



Development of Sustainable Entrepreneurship Competencies in Higher Education: A self-assessment tool for students

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Abstract

Sustainable entrepreneurship support society in moving towards a more sustainable future. Within higher education in Europe, we have observed a trend of an increasing number of modules focusing on sustainable entrepreneurship. Becoming a sustainable entrepreneur does not only require new knowledge but also new skills, and changes in norms and attitudes. In this paper we have studied the development of sustainable entrepreneurship competencies of students in two modules, both aiming to develop students' entrepreneurial skills. We adopted the competence framework for sustainable entrepreneurship by Ploum et al. (2018) and provided a questionnaire to answer before and after the modules to assess the development of a number of competencies. For both modules skills development was observed for most of the competencies evaluated. In conclusion, teaching activities lead to desired development of students' competencies, and the assessment tool can be used successfully to assess this development. Therefore, the tool can be useful for both teachers and students, although we recognize further improvement in user friendliness and how to get high-enough answering rates.

Keywords: Sustainable entrepreneurship competencies; Student self-assessment; Student-Business Collaboration

1. Introduction

Sustainable entrepreneurship (SE) and green business model innovation support society in moving towards a more sustainable future. Training students to become sustainable entrepreneurs does not only require new knowledge but also new skills, and changes in norms and attitudes [1]. SE can be understood as the discovery, creation, evaluation, and exploitation of opportunities to create innovative goods and services that are consistent with regional, national, and/or global sustainable development goals [2] [3] [4]. What competencies students need to act as sustainable entrepreneurs and hence, should be addressed in Sustainable Entrepreneurship Education is still an unexplored area of research. Although there is no general definition of these Sustainable Entrepreneurship Competencies (SEC), many scholars describe it as the ability of "successful task performance and problem solving with respect to real-world problems, challenges, and/or opportunities" [1] [5] [6]. These problems are mostly of a complex nature, having impact on the global society and environment, and their origin and consequences are often not predictable [7]. Successful task performance in this context needs knowledge (e.g., about sustainability in general, global challenges for a sustainable development, idea generation, business modelling), skills (selection and application of appropriate methods and tools) and norms and attitudes (e.g., inter- and transgenerational justice) [1]. Biberhofer et al. (2019) point out that, in addition to the usual entrepreneurial competencies, sustainability-oriented entrepreneurs must be able to reflect on their entrepreneurial activities in conjunction with their values and worldviews and understand the impact of their company on the environment and society [8].

Within higher education in Europe, we have observed a trend of an increasing number of modules focusing on SE but most teaching is of a more theoretical, research-based nature with more focus on learning about entrepreneurship than on how to become an entrepreneur. Competencies needed to become an entrepreneur develop in concrete situations when action is required, hence an experiential learning approach is suitable to facilitate development.

To better understand students development of SEC we have, within the project ScaleUp4Sustainability, evaluated the development of students in two modules, both aiming to develop students' sustainable entrepreneurial skills in a context of case-based learning in student-business collaborations: Eco-Venturing at the University of Oldenburg (UOL) and Environmentally Driven Business Development at Linköping University (LiU). We used the SEC-framework of Ploum et



al. [1] and implemented a self-assessment questionnaire to be answered by the students in the beginning and the end of the studied modules. With this contribution we want to present results from this evaluation together with our user experience including benefits and limitations of the tool.

2. Method and Case studies

In this chapter we briefly present the evaluation tool used and the two case studies (modules) where it was applied, for more detailed information see [9].

Evaluation tool for Sustainable Entrepreneurship Competencies (SEC)

Based on the SEC-framework [1] we developed a questionnaire for students to answer in the beginning and end of a module to track individuals' development. It includes background information about the students (general information, motivation, entrepreneurial experiences, and intentions) and a self-assessment including the six competencies presented in Fig. 1. For each competency, a set of performance criteria where to be assessed by the students and ranked from low (1) to high competence (10).

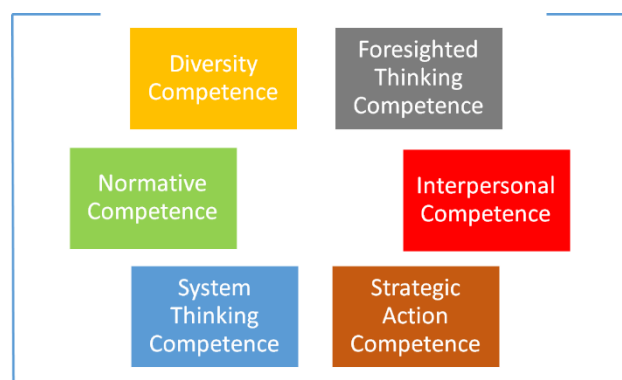


Figure 1: Competence framework for sustainable entrepreneurship [1]

Case studies

During 2019-2022 evaluation of SEC was performed several times in modules at UOL and at LiU, two of the evaluated modules are presented in this paper.

Eco-Venturing, a module (6 ECTS) at UOL, is offered to students of business-related master programs. Overall learning objective is the acquisition of entrepreneurial competencies for development and implementation of environmental innovations and sustainable business ideas. This includes identifying needs for new solutions in the context of sustainable development; knowledge and skills for entrepreneurial development and implementation of innovative solutions; the ability to strategically develop "green" business fields and markets, and combining economic, environmental, and societal objectives. The involvement of start-ups and established ventures is core. They bring in company-related sustainability challenges and student teams co-innovate with them. Students learn different tools during in-class teaching and are coached by lecturers while working in individual project teams.

Environmentally Driven Business Development (6 ECTS module) is offered at LiU to masters' level engineering students in Energy, Environment, Management, as well as Industrial Engineering. The module aims to develop capabilities to formulate and plan a business solution for an environmental problem. Theories and practical examples are presented at lectures. Seminars and workshops are arranged for further supporting the learning and in a group assignment a sustainable business idea is planned and described. Idea Generation, "Shitty Prototyping", Value Creation Forum and Final Exhibition are central activities on top of lectures and workshops. The business ideas mainly are students' own ideas and have resulted in 60 business plans over the years of which three have been implemented start-ups.

Data collection and analysis

The evaluation was performed using online questionnaires made available to the students in the beginning and the end of the modules. The collected responses were anonymous and clearly communicated as not being part of the student examination. Tokens enabled the assignment of the



two questionnaires. For the period of 2019-2022 a total of 136 and 93 students provided answers at the beginning and end of the modules respectively. In this paper we focus on the results from the last run of the modules in 2021/2022. All figures presented include data from linkable questionnaires only (data of 19 students of UOL and 26 students of LiU).

3. Results and Discussion

For both modules, development was observed for all SEC (Table 1), most of them statistically significant [9]. Largest development was observed for Strategic Action Competence (SAC), Diversity Competence (DC) and Systems Thinking Competence (STC), whereas only minor changes were observed for Interpersonal Competence. The observed development of SEC indicates that our teaching activities are contributing to the student's development of knowledge, skills, norms, and attitudes highlighted as important by [1]. The minor changes in Interpersonal Competence could be explained by that master students already are experienced in project work and interpersonal processes.

Table 1. Development of Sustainable Entrepreneurship Competences as evaluated in Eco-Venturing (EV; n=19) and Environmentally Driven Business Development (EDBD; n=26). Each competence includes 3-8 criterias which are ranked by the students (Likert scale from 1=low to 10=high) and here we present a summarized average for each competence in the beginning (1) and end (2) of the modules together with the calculated change (Diff).

	Diversity Competence			Foresighted Thinking Competence			Systems Thinking Competence		
	1	2	Diff	1	2	Diff	1	2	Diff
EV	5.6	7.7	2.1	6.1	7.8	1.7	5.8	8.0	2.2
EDBD	4.8	7.0	2.2	5.5	7.5	2.0	5.1	7.2	2.1
	Normative Competence			Interpersonal Competence			Strategic Action Competence		
	1	2	Diff	1	2	Diff	1	2	Diff
EV	6.8	8.3	1.6	6.5	7.6	1.2	5.8	7.4	1.6
EDBD	5.6	7.5	1.9	7.0	7.7	0.8	4.3	7.1	2.8

At the beginning of the two modules, the students assessed their competencies as lowest for DC, STC and SAC. Development was observed for all three, largest for DC and STC (both modules) and SAC for Environmentally Driven Business Development. At the end of the modules, the average rating of all the competences has converged, with Normative Competence (NC) among them rated highest.

Having a closer look at **Eco-Venturing**, we present the self-assessment of STC as an example of how each performance criterion has been rated by the students in the beginning and end of the module (Fig. 2).

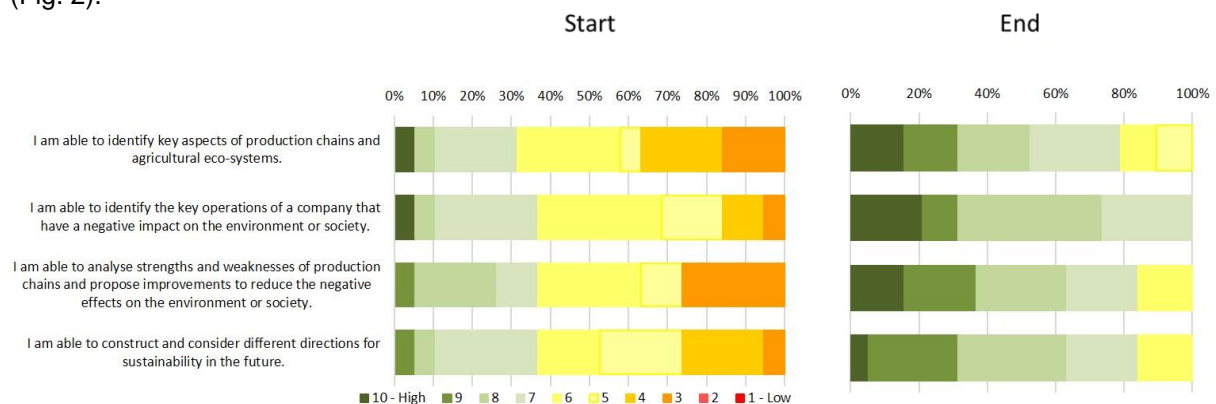


Figure 2: System Thinking Competence as shown at the beginning and at the end of Eco-Venturing in 2021 (n=19).

Analysing systems played a vital role in current Eco-Venturing challenges. E.g., students had to analyse sustainability risks in supply chains or had to identify and interview stakeholders. These



issues were supported by teaching input and coaching. Looking at all underlying competencies, “I am able to identify key operations [...] that have a negative impact [...] (STC) and “I am able to analyse strengths and weaknesses of the production chain and propose improvements [...] (STC) have experienced the highest increase similar as within DC: “I use the experience, activities and values of various stakeholders” (DC) and “I am able to actively involve stakeholders [...]” (DC). As the focus had been on these topics, STC has developed more than other SEC.

For **Environmentally Driven Business Development** we take a closer look at SAC for which the largest development was observed (Fig. 3). In total eight performance criteria were assessed connected to SAC and four of them showed the largest development of all criterias included in the evaluation at large. The specific competencies “I challenge not sustainable ways of working [...]”, “I am able to monitor the sustainability performance [...]”, “I am able to motivate higher management [...] to invest in sustainability” and “I am very good at identifying opportunities for sustainable development” are all closely connected to activities within the module such as idea generation activities, examples at lectures and literature seminars. Additional competencies with a large increase and close connection to activities in the module are “I am able to integrate social, environmental and economic issues into future plans of a company” (Foresighted Thinking Competence), “I am able to explain the importance of involving local stakeholders [...]” (DC) and “I know how to explain the decisions a company has made concerning sustainability” (Normative Competence).

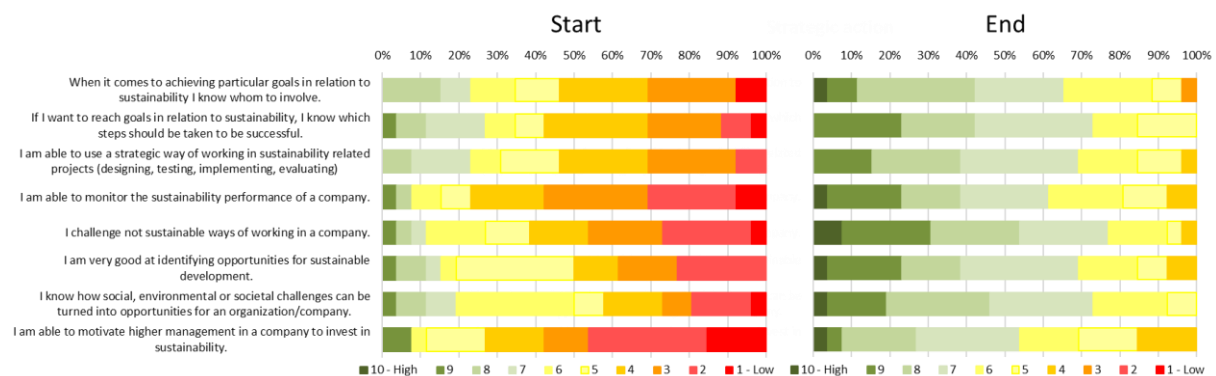


Figure 3: Strategic Action Competence as shown at the beginning and at the end of Environmentally Driven Business Development in 2021 (n=26).

Based on the results presented in this paper and our experiences after having implemented the evaluation tool for several modules in 2019-2022 we conclude that student’s development of SEC can be made visible. We believe that there is a need for assessing the impact of case-based student-business collaborations in teaching as we expect to make a difference for student’s development and career that is not necessarily shown in the traditional examinations. The development of competencies can be a possible indicator for this impact and a tool evaluating this could therefore be valuable to implement.

To increase the usage of the tool and the response rate to get a more complete picture of the impact some factors will be of high importance: Completing the questionnaires must be easy for students and, if possible, integrated into the scheduled teaching activities. Using tokens allows to match questionnaires and in consequence, facilitates a deeper evaluation. Reducing the number of criterias/competencies to those that are most relevant for the module will allow to evaluate the impact/quality of that specific module as well as making it less time consuming for the students to assess themselves. And finally, complementing the Likert scale with a more comprehensive process model including reflection could increase the comparability between individual students and across modules. This could support coaching of students as well as to develop their capacity for self-reflection.

4. Conclusions

The evaluation tool successfully could be used to indicate students’ development of Sustainable Entrepreneurship Competencies (SEC). Increased competencies can be an indicator for quality and relevance of a module and its teaching activities. For the two modules Eco-Venturing (UOL) and Environmentally Driven Business Development (LiU) development was observed for all SEC of which



largest development was observed for Strategic Action Competence, Diversity Competence and Systems Thinking Competence. The developed competencies could also be connected to teaching activities of the modules. However, lecturers should be aware, that the tool does not measure absolute level of competencies – it shows the students' self-perception at the time of evaluation.

To further increase the usefulness of the evaluation tool it is recommended to continue the development by for example reducing the self-assessment to those competencies that are more closely related to the learning objectives of the specific module, aiming at an increased response rate and simplified evaluation. For the future a tool like this could support coaching of students as well as to develop their capacity for self-reflection.

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