Rethinking Project Types in Engineering Education

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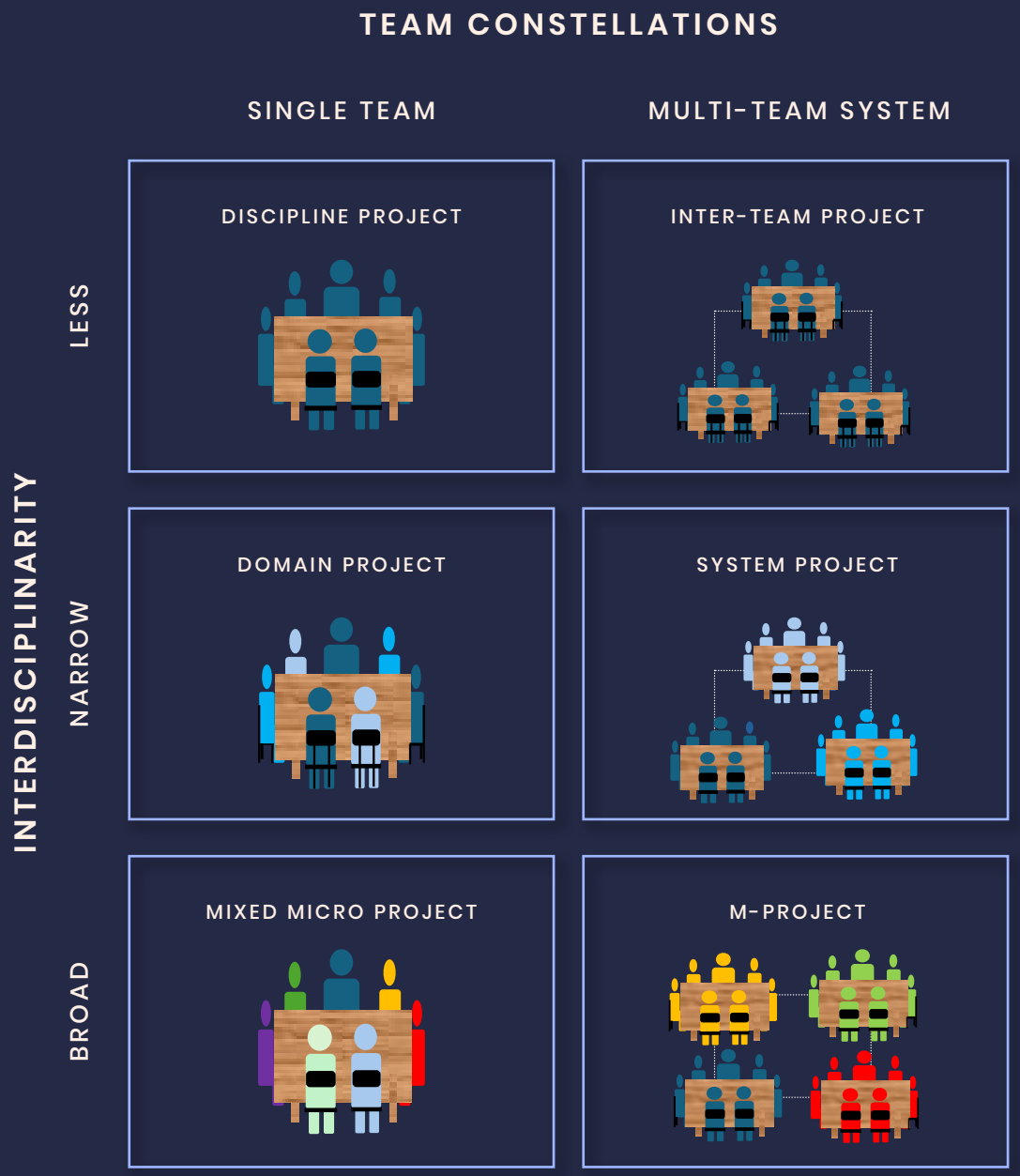

Rethinking Project Types in Engineering Education

As the world faces increasingly complex challenges, engineering education must evolve to prepare students for interdisciplinary collaboration. Researchers at Aalborg University, led by Dr Anette Kolmos, have developed a new framework for categorising different types of student projects, with the goal of fostering the skills needed to tackle real-world problems.

Interdisciplinary Engineering for the Future

In an increasingly interconnected world, engineers are being called upon to develop innovative solutions to complex global challenges like climate change and sustainable development. However, many engineering programmes still focus primarily on discipline-specific technical skills rather than the interdisciplinary collaboration and systems thinking needed to address these multifaceted issues.

To help bridge this gap, researchers at Aalborg University in Denmark have developed a new framework for categorising different types of student projects in engineering education. Their goal is to create a more nuanced understanding of how various project structures can build interdisciplinary competencies and prepare students for the realities of professional engineering work.

Led by Dr Anette Kolmos, Professor of Engineering Education and Problem-Based Learning, the research team conducted an in-depth study of student experiences across several novel project formats implemented at Aalborg University. Based on their findings, they propose six distinct project types that offer a progression from narrowly focused disciplinary work to broad interdisciplinary collaboration.

Building Bridges Between Disciplines

The foundation for the new framework came from Aalborg University's decades of experience with problem- and project-based learning (PBL) in engineering education. Under this model, students spend about half their study time working in teams on semester-long projects, typically within their own discipline.

While this approach has proven effective for developing technical and collaborative skills, Dr Kolmos and her colleagues recognised the need to push students beyond disciplinary boundaries. In 2019, the university launched its first 'Megaprojects' – large-scale interdisciplinary initiatives bringing together students from multiple faculties to work on complex sustainability challenges.

Through extensive interviews and observations, the researchers identified several key challenges students faced in the Megaprojects. These included difficulties aligning different programmes' structures and timelines, transforming disciplinary project skills to an interdisciplinary context, and bridging epistemological differences between fields.

A Spectrum of Collaboration

Based on their findings, Dr Kolmos and her team developed a framework defining six distinct project types. These range from narrowly focused discipline projects to large-scale interdisciplinary initiatives addressing complex societal challenges across multiple faculties. The progression moves from single-discipline focus to increasingly broad interdisciplinary collaboration, while also incorporating varying scales of teamwork from individual project groups to networks of multiple teams.

Dr Kolmos explains that each project type offers unique learning opportunities and challenges. By exposing students to this range of collaborative structures throughout their education, they can be better prepared for the diversity of real-world engineering work.

Putting Theory into Practice

To test and refine their framework, the researchers worked with Aalborg University to study new project formats which form the empirical base of their model. These included 'leadENG' projects bringing together students from different engineering programmes, as well as intensive 'Hackathon' events with interdisciplinary teams tackling industry challenges.

Dr Kolmos and her colleagues conducted in-depth qualitative studies of student experiences in these new formats. Their findings highlighted both the value and the challenges of interdisciplinary collaboration at different scales. Students in the leadENG projects

reported significant benefits from working across engineering disciplines, gaining new perspectives on their own field and developing a better understanding of how different specialities contribute to complex systems.

However, the researchers also found that students often struggled to transfer their project management and collaboration skills from disciplinary to interdisciplinary contexts. This underscored the need for explicit instruction and scaffolding to support interdisciplinary teamwork. Dr Kolmos emphasises that skills developed in disciplinary projects do not automatically translate to interdisciplinary settings, necessitating deliberate cultivation of competencies for working across boundaries.

Real-World Implementation

A key strength of Dr Kolmos and her team's research is its grounding in real-world educational practice. By working closely with university administrators and faculty to implement and study new project formats, they were able to refine their framework based on concrete student experiences.

This action research approach allowed the researchers to not only develop theoretical models but also provide practical guidance for educators looking to enhance interdisciplinary learning. Their findings have already informed curriculum changes at Aalborg University and are drawing interest from engineering programmes worldwide.

Dr Routhe stresses that successfully implementing more interdisciplinary projects requires careful consideration of factors like curriculum alignment, student preparation, and faculty support. The team's research highlights the importance of scaffolding students' progression from disciplinary to interdisciplinary work, rather than expecting them to make the leap in a single step.

As they continue to refine and expand their framework, Dr Kolmos and her colleagues are exploring several promising avenues for future research. One key area of interest is investigating how students can more effectively transform collaborative skills between different project contexts.

Preparing Tomorrow's Engineers

As the global challenges facing society grow increasingly complex, the ability to work across disciplinary boundaries is becoming ever more crucial for engineers. Dr Kolmos and her team's research provides a valuable roadmap for engineering educators looking to cultivate these essential skills in their students.

By offering a nuanced framework for understanding different types of collaborative projects, their work helps bridge the gap between educational theory and practice. As more engineering programmes adopt interdisciplinary approaches, frameworks like this will be essential for guiding curriculum development and preparing students for the realities of modern engineering work.

As the team members continue to refine and expand their work, they are helping to shape a new generation of engineers equipped to tackle the complex, interconnected challenges of the 21st century. By rethinking project types and collaborative structures, they are laying the groundwork for an engineering education that truly prepares students for the interdisciplinary nature of real-world problem-solving.

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Dr Anette Kolmos is a Professor in Engineering Education and PBL at Aalborg University, Denmark. She was the Founding Director of the UNESCO Centre for Problem Based Learning in Engineering Science and Sustainability, and has extensive research experience in engineering education, amassing over 350 publications to date.

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FURTHER READING

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