

DEVELOPING INTRODUCTORY COURSES INTEGRATING SUSTAINABILITY FOR PROGRAM PROGRESSION

Chirag Trivedi, Reidar Lyng and Geir Asle Owren

Faculty of Engineering, Norwegian University of Science and Technology (NTNU),
Trondheim, Norway.

OVERVIEW OF THE ROUNDTABLE

During 2019 – 2021, NTNU carried out the Technology Education of the Future (Norwegian abbreviation FTS) project, which delivered a framework for future development of the study portfolio within technology. Recently, the mechanical engineering study program has been updated with new Learning Outcome Descriptions. A particular emphasis was placed on developing new courses that focus on introducing sustainability in context while simultaneously establishing a good foundation for further integration of sustainability issues in advanced courses. A new course was designed for first-year students in mechanical engineering, covering different renewable energy sources, including wind, solar, hydro, battery, biomass, together with an introduction of the concepts of lifecycle analysis and carbon footprints.

The course is structured into: (1) concept and theory, taught in conventional lectures and materials, (2) exercises together with a laboratory tour and a field tour, (3) a student group project (project based learning). The project work allows the students to apply what they have learnt in (1) and (2) to real-life cases with some assumptions.

The course will be offered for the first time in Autumn 2023 in a new study program and we are still making decisions on aspects of course design, such as, e.g., how to make use of formative assessment and assessment formats. What should be considered when designing introductory courses with the ambition to introduce sustainability issues? The central challenge in designing the course and deciding on the contents was to determine “how much content is enough, and what is most important to learn” Sustainability is a very broad topic difficult to cover in one course and students should not be overloaded. The students should learn about fundamental aspects of renewable energy and sustainability and start developing their competence in this area.

We invite you to join in a round table discussion on what to consider when designing introductory courses with the ambition to introduce sustainability issues so that students encounter them as early as possible in the study program. We also desire that the students learn the academic content in a sustainability context to avoid decoupling of academic content and sustainability. We will share our present course design which includes real life scenarios.

KEYWORDS

Course design, Energy, Engineering, Project based learning, Sustainability, Standards: 1, 2, 3, 4, 5, 7, and Optional Standard 1.

ACTIVITIES

- We invite you to join in a round table discussion on **what to consider when designing introductory courses with the ambition to introduce sustainability issues so that students encounter them as early as possible in the study program.**
- We also desire that **the students learn the academic content in a sustainability context to avoid decoupling of the academic content and sustainability.**

The Round Table is organized in one short 10 minute introduction, two 20 minute group discussion sessions, and short summaries in plenum. Suggestions, comments and advice will be collated and distributed to interested participants after the conference.

Timeline:

- 00:00 – 00:10 Introduction of the newly designed course and Learning Outcome. Details, including intended learning outcomes, course design, and relevant references will be available online before the roundtable, and will also be handed out at the start of the Round Table Discussion.
- 00:10 – 00:30 In groups: The integration of sustainability topics into a first-year engineering course on renewable energy. What should be considered?
- 00:30 – 00:35 Short summary
- 00:35 – 00:55 In groups: Suggestions for course design, and how to make good use of a field trip, project based learning and formative assessment.
- 00:55 – 01:00 Short summary and closing remarks.

TARGET AUDIENCE

1. The discussion is focused on an engineering course in the context of sustainability. The specific focus is renewable energy topics such as wind, solar, hydro, battery, etc. Any participant interested in these aspects is welcome to join to the discussion.
2. Any participant involved with first-year university courses is also welcome. Experience with teaching in large classes is relevant in this context.

FOLLOW-UPS

We will distribute a roundtable summary to those who are interested.

REFERENCES

Øien, G. E. D. og Bodsberg, N.R. (2022). A Roadmap for Engineering and Technology Education Reform at the Norwegian University of Technology (NTNU). Presentert på SEFI Annual Conference, September 2022, Barcelona, Spania.

Øien, G. E. D., Bodsberg, N. R. og Lyng, R. (2022). Redesigning Norwegian Engineering Education 1: Benchmarking and Principles for Development. Presentert på The 18th International CDIO Conference, Reykjavik, Island, Juni 2022.

BIOGRAPHICAL INFORMATION

Chirag Trivedi is Associate Professor at the Department of Energy and Process Engineering at Faculty of Engineering, NTNU. His research focuses on hydropower, turbines and Computational Fluid Dynamics. Chirag Trivedi is involved in teaching several courses within mechanical engineering and supervision of master's and PhD students.

Reidar Lyng is Associate Professor of university pedagogics at The Dept.of Physics at NTNU, presently co-chairing the Centre for Science and Engineering Education Development (SEED) at NTNU in Trondheim. He holds an MSc degree in Chemical Engineering and a PhD degree in Physical Chemistry. He has more than 35 years' experience of education development from NTNU and several Swedish universities. His research and development interests are wide ranging and include the systemic interplay between teachers, students, and learning spaces. Reidar is regional co-leader for the EU within CDIO.

Geir Asle Owren PhD is Study Program Director for the portfolio of programmes in the Mechanical Engineering area. His interests include study program design and education.

Corresponding author

Geir Asle Owren
Faculty of Engineering
NTNU, Trondheim.
Norway.
geir.owren@ntnu.no



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