



Digitainability: Promoting responsibility & implementing innovations through project-based learning



Short Description

Four interdisciplinary project weeks to explore the potentials and risks at the intersection of digitalization and sustainability 2022-2023

In the 21st century, our world is shaped by two megatrends: major the rapid digital transformation across states, economies, and societies, and the urgent need for social, economic, and ecological sustainability. As we face increasing challenges from the depletion of natural resources, it is essential to adopt a more sustainable way of living and working. In this context, digital innovations and applications emerge as vital tools in our pursuit of environmental protection and sustainable development. The potential for synergies between digitalization and sustainability is vast, offering opportunities to address resource issues, develop innovative mobility concepts, reshape industry standards, and tackle social inequalities.

However, it is crucial to recognize that digitalization is not inherently positive; a thoughtful direction and mindful integration are required to mitigate negative effects such as rising energy consumption, increasing CO2 emissions, and potential social, health, and ethical implications of digital technologies.

The **project weeks** span over two weeks, featuring expert inputs and discussions, as well as an interactive workshop week that includes design sprint challenges, and networking sessions. Students are encouraged to think creatively and develop practical approaches to address the complex issues at the **intersection of digitalization and sustainability**.

The project has been funded by the TUM Ideas Competition for "Study-Related Reinforcement of the Excellence Strategy" The aim of the interdisciplinary teaching project "Digital Sustainability Transformation by, with and for TUM" is two-fold.

Firstly, we impart the latest scientific findings and practical experience at the interface of the two megatrends of digitalization and sustainability to particularly motivated Master's students from all TUM faculties.

Secondly, the teaching-learning arrangement gives students the opportunity to actively participate in shaping sustainable digitalization as part of project-based teaching. Thus, the aim is to give students the opportunity to further develop, concretize, and ultimately implement their project ideas for real-world challenges in dialogue with stakeholders from politics, business, and civil society.

As part of this teaching format, four project weeks on the topics of "Sustainable Smart Cities", "Smart E-Participation", "Cities. Digitalization and the Industry 4.0" and "Responsible Artificial Intelligence" were held between September 2022 and February 2024. During these project weeks, students received specific knowledge from experts, participated in methodology workshops, and worked on innovative project ideas to work on real-world challenges in the field of digital technologies and sustainability that have been contributed by the project partners.

The practical approach coupled with the strong collaboration with the project partners should prepare the students for their career start.

Detailed description of the project weeks

Teaching objectives and contents

Each iteration of the course "Digitainability" was divided into an input phase during which students alternately familiarized themselves with the topic in self-study phases with the help of materials and written assignments and seminar sessions in which the acquired knowledge was deepened, discussed and expanded through short presentations by experts from the field.

Each seminar session focused on a key topic such as "Privacy & Security", "The Future of Mobility" or "The Role of Data in the Smart City" and various experts from academia, industry, civil society, and the public sector have been invited to give additional insights from their experience on the respective topics.

A selection of guest lecturers:

- Dr. Des. Ahmed Maati (TUM)
- Lukas Daßler (TUM)
- Basanta Thapa (National eGovernment Competence Center)
- Nicole Wolf (WeChange.org)
- Tara Tarakiyee (Sovereign Tech Fund)
- Alexander Sander (Free Software Foundation Europe)
- Julia König (Smart City Munich)
- Yulika Zebuhr & Wolfgang Blumthaler (Acatech)
- Oliver May-Beckmann (MCube)
- Dr. Alina Wernick (University of Helsinki)
- Nick Förster (TUM)
- Elisa Maschmeier (WOW! Urbane Utopien)

Following the self-study and input phase, the challenges were presented by the project partners. The students then selected a challenge and formed interdisciplinary teams to tackle it.

A selection of tackled challenges¹:



Bayerische Landeszentrale für politische Bildung: Help new social movements to plan effective forms of civic & political participation – taking into account the advantages and disadvantages of the various activities to achieve their goals.



Vote Rookie: What does the participation of tomorrow need? Find an engaging way to address and involve young people in digital and analog ways to participate. Focus especially on the different target groups and consider case studies.



Landeshauptstadt München

Landeshauptstadt München: How can we get as many different groups of residents as possible to participate digitally?



Acatech/Plattform Lernende Systeme:

Artificial intelligence is increasingly permeating society and will also find use in digital

administration. How must the use of AI be designed

so that it is used for the benefit of citizens and

¹ Please find an overview of all challenges and the respective student projects from project week 1-3 here:

https://www.hfp.tum.de/en/policy/research-teaching-projects/teaching-projects/digitainability/

in accordance with core values and principles? In addition to the external experts and challenge givers already mentioned, two coaches from the Center for Key Competencies at TUM were also involved, preparing the teams for the intensive project work in a workshop on team collaboration and communication.

As soon as the students formed the teams, the workshop week began, in which the students developed their technical and non-technical solutions for the challenges using a toolbox of various agile methods. Each workshop week was concluded with a public pitch night in the TUM Think Tank, during which the results were presented and discussed.

In the fourth iteration of Digitainability, we teamed up with Sarah Rachut from the Professorship for Law and Security of Digitization and Dr. Markus Siewert (TUM Think Tank) to develop and conduct a seminar on "Responsible AI". In this format, the student teams additionally participated in the nationwide competition "Digital Future Challenge" by Initiative D21 and the Deloitte Foundation under the patronage of federal minister Dr. Volker Wissing. Two teams of students from TUM and LMU from the Digitainability Seminar were able to achieve first and second place out of a total of more than 50 teams with their projects "EduPin" and "Aura Allies". The cases and the results of the semi-finals and the finals can be found on the Website of Initiative D21.

Methodology

The self-study phase followed the "flipped classroom" concept, according to which most of the teaching content is not taught in the seminar, but is instead worked on by the students independently using various materials and tasks. The seminar sessions therefore offered an opportunity to deepen, exchange, and discuss the teaching content. Additional impulses and insights into practice were provided by the short lectures from experts in the seminar. Also, during the self-study phase, following the principle of "learning through teaching", the students had the task of preparing some complex content in a way that their fellow students could understand and were thus able not only to acquire knowledge themselves but also to train skills in the area of knowledge transfer.

During the workshop week, various methods of agile project management, in particular design thinking, were used to work on the challenges. In short creative sprints, the teams first explored the environment of their challenges and created stakeholder maps before using "user persona" and "storyboards" to get closer to the everyday lives of the (typical) users of their product or service. On this basis, ideas and subsequent prototypes were then developed and tested using methods such as "brainwriting" and the creation of an "affinity map".

The chosen didactic structure promotes the development of so-called 21st-century skills in different ways. The central idea is that the skills acquired in the individual teaching and learning units do not stand alone, but should be further developed and deepened step by step. The self-learning component requires and promotes analytical and critical thinking in the context of complex issues, trains the independent development of emerging topics, and the ability to think and collaborate beyond the boundaries of individual disciplines.

Conclusion and Feedback

The commitment and inventiveness of the students can be seen as very positive, as they developed very well-thought-out solutions and approaches to real-world problems within just one week. The project week's results and the led to very positive feedback from the project partners. All student teams remain in contact with their challenge-giving organizations and have planned appointments beyond the course to further develop their projects. Whether and how satisfactorily the project ideas will be transferred into actual implementation remains to be seen at this point.

This part of the project can certainly still be improved in the future, as the students' ideas generally well received the are bv challenge-giving project partners, but there is a lack of structure for implementation. The will to implement it is usually given on both sides, but in practice, a lack of time or financial resources on the part of those giving the challenge and other obligations such as the master's thesis, internships, or upcoming stays abroad on the part of the students make it difficult to consistently pursue the project ideas beyond the seminar.

In the final feedback round that was conducted at the end of each course, students were very positive. The dynamic, challenge-based format and the opportunity to develop their own projects were particularly well received as a change from traditional seminar formats. The time commitment was rated as relatively intensive. The results of the regular evaluation are as well positive as the attached survey results show.

Outlook

Experience so far has shown that the project weeks are an extremely suitable format for working on current and emerging topics with students and preparing them for the professional world.

In particular, the requirement to develop ideas and solutions within a limited time frame in a team with different skills and to deal with any setbacks proves to be very practical. Thus, from our side, the project week format is highly recommended.

The registration and crediting processes may still need to be optimized in the future, as the course was not equally visible and creditable for all master's degree programs. This meant that some courses did not really have access. Simplifying administrative processes has the potential to further increase the desired interdisciplinarity among students.

We would like to thank you again for the funding provided by the TUM Ideas Competition for Study-Related Reinforcement of the Excellence Strategy. Our thanks are also extended to our student employees, who were a valuable asset and support, and to the many colleagues and experts who actively participated in the events. If you have any questions, we are happy to help you at any time.

Best regards,

Prof. Dr. Stefan Wurster, Dr. Markus Siewert and Helene von Schwichow