

Awareness building regarding sustainability in a student-driven product development project

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Extended Abstract

To prevent further damage occurring through climate change, the net human-caused global carbon dioxide emissions must fall by about 45 percent below 2010 levels by 2030 and reach net zero by 2050 [9]. One aspect of a sustainable pathway to contribute to the climate goals is to avoid half-knowledge and to promote understanding of transparency and traceability in sustainability, beginning with product development. In product development, it is well-known that if changes are made early in the process, they tend to be implemented more cost-effectively. This connection is also given in the context of sustainability. Making changes in the development of products is especially inexpensive and easy to do at the beginning of the product life cycle. [3] The aim is to establish sustainability in university courses with a product development focus using a workshop designed to foster a better understanding of this topic. The focus of the workshop presented on this poster is to make sustainability more tangible and accessible to students in various study fields. Therefore, the theory shall be combined with examples from the industry. Open knowledge exchange between the maker community, industry, and academia represents an important step toward Open Sustainability [1] and contributes to a more livable world for future generations.

Sustainability Workshop

The planned transfer of knowledge to the students in product development is carried out by the means of a workshop. The workshop will be held as part of the Product Innovation (PI) course at Graz University of Technology. Within one academic year, from October to June, students are guided from zero to the finished product or concept. The student teams are formed out of persons with different backgrounds

in various fields of studies and come from different nationalities to face real challenges in the industry. The goal is to develop a product concept, a working prototype and a business plan and finally present them to a broad audience from industry and research at a final event. [7] By teaching sustainability as part of the Product Innovation course, students from a wide range of backgrounds are reached, including those who may not have heard of sustainability in their major studies. If environmental aspects are visible at this stage of product development, an ecologically and economically more sustainable product can be created. By means of a sustainability workshop in the PI course, the students get provided with basic knowledge about sustainability on the one hand and sustainable product development is promoted on the other hand. As shown in Fig.1 the sustainability workshop is based on seven steps. The workshop is a very interactive and iterative process. In the following the steps of the workshop are described briefly.

Step 1: Theoretical Knowledge Transfer

Input units starting with the basic definitions of sustainability up to the different approaches of ISO14001 [8], the Greenhouse Gas Protocol [11] and the Life Cycle Assessment [5] are taught within this step. The time frame for the first step is about 1.5 hours.

Step 2: Benchmarking Best and Worst Practice

An observation of the current market situation, helps the students to deepen the theoretical knowledge. The benchmarking process enables the students to gather information about already available sustainable products. By collecting best and worst practice examples through internet research and the forthcoming discussion students become more familiar with the topic. For benchmarking and the discussion, about 1.5 hours are an adequate timeframe.

Step 3: Application within Product Development

Students learn how to deal with using resources, energy flows and their efficiency, and the calculation of Greenhouse Gas

(GHG) footprints. In this step, students gather the toolkit for applying the learned knowledge of the first two steps to the product development process. Therefore about 1.5 hours within the workshop are planned.

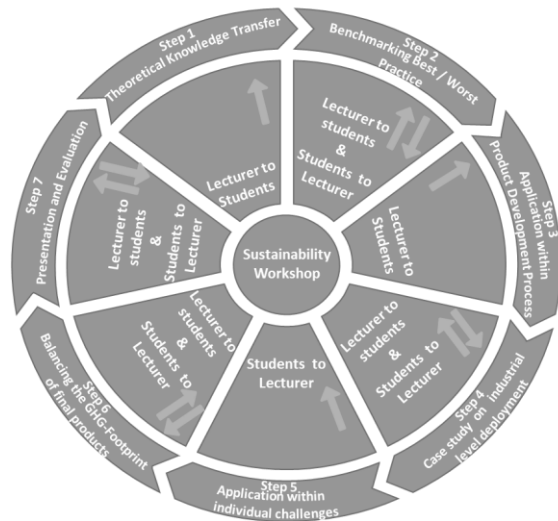


Fig. 1 Seven stages of the Workshop Process

Step 4: Case study on industrial level deployment

Through a previously prepared case study tackling the topic sustainability in industrial companies, the students learn how sustainable product and process development looks in practice. The case study session itself is a highly interactive session. It is advisable to send-out the case study to the students a few days in advance, so they can read and prepare it. To support the students in their preparation some case-guiding questions are available. In the course Product Innovation at Graz University of Technology, individual cases are available through previously performed projects between the institute and multiple industry partners. If there are no own cases available, using the sustainability track from case studies published e.g. by Harvard Business Publishing with the case "Sustainability at IKEA" is recommended. [6] The case study intends to help students understand the practical context and thus better address the needs of their industry partners in their own project. The case study takes about 1 hour and 20 minutes to complete.

Step 5: Application within individual projects

Students now apply the skills they have learned to their own projects. The project timeframe of the course Product Innovation is about seven months. During regular Checkpoint meetings the students show their progress. [7] Here, it is new that, in addition to the progress in the projects, the application in the specific case of sustainable product development is also presented. This step shall only be seen as kick-off during the workshop and take within the workshop not longer than 30 minutes.

Step 6: Balancing the GHG-Footprint of final products

Here the GHG-footprint calculation is conducted. For this step, an Excel-File for the students is prepared. Within this file, the students make their calculations on the GHG-emissions of their product. Such a file should include:

- Emission standard according to the Greenhouse Gas Protocol
- Open space for their process
- Standard emission factors of often used material, energy usage, and mobility

- Sources where students look up relevant emission factors for their project (e.g. ecoinvent [2] or GEMIS database [4])

Within the workshop, the explanation of this step has to be done very carefully and with examples. Therefore 1.5 hours are planned. This step is partly conducted during the project as well as at the end of the project when finalizing the calculations.

Step 7: Presentation and Evaluation

This step is done in two different stages of the project. Students get preparation time, about 1 hour, to sum up everything learned within the workshop. Therefore, short presentations are worked out by the students. In five-minute short presentations the students show the learned knowledge. The first part of step 7 takes about 30 minutes. The second part of this step will take place at the end of the Product Innovation project. The students present in addition to their project results also their GHG-footprint.

Conclusion and Outlook

To create a difference and keep our world livable for future generations, it is important to bring sustainability to many students. With the course PI, students from many different disciplines are addressed. Through open innovation principles in sustainability, it is possible to create transparent and traceable data and add value to the environment, society, and the company. [10] The workshop presented in this paper is one way to communicate sustainability transparently on the one hand and promote Open Sustainability on the other hand. Dealing with the topic of sustainability in this approach has the potential to support academia, industry, and students and broaden their possibilities of collaboration.

This workshop will be taught in the Product Innovation course of the Graz University of Technology in the academic year 2022 / 2023. To derive measurable insights from this workshop, the students answer two questionnaires. One of the questionnaires is filled out at the beginning of the project in October before the workshop starts. This questionnaire intends to provide information about the students' knowledge of sustainability. At the end of the course PI the students fill out a second questionnaire. This questionnaire checks whether their knowledge about sustainability has deepened or not, compared to the initial situation.

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