughout the 5 years of education, especially since the students studying on the Master level have different backgrounds.

During the interviews, several Program directors explicitly mentioned the positive effect of the different evaluations that have been conducted, making them a tool for the analysis of the progress and incitement for continuous improvement. An interesting observation was that most of the discussions on integration of sustainability in education were positive and the subject was perceived as a natural/necessary part of the education. This is a very positive development compared to the first meetings during 2012-2013.

The pedagogical course has provided insights in the different possibilities of teaching and learning sustainability and has inspired teachers to try various learning activities and methods of examination. Some of the initiatives developed during the course have already been implemented or underway.

One of the most important factors for the progressive work on integration of sustainable development is that the leaders of the schools support Program directors, that this work is prioritized and that resources are allocated for the initiative. The support from the leaders of the university is also of high importance if changes are to be realized on the school levels. It gives the progress the necessary drive. In 2012, top management stimulated the development of educational initiatives related to sustainable development by offering funding for projects. Some of the projects that applied received sizeable funding (approximately 100.000 euro). This funding supported the development of new courses including the first version of the pedagogical course. The effects of this funding support are still visible today.

A general observation is that the commitment from KTH-Sustainability has been a key factor in the integration of sustainable development in educational programs. The support has been appreciated and continued support has been requested. KTH-Sustainability has also offered opportunities for seed funding of educational projects (approximately 10.000 euro).

5 Defining the future

The project will continue for at least another three years, but the approach will be adjusted to further develop a more supportive role, somewhat removing the evaluation aspects. This change was suggested by the external evaluation panel that assessed the overall project KTH-Sustainability in 2014 (Holmberg et al, 2015). All of the schools at the university are setting up new action plans for continued integration of ESD in the educational programs in accordance with KTH's new sustainability goals for the period of 2016-2020. The action plans will be part of the environmental management system and followed up yearly during audits. This will assure continuous progress and give opportunity for a more coaching role towards the implementation of the goals.

There is also an aspiration that some of the work regarding integration of sustainable development on the course- and program level can be driven by the teaching staff within the schools and programs. Therefore there is an ambition to build and support teams of teachers at every school. These teams will focus on improvements on the program levels and be able to assist the teachers within the core subjects in the programs. It is also of high importance that the teaching staffs have opportunities for further education in teaching sustainability; therefore, the pedagogical course "Learning for Sustainable development" will continue to be of high priority for continuous development.

The project will also continue to create inspirational environments for teachers and leaders within education to discuss the challenges and exchange ideas and experiences. So far, the focus has been on assuring integration of ESD during the first three years of education. Now the work will continue with implementation on the Master- and Doctoral levels.

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