ITS21 2021
interdisciplinary teamwork skills
for sustainability

DTU

Nordplus

Proceeding for ITS21 Interdisciplinary Teamwork Skills conference

23 & 24 June 2021

ITS21

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Welcome to the conference

This year's theme for the conference is "Interdisciplinary teamwork skills for sustainability".

Sustainable development through education

Sustainable development is one of the most important challenges today, and tomorrow's social challenges are to a large extent that the development of society must be sustainable.

This requires a lot from educational institutions, as they continuously should be able to acquire new knowledge. In order to succeed, they should also be able to offer interdisciplinary collaboration settings that support the use of knowledge from different disciplines. This requires both depth and breadth. We see young people leading the way as sustainable change makers, but - how can we as educators support and educate change makers?

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Program for the conference - Day 1

09.30-10.00 Welcome to the conference by Hanne Løje,
Associate Professor at DTU Engineering Technology

Welcome to DTU by Malene Kirstine Holst,
Director at DTU Engineering Technology

10.00-11.00 **Keynote 1.** Katherine Richardson, KU:
"Bringing systems thinking to education"

11.00-11.15 Break

11.15-13.15 Parallel sessions - Value Creation or Interdisciplinary:

Track 1: Value creation (15 min. presentation + 5 min. questions)

"Exploring reflecting reports in entrepreneurial learning and value creation – facilitated byeducators"
Bragelien, J.J., Voldsund, K.H. & Eggen, M.,
Western Norway University of AppliedSciences
Abstract 13

"Enhancing working life relevance for engineering students – through teamwork, creative problem-solving, technical prototyping and real-life projects"
Pettersen, I. B., Høvig, Ø. S., Mjånes, J. O. R., Sande, J., Haugland, A. I.,
Western Norway University of Applied Sciences
Abstract 14

"Value creation across disciplines, traditions and culture"
Hyldegaard, J. (KU) & Johansen, S. SDU
Abstract 15

"On the role of the university: The Emergence of entrepreneurship and innovationteaching at Danish universities"
Johansen, S. (SDU) & Hyldegaard, J. KU

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Abstract 16

Track 2: Interdisciplinary (15 min. presentation + 5 min. questions)

"Institutional barriers for implementing interdisciplinary education"
Löwegren, M., Lunds University
Abstract 18

"The future of sustainability in higher education: Learnings from an interdisciplinary summer school in Vietnam"
Kornum, T. M., Cuong, D. C., & Manh, C. BAAA
Abstract 04

"A guided team-building process in a virtual project-based learning scenario"
Bücking, L., University of Hannover
Abstract 06

"Project-based learning and teamwork in an online environment – challenges and possibilities"
Buø, R., Espenes, T. C., & Sjølie, E. NTNU
Abstract 10

"Virtual teamwork and learning of teamwork skills in higher education"
Holen, A. & Sortland, B. NTNU
Abstract 17

13.15-14.00 Break

14.00-15.00 **Keynote 2.** Martin Lackeus, Chalmers:
"Value creation pedagogy"

15.00-15.10 Break

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15.10–16.40 Workshops (90 min):

Workshop 1:

"Creating value with and for students and companies in course collaboration"
Grex, S., Keiding, V. & Løje, H., Technical University of Denmark
Abstract 19

Or

Workshop2:

"Online team building for interdisciplinary project teams"
Carstens, P. & Bücking, L., University of Hannover
Abstract 07

16.40 Thank you day 1 by Hanne Løje

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Program for the conference - Day 2

09.00-09.15 Welcome back and reflections about the first day by Hanne Løje

09.15-10.15 **Keynote 3.** Kristoffer Ravnbøl, Naboskab:
"Nordic Youth as Sustainable Changemakers"

10.15-10.30 Break

10.30-11.30 Parallel sessions - sustainable and interdisciplinary:

Track 1: Sustainable (15 min. presentation + 5 min. questions)

"Entrepreneurial methods to support sustainable innovation"
Verhulst, E. & Brandshaug, S. W. NTNU
Abstract 11

"Interprofessional workplace learning to improve sustainability"
Johannesen, A., Brenna, S. J., Agdesteen, G., Gundersen, E. C., Kleppe, L. M.,Jakobsen, R., Kjome., S. & Bærheim, A., University of Bergen
Abstract 12

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10.30-11.30: Parallel sessions – sustainable and interdisciplinary:

Track 2: Interdisciplinary (15 min. presentation + 5 min. questions)

"Wrestling with change: how interdisciplinary teams shape consultants in the financial sector"
Nielsen, J. K., Iversen, K. Aa., & Haahr, U.,
BAAAAbstract 02

"Four-dimensional education - what should tomorrow's teachers focus on?"
Olsen, S. Ø. & Olsen, M. R. BAAA
Abstract 01

"Facilitation isn't that easy – is there an easier way for the future?
Veine, S. NTNU
Abstract 09

11.30-11.45: Break

11.45-12.30: **Keynote 4.** Are Holen & Bjørn Sortland, NTNU:
"The Use of Work-related SocialDimensions in Teamwork"

12.30-13.00: Linda Weiss, DTU Skylab "CATALY(C)ST – "Nordic Project mixing community led co-creation with classic applied research approaches"

13.00-13.30: Final sum up and good-bye

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Keynote speakers

Bringing systems thinking to education

The reductionist approach introduced to science and education by Newton has dominated the organization of our research and educational systems. We are, however, beginning to realise that the knowledge generated within single disciplines is not adequate for solving the complex challenges faced by society today. Solutions to these challenges require making compromises where synergies are exploited at the same time trade-offs are minimized. To make such compromises, we need to understand the interactions between different disciplines and challenges. This talk examines the types of research and education needed to address the challenges of today.

Katherine Richardson
Professor in Biological Oceanography, Section for Biodiversity, Globe Institute, Faculty of Health and Medical Sciences and Leader, University of Copenhagen's Sustainability Science Centre

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Value creation pedagogy

Martin will talk about his research on value creation pedagogy, defined as when students get to learn through creating something of value for others. This makes students highly motivated by feelings of meaningfulness, thus learning more in-depth and taking more responsibility for their own learning. Martin will also talk about his work-learn balance theory, i.e. when people have a good balance between learning and value creation for others more in general. It can be for students, and it can be for employees.

Martin Lackeus
DrEng., Technology Management and Economics, researcher in entrepreneurial education at the division of Entrepreneurship and Strategy at Chalmers University of Technology in Sweden, teacher at Chalmers School of Entrepreneurship.

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Nordic Youth as Sustainable Changemakers

This presentation dives into the role of youth as changemakers in the climate movement in the Nordics. For the youth today, climate change is both a massive concern and a motivational driver for change. But what are the youth concerned about? And how do they see themselves contributing through education, work, entrepreneurship or protest? Based on an anthropological study of Nordic youth, this presentation will provide insights into what climate means to Nordic youths and their concerns, motivations, and actions in regard to more sustainable consumption and living. A better understanding of the youth can help teachers and educators in how to better support, encourage, inspire, and engage the students of today and tomorrow in their desire to make the world better and greener.

Kristoffer Ravnbøl
Anthropologist and CEO of Naboskab

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The Use of Work-related Social Dimensions in Teamwork

NTNU
Norwegian University of Science and Technology

Interdisciplinary student collaboration paired with experiential learning seem to improve productivity of groups when combined with reflection, peer feedback and facilitation. Via an inventory, our research has identified four basic interactive dimensions of teamwork behaviors: Management, Social coherence, Groupwork commitment, and Attitudes toward evaluations. By completing this inventory, called the Teamwork Indicator (TWI); it estimates central aspects of the current group functioning. Subsequently, if the group scoring on the TWI is used adequately for discussions of typical interactive patterns within the group, improvements of behavior on the individual and group level has frequently been seen. The inventory has been used on student teams in both Norwegian and English language, and the psychometric properties are good in all tested environments. Adequate use of the inventory can improve the quality of group interaction towards a more sustainable output. Research also indicates that between-student feedback is more effective than teacher-student feedback. The presentation will shed light on the four dimensions, and how to use the TWI inventory to stimulate reflecting and feedback-oriented parts of teamwork toward enhanced, more sustainable group.

Are Holen and Bjørn Sortland, NTNU

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Conference tracks

Oral presentations

01 "Four-dimensional education - what should tomorrow's teachers focus on? How to teach character qualities?

Susanne Østergaard Olsen and Mette Risgaard Olsen, Aarhus Business Academy, 2021.

In Denmark, many curricula at institutions of further education include concepts such as personal development, personal competencies, character qualities and action competencies. The concepts are set up as a prerequisite to preparing students for a precarious, volatile and complex labour market, where knowledge quickly becomes obsolete, and where the personal competencies and character qualities become crucial. The question is: Can—or indeed should—character qualities be taught in further education? If so, how can a business academy approach character quality as a subject? And how can the outcome, if any, be measured?

What follows is a brief insight into the experience of implementing a specific teaching course in personal competencies and character qualities at Business Academy Aarhus—along with the preliminary results and recommendations from 3 years of experience.

The teaching in character qualities was based on Fadel's model, "Four-Dimensional Education: The competencies learners need to succeed in the 21st century" (Fadel, Bialik & Trilling, 2017). The four dimensions of the model are: knowledge, skills, character qualities and meta-learning. Business Academy Aarhus prioritises the development of students' personal competencies, but with no specific course to that effect, it was relevant to develop a course based on the six specific character qualities: Mindfulness, Curiosity, Courage, Resilience, Ethics and Leadership.

The course in character qualities was a blended learning course, each session being based on the students' individual preparation through online materials available in Canvas (LMS, Erhvervsakademi Aarhus). The material consisted of texts, video material, such as films and music related to the six character qualities as well as a series of exercises where the student had to relate to and reflect on each of the six character qualities - including how each character quality could be implemented in the

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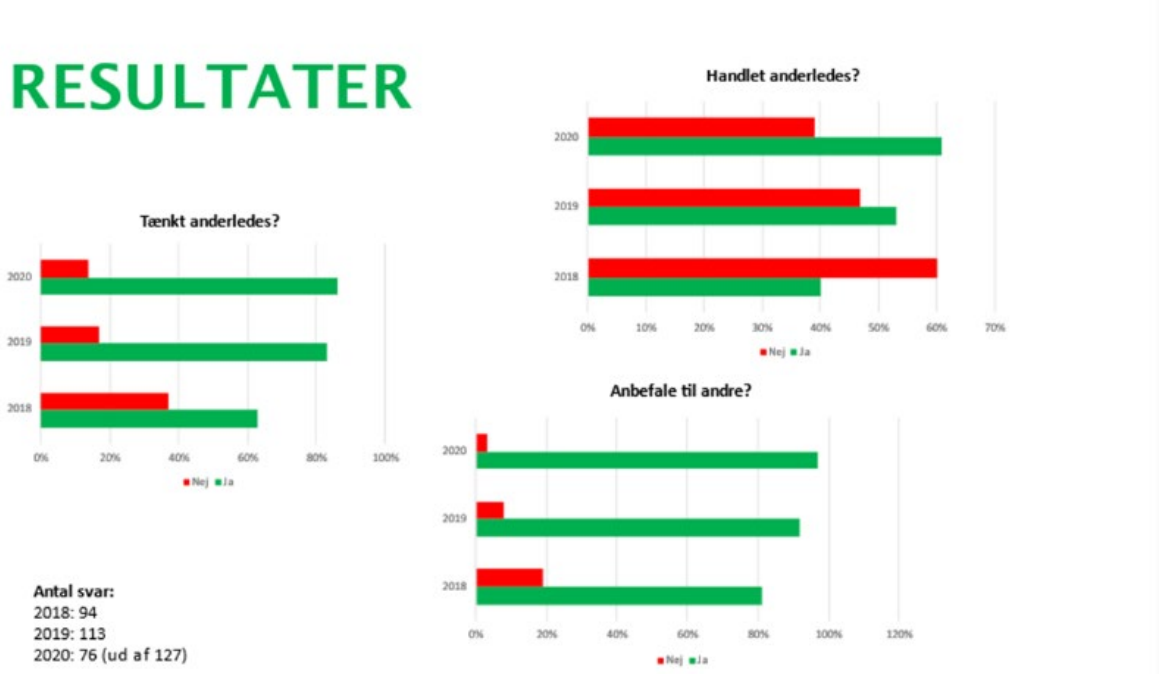
student's everyday life and in their future profession. Physical exercises, such as walk'n'talk, speed dating, winter bathing, meditation, church visits, etc. were also included.

Before, during and after the course, it was discussed how to measure and evaluate the outcome. The decision fell on a qualitative evaluation with the students' written reflections after each session and a final evaluation with five questions, the most important of which were whether the course had made the student think and act differently, and whether the student would recommend the course.

The results of the evaluation appear below.



The results show that it is possible and relevant to work with the students' character qualities at an institution of further education. A number of elements can still be discussed, e.g. adjustments to the course, integration of character qualities in all semesters and programmes, measurement of outcome, etc. It is very important to emphasise that the purpose of the course was to give the student insight into the character qualities, personally and professionally, and to encourage and develop the student ability to reflect on their own character qualities. This goal has been achieved. It should be pointed out that the goal was not that the individual student should "move" or develop on a scale from 1 to 10

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while working with character qualities or during the semester—for instance that on the Courage scale, the student started out with 3 and ended with 10. Overall, the conclusion is that the course can strengthen the students' prerequisites to succeeding in the 21st century labour market.

02 Wrestling with change: how interdisciplinary teams shape consultants in the financial sector

Jesper Klintrup Nielsen, Associate Professor, Competence Centre for Management & HR, jkni@eaaa.dk

Karen Aarup Iversen, Associate Professor, Competence Centre for Finance and Economics, kai@eaaa.dk

Ulla Haahr, Project Manager, Department of Research and Innovation, ulha@eaaa.dk

This abstract provides examples of industries and business segments with a demand for graduates with interdisciplinary team competencies. This also includes the financial sector, a sector which has seen major transformations, and which is now actively seeking employees with new competencies for new job functions.

Keywords: #value creation #innovation # interdisciplinarity #sme #sustainability #financial education

'Experts in teams' (EIT) – an interdisciplinary innovation course – has been offered at Business Academy Aarhus (EAAA) since 2013. The course was based on a similar subject, "Experts in teamwork" at NTNU in Trondheim, Norway. EIT is today a 5-ECTS course with students from different fields of study working together in interdisciplinary teams of 4-6.

Since 2013, a focal point has been the involvement of small and medium-sized enterprises which contribute with presentations, real-life cases and participation on expert panels on sustainability and innovation. Through this mutual collaboration, students train their ability to develop innovative solutions based on interdisciplinary teamwork. The subject also provides companies with new input and an opportunity to recruit future interns or employees.

In recent years, the framework has been sustainability and the triple bottom line, and other business segments have shown an interest and have become involved, among them microcompanies as well as entrepreneurial companies and Aarhus Municipality.

2020 saw an unexpected development: 12 of the 32 EIT students were students from the Bachelor's Degree Programme in Financial Management and Services (FIBA). The students in this 3.5-year

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programme will work with complex advisory, sales and consultancy services within banking, mortgage credit, insurance, real estate, real estate administration, auditing and financial management, among others.

The degree programme in Financial Management and Services is a relatively broad programme with a focus on more hard-core financial subjects as well as soft-core subjects such as strategy, organisation and management. It makes perfectly good sense for the students to choose EIT where innovation as well as teamwork competencies come into play. In particular, the practical training of collaboration processes, which involves evaluation and reflection on the process, is very valuable to the students. They gain a better understanding of not only their own role but also that of others in project work – an understanding they will benefit from in their future careers.

The programme has been developed in close collaboration with the financial sector, which has had a great influence on both structure and content. At sector meetings between educational institutions and industry, the finance sector has in recent years expressed a clear demand for consultants with new competencies. The advisory function has changed in recent years. Previously, a bank adviser would work with his own client portfolio and take on a general role. In many banks today, it is often a team that collaborate on the client portfolio, in which case the individual employee becomes more specialised. This way of working requires good collaboration skills. EIT helps to build a bridge between the specialists, so that they ensure the best possible client advice and thus value creation for the financial company.

There is good reason to support the financial sector's demand for interdisciplinary team competencies in connection with the transformation of the sector. This example seems to suggest that even a large principal sector can see opportunities in interdisciplinary collaboration competencies as a foundation for the advisory function and as a means to creating value and business development. At Business Academy Aarhus, the development of these competencies will continue to be based on the tried and well-known EIT subject with its structure, learning objectives and collaboration with companies.

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03 Sustainability as driver for interdisciplinary teaching

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Line Schmeltz Dam, PhD., MA.
Senior Associate Professor of Strategic Communication
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Introduction

Talking about sustainability has become inevitable. The current pandemic and the climate crisis further ad to this development, and our students are often at the forefront when it comes to calling for a more sustainable way of living - and so, more focus on sustainability as part of their professional training and education is required.

For some years now, Corporate Social Responsibility, sustainability, green business models, purpose etc. have been part of the curriculum in many diverse educational settings – from universities to business schools and university colleges, and in different programmes from marketing to management, agriculture and innovation. But quite often, sustainability has been treated as a separate, stand-alone topic. This is, however, changing, as sustainability is becoming both more important and also more complex. We still see an array of new courses specifically on sustainability emerging, but we also see the opposite, namely that sustainability is being infused as an underlying reference point across courses and topics. The latter seems crucial if we want our courses and teaching to reflect the demands and complexity of a sustainable future, as sustainability does not pertain solely to one isolated part of a business or organization. On the contrary, sustainability often, and in its most excellent form, is cross-departmental, interdisciplinary and involves many actors both inside and outside of the organization.

The study

The proposition of approaching sustainability as a complex, cross-sectional concept is based on a study on how Danish companies approach and communicate sustainability. In the study, we interviewed

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communication professionals in charge of communicating their companies' CSR engagement. Subsequently, it could be expected that their area of responsibility and practice would relate to communication only, but the findings illustrate a completely different picture: As soon as the companies start engaging themselves in a change towards more sustainability, the tasks of the communication professionals become much more complex and also intertwined with operations and activities across the entire company.

Thus, all participants and organizations that we have interviewed confirm the same finding: that sustainability involves a range of actors across the organization. And even though sustainability has been formally placed in one department or with one single person, working with sustainability inevitably leads to involving more people and departments. In consequence, this entails that organizations and professionals can look and work across silos, departments, and professional areas within the company.

In sum, we argue that sustainability needs to be approached as a complex, cross-functional and thus collaborative area of practice – and, conversely, that sustainability drives interdisciplinarity when we look at how it is evolving in the professional world around us. Hence, we need to treat sustainability the same way when we build educational programmes, plan courses and teaching: rather than placing sustainability in one devoted area or programme, sustainability should be viewed and taught across disciplines and can thus also function as the catalyst for cross-disciplinary teaching.

04 The Future of Sustainability in Higher Education: Learnings from an Interdisciplinary Summer School in Vietnam

Senior lecturer Tilde M. Kornum, Business Academy Aarhus, Denmark, Mr. Doan Chi Cuong, Da Nang University, Vietnam, and Dr. Chu Manh Trinh Cham Islands MPA.

This oral presentation introduces an alternative approach to educate change makers in the 21st century. Leveraging our learnings from an inter-institutional, cross-cultural, and interdisciplinary summer school on *"Sustainable Environmental Management"* in Vietnam, we aim to foster an enriching discussion and seek to inspire the future educator to rethink her approach to sustainability in higher education.
To achieve this, we introduce three key topics from our experiences: first, designing inter-institutional, cross-cultural, and interdisciplinary learning environments. Secondly, ensuring sustainable value

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creation in educational settings. Lastly, equipping future educators, institutions, and politicians with the mindset required for a true step change.

Designing inter-institutional, cross-cultural, and interdisciplinary learning environments

Our objective was to educate students on how to leverage interdisciplinary and cross-cultural synergies while solving real environmental challenges faced by a local Vietnamese community.
The first step to fostering collaborative environments starts with the educators themselves. To this end, as a joint program between Da Nang University, Cham Islands MPA, and Business Academy Aarhus, the summer school was by construct inter-institutional.
To unlock cross-cultural synergies, we had students from 6 countries (Denmark, Vietnam, Czech Republic, Slovakia, Poland, and Hungary). Furthermore, the student mix guaranteed potential for interdisciplinary synergies with students from marketing, chemical and biotechnical science, biology, and environmental & agricultural technology.

Ensuring sustainable value creation in educational settings

To achieve real impact, students were tasked with identifying sustainable solutions ready for implementation by either the locals or a Vietnamese NGO. In moving from 'classroom education' to 'impact-driven education', we experienced significant changes for both students and educators alike: The students, having signed up for a specific environmental challenge, cared deeply about the outcome. Not only did this ensure real value creation for our projects, we believe this approach inspires students to become change makers when they progress beyond education.
As educators, our role changed from specialists (lecturing) to 'process consultants' (supporting) as we facilitated interdisciplinary problem-solving. Instead of lecturing theories, we described environmental challenges. Instead of arbitrary student groups, we emphasized heterogeneity through diverse nationalities, genders, ages, and educational backgrounds.
However, as educators strive for an impact-driven future we should not ignore granular challenges often faced in interdisciplinary and cross-cultural contexts. To name but a few – and hopefully inspire others to proactively address this topic – were disagreements on field research & teambuilding, time differences, poor internet connections, and 'family group sizes'.

Equipping future educators, institutions, and politicians with the mindset required for a true step change

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To help students develop interdisciplinary teamwork skills, we claim educators themselves need to be experienced interdisciplinary team workers and genuinely interested in different disciplines. Furthermore, today's educators are often required to combine this with an understanding of, and interest in, different cultures and languages – particularly relevant for the teaching of sustainability. However, preparing the educators is not enough. To truly effect change, we need educational institutions and the political system to support more collaboration; not only between institutions but also across disciplines.

06 A guided team-building process in a virtual project-based learning scenario

M.Sc. Linda Bücking, Institute of Mechanics and Computational Mechanics, Leibniz University, Hannover

Introduction

Today's world's grand challenges cannot be solved by one engineer alone. Interdisciplinary dependencies, global issues such as climate change, and the digitalization of the field require engineers to work across disciplines and cultures. Thus, conveying competences that range beyond subject-matter knowledge is becoming a crucial aspect of engineering education that influences the graduates' future employability, success and their impact as change-makers.
However, course structures at German universities rarely target the development of relevant self, social or methodological competences. Commonly, students enter the job market with little prior experience in working in teams outside of their peer groups. Hence, the course "Computational Mechanics" at Leibniz University aims at sustainably strengthening those skills through a guided project-based learning process. This experience report gives an overview over the implemented methods, tools and the results.

Approach

The guided teambuilding process comprised four interactive sessions - namely Kickoff, Team Update, Intermediate Presentation and Adjourning - which were embedded in a civil engineering project assignment. The project was conducted fully online. During these sessions, the students learned to use methods and tools for effectively working in heterogeneous teams, considering various stages of group development [1]. The session design followed the Experiential Learning approach [2] and empowered the students to later apply their learnings to other educational or professional contexts.

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Each team consisted of different "experts" and was formed using personal profiles in which the students indicated their skills and interests. During the Kickoff session, each newly-formed team became acquainted by discussing guiding questions and making individual agreements for the future collaboration. The Team Update and the Intermediate Presentation aimed at solving possible conflicts and improving the teams' performance: First, the students assessed and conceptualized their teams' dynamics, using the Tuckman model [1]. They identified measures for improving their collaboration which enabled them to take ownership of the process. Later, they presented their current results and challenges to each other which presented an opportunity for peer learning and to receive formative feedback from the teachers. Before and after the project, the students self-assessed their current mastery of a set of competences that was considered to enhance their success in the project. The students further practiced to give and receive feedback on their social competences during the Adjourning session.

Findings

The developed framework supports team building in heterogeneous groups in project-based learning environments, while enhancing the students' self-efficacy and self-awareness. The process consists of structured discussions, feedback loops and self-reflection assignments. Even though many students felt a strong aversion towards working with peers they did not previously know, they reported feeling more comfortable over time and achieved good overall results. The conducted survey indicates that the students mainly improved their writing and presentation skills as well as their ability to communicate their thoughts and feelings within the group project. The competence-based framework enriches group work in online and offline environments and can be adapted to a broad range of disciplines.

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07 Online team building for interdisciplinary project teams (workshop)

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It is impossible to work with people we do not know. However, the current pandemic and the increasing globalization require teams to work remotely or in distributed settings. The resulting lack of interaction often threatens the successful collaboration and lowers the quality of the results. This applies especially to highly heterogeneous teams, such as interdisciplinary teams. Building trust and connection - which is typically achieved by interacting face to face - is a prerequisite for performance and the team members' well-being. Thus, this workshop explores how university teachers and team leaders can influence group dynamics of virtual student or professional project teams.

After the workshop, the participants will be able to describe the Tuckman model [1] of team stages and apply it to the teams they are working with. Based on this, they will be able to shape team-building processes in the virtual space and choose suitable online tools according to their teams' needs. The participants will conceptualize their learning outcomes by the end of the workshop and define individual next steps.

The learning goals will be achieved in an engaging and interactive way: After an icebreaker and receiving a short input on the model, the participants will reflect on their own experience and develop solutions through group work. The facilitators will provide guiding questions and a frame for the expected outcomes of the group work which will enable the participants to identify their role and suitable online tools for each stage. In a second step, the participants will share the developed solutions and ideas with the other groups. Further, the workshop will include opportunities for extensive exchange and discussions. In case the ITS21 is held online, the facilitators will use interactive online tools to lead the participants through the workshop. After the workshop, the participants will receive a handout including information on relevant theory as well as the findings of the group work.

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09 Facilitation isn't that easy - is there an easier way for the future?

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For 20 years, we have used facilitation as one of the most important pedagogical methods to create interdisciplinary collaborative competence among students in Experts in Teamwork (EiT) in Trondheim (Helgesen et al., 2009; Sortland, 2015; Thaulow, 2003; Veine et al., 2019). Facilitation means making things easier (Wardale, 2013), but it is not that easy to do. Learning assistants in EiT claim that facilitation is not an easy concept to understand (from an unpublished survey conducted in 2019) and they are the ones who are supposed to practice it. Facilitation creates resistance among students (from the same unpublished survey) and they are the ones who are supposed to learn from it. What is facilitation? Why do we still use it? In this presentation, I will look at the roots of the facilitating practice we use in EiT in Trondheim. Based on a survey, I will present how students experience this rather unusual concept, and I will discuss the benefits and limitations of this long standing practice in EiT and ask the question: Is there an easier way to create interdisciplinary collaboration skills in students for the future?

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10 Project based learning and teamwork in an online environment -challenges and possibilities

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Project-based learning (PjBL), where students work in teams on real-world problems, is increasingly applied in higher education. The intention is to prepare students for future work life by using pedagogical approaches that more closely replicate work. One of the expected learning outcomes is that the students learn how to collaborate and function as a team. The preferred mode for PjBL has so far been face-to-face mode. However, the covid-19 pandemic has triggered an acceleration in the development and use of online collaboration, in work life and education. There is reason to assume that the use of online collaboration in higher education will increase compared to "pre-Covid-19". Although PjBL in online settings is becoming increasingly common, research has only to a limited extent addressed this kind of student collaboration. Research has mainly focused on how teachers can structure, design, and facilitate collaboration to enable social interaction and improve learning, or on evaluation and development of digital platforms and tools (such as Blackboard, ItsLearning or social media platforms).

Little attention has been given to how student teams *self-organize*, i.e. how they structure and manage their work to function adequately as a team in virtual settings, and also to how student teams may flexibly use a variety of online communication tools to support their different needs.
This study explores university students' experiences with teamwork within a PjBL course before and after the universities were closed down due to the covid-19 pandemic. It aims to answer the following research questions: 1) How did the students experience the new situation? and 2) To what extent and how did their collaboration change in the online environment? The study was conducted in an interdisciplinary project course for graduate students at the Norwegian University of Science and Technology (NTNU). 1800 students worked face-to-face in self-managed teams of 5-6 students when the Covid-19 pandemic caused the sudden move to digital platforms. Data include open-ended survey questions (N=1611), individual interviews (N=15) and 21 exam reports with group process reflections.

Data analysis revealed two main findings: 1) less social interaction and team cohesion, 2) less direct collaboration. When reflecting on what caused these changes, the students described difficulties during and between virtual meetings. In meetings, loss of body language and physical proximity and

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technical issues posed considerable communication challenges, which led to more structured meetings. One the one hand, the meetings became more effective, on the other hand the interaction became less dynamic and almost exclusively focused on the task. Between meetings, when working independently on tasks, students experienced a higher threshold to contact each other and were more often left alone to resolve issues. Due to these challenges, many groups split the task into sub-tasks and worked on individual tasks, making group members less interdependent. However, we also found examples of groups who met these challenges by creatively using a variety of online tools and platforms.
In this presentation, we will present the findings and discuss implications for teaching and learning in project-based courses after Covid-19.

11 Entrepreneurial methods to support sustainable innovation

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Abstract
Entrepreneurship education is often looked at as shaping future leaders of new businesses. However, it can also be understood in a broader sense (Lakéus, 2015), where students develop entrepreneurial skills and a mindset to become change agents. Nowadays, the number of sustainable challenges is still growing, whereby higher education has an important role in preparing students to be able to work with such complex problems (Zhou et al., 2020). Entrepreneurial methods are thereby mentioned to support the development of the needed skillset (Filser et al., 2019).

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In our presentation, we want to share experiences from using entrepreneurial methods in the master course *Experts in teamwork: sustainable innovation in industry cluster ACT* at NTNU. We do this with the following question in mind: How can entrepreneurial methods support student teams to work with sustainable innovation? In order to do this, we use the educational framework developed by the Centre for excellence in education Engage (Medbø, 2019). Engage seeks to "*Develop higher education to increase the number of students in Norway and around the world with entrepreneurial skills and mindset to become change agents and innovate for the better*" (Engage, 2017). The framework supports this aim by offering educational approaches that contribute to the development of these entrepreneurial skills and mindset.

Based on the five main elements of the framework, we will present which entrepreneurial methods we applied and how, in order to encourage and support interdisciplinary student teams to *act, interact, challenge, embrace* and *reflect* on the project they worked on over a period of three weeks.
• *Act – Engage by doing* through using creative processes on projects in iterative cycles: researching, developing, testing, receiving feedback and learning.
• *Interact – Engage with others* through working in interdisciplinary teams and in close dialogue with industry and researchers.
• *Challenge – Engage with the world outside the university* through cooperation with external partners providing real-world challenges and proposing solutions that add value to different stakeholders.
• *Embrace – Engage with and handle uncertainty* by normalizing chaos in the early phases of the innovation process.
• *Reflect – Engage with internalizing knowledge and skills* through regular personal and group reflections.

Besides sharing our experiences and reflections, we invite the public to share experiences and ideas on how different methods, from entrepreneurial and other educational strands can support students to work with sustainable innovations.

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12 Interprofessional workplace learning to improve sustainability

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ABSTRACT

The United Nations sustainable development goals (SDGs) aim to create a better and more sustainable world by 2030. Each of the SDGs are multifaceted and require interprofessional (IP) resources to be resolved in a satisfactory manner.

At the Centre for interprofessional workplace learning (TVEPS) in Bergen, Norway, we offer IP learning for students from 17 different health and social welfare professions. Towards the end of 2020, we used the TVEPS IP model to focus on SDGs by launching a pilot project in collaboration with a local municipal medical centre.

In the TVEPS IP model, interprofessional groups with 4-5 students normally meet with two patients/clients, mostly within primary care. The practice placement lasts for one day. Through an in-depth conversation the students disentangle the patients' strengths and challenges and develop tailored care plans to help improve the patients' everyday lives. One week later the student group meets with the workplace personnel and a facilitator from TVEPS for a dialogue about the careplans.

In 2020, Øygarden medical centre requested help from TVEPS to improve SDG fulfillment. In November, we sent an interprofessional group of students to disentangle strengths and weaknesses not of an individual patient, but of the centre itself with regards to SDGs. The group consisted of four environment-conscious students from the fields of medicine, nutrition, economy and administration, and radiography.

Due to Covid-19 restrictions, the students could not physically visit the medical centre, but head of the centre gave the students a digital tour and answered extensive questions in a Teams meeting. Based on the information gathered, the students then disentangled SDG strengths and weaknesses at the centre, and tailored an SDG careplan.

Suggestions for fulfilling the SDGs ranged from small everyday details like free penholders for all employees so that they would not smear their uniforms with ink and contribute to unnecessary amounts of uniforms purchased pr year - to larger-scale changes like employing a full-time sustainability coordinator and covering the building with solar panels for renewable energy.

The TVEPS IP model was easy to modify from a patient perspective to a sustainability perspective, and the project had great potential benefits for all involved: students learned interprofessional

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collaboration and learned about sustainability, while the workplace arena was aided towards improved sustainability and a better future. Numerous workplace arenas could benefit from this type of IP workplace learning, and we recommend it to be expanded beyond the current pilot format.

13 Exploring reflecting reports in entrepreneurial learning and value creation – Facilitated by educators

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Introduction: Experiential learning is essential in entrepreneurship education at university level, with more guidance and less traditional lecturing. In entrepreneurship education a newer educational approach has been emerging for a while, with a focus towards learning-by-doing and problem-based learning for example in the real world outside campus (Pittaway & Cope, 2007). The educator is having more of a facilitator role. In this context, reflection, and critical reflection throughout writing a reflection report is regarded as a valuable entrepreneurial learning process (Moon, 2004; Pittaway & Edwards, 2012). In this paper, a connection between entrepreneurial learning and the act of reflective thinking has been strengthened. We explore how reflection reports can be structured and developed in two internship courses.

Questions we care about: Universities can contribute to solve challenges together with companies and organizations. The objective of this paper is related to critical reflections throughout writing a reflection report. The questions we care about is how reflection reports can be organized to strengthen the students' entrepreneurial learning. We explore, by describing from practice, how reflection reports can be structured and used in an internship course where entrepreneurial learning and value creation can take place. In the next sections, we describe the empirical context, methods, and preliminary results.

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Empirical context: The empirical context of this study is two courses held during the second semester of the master's programmes "Innovation and entrepreneurship" and "Innovation and management" at the Western Norway University College of Applied Sciences (HVL) in Norway. The essence of the courses is a ten-week internship in which students work as interns in regional start-ups or in established businesses in the private or public sector. During the internship, the student will interact closely with the interdisciplinary team. Through learning-by-doing the students are to perform or participate in innovation processes and entrepreneurial tasks within the organization and as such develop entrepreneurial competences and skills. The course is organized in close collaboration with regional clusters and the entrepreneurial ecosystem. In parallel with the internships, it is mandatory to participate in weekly afternoon seminars with guest lecturers from the industry and/or the innovation ecosystem. During these seminars, the students reflect on industry-specific innovation strategies and collaboration compared to their own internship experiences. Critical reflection and reflective writing represent important entrepreneurial learning methods. This is emphasized with two compulsory reflection seminars, mentoring and supervision of the candidates. Additionally, 40% of the total character is based on the submission of a written reflection report on students own entrepreneurial learning. 60% of the total character is based on an oral exam. The act of reflection and doing reflective writing is a well-known and proven assessment and learning method used in a variety of courses and educational programmes in which experiential learning (EL) makes out essential parts (e.g. nursing and teaching). Reflection is an integral part of EL as proposed through Kolb's learning cycle (Kolb, 1984). A common feature of such courses is that they represent disciplines in which knowledge often comes in a tacit form and is best learned through the act of practical engagement (L. McGuire et al, 2009). The internship/practical courses at HVL were developed as "copies" of the national programme "Gründerskolen" in which reflective thinking and the act of doing critical reflection constitute a central part.

Methods: The study uses an explorative research approach. The data originates from diverse sources such as professor's experiences from developing the courses, reflection reports and interviews/focus group meeting with some of the companies. The reports are analyzed on a quantitative level and no need for students consent. Companies (will be asked) consented to the use of the data-material about value creation in anonymized form.

Results: Reflection reports from the internship courses fall 2019 – 2021 have been analyzed, and we find several indications that the students' entrepreneurial learning has been strengthened. We find

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that value creation is related to both students entrepreneurial learning and task execution during the internship, for example better self-confidence contributing to ask the right questions and/or build in the right answers in innovation projects.

Conclusion: In this paper we have discussed and highlighted important factors for how universities can structure and facilitate active learning. Reflection reports combined with internship and working with real-world cases can make the students more self-confident, motivated and employable. This paper (in progress) proposes five key outputs presented in Table 1.

Key output; (1) Graded reflection reports versus passed/no-passed leads to more thorough student working and better reports, (2) Close mentoring/coaching of students in reflective thinking and writing has positive and motivating effects for the students entrepreneurial learning, (3) Reducing the number of compulsory reports from two to one creates more focused learning and better reports, (4) Compulsory reflection seminars with focus on theoretical underpinning and practical implementation helps students understand and perform critical reflection, and (5) Introducing a portfolio of questions seems to help the students in their act of reflecting. The results have implications for research and entrepreneurship education. There is a need for future research.

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Table 1: Activities and Key outputs (Value creation and entrepreneurial learning)	**2019**	**2020**	**2021**	2022	**Key outputs**
Activities					
Internship & Reflection report	Yes	Yes	Yes	Yes	Entrepreneurial learning + Value creation + (reports)
Grading Scale	Passed/ Not passed	A-F	A-F	A-F	Quality + (1)
Supervision (draft)	No	Yes	Yes	Yes	Quality + (2)
No. Reports	2	2-> 1	1	1	Quality + (3)
Reflection seminars in smaller groups (RS)	0	2	2	2	Quality+ (4)
Question bank/ Supervisors meet twice	No	No/ Test	Yes/ Yes	Yes+/ Yes	Quality + (5)
Student's main contribution	x	x	Survey Comp.(Q3-2021)	Survey Comp. (Q3-2021)	Value creation+ (survey)

14 Enhancing working life relevance for engineering students – through teamwork, creative problem-solving, technical prototyping and real-life projects

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Abstract
The engineering student has a critical role to play in solving societal grand challenges, both as intrapreneurs and as technology entrepreneurs. Yet, for them to master this role, it is critical to teach

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engineering students the appropriate skills during their higher education. Creative problem-solving, technological competence, cross-disciplinary competence and systems thinking are all assumed important 21st century skills. An increasing number of educational programmes aims to develop these skills through practice-based team learning in real-life projects. Yet, it is not straightforward to ensure working life relevance in these programmes, as this will depend on the type of project selected as learning arena, the possibility for students to develop creative problem-solving and technical prototyping as well as the pedagogy. Besides, when the engineering student is placed in cross-disciplinary teams, business students may take a dominant role. One reason for this might be the emphasis on a business-oriented approach to entrepreneurship education compared to a more technology-oriented practice.

In a project financed by the Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education (DIKU), a group of educators at Western Norway University of Applied Sciences (HVL) seek to strengthen the working life relevance for engineering students through teamwork, creative problem-solving, technical prototyping and real-life projects. The development project focus on two courses, one at the bachelor level with the title *ING303 "Systems thinking and innovation for engineers"* (300-500 students), and one at the master level with the title *INN524 "Innovation in cross-disciplinary teams"* (ca. 80 students). Both courses involve student-active learning and practice in student teams working on real-life projects.

In the project, we organize creative and interactive workshops with educators, students, and external partners from industry clusters, TTOs, makerspaces, and other actors in the regional ecosystem. We concentrate on the following activities: 1) Identify relevant cross-disciplinary engineering projects relevant for both prototyping and business development as a learning arena to develop cross-disciplinary engineering competence. Regarding this, we aim to integrate real-life R&D projects from industry, University, start-up projects from the entrepreneurial ecosystem and students' own projects. 2) Develop/apply innovation methodologies where engineers can use and exploit their engineering competence, 3) Develop prototyping and technical demonstrations as tools in innovation development processes, and 4) Strengthen engineers creative problem-solving competences in cross-disciplinary teams, through prototyping and makerspace activities. Besides, we will also develop appropriate pedagogy and assessments in the curriculums.

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The project started in March 2021 and will continue in a 3-year period. We foresee the project activities to unfold as a creative and interactive process, where all participants (educators, students and external regional partners) contribute in a co-creating process aiming for the same goal: to strengthen working life relevance for the engineering student. Besides, the project may reinforce relations and collaboration between the University and external industry and regional entrepreneurial ecosystem. Engineering students may also be stimulated to take a role as technology intrapreneurs and technology entrepreneurs through working with real-life projects.

15 Value creation across disciplines, traditions and culture

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Value creation across disciplines, traditions and culture

According to Lackeûs (2017; 2018) teachers interested or engaged in entrepreneurial education are often caught between two main educational approaches: 1) *entrepreneurship education* letting students learn about and through starting a new venture and 2) *enterprise education* letting students become more creative, innovative and opportunity oriented (learning through cases and problem solving). He introduces a third, yet bridging, approach named "*The value creation education approach*". The underlying rationale is that all students can and should train their ability and willingness to create value for other people. But how does that correspond to the teachers' understanding of "value" and *their* willingness to foster this approach and mindset?

As part of a project (2020-2021) on continuing education in I&E at the university we have been looking more into the question of 'value' in university teaching. The aim of the project is to develop an interdisciplinary course (2½ ECTS) for teachers and educational leaders on I&E at the university. The project is a collaboration between the University of Copenhagen and the University of Southern Denmark and is funded by the Danish Foundation for Entrepreneurship.
Based on a survey, expert interviews and discussions with stakeholders and peers, it is our impression that people find 'value creation' to be an interesting and relevant topic to discuss – but when it comes to one's own practice it seems to be affected by some resistance among academics across disciplines,

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traditions and culture. The question is why? And further, how we can work with value creation in course and program development.

In this presentation we firstly present the project and background framing our focus on value creation. Then we address the following questions for further exploration and consideration:

- How do we understand value across disciplines, traditions and culture?
- How do we talk about value in I&E-related teaching – if at all?
- How can we describe competences in value creation and work with progression across courses and programs?
- How can we assess competences in value creation in courses and programs?

The aim of the presentation is to inspire and get more insights into pros and cons in how we approach and understand 'value creation' in I&E courses and programs of higher education.

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16 On the role of the university: The emergence of entrepreneurship and innovation teaching at Danish universities

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Our universities are peculiar institutions. Although a cornerstone of Western civilization, they are somewhat offset from the rest of society with autonomy on what to research in and what to teach (Universitatum, 1988). This autonomy, however, is strained because of society's pull to ensure that

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value is created for society. Political observation determines to which extent the pull is justified and should be exerted. Beyond politics, however, there is everyday life, where researchers and teachers alike simply "just want do their job" but are challenged by the pull, i.e. by that which seems to be constantly changing discourses about justification and practice. One such discourse, that has found its way into our universities, is the notion of entrepreneurship and innovation (I&E) teaching (Rasmussen, Moberg, & Revsbech, 2015).

I&E teaching at our universities has a narrow (instrumental) interpretation and a broad (empowering) interpretation. In the narrow interpretation, I&E is aimed at creating value for society through strengthening businesses in the global capitalistic markets, i.e. our universities are instrumental to the business world. In the broad interpretation, I&E is aimed at that beyond businesses: at society at large and our way of life in general. Independent of interpretation, I&E is, because of its inherent focus on value creation, a radical challenge to the traditional (mode 1: mode 22,) perception of knowledge production and transfer at a university (mode 1: (Merton, 1942), mode 2: (Gibbons et al., 1994; Ziman, 2000) ; knowledge is no longer valuable "in itself", it is valuable only when we can argue for its usefulness. Clearly, such a shift holds implications for academia.

In this presentation, we track the emergence of entrepreneurship and innovation teaching at Danish universities relating it to the global context. We argue, that only within the last few years have we begun to really discuss the possibility of deploying I&E teaching university wide. In other words, we are in the beginning of a what will probably be a long process of changing mindset. We also argue, that because of this longevity of the process, stress is induced into the system and teachers will find themselves, knowingly or not, in uncharted territory. We end up arguing, that I&E teaching is here to stay and that it will be much more than just a parenthesis in our curricula. Furthermore, we suggest that this is not a bad thing! In the right interpretation – it cannot be too narrow - and with changes accordingly to our perception of teaching, I&E will allow all faculties, and in particular the Social Sciences and the Humanities, to sustainably meet society's pull.

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17 Virtual Teamwork and Learning of Teamwork Skills in Higher Education

Bjørn Sortland and Are Holen, NTNU

In the last academic year (2020/2021), the NTNU educational program "Experts in Teamwork" was extensively carried out in two different formats due to the covid 19 pandemic: (1) mixed virtual and "physical", and (2) virtual only. The total number of students involved was around 3500. From previous years, we have experiences and data about the effects of a (3) fully regular "physical" format. In the presentation, we will share data and experiences of relevance to educators about similarities and differences between these formats. We will discuss their implications for the students' development of social collaborative skills that can enhance sustainable interdisciplinary interaction and productivity in teams. Will online contact between students limit the interpersonal outcome? Or, will the online opportunities develop new, alternative behavioral interactions of relevance. Questions of such and related issues will be addressed.

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18 Institutional barriers for implementing interdisciplinary education

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A number of reports and policies has been put forward on all levels from the EU to the local university, stressing the importance of entrepreneurship in higher education (cf European Commission). The reason for this is the realization of us living in a world that is constantly changing and facing a number of challenges that need the creativity and drive of entrepreneurial individuals to be solved. The same reports and policies recognize that not one subject area alone can solve these complex problems - interdisciplinarity is needed. In addition, research (cf Chamorro-Premuzic 2017) has shown that teams with different competencies tend to be more creative than homogeneous teams when it comes to idea generation. However, in order to engage in true interdisciplinarity we need to convince all faculties and subject areas to embark on the journey of entrepreneurship.

This presentation will describe, analyse, and discuss the development of an interdisciplinary course in entrepreneurship at Lund University, Sweden, and the process in which the course was implemented and later closed down. The purpose is to gain a deeper understanding of the institutional barriers that need to be overcome for successful implementation.

The course in question was initiated by the author in 2015 inspired by the restructuring of the innovation and entrepreneurship activities at the University. Following a top-down approach, thoughts about an "entrepreneurial system" to complement the "innovation system" was presented to the University management. It became a point of discussion at the Board of Education, and funding was secured to implement the project. Meetings with all 8 faculties at the University were held, and an agreement was made to run a 7,5 ECTS course in "Project development" on an e-learning platform and as a voluntary course for students. The course was fully funded and induced no costs for the faculties. In the end of the day only 4 faculties actually implemented the course, and it run three times before the funding was withdrawn and it was closed down.

The author argue that the case serves as an example of institutional barriers that need to be overcome for successful implementation of interdisciplinary activities. The argument uses institutional theory which implies that organisations must conform to the existing rules and beliefs in the environment in order to survive (cf DiMaggio et al 1983). Hence, we need to understand what impact the structure, management, and the coordination of the University have on the introduction of interdisciplinarity. In addition, the discussion will centre around the institutional entrepreneur (Battilana et al 2009) and the

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different approaches possible to take for implementation of an interdisciplinary course at a comprehensive university.

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19 Creating value with and for students and companies in course collaborations

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Abstract

Background and explanation
The value of case-based learning in engineering education is widely recognized and an important learning element in many courses. In this workshop, we focus on the part of case-based learning involving live cases in the courses. This can for example be courses where students actively engage with a partner organization, or work on a real-life case/project provided by a company or an organization. We want to shed light on value creation taking place for particularly the partners engaging in course experiences like this.
Live-cases with direct involvement is often resource consuming for the partners, but we assume that live-case cooperation also creates significant value for the partners, however this kind of value is not given, is difficult to predict and, in many cases it can also be difficult to evaluate and quantify.
The purpose of this workshop is to explore the value created in collaboration between students and external partners and to provide arguments for why partners should engage in student cooperation. Therefore, we invite participants to share their own experiences and knowledge on creating value in this type of setting. It can either be actual examples from your own teaching or frame works for understanding the value created in these collaborations (or both).
To take a deeper dive in to this topic, the authors are working on a pilot study aiming to conceptualize and validate an operational model for the evaluation of value creation inspired from the theoretical based frameworks on value creation presented by Elke den Ouden (2012) and Martin Lackéus (2018). This pilot study will pave the way for further research, where live case cooperation in different sectors is evaluated and compared.

Set-up
As introduction to the workshop, the authors will present their framework and empirical work so far. The workshop participants will be divided into groups and each group will have time to discuss their framing of value creation based on their empirical experiences. Each group will present their discussion

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in plenum. At the end of the session the authors will sum up on the results from the workshop. There will be time to discuss how to proceed if there is an interest in further collaboration.

Expected results

The expected outcome from the workshop is empirical examples on course collaborations between students and companies and more knowledge on how to frame the value creation of these collaborations. We expect to use the obtained knowledge together with our own empirical data and combine them into either a journal article to be shared with participants, or to formulate a research project for interested parties within the education community.

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Paper

A guided team-building process in a virtual project-based learning scenario

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Background

Interdisciplinary collaboration is necessary to approach the complex problems of the twenty-first century, such as climate change and artificial intelligence. This makes team work an essential aspect of an engineer's daily work. Besides, globalization and digitalization require engineers to work in highly intercultural settings and to collaborate in online environments. The current Covid19 pandemic is additionally reinforcing this development. Further, engineers usually work in project-based settings and often contribute to various heterogeneous project teams at a time.

These requirements influence the skill set that is expected of engineers to successfully work under the before-mentioned conditions: On one hand, they act as subject-matter experts within their teams and take individual responsibility. On the other hand, engineers need to possess excellent communication skills and to come to an understanding with project partners and stakeholders of vastly different backgrounds.

Problem statement

The demands of the twenty-first century are poorly reflected in the engineering education at German universities. Written examinations are a common form of assessment, especially in Bachelor programs. However, they neither allow for the development of transferable social competences nor encourage learning scenarios that aim at the application of the knowledge gained. Although managers and employed engineers consider both of these aspects as crucial for successfully starting a career in engineering, developing these skills is not an integral part of the corresponding curricula (VDI, VDMA, Stiftung Mercator GmbH, 2016). To prepare students for the demands of the labor market, enhancing social and team competences should therefore be at the core of engineering education.

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Thus, the course Computational Mechanics at Leibniz University Hannover (LUH) aims at enhancing these skills by employing a project-based learning scenario in which teamwork skills contribute to the students' success. The course is offered in the third year of the Bachelor program Civil and Environmental Engineering and typically attracts fifty to sixty students. In this course, the students learn the fundamentals of the Finite Element (FE) Method and how to interpret the results of FE computations. As the method is widely used in structural engineering applications, the learning outcome of the course is decisive for the students' further academic and professional development. The learning is assessed in a project in which the students apply the FE method while working in teams of three to four members over a duration of fourteen weeks. This approach combines the acquisition of the course content with the development of relevant soft skills. Hence, the chosen learning scenario represents the future reality of the students' work environment and encourages them to "learn by doing".

As the students have little or no previous experience with working in teams when they start the course, the project-based learning scenario is accompanied by a facilitated team-building process. To enable the successful collaboration and increase the students' self-awareness and self-efficacy, the students attend four additional sessions over the course of the semester (see Figure 1. Each session spans a duration of ninety minutes. The structure and the execution of these sessions follows an experiential learning approach (Kolb D. A., 1984) and evolves around the Tuckman model of team development (Tuckman B. W., 1965). This experience report explains the design and implementation of these sessions in the winter term 2020/21 in which the course was taught completely online. It further discusses the sessions' impact on the students' development.

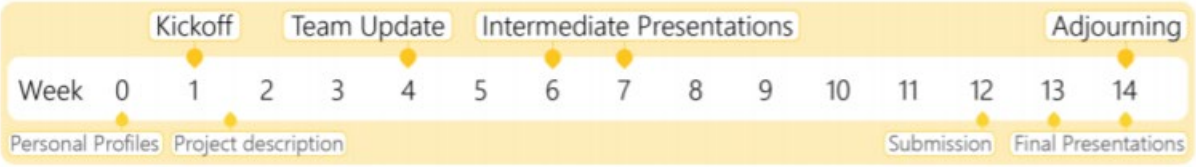

Figure 1: Timeline of the project. Team-building sessions above the timeline, related milestones below the timeline.

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Theoretical framework

The Tuckman Model

The Tuckman Model of Team Development describes four phases through which a team moves until it reaches a state of high performance and was later extended by a fifth phase (Tuckman B. W., 1965; Tuckman & Jensen, 1977). Even though the main findings were derived from therapy groups, it is now widely used and recognized in the corporate environment and the non-formal educational sector.
The phases can be depicted in sequential order, namely Forming, Storming, Norming, Performing and Adjourning; however, the structure should not be seen as rigid, as teams can fall back into a previous stage.

The Forming phase revolves around orientation and becoming acquainted with each other. Curiosity and insecurity characterize this phase. The team members seek social interaction and guidance, are polite and establish first connections. The roles are not yet clearly defined. During the Storming phase, differences become apparent, as individual personalities emerge. This can lead to competition and tensions within the group, often showing as conflicts or by persons withdrawing from the group.
This phase is the most critical phase to move through, is often perceived as frustrating, and the performance level is typically low. In the Norming phase, the group overcomes the preceding resistance and establishes rules of cooperation in an implicit or explicit way. The team members feel connected and start to share intimate, personal opinions. Consensus is reached about the individual members' roles, creating space for focusing on common team goals. During the Performing phase, the team members are committed to the team's mission and are able to deal with problems constructively. The team is mature and cooperates well; its structure supports the task performance. By the end of a project, when the team's goals have been accomplished, the team moves into the Adjourning phase. This phase can be characterized by mourning and re-orientation. During this phase, it is crucial for the team to acknowledge its achievements.

Different teams can experience the respective phases with different intensities and can move dynamically between the phases, especially when being exposed to internal or external changes.
The guided team-building process supports the students to navigate through the phases of the Tuckman Model. As the virtual setting complicates the teamwork, the students are guided to surpass

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the initial threshold of establishing personal connections, are encouraged to pro-actively navigate through the Storming phase, and are supported in organizing the members' responsibilities. Further, the model helps the students understand the dynamics in their teams over the course of the project. Despite of the guided approach, the process enables the groups to take ownership of their team development and to move through the phases at their own pace.

Kolb's cycle of experiential learning

Kolb describes learning as a "continuous process grounded in experience" (Kolb D. A., 1984). This also applies to the acquisition of transferable skills, such as in the course Computational Mechanics. Kolb states that learning happens by making an experience, followed by reflecting on it, drawing conclusions and adapting one's behavior, which ultimately results in a new experience. The cycle, depicted in Figure 2, can be entered at any so-called "mode" of learning. To learn effectively, the learning process should encompass all four modes.

Figure 2 Kolb's cycle of experiential learning [modified from (Kolb A. Y., 2017)].

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The project-based learning scenario in the course Computational Mechanics provides an experience to the students rather than making them passive recipients of knowledge. The accompanying sessions aim at reflection, conceptualization and planning of the next steps. This approach allows them to learn sustainably. Furthermore, it fosters the students' self-awareness and increases trust among the group members, which is achieved by continuous meta-communication. During the project phase, the students go through various loops of the experiential learning cycle.

A facilitator guides the student through the experiential learning process. Although, each student reflects on an individual experience and finds individual answers, the students share and discuss their thoughts and feelings with their team members. Thus, the process leverages the group as an additional source of learning, so that the members of each team go through a unique, but joint learning experience.

Embedding the theoretical framework in the team-building process

Personal profiles

As the students should learn to constructively engage with differences within the group, heterogeneous groups are formed, comprising of members contributing different skill sets and interests. To register for the project, the students fill in personal profiles, introducing themselves and reflecting on their strengths and weaknesses when working in teams. The proposed strengths and weaknesses were adapted from Belbin's team roles (Belbin, 2010). The students then upload their profiles on a learning management system. This ensures their access to each other's profiles and encourages the students to engage with the virtual platform, which is a prerequisite for successful virtual learning (Salmon, 2002).
It further builds motivation and curiosity for the project. In the profiles, the students indicate which topics and tasks they prefer to specialize in for the course of the project, enabling them to reflect on their individual motivation and interests. Using the information from the profiles, the groups are formed.
The composition of the teams simulates the roles of different "experts" within a professional project team.

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Kickoff Session

The project then starts with a virtual Kickoff Session, which aims at building trust and connections within the newly-formed teams by initiating a dialogue about how each group wants to cooperate.
The groups work with guiding questions related to their personal traits, experiences and working preferences, which they discuss in their groups. This exercise aims at creating a safe space within the group and at increasing the students' self-awareness by reflecting on the guiding questions.
In combination with this exercise, the students revise their team members' personal profiles to discuss possible task distributions and plan their collaboration.

Additionally, the Kickoff Session targets the online socialization of the students, as suggested in the 5-stages model by Salmon (Salmon, 2002). The groups practice using the relevant virtual platforms and tools and interacting effectively in the virtual space. Each group accesses a self-organized space within the learning management system that includes file storage and a video conference system. In addition, the students receive guidelines on collaborative writing tools they can use for the project. Beyond that, they are encouraged to discuss their collaboration with regard to working in the virtual space which gives them ownership and confidence for conducting the project online. Thus, this session enables the students to become familiar with the online space and tools, before the project's content is introduced.

Further, the Kickoff Session teaches the students basic project planning techniques to employ in their teams. Becoming familiar with a structured approach to organizing a team project aims at increasing the teams' effectiveness and should ultimately improve their results. Besides preparing the students for a project-based working environment, this is an important study skill, which the students can use to organize their workload, for example in future individual thesis projects.

Team Update Session

The Team Update Session's goals are to identify and overcome possible obstacles in the group and to increase the students' self-efficacy by increasing their understanding of group dynamics. The students attend the session four weeks after starting to work on their projects. During the session, they reflect and name their emotions related to the current developments in their teams. They are further introduced to the Tuckman Model (Tuckman B. W., 1965) and contextualize their groups' dynamics by relating them to the model, using interactive online participation methods. This process aims at normalizing possible tensions, negative emotions or conflict experiences in the groups. In a

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second step, the facilitator introduces techniques that the students can use to respond to difficult dynamics.
This empowers them to identify potentials of the group, increase the team performance, and the members' satisfaction. Following this block, the facilitator invites the students to use the remainder of the session to apply their learnings in the project groups in a self-organized way, giving full ownership to the student teams.

Intermediate Presentation

The Intermediate Presentation offers an opportunity to present preliminary results and discuss obstacles, as "learning is best conceived as a process, not in terms of outcomes" (Kolb D. A., 1984).
Besides showing the current status of their projects, each group answers these additional two questions during their presentation: (i) What are our current challenges? and (ii) What are our next steps?
After the presentations, the teams receive formative feedback on the content and their presentation skills from the teachers.

In addition, the Intermediate Presentation provides an opportunity for social learning. The students can compare their approaches to those of the other teams. Hence, they are inspired to experiment with new ideas. Furthermore, the students can learn from the feedback provided to all project teams and familiarize themselves with the requirements for the final presentation and graded assessment.

Adjourning Session

The Adjourning Session follows the projects' submission, final presentations and grading. This session serves the purpose of evaluating the teams' performance, giving feedback to each other, acknowledging the work done and ending the collaboration. First, the students receive the detailed written feedback on their project submissions, which they then discuss and evaluate within their teams.
Secondly, the students receive individual feedback from their teammates on their strengths and weaknesses when working in a team. This feedback is prepared beforehand by the students filling in an assessment form for each of their teammates, which is later shared with the respective person. This assessment uses the questions of the self-assessment described in the next section and therefore enables the students to compare their own view to that of their teammates. Before

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adjourning, the students discuss what has made their team successful, conceptualizing their main takeaways from the teamwork.

Self-assessment

To accompany the team project in the course Computational Mechanics in the winter term 2020/21, the students performed a self-assessment on relevant social competences. The social skills and attitudes that contributed to the successful performance in the project-based learning scenario were determined as

a) asking for help when needed
b) working with people that think differently than oneself
c) clearly expressing thoughts and feelings
d) solving conflicts constructively
e) taking responsibility
f) involving others in what one thinks and does
g) receiving constructive criticism and developing based on it
h) giving constructive criticism, based on which the recipient can improve

Prior to the start of the project, the students filled in the self-assessment form on the learning management system. For each of the competences, they indicated on a scale from 1 (low) to 5 (high) to which extent they possessed the given competence. After the project submission, the identical assessment was conducted again. Having completed the course, the students received an individual evaluation of their personal development regarding each of the competences.

Discussion

Over the course of the winter term 2020/21, the students showed a change in attitude towards the project. The students at first were skeptical towards the unknown learning scenario and were reluctant to collaborate with students they did not previously know. On several occasions, they voiced strong resistance against the layout of the project. However, once the groups had been formed, they remained relatively stable; only single students decided to leave the course. This indicates that the project-based learning scenario combined with the guided team-building process might increase the sense of commitment and responsibility in the students. Additionally, belonging to a team might

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have been an additional source of motivation to engage with the topics of the course, especially while studying fully online. The facilitated team-building process probably further supported the students in engaging with the ambiguity of the unfamiliar learning scenario. During the Team Update Session, the students reported that they currently experienced positive emotions in their project teams and that they perceived the collaboration as fruitful. This supports the hypothesis that the guided team-building process, especially the Kickoff Session, was beneficial for the teams' development and to resolve the students' doubts.

In the course evaluation, the students indicated that the project had significantly contributed to understanding the subject matter of the course. They further emphasized the importance of the intermediate presentation sessions in regard to their learning process. The opportunity to receive formative feedback and to learn from the other teams' presentations was seen as beneficial for their results. On the other hand, it remains unclear to which extent the Team Update Session contributed to the teams' success. Although it provided a space for reflection and exchange, the teams seemed advanced in their development, which challenges the assumption that the session is needed. However, offering this session earlier can increase its benefits by providing support during more critical stages in the teams' development and can additionally support the students' orientation in the new learning scenario.

The experiential learning approach proved effective and shows further potential in the Higher Education context. It allowed the individual students and the project teams to develop at their own pace, while leveraging the benefits of social learning. It further promotes the development of self-directed learning skills, as it encourages the students to reflect on their experiences.

The self-assessment, comprising of one assessment before and one after the project phase, was completed by nineteen students. An additional twenty-eight students filled in only the first or the second assessment, allowing them to individually reflect their competences without monitoring their development. The survey showed that the students perceived an improvement in six of the eight competences, as indicated in Figure 3. This shows that the students could develop relevant social skills during the project phase. Interestingly, the students on average indicated that their competence in "involving others in what one thinks and does" decreased during the project phase. This phenomenon also occurred in individual students' answers for the other questions and suggests that the students increased their self-awareness, now being able to assess their competences more realistically. On average, the students did not perceive an increase nor a decrease in their competence to work with people who think differently than themselves. The development of this competence might have been

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more dominant for project teams with members of different disciplines. In summary, the students mainly developed the competence of clearly expressing their thoughts and feelings. However, it is unknown to which extend the guided team-building process aided the development of these transferable competences.

Next to developing the assessed competences, the students could also acquire crucial digital competences, as the course was conducted fully online. They became skilled in using digital collaboration tools and gained experiences in initiating and sustaining a digital collaboration process, overcoming several obstacles along the way. These digital skills are relevant twenty-first century skills whose acquisition should be embedded in university curricula on a larger scale.

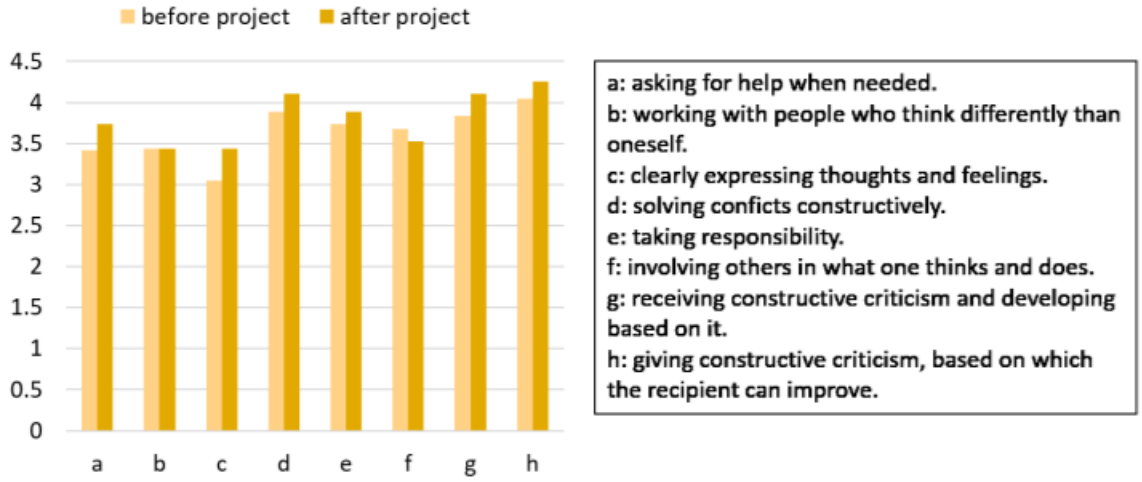

Figure 3 Results of the self-assessment. Each competence assessed on a scale from 1 (low) to 5 (high).

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Conclusion and Perspectives

The course Computational Mechanics at LUH offers a project-based learning scenario combined with a guided team-building process. This experience report described the process design and implementation at LUH in the winter term 2020/21. The four team-building sessions, distributed over the project phase, supported the students in their teams' development and therefore strengthened their success in the course. As the course was conducted completely online, the students received training to successfully work in the online environment and use suitable online tools to enhance the team-building process. The Tuckman Model (Tuckman B. W., 1965) provided a suitable framework for the design of the team-building process. Using an experiential learning approach (Kolb D. A., 1984) was unfamiliar to the students at first, but proved to be effective. Its application in Higher Education seems promising and should be explored further. Overall, the guided team-building process supported the students in building the capacity to proactively and self-responsibly engage in project teams in their future academic and professional careers. However, further empirical research is needed to better quantify the effect of the team-building process on the students' development.

The presented team-building process is suitable for any project-based learning scenario and can easily be adapted to an on-campus environment. Because the process empowers the students to constructively engage with differences within a team, it shows huge potential for an application in interdisciplinary teams. The competences developed in the project teams are important prerequisites for an engineering career in the increasingly complex and interconnected working environment of the twenty-first century.

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