Course Analysis MF2114

Design for sustainability
HT 2021

Date and author: 2021-11-30 by Mia Hesselgren

1   Course information

Course content

The course *Design for sustainability* introduces a range of alternative sustainable design approaches for developing complex technical systems. These approaches are relevant for industrial design engineers to use professionally when engaging in sustainability transitions at various levels. Through contextualizing sustainability concepts in relation to design and product development processes with a system focus, this course intends to contribute to create overview and understanding of how different design approaches can be used in sustainability transitions of industrial systems. With focus on development of technical systems the course aims at establishing understanding of how design can be used to influence relations between people and technologies, and as such contribute to sustainability transitions. Furthermore, the course contributes to learning by doing and different design methods are tested and applied in a design project to concretize sustainability complexities.

Intended Learning Outcomes

After completion of the course *Design for sustainability* the student should be able to:

-    ILO 1: Describe and value different possible design approaches that can contribute to sustainability transitions of industrial systems.
-    ILO2: Apply relevant design methods to develop proposals for technical systems.
-    ILO 3: Critically evaluate design of products and systems in relation to sustainability.

Course responsible teacher:
Mia Hesselgren

Other teachers in the course:
Teo Enlund, Magnus Eneberg

Examiner:
Sara Ilstedt

Learning activities:

The course includes the following main course activities:

– The course focuses on development of technical systems and includes lectures and exercises covering various approaches for how design can contribute to sustainability transitions.

– The course contains a team-based design project where proposals for sustainable development of technical systems are created. The design project is practical and requires attendance and active engagement from the students and includes interactions with teachers through coaching.

– The course includes writing assignments that contribute to reveal tacit knowledge and stimulate critical valuations and reflections.

Additional Comments

This course aims at preparing future industrial design engineers to be able to contribute to sustainability transitions. As such, the course objectives are to advance students' competencies in eight different areas. As identified by UNESCO (2017), competencies that are crucial for advancing sustainable development include systems thinking competency, anticipatory competency, normative competency, strategic competency, collaboration competency, critical thinking competency, self-awareness competency and integrated problem-solving competency. This course aims at strengthening these competencies through supporting development of connected abilities by actions, experiences, and reflections. Therefore, to learn sustainable design engineering, the course is based around a design project where different design methods are applied, and sustainability complexities are concretized. The course aims at supporting development of an overview of the many different approaches available for sustainable design and deepen knowledge in one of the design approaches by trying it out in the design project work. Thereby, while conducting the design project, actions will be required throughout as various design decisions will have to be made. Moreover, experiences from these actions will arise and discussed, and reflection-in-action will be required to complete the hand-in assignment that runs parallel to the design project.

2   Students' view of the course

The students have really appreciated the course. Some concerns were raised regarding the ambiguities of the project.

Response rate of LEQ course evaluation survey:

45% (17 out of 38 respondents)

Brief summary of students' responses from the LEQ survey and/or other types of course evaluation:

Most of the students were pleased with the course. They appreciated the course content and the focus on sustainability which they expressed that they found important. Moreover, the students also liked the learning environment and course activities with a mixture of individual work, teamwork, lectures, seminars, and supervisions. Furthermore, the workload was found by most students to be in line with the number of credits awarded. Some students really appreciated the structure of the course with informative lectures at the start and applied project at the end of the course, and some expressed that

they found this course very important for them, and a couple of students even claimed that this was the best course they had taken at KTH.

There were a few students who expressed concerns with the complexity and ambiguity of the project part of the course and wished that there would have been more guidance for the team-based project. Also, a few students claimed that they found it difficult in the beginning of the course understand all the requirements and assignments. Moreover, a couple of students expressed the need for even more detailed feedback on course assignments and in supervisions.

Additional Comments

At the final seminar in the course, students also wrote post-it notes on a Miro board to describe what they liked about the course and what they wished for. From these notes, most students expressed that they liked the structure, the content and learning environment. For example:
"I like the emphasis on learning in the course. It feels like you learn for your own sake, and not to "do well" on a test."
"Enjoyed reading and comparing discussion posts from peers."
"Having the presentations early, the discussions in the seminar became eye opening and interesting."
"I like that the course covers design from a system perspective."
"Clearer focus on thinking about the system something is placed in, not just creating an object or service."
"Design for Sustainability is an important topic."

From these notes there were also some concerns and issues raised the ambiguity of the project assignment and unclarities of expectations of deliverables. For example:
"It was hard to understand what was required from you in both the individual assignment and the project."
"The lack of concrete requirements made the design process and the writing of the assignments harder."
"The deliverables and what they consist of are a bit hard to understand."
"More clear instructions according to the deliverables. EX. TWO landscape A3 for the portfolio and ONE A3 for the individual assignment."
"I wish it was clearer in the beginning what the anthology was supposed to be. It was hard to understand without an example."

Furthermore, a course committee with three student representatives was appointed at the start of the course. The course responsible met with the course committee in the beginning and at the end of the course. The course committee prepared for these meetings by asking their fellow students about any feedback to be brought forward. During these meetings the representatives expressed that the overall comments were very positive and that the students really enjoyed the course and found its content important and relevant. They also expressed that there were some concerns about the ambiguities of the project assignment which had caused some confusions and that it took some of the students effort to get used to dealing with complex problems in a "grey zone", rather than solving problems and sorting out "black and white" solutions. Some students found the course challenging but at the same time did see it as a kick-start of advanced studies at master level and therefore appreciated the approach.

3   Teacher analysis of the course

The analysis should present the development of the quality of the course as well as measures that have been taken after previous course analysis. The course's strengths and weaknesses based on the course evaluation and the teacher's reflection.

Changes of the course before this course offering:

This course is newly developed by the course responsible and HT21 was the first time that it was given.

The course's strengths (based on the students' experiences and the teacher analysis):

The course MF2114 was developed to support the master students of Industrial Design Engineering to build understanding of alternative sustainable design approaches available for developing complex systems. As such, the course is aimed at supporting creation of an overview of a large field and understand alternatives available for design engagements when dealing with sustainability issues. To support this theoretical development the course contains a first module with lectures, exercises, and an academically advanced reading list. Furthermore, the course was developed to also support students to construct in-depth knowledge on design for sustainability through learning by doing, to thereby aim at enabling deep learning. As such, the course is an applied course with a design project to concretize sustainability complexities. To support this applied knowledge creation the course contains a second project-based module that includes a team-based project work and supervisions. To conclude the course, the students produce an anthology describing the various approaches of design for sustainability, including critical reflections on the theories and presentations of the applications in respective projects. As such, the third module of the course contains both group work and an individual assignment, presentations and seminars, peer-to-peer reviews, and feedback sessions, all to stimulate critical thinking and enable deep learning.

The major strength of this course is the combination of theoretical and applied knowledge creation with a learning by doing approach that enables deep learning and advanced knowledge construction on design for sustainability. This was also highly appreciated by the students.

Areas for improvement of the course (based on student experiences and teacher analysis):

Some students expressed concerns with the ambiguity of the team-based design project assignment. This ambiguity was intended since being able to deal with complexities, uncertainties and ambiguities are important parts of designing for sustainability. However, this is an area that could be slightly adjusted for next year with some more emphasis on preparing the students for how to deal with ambiguities. Thereby, this module could become clearer to the students.

Proposed changes to the next course round:

In the next course round, HT22, the anthology from this year will be used as an example to illustrate what is expected as final outcomes of the course. Also, in the next course round, the brief for the project assignment, and its setting, will be adjusted to become a bit clearer. However, the project brief will still leave room for uncertainties and ambiguities to be dealt with in the project assignment, but the students will be provided with some more support to understand their project assignment.

Additional Comments

As a complement to kick-starting the Industrial Design Engineering master track with this course, it would be useful to also support these students with other overarching activities in the beginning of the

term. Several students expressed that they found it difficult to deal with the English academic literature. The Swedish speaking students could need more support in this transition. Moreover, there were concerns raised about how much more advanced the master studies felt compared to bachelor years. During the first week of the term, it could be useful to bring the students along on how the master courses in design are at a more advanced level and which new requirements that entail. However, resources for such supporting activities are not provided for by this course but could perhaps be part of the master track.