18 COURSES DEVELOPED

The 18 formats have been organized by delivery format.
According to the EuroTeQ experience the main delivery formats used in EuroTeQ courses are:

- hybrid course (all contact meetings take place virtually and on campus at the same time for different students. For example: home university students attend physically and EuroTeQ students via Zoom or another virtual environment).
- 100% online – synchronous course (synchronous learning refers to instructors/teachers and students gathering at the same time and place (Zoom or another environment) and interacting in “real-time”).
- 100% online – asynchronous course (asynchronous learning refers to students accessing materials at their own pace and interacting with each other over longer periods).
- blended course (the course takes place partly in-person and partly via online learning, e.g.: the course starts with a week length intensive introduction and the rest of the course will be held online or in hybrid form).

SYNCHRONOUS ONLINE COURSES

Introduction to Sustainable Production – A Sense of Urgency / Technical Aspects of Sustainable Production

- Statistical data:
  - **Time** in the course catalogue: **06/21 - 12/22**
  - The course was **newly developed** for the Teaching Seed Fund
- Number of teaching staff involved:
  - Proposal and administration: 2 research associates, 1 research group leader
  - Courses preparation: 3 research associates, 1 professor, 1 research group leader, 3 researchers from UCEBB in Prague
  - Course teaching: 1 professor, 1 research associate.
- Number of students
  - Introduction to Sustainable Production - A Sense of Urgency (SoSe 22): **2 students** (cancellation due to insufficient number of participants)
  - Technical Aspects of Sustainable Production (WiSe 22/23): **5 students** (due to low number of participants inclusion in lecture of TUM)
- Course Format
  - The courses were planned as **synchronous online courses**, meaning that, besides asynchronous phases during which students study autonomously, they met **online face to face.**
- Teaching and Learning Formats
  - **Listening to a lecture** was part of the concept, but as well **active participation** and **working in groups**. The students were required to solve exercises, work on problems and cases and do some presentations.
  - For communication mainly **Moodle and Zoom** were used. Moodle is the primary teaching and learning platform that is connected to everyday teaching at TUM. Teachers can use it to organize

their online- and offline teaching, conduct formative assessment and to include various teaching activities for asynchronous phases. Simultaneously they can communicate with their students in forums or deposit course material. Zoom meetings for the synchronous sessions took place.

- Learnings from the course and course format
  - Unfortunately, the course was **not visited well**, therefore it was **cancelled** once and **included in the regular course catalogue from TUM** subsequently. It will **not be offered this way again** as the administrative efforts have been comparatively high.

Remote Energy Lab

- Statistical data:
  - **Time** in the course catalogue: **09/21 – 04/22; 09/22 – 04/23**
  - The course was **newly developed** for the Teaching Seed Fund
- Number of teaching staff involved:
  - Course development, lectures, practical sessions, communication with students: **1 Postdoctoral Researcher, 4 PhD Students**
  - **Two professors**
- Number of students
  - Students from **TUM: 0 (1 dropout)**
  - Students from other **EuroTeQ universities: approximately 9**
- Course Format
  - The courses were planned as **synchronous online courses** meaning that students and lecturers **met online face to face.**
- Teaching and Learning Formats
  - During the synchronous session the students **listened to the lectures** and **participated actively.** They also did **group work.**
- Innovative aspects
  - The interdisciplinary and intercultural cooperation with students from different EuroTeQ universities was, besides the factual content, one core component of the course.
- Learnings from the course and course format
  - The backgrounds of the students were very diverse. Not only different master programs but also different nationalities were present in the courses. Therefore, they had to make sure that all are on the same page. The feedback from the students was positive albeit some technical issues occurred.
  - The organization was not always practical and the enrolment to the courses was complicated in the first year. In the second year it was already a lot better organized. To organize good international collaborative courses is a task for many and the teachers are reliant on support from their home university in terms of platform support and marketing.

"The Hacker Experience"

The course will provide students with a **basic understanding of "How the Internet Work"**, will provide a crash-course in network programming in C. The course will then, through a mixture of theory and hands-on exercises, have students **study and practice various real-world cyberattacks** — for example, how to transparently redirect connections to a website to a "pirate" website, or how to hi-jack active network connections. Through this, students will acquire a thorough understanding of real-world Internet protocols, as well as the basics of how a "hacker" operates and thinks.

Through a set of lessons, tutorials, and challenges, we will understand — and try out — how to “break things”. This may include topics such as:

- TCP Connection Hi-jacking & SYN flooding
- SQL Injection attacks on WWW servers
- Heartbleed - that SSL-bug that caused the whole Internet to flip out
- DNS Cache Poisoning

We will also call on outside experts, to present their experiences, favorite attacks, and possible countermeasures. The practical part of this course consists of a set of tutorials and a set of challenges.

- **Tutorials:** are optional and serve to help students who need them acquire a certain set of skills. Each tutorial requires a submission of some code, which will be evaluated, and a grade (0-5) will be awarded.
- **Challenges:** each represent **"a thing to hack"**, such as DNS, or TCP, or DHCP, or invoking a buffer overflow, or performing a man-in-the-middle attack, or ... Challenges will each have an explanation, and supporting material, for what is expected - but will require independent thinking. Each challenge requires a submission of some code, which will be evaluated, and a grade (0-10) will be awarded. Note that a code submission which "does the job, nothing more, nothing less" will be graded 5. Grades in the interval (5-10) reflect an additional effort, such as highly modular code, flexible, robust, or supporting different attack approaches.

You're encouraged to work in a small group of 1-2 students for each challenge.

Project in Modelling Living System

This course gives the students an overview of the field, through lectures and **study of research papers**, and has them carry out a **modelling project in small groups**. Each group defines their topic, proposes hypotheses from experimental data, formulate the corresponding model, solve it numerically, and discuss how to test the model experimentally.

By the end of this course, the students are able to **build a mathematical model from a list of biological hypotheses, to solve it numerically, and to discuss model predictions in the light of experimental data.**
Each class session is divided into two parts: one part is devoted to **reading research papers** and acquiring the methodology for **analyzing scientific writings**, and the other to **group work**.

The assessment is focused on the trajectory rather than on the end product ; it is important to explain the reasoning and approaches and worthwhile to mention failures. The grades will have three components :

- Article presentations;
- Report per group that contains Notebook Jupyter scripts, comments, and main conclusions;
- Oral defence of the project.

ASYNCHRONOUS ONLINE COURSES

Developing an Entrepreneurial Mindset through serious games

Statistical Data:
5 ECTS - 13 weeks
Spring 2022: 3 staff, 4 TA's
Spring 2023: 2 staff, 4 TA's
Autumn 2023: 2 staff, 4-6 TA's
150 DTU Students, 12 EuroTeQ Students
Dropout:

Course Description:
Each session consists of an online module on a specific topic related to the entrepreneurial mindset. The session will introduce a range of approaches (e.g., concrete, abstract, theoretical, practical) on how to address the topic at hand. In online games and modules, students will explore how these different approaches can be applied. Students try out the approach and learn quickly by trying out different strategies in the modules and games. Because of the competitive nature of the games, students will also learn from other students; sometimes it might be best to be the first one to act, sometime might be better to first see what others are doing. At the end of the course, students are equipped with a wide variety of tools, techniques, methods, and experiences that will help them to apply an entrepreneurial mindset in the context they are working in.

Pedagogical Format:
Gamification – Fully Online (Synchronous/Asynchronous) – Group Work – Poster Presentations

Digital Tools used:
DTU Learn (LMS) – content and games
Miro – teachers and students both record and upload videos + provide feedback to one another
MS TEAMS – Communication and Group Work

Feedback (from students):
- EuroTeQ students are motivated to take this course as the new format of learning through serious games appeals to them and is not offered at their home university (within this topic).
- The fully online format works well for students as everyone accesses the course on equal footing.
- Students' express happiness with the wide use of different online tools.

Wishes for the future (Teacher):
- More contact with teachers at partner universities to share/produce content
- Funding for TA's who are instrumental in the development of this course (technical knowhow, student relations etc)

European Culture Course (Art, Literature, and History).

The goal of the course is to **develop intercultural exchanges between students and to spread European culture within the EuroTeQ university network**. The innovative, multilingual course will be offered online and will be made available to both EuroTeQ student body as well as to Polytechnique students alone in the long run if necessary.

Using digital lectures, quizzes and diverse forms of resources (pictures, sound, videos, writings, etc.) students will learn more about arts movements, literature, and specific events the form the basics of a common European culture.

Each video will focus on a specific aspect of European culture such as an artistic movement or an historical event with numerous cultural repercussions. For example, “The Riots of 1968 in Europe”, “Stendhal and European Romanticisms”, “European Avant-Gardes”, “Literary Roots of Contemporary Europe”, “European Naturalism”, “European Cubism”, “The Origins of European Languages”, “Cinema and Resistance”.

This course is an online course with short multilingual videos on the topics listed above. They will be offered in at least 2 languages. Videos include interviews with specialists. Quizzs about the content of each video and other documents to learn more about European Culture.
Student are invited to discuss the subject of the videos and to interact on the forum and chat.
What was planned? Why were these options planned?

Students could do **peer work as to offer new content** - **sharing information about their own culture** - and come up with their own synthesis of what European culture is, which would make them active participants in the elaboration of the course. Digital tool such as **Miro** could be used to **share content and work collaboratively**. Some synchronous classes could also be organized.

Factory produced wooden houses.

The course was conducted as an online offering through TalTech Moodle over a 12-week period during spring 2022. The course was structured into one-week modules. Students engaged with study materials, primarily in the form of videos, followed by self-evaluation tests. Additionally, an online exam was administered midway through the course as well as at its conclusion.
The instructor had proactively transformed it into an online format. This decision was driven by the instructor's inability to conduct the course at fixed times, opting instead to regularly monitor and support student progress on a weekly basis. Valuable suggestions were received during consultations with an academic developer and an educational designer regarding course organization and enhancing student learning, leading to the implementation of improved self-evaluation tests at the end of each week.
The asynchronous format proved effective in accommodating students who were not physically present on campus. It granted exchange students the flexibility to navigate the course at their own pace, minimizing schedule conflicts. The weekly format however provided a fixed timeframe to support the students learning. Simultaneously, foreign students received equitable treatment alongside their counterparts at the home university. This approach facilitated streamlined course management for the instructor, devoid of exceptions. However, a notable drawback of this format was the lack of student interaction, which hindered opportunities for peer learning.

Essentials of Digital Health

The course spanned over a period of 8 weeks, beginning with a two-week introduction phase. During this period, students were introduced to the course content, and a complex case was presented for them to solve gradually in the subsequent weeks. As the course progressed, each new week provided fresh insights into the topic, revealing diverse approaches and perspectives. An integral aspect of the learning experience was the provision of peer feedback, allowing students to evaluate and provide input on each other's solutions. In the final two weeks, students participated in group work, applying their accumulated knowledge to solve another case without additional instruction.
Developed with the specific requirements of EuroTeQ in mind, the course incorporated elements of peer evaluation and group work to foster collaborative learning among the students. This format proved successful in facilitating meaningful discussions and enabling substantial analysis of their peers' work. However, it is essential to acknowledge that the development of this course presented a significant challenge in terms of time and effort. Considerable resources were allocated to recording video lectures for independent study and creating the case studies. The course's development heavily relied on the assistance of an academic developer and an educational designer.

HYBRID COURSES

Philosophy and Architecture

Each design decision needs to be justified against an idea of what is desired, and each desire must in turn be justified against experience and hope, preferably in the form of compelling (scientific) evidence. The course draws from different subfields of philosophy (epistemology, aesthetics, philosophy of technology, ethics, political philosophy etc.) to investigate how design choices can be understood using philosophical ideas.

Through the concrete examination and critique of specific buildings, designs and urban agglomerations from a specific point of view, namely that of the text students are required to study and present, they will, at the end of the course, be in a position to place their own efforts in design and design thinking within an increasingly refined and well-practised frame of reference, helping them to make considered design decisions within social space and thereby undertake and undergo the odyssey of the design process with greater awareness. The purpose of this course is to give students the opportunity to learn to: Analyse and critique a given piece of philosophical literature, seeking out its main argument, finding the reasons for that argument an applying the argument to the question of (architectural) design with the help of the analysis of concrete examples. Students present their analysis and application of the literature in the form of a group presentation showing a clear structure and giving a well-rounded narrative. They write an essay/position paper exploring their own theoretical position relative to a chosen topic in an exam setting. They explain their choice for this topic in relation to their own ambitions as a practitioner. They formulate a specific research question which can be investigated using literature as well as concrete examples from the built environment in order to form a thoroughly argued attitude to the design process. They contextualise the topic within the current debate about the built environment. They summarise the positions of (two) other authors on this topic and nuance their theoretical positions and take up a position within the debate. They define and underpin their own position with arguments and examples and perform research according to the accepted criteria of scholarship.
This hybrid course consists of:

- Interactive lectures (2 hours a week)
- Discussion seminars prepared by groups of students (2 hours a week)
- Presentations by students
- Preparing discussion topics
- Group essays (end assessment)
- Peer review
- Individual essay (end assessment)

- Lessons learned:
  - Because students prepare the discussion seminars and present this, they feel ownership of the course. These presentations are very inspiring for both students and teachers.

- Statistical data:
  - Per course 25-30 TU/e students participating. No dropouts.
  - First run: 6 EuroTeQ students. Second run: 2 EuroTeQ students. Some dropouts, no clear reasons. EuroTeQ students are not very visible and active.
  - 2 teachers involved in the course.

- Digital tools used:
  - Canvas (LMS)
  - MSTeams
  - FeedbackFruits (peer feedback and peer review).

Innovation Pilot

Statistical Data:
10 ECTS - 13 weeks
Autumn 2022
Spring 2023
Autumn 2023
5 Facilitators, 5 TA's. 1 Course Coordinator, Company Acquisition
250 DTU Students, 1 EuroTeQ Student
Dropout: none

Course Description:
The course enables you to solve complex challenges in companies through using your engineering knowledge and thereby train an innovative mindset.

- In the course, you will learn how to organize and implement a multidisciplinary innovation process using relevant innovation models and methods as well as technological knowledge.
- Give you a basic understanding of activities and processes in an innovation process and work on how innovation models and methods are applied and adapted to an innovation challenge in practice. The goal is also to connect business understanding and value creation with the innovation process as well as solving this kind of challenges in a manner of an engineering professional.
- Train the understanding and analysis of a problem and its context, and relate it to a business, organizational, technological and user perspective and, on this basis, formulate a number of possible solutions.
- Train communication of problem awareness, needs and solutions to relevant stakeholders through, pitch, prototypes, and written presentation.
- Provide insight and experience in working and collaborating across engineering disciplines as part of your engineering professionalism.

Pedagogical Format:
Hybrid and Blended – Group Work – Poster Presentations – Double Diamond - CBL

Digital Tools used:
DTU Learn (LMS) – Communication and content management
Miro – Group Formation
MS TEAMS – Company Collaboration and Group Work

Feedback (from students):
None yet (first student is participating in the Spring 2023 semester)

Wishes for the future (Teacher):

- Smoother contact with EuroTeQ students (well established channels for direct communication)
- Didactic Support from educational developers (group work, scaling, diversity)

Supply Chain Management

The course adopted a hybrid approach, with students both present in-person and online. This approach had been established and refined over a significant period of time. The course structure followed a flipped classroom model, where students were provided with weekly learning materials such as readings and listening materials. In-person class sessions focused primarily on dynamic discussions and collaborative groupwork. Additionally, simulation games and presentations were integrated into the course to enhance the overall learning experience.

To facilitate interactive discussions and engagement, a range of online tools were utilized, including Shared Google files with edit rights, Moodle, Kahoot, and Mentimeter. These tools played a vital role in fostering lively exchanges

and interactions among students. Adjustments were made to the simulation games to ensure they aligned with the hybrid format, or in some cases, separate versions were created to ensure that both in-person and online students could have comparable learning experiences.
One notable challenge faced in the course was encouraging students to embrace the "open camera groupwork" format. Despite efforts to emphasize the significance of active participation and collaboration, there were instances where certain students chose not to open their cameras or displayed limited engagement during group activities. However, it is worth mentioning that when students actively participated, the format proved to be effective in promoting collaboration and learning.

Visual design – fusion of arts and technology

EuroTeQ Teaching Seed Fund project by Kateřina Sýsová (Nováková)

The Visual Design course departs from traditional software-skills teaching of graphic design programs (Photoshop, Illustrator, InDesign) as it takes storytelling as the main motivation for students to learn the required skills. Students are encouraged to work in groups. They generate their own photos, own illustrations and also own sketches resulting in a real printed and self-assembled book, where all stories from all groups are gathered. Remote sketching is supported by the tool ColLab sketch (developed at our department), which allows for instant online and distributed graphic cooperation.

The outputs of the course are open to the public, so students are motivated to deliver quality work. An excursion through the city is made in the middle of the semester, where own photo-material is gathered and possible “action places” are found. This can be done individually by each student or the students together. The point of the excursion is also to find partners for the group-work. For this course, the students need to be neither from the same class nor from the same schoolyear. It is a vertical subject. The second part of the semester is started with making a 1 page of storyboard in any format. The teacher helps with a structure of the story and Adobe InDesign is taught in order to give the story a booklet format consisting of 16, 20 or 24 pages A5. Students choose a graphic style of the story, colours and layout. The final format is for each group the same, so that all stories from the class can be fixed together into one book.

The benefits are:
Students are personally motivated to generate best work possible when showing the work to the others and to the public.
When working in groups, students learn from each other.
The course is independent of level of education and actual position of the student.
The outcomes are real products.
The books document the city or university from the point of view of the students and can deliver a feedback.

Participation:
Home University students: 20
Euroteq students: 15

Dropouts:
Home University students: 0
Euroteq students: 2

Interactive jupyter notebooks

Two EuroTeQ Teaching Seed Fund projects based on this technology were funded:

1. **Aurel Gabris: Interactive notebooks for a course on quantum computing**
2. **Dmytro Miskhin: Interactive jupyter notebooks**

Jupyter notebooks are powerful tools for merging text, in particular mathematical formulas, and code examples in one place. Jupyter notebooks supplement lectures with hand-on experience and a tool for homework assignments. The notebooks are used both by students present in person and on-line from partner universities, hence providing a similar level of experience.

The course of **Aurel Gabris** was developed in cooperation with Ulrich Hoff at bigQ - Danish National Research Foundation Center of Excellence for Macroscopic Quantum States at Technical University of Denmark. His contribution was valuable in introducing modern teaching approaches that are used routinely at DTU, but less common at CTU Prague. The embedded code, which can be modified and experimented by the students during the lecture facilitate a deeper intuitive understanding of the basic features of quantum computing. The course 02QIC goes beyond the idealized model of quantum computation and communication, introducing the concept of open systems and their mathematical model. For the ideal (error-free) quantum communication and quantum computing topics it was possible to use and adjust the open source QWorld materials. The more challenging and innovative part of the work was to use the Jupyter notebook format for the lectures dealing with open systems and error correction, since to our knowledge, no educational attempt has been taken in this direction.

Dmytro Mishkin used Jupyter notebooks in the course called “Computer Vision Methods”. https://cw.fel.cvut.cz/b202/courses/mpv/start. The tool was also offered on-line for students from partner universities. The active “play with the code” is important in getting an intuitive grasp of the learned concepts, especially if they are complex and sometimes hard to understand. Moreover, the students will develop code prototyping and visualization skills.

Gabris courses on Quantum computing:
02QPRG (2021/2022), 02QPRGA (2022/2023)
02QPRG was 2 ECTS course, with 100 mins on-line lectures, self-study materials and homework quizzes. The aim of the course is to teach basic concepts and algorithms of quantum computing taking a hands-on approach. Also provide the opportunity to acquire the skills and familiarity with tools to use quantum computers.

02QPRGA is 3 ECTS course with 50 mins hybrid lectures and 50 min on-line lab tutorials. Content identical to 02QPRG.

Participation:
Home University students: 3 (2021/2022), 9 (2022/2023)
EuroTeQ students: 16 (2021/2022), **27** (2022/2023)

Dropouts:
Home university students 1 (2021/2022)
EuroTeQ students 4 (2021/2022)

Observations: We spend more time on the required preliminaries, in an attempt to reduce dropout. Most studying is to be happening in self-study, with lectures and tutorials focusing only on some smaller areas, or in contrast to do some synthesis.

Mishkin and Matas course: Computer Vision Methods, code: BE4M33MPV

Participation:
Home University students: 70
Euroteq students: 6

Dropouts
Home University students: 21
Euroteq students: 5

Observation: The course is traditionally very hard, and many students underestimate the effort required to finish it. Last year most of EuroTeQ students lacked necessary programming skills to pass the coding assignments.

BLENDED COURSES

Metal Additive Manufacturing: From Theory to Practice

- Statistical data:
  - Time in the course catalogue: 09/22 – 04/23
  - The course was newly developed for the Teaching Seed Fund
- Number of teaching staff involved:
  - Lead initiation, Moodle management and exam management: two lecturers
  - Lectures: one professor
- Number of students
  - Students from TUM: approximately 43
  - Students from other EuroTeQ universities: approximately 50
- Course Format
  - The courses were planned as online courses in a blended format, meaning that students and lecturers met online face to face and had longer phases in between, before and after the meeting where the students studied autonomously on their own, alone or in groups.
- Teaching and Learning Formats
  - During the synchronous session the students were encouraged to listen to the lectures that the professor held. Active participation was required as well as working with other students in groups and alone on exercises, problem solving and case studies. The meetings took place in Zoom and MS Teams.
  - The students had to prepare the synchronous sessions during the asynchronous phases. Those were prepared in Moodle. Reading notes and watching pre-recorded videos/lectures were one part of the assignment. Additionally, they had to work with feedback from the lecturers and their peers. They could take part in formative assessments to test their gained knowledge.
- Innovative aspects
  - The technical background of MAM is considered as the technology of the future in manufacturing, but still neglected in English-taught educational programs. This course will help to keep the students from EuroTeq-universities “abreast with this emerging technology” (cf. https://euroteq.eurotech-universities.eu/wp-content/uploads/sites/2/2022/04/Metal-additive-manufacturing_-from-theory-to-practice.pdf) in a MOOC-format.
- Learnings from the course and course format
  - The feedback from the students was positive. They appreciated the format that allowed a lot of asynchronous work and could therefore be included in individual curricula. But they also liked that a lot of experienced teachers collaborated to make this course happen and that the focus was on taking the theory into practice through case studies.
  - To offer the course again more resources would be necessary because the organisational effort was comparatively high.

InnovationSpace Projects

This course aims toward challenge-based in interdisciplinary student teams, working on open-ended assignments in close interaction with high-tech companies and societal organizations. It combines the design and engineering of a product/service/system and new business development. The course involves no lectures, but studio style group work, self-study and personal and team development. Several out-of-the box pressure-cooker style workshops are given, either online or offline. Students are in the lead of their own learning processes. The course is part of educational innovation in TU/e innovation Space.

The course consists of a large integrative project (10 ects, over one semester, two quartiles) in which in-depth engineering design skills are developed and previously acquired knowledge and expertise are actively shared with students from different backgrounds. A systems approach, observing the complete system rather than a specific component, is stimulated. The students are encouraged to acquire new knowledge and skills by themselves.
The challenges are business and societal challenges that are sufficiently open, complex, and innovative to demand for interdisciplinary collaboration among students. Challenges are offered in collaboration with TU/e innovation Space. Companies, governments, institutes and society as a whole are involved as much as possible.
During the interactive Kickoff workshop, the students meet the challenge-owners and listen to their pitches. Based on their preferences, interdisciplinary teams are formed in close collaboration with the course coordinator and the coach. During the project, students interact with the relevant stakeholders to present them with real life problems and creatively developed solutions. Interaction with business and societal organizations is an important element of this course, next to involving real users.
The project includes defining and refining (i.e., co-evolution of) a problem and ideas for a solution simultaneously and iteratively through analysis, synthesis and reflection processes. Great attention is given on iterative experimentation of ideas through visualization, prototyping and testing until a feasible problem-solution fit emerges. This means students have to go out and talk to experts, potential clients and end user as part of the validation.
Students reflect weekly on their personal and team development. The teams present and discuss their intermediary results and get feedback from peers and the coaches. In coaching sessions, teams get also individual feedback to help students steering and structuring their own development and achievements. There is progress pitching and midterm pitches with peers, coaches, challenge owners and experts.
The final output per team is a pitch in front of a jury and the external stakeholders involved, the developed prototype, a final report, and reflection on the learning objectives.

- Lessons learned:
  - After the first run, we realized that EuroTeQ (or other external) students can only participate either when they are able to come to TU/e for the kick-off, during the midterm and, also, at the end for the final pitches. Or as an alternative that a complete group (5-6 students) only works online. Otherwise, it is not workable.

  - Students are very motivated to participate. They are called ‘junior colleagues’, because they are pushed out of their comfort zone. They must interact with external stakeholders and must find their way with that.

- Statistical data:
  - Staff involved: 1 responsible teacher, 2 teacher/coaches, 1 student assistant, different challenge owners, jury of experts**.**
  - Every semester 35-40 TU/e students start with the InnovationSpace Projects course. No dropouts.
  - 2 EuroTeQ students

- Digital tools used:
  - Canvas (LMS)
  - MSTeams
  - Miro

Transceivers 2

In this course students learn the design of advanced RF transceivers circuits, both schematic and layout. The course covers the subcircuits most often found in modern transceivers, such as low-noise amplifiers, power amplifiers, mixers, oscillators and synthesizers. Other circuits such as frequency dividers, beam formers, phase shifters, switches, filters, matching networks etc. are discussed depending on interest & available time.
The way of working is via the flipped classroom method: students study theory at home via video. Every week they get an individual assignment they work at home. During classes they do design reviews, as is usual in industry. After the first half of the course, they go and work in the lab to connect circuits and also work on the layout of the circuits. So, the most important learning activities are:

- Lectures

- Design review of peers and teachers
- Assignments (individual and as a team)
- Labwork: at home and at TU/e (life or remote)
- Excursion to industry with presentations
- Design review of experts
- Evening sessions for questions for teachers (and peers)
- Oral carrousel exam

- Lessons learned:
  - The teacher experienced that a classic course with lectures, examples and a written exam didn't work. Instead, he made videos of the content of the former lessons that students have to study beforehand. Students get assignments every week and during the classes these assignments are reviewed by teachers and peers.
  - Instead of a written exam, an oral exam (design review) in a carrousel form takes place. Among others, creativity and critical analysis is taken into consideration while assessing.

- Statistical data:
  - Per course 25 home university students participating, no dropouts. 1 EuroTeQ student.
  - 3 teachers involved, one student assistant and some experts from industry.

- Digital tools used:
  - Canvas (LMS)
  - MSTeams (Hybrid Education)
  - Several design- and lab tools

Energy transition - the path towards net zero

Statistical Data:
5 ECTS - 3 weeks
Summer 2021
Summer 2022
2 teachers from DTU, 2 teachers from Tu/e
Summer 2023 – was uncertain due to lack of funding for blended formats from DTU/EuroTeQ. Since interviewing the teacher, Tu/e has managed to secure funding meaning for summer 2023 as well.
12 DTU Students, 13 EuroTeQ Students
Dropout: None

Course Description:
This course is organized by DTU Energy and the Technical University of Eindhoven (TU/e and TUM) within the EuroTeQ framework. The students will have the possibility to interact with their peers from the partner university and world leading experts to accelerate the transition to a sustainable future. The continuous growth in energy demands is putting ever more stress on climate and the environment. In line with the Intergovernmental Panel on Climate Change, we work on the target of net-zero CO2 emissions by 2050. This goal cannot be achieved with the new zero-emission technologies emerging alone, but needs to be accompanied by mitigation strategies from energy saving to carbon capture utilization and storage technologies developed and implemented at an international level. The course is composed of online lectures from world experts in energy technologies and a project in collaboration with students from TU/e and TUM.

Pedagogical Format:
Blended: 12 days online (synchronous), 3 days physical – Group Work – Poster Presentations – Project Based

Digital Tools used:
Zoom – Online Teaching
MS TEAMS – File Sharing

Feedback (from students):

Students are generally happy and satisfied with this course, which is also reflected in the fact that none of them drop out.

Wishes for the future (Teacher):

- Covering travel expenditures for students.
- Different grading scales.
- Funding for TA's, at the moment, a PhD helps with TA'ing, this is done on goodwill, this is not sustainable.