ETALEE2023

IngeniørUddannelsernes Pædagogiske Netværk

Exploring Teaching for Active Learning in Engineering Education

VIA University College, Horsens, May 25-26 2023

Book of Abstracts

DTU Technical University of Denmark

AALBORG UNIVERSITY DENMARK

SDU

ABSALON UNIVERSITY COLLEGE ABSALON

VIA University College

AARHUS UNIVERSITY SCHOOL OF ENGINEERING

Programme - ETALEE 2023

Thursday - 25 May 2023	
08.30 - 09.45	Registration - coffee and tea
09.45 - 09.55	WELCOME by Prorector Gitte S. Harrits, Auditorium 1
09.55 - 10.40	Keynote - Professor Euan Lindsay
10.45 - 12.15	Parallel Hand-on I/Explore session
12.15 - 13.15	Lunch
13.15 - 14.45	Parallel Hand-on II
14.45 - 15.00	Coffee/Tea
15.00 - 16.30	Explore possibillity for Network groups
16.30 - 17.30	Networking/snacks&mocktails, Lab tour

19.00 - 22.00	Conference dinner at "FÆNGSLET"

Friday - 26 May 2023	
09.00 - 10.00	Keynote - Dr. Ruth Graham, Auditorium 1
10.00- 10.15	Coffee and tea
10.15 - 11.45	Parallel Hand-on III
11.50 - 12.15	Closing session/Evaluation, Auditorium 1
12.15	Take-away lunch

Table of content

Keynotes

Professor Euan Lindsay,
Thursday 09.55-10.40

”Future Models for Engineering Education ”

Dr. Ruth Graham,
Friday 09.00-10.00

”Crisis and catalyst: the impact of COVID-19 on global practices in engineering education ”

Keynote I
Thursday 09.55 - 10.40

”Future Models for Engineering Education ”

Professor Euan Lindsay , AAU

The nature of engineering practice is evolving, and engineering education needs to evolve in parallel. Contemporary engineers work in increasingly asynchronous distributed digital workplaces, and our traditional face to face models of education are increasingly unfit for purpose over time.

Professor Lindsay’s talk will address the kinds of models that are emerging to address the needs of contemporary graduates, and the ways in which they take advantage of the affordances of digital technology to support the learning of engineering students. He will draw from his experience in establishing a novel engineering degree program at Charles Sturt University in Australia, focussing on how the program addresses the emerging trends in higher education, how those trends have continued to evolve, and what they will mean for the future of engineering education here in Denmark and beyond

Keynote II
Friday 09.00 - 10.00

”Crisis and catalyst: the impact of CO-VID-19 on global practices in Enginee-ring education ”

Dr. Ruth Graham,
R. H. Graham Consulting Limited

The systemic transformation of engineering education has its roots in the decade before the Covid-19 pande-mic. Engineering faculty and their institutional leaders across the world were driving forward changes in the engineering curriculum to ensure that tomorrow’s engi-neers have the competencies needed to tackle the eco-nomic, social and environmental challenges of the 21st century. But the pandemic has been an additional catalyst for change, necessitating major reforms to program design and delivery and the wider student experi-ence. Together, these changes are set to have a major impact on the fu-ture trajectory of the engineering education sector.

The talk will discuss findings from the Crisis and Catalyst report, which examines the impact of Covid-19 on engineering education worldwide. Drawing on interviews with members of the engineering education com-munity from across 36 countries, the talk will explore the likely impact of this systemic shock on the direction of travel of the sector and the state-of-the-art in the field.

Abstracts
Hands-on Session I
Thursday 10.45 - 12.15

Digital competences terminology and activities for life-long learning in engineering - Mads Ronald Dahl, CED, Aarhus University

Different ways of group formation – pros and cons - Hanne Løje, Technical University of Denmark

Digital competency developing activities in Engineering Education and curriculum alignment.

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ABSTRACT
Keywords – Digital competency, curriculum development, curriculum analysis and alignment

Please indicate clearly the type of contribution you are submitting: __x_ hands-on, ___explore, ___poster.

Background

Digital competences are essential for the field of engineering and at all levels of employment. As the technological development and digitalisation in modern society have influenced the working world of engineering, there could be a recognised need for new competences and generic terminology.
When the literature and media states that the digital transformation and technology will play a key role in enabling a more sustainable future it falls back on engineering to utilize the development and opportunities. The engineer of the 21st century is very much in a different position and must be educated accordingly (Tryggvason et al. 2006).

There is no shortage of technical areas and digital subjects to be explored: Artificial Intelligence, Internet of Things (IoT), Mobile Computing, Robotics Augmented/Virtual Reality, Big Data Analytics, Blockchain, Programming, Cloud Computing, Human Machine Interface, Intelligent Manufacturing, Intelligent Sensors, Internet of Services (IoS), and Three-Dimensional Printing + more. But all these areas and topics will again change over time and develop into new topics and other areas. Thus, we can't define digital competencies in a generic way by describing the different applications or examples of usage. Furthermore, it would be a fragile terminology for digital competences that was based on one or few subject specific topics. The work of engineers most often takes place in complex networks with many different professionals and collaborators. So, there must be some overlap in digital competences between professions, topics and subjects. The digital skill sets of today's engineers will go through a continuous transformation with respect to the requirements of the digital age. The mindset and foundation of relevant digital knowledge, skills and attitudes must be integrated in engineering education as relevant lifelong learning of each individual engineer. The task of curricula alignment with digital competency development is important and can be compared to train engineering students' interdisciplinary skills (Van den Beemt et al. 2020).
The European Digital Competence Framework (Vuorikari et al, 2022) gives a generic and structured terminology for describing digital competencies for citizens that can be fruitful as a base reference for development of more specific and subject oriented language for digital competencies in engineering. The Framework DiKoLAN (Digital Competencies for Teaching in Science Education, Kotzebue et al. 2021) addresses the challenge of implementing subject specific technology related professional digital competencies in science education and teaching. Using these two frameworks to analyse and develop curricula can give an orientation aid for better alignment and integration of digital competencies in education.
This workshop will give the participants an opportunity to try our dialog tools and activities for adoption of the terminologies introduced in the frameworks, identify relevant activities, and develop their own narrative for subject specific digital competencies in engineering.

The workshop agenda:

Introduction:

- Short introduction of the workshop, participants and making groups
- Introduction to DigComp 2.2 terminology (10 mins)
- Introduction to activity 1.1

Hands-on Activity

Activity 1.1: mapping of digital competencies of engineering using DigComp 2.2 and DiKoLan (20 min, upload picture of board to padlet)

Introduction to activity 1.2

Activity 1.2: Elaborate on selected area of digital competency development in activity 1.1 (10 min, upload picture of board to padlet)

Introduction to activity 1.3

Activity 1.3: Exploring the context of a central digital competence in engineering education and give examples of both course level and curriculum level alignment
(30 min, upload picture of board to padlet)

Evaluation

Discussion & Evaluation & Conclusions (20 mins)
Total 90 mins

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Different ways of group formation – pros and cons

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ABSTRACT

Keywords - Group work, group formation, group activities

Please indicate clearly the type of contribution you are submitting: _X_ hands-on, ___explore, ___poster.

Background
A central ability when doing professional engineering work is to be able to collaborate in multidisciplinary teams, therefore group work is a common part of an active learning strategy in higher educations to enhance deep learning and thus to develop teamwork skills. However, group work can be challenging for the students and difficult to do if they have none or little experience in group work and no guidance or support is available (Oakley et al., 2004). Group work can be a key component of student-centered learning, but the student-learning outcome can depend on the formation of the groups. Some of the factors, which can affect a proper development of group work, are the group composition, different motivation, expectations, level of commitment, lack of group norms etc. (Aranzabal et al., 2022).

Formation of groups can be done in several ways. One way is to let the students self-select group members. When the students can self-select members for a group, they often choose other students, they know and who share their own academic ambitions. This often leads to groups, which are unbalanced with regards to culture, background and skills. Self-selection has thou advantages as the students work with other students they already know, and they thus have some knowledge about the other group members strengths and weaknesses, which can help the group to work more effectively.

The teacher can also assign the students to groups. This can be done randomly based on a simple principle such as counting group members to a group nr. (1, 2, 3…6). It can also be based on some criteria like for example on test of personalities, test of preferences, educational background, cultural background etc. Having the teacher to form these groups, makes the groups more equal with regards to diversity, but there can be a higher risk of conflicts due to these differences (Hartley & Dawson, 2022).

Donovan et al. (2018) found in their study that the low competence students had higher learning outcome when they were in heterogeneous groups while mid- and high competences students performed well in both group types. Students of all competence types had better attitudes toward group work in heterogeneous groups. How to structure the group formation process to maximize the learning outcome is not clear.

Group formation takes time, which the teacher should be aware of and thus allocate suitable time for group forming activities (Warhuus et al., 2016). If the teacher has assigned the teams randomly, there is often a need for some extra time, to give the group members a chance to get to know each other (Hartley & Dawson, 2022).

The objective of this study is to discuss different ways of group formation and group activities to gather some tips and tricks. In the hands-on session, the participants will be introduced to try different ways of group formation and discuss pros and cons of these different ways. Furthermore, the participants will share their own experiences from teaching.

Hands- on activity

Introduction (10 min)

In the introduction, participants will be presented to the different ways of forming groups and which pros and cons there are connected with the different ways. Before the hands-on part starts, the participants are asked to fill out a small test based on their preferences.

Hands-on activity (60 min)

- Part A: Based on the preference test results the participants are divided into groups. Half of the groups are based on the result of the test done in the beginning of the hands-on session and the other half of the groups are based on a random formation without using the test results. In groups, the participants are asked to present themselves and to do some ice breaking activities as well as to do some other group activities introduced at the workshop.

- Part B: The participants stay in the same groups as before and now they must discuss the experience of trying the different ways for forming groups. Furthermore, they should also discuss their own experiences with group formation and what they do to have a good process for group formation.

At the end of the session (20 min)

- At the end of the session, there will be a wrap up of the group discussions by sharing examples including opportunities and challenges with regards to ways of group formation.

Expected outcomes/results (possibly data/experience from own practice).

The expected outcome from the hands–on session is creation of new experiences for workshop participants on how to organise group formation processes and sharing of experiences. The participants will be provided with ideas to use in their own teaching and the applied guides for activities.

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Abstracts
Explore Session
Thursday 10.45 - 12.15

Making Room: Improving Students' Opportunities for Participation - Anna Augusta Fornø IT-University of Copenhagen

Fast feedback fostering student motivation. - Jørgen Bro Røn, University of Southern Denmark

Making Room: Improving Students' Opportunities for Participation

Anna Augusta Fornø
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ABSTRACT
Keywords – Active participation, Belonging, Equality, Inclusion

I. Introduction

Active participation in the classroom is known to be a powerful tool to increase the motivation of students, help them develop important skills, such as critical thinking, and overall improve their learning outcomes (Rocca 2010). Thus, it is beneficial for universities and teachers to work to ensure the active participation of their students, in order to reap these benefits. However, this is no simple task – generally, students tend to behave according to the social norms of the classroom in order to fit in (Bager & Herrmann 2013). This means that participation is shaped by the dynamics and expectations of the classroom, created by both students and teachers. Participation can vary from student to student depending on how well they are able to interpret and adapt to these norms and expectations – usually the students who are best able to participate comes from more privileged backgrounds (Thomsen 2022). For example, students from homes with well-educated parents and with a higher social class tend to be better able to adapt to social norms and expectations of the classroom, because they are already familiar with the dynamics of the educational system (Ladson-Billings 1995). In contrast, students from less privileged backgrounds can experience more difficulties during their university studies (Herbaut 2020; Thomsen 2022). Therefore, the aim of this inquiry is to explore how social norms in the classroom shapes opportunities for participation for students, and how this knowledge can help to develop a pedagogical practice, that improves the overall participation for as many students as possible, leading to better learning outcomes.

II. Key Theoretical Concepts

Central to this inquiry are the concepts of *sense of belonging* (Halse 2018; Tinto 2017) and *position* (Maher & Tetreault 2001). They provide a framework for understanding how students experience being at a university and what influences their behaviour in the classroom.

Sense of belonging describes the integration of a student in to the daily life of their study programmes and the university in general (Halse 2018; Tinto 2017). It concerns both the social ties a student has, such as friendships or study-groups, and the student's attachment, such as their interest and motivation, to their specific field of study. Secondly, the concept of *position* considers implications of the social position a student has in the classroom (Maher & Tetreault 2001). It describes how students are placed in a hierarchy in the classroom based on their background, such as gender, ethnicity, social class and more, and how these positions come with better or worse opportunities for participation (Maher & Tetreault 2001). Another central concept is of course *participation*, which is here defined as active partaking in classroom activities, such as discussions, group work, presentations and so on (Biesta 2016). Because this inquiry aims at creating opportunities for participation for as many students as possible, a democratic model for participation is used – this underlines the importance of equality, diversity and inclusion within the classroom (Biesta 2016).

III. Research Set-up

This inquiry was designed to uncover the dynamics in the university classroom, and how students are able to participate and interact with their peers and teachers. Therefore, two different methods were combined, ethnological observations and research interviews, to gain insight in to both the classroom dynamics and how students experience and navigate these (Lamont & Swidler 2014). The observations were carried out during regular teaching sessions and focused on the different ways students are invited to participate in classroom activities by both teachers and other students, and how these interactions shape participation. The

interviews were carried out after the observations, and the questions were built on what had been observed in class. The interviews focused on exploring students' sense of belonging and how it shapes their positions and opportunities for participation in the classroom. The data-collection was carried out on two bachelor's programmes, an engineering and a social science programme, at Aalborg University in the spring of 2022.

IV. Analytical Insights and Pedagogical Implications

The empirical inquiry confirmed that students' sense of belonging affects their position in the classroom, and in turn, this affects how they are able to participate. Students with a greater sense of belonging were more involved and active in the classroom. They also tended to be in more privileged positions among their peers, having many positive interactions and relationships at their study programme, which gave them a better ability to participate in the classroom. The analysis also points to the importance of how materials and concepts are presented by the teacher. For example, presenting theoretical concepts in an objective or indisputable manner limited how students could engage in discussions about said concepts.

Based on the analytical insights, four pedagogical initiatives are suggested to improve opportunities for participation for as many students as possible. Here it is of course important to consider the context they are to be used in, so they may be adapted accordingly. They are:

1. *Support the students' belonging*: showing interest in students can help them to develop a stronger sense of belonging, which impacts their position in the classroom, and enables them to participate more actively.
2. *Use a variety of teaching methods and activities*: this creates many different opportunities for students to participate, so it accommodates a variety of individuals. This also legitimizes different ways of participating, and can thus create space for students to develop their own, more active study practices.
3. *Encourage critical reflection and discussions*: by encouraging students to engage in this way with the content of their courses, teachers can help students to develop deeper understanding and their own perspectives.
4. *Involve the students*: recognizing and including the needs and interests of students when teaching can strengthen their motivation and participation. This legitimizes students' perspectives and helps to develop a less hierarchical classroom.

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Fast feedback fostering student motivation.

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ABSTRACT
Keywords – Feedback, extrinsic motivation, assessment, practice.

Please indicate clearly the type of contribution you are submitting: ___ hands-on, _X_ explore, ___poster.

I. Background

Feedback [1] can have a big impact on student learning. Especially when feedback is part of a formative assessment [2] When students receive feedback, they get information about what they are doing well and what they can improve, and this can lead to higher extrinsic motivation.[3]
When students receive positive feedback for their performance, it can increase their confidence and motivation to continue learning and improving. Similarly, constructive feedback that includes specific suggestions for improvement can help students overcome obstacles, master new skills and concepts, while increasing their motivation to participate in an active learning environment.

II. Explanation

Beginning in the second week of the semester, the students are given 2 sets of assignments, 2 weeks apart, relating to basic electrical circuit theory, which the subsequent part of the course builds on. The students have 1 week to solve each of the assignments and receive individual personal feedback via the e-learning system "itslearning" no later than 2 days after the deadline for submitting the assignments. The feedback begins with an overall assessment of what has been submitted, but also focuses on errors, misconceptions and misunderstandings and indicates how the task could be solved correctly in the event of an error. Along with feedback, the students receive a copy of the lecturer's proposal for solving the tasks. As far as possible, the feedback supports covering the 7 principles of good feedback practice [4]. The students are deliberately not being graded as research suggest that this might have a demotivating effect [5].

III. Results

At the end of the course, the students were given a questionnaire via "itslearning" with 7 questions addressing the quality of the assignments, the quantity, quality, speed and communication of feedback. Whether the feedback increased students' perceived learning and whether feedback influenced the students' motivation to actively participate in the lessons afterwards. 30 out of 36 students answered the questionnaire. The figure below shows the mean value and standard deviation of responses. The result of the study indicates that the rapid feedback has had a significant impact on the students' learning outcomes and motivation.

IV. Discussion

At the end of my presentation at ETALEE2023, I would like to discuss with the participants in the ETALEE2023 "Explore session", my approach to "Fast feedback" with implications, potential pitfalls and possible future development of the concept.

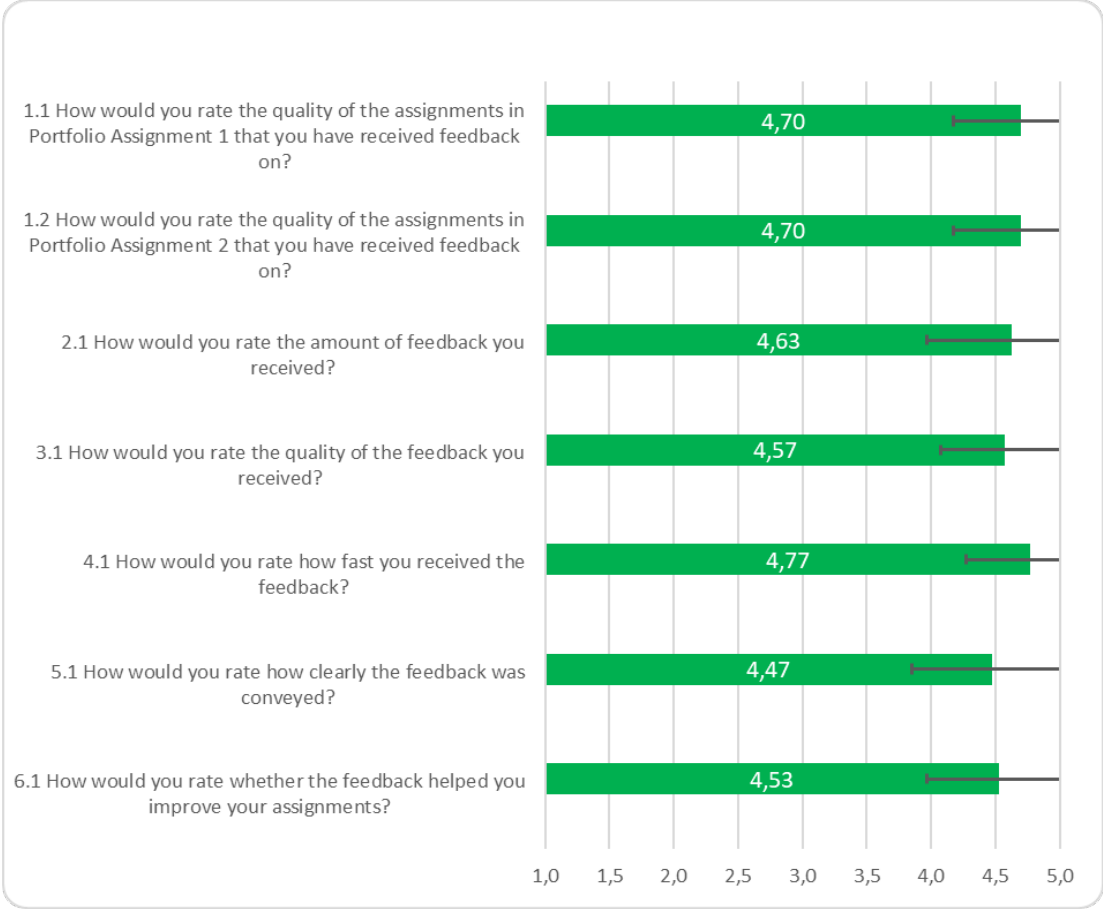

Fig. 1: Questions related to feedback – scale is 1 – 5

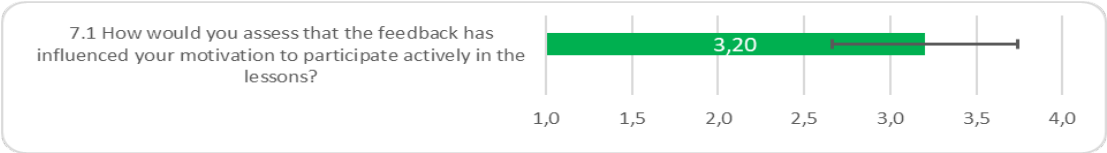

Fig. 2: Impact on students motivation – scale is 1 - 4

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Abstracts
Hands-on Session II
Thursday 13.15 - 14.45

Teacher-student connection for student motivation - Elizabeth Rees, Hanne Løje, Lene Duedahl-Olesen, Technical University of Denmark

Toning courses with sustainability - Mette Lindahl Thomasse, VIA University College, Hanne Løje, Technical University of Denmark

Teacher-student connection for student motivation

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ABSTRACT

Keywords – Student motivation; teacher-student connection

Submission: hands-on workshop

Background

Engineering education has traditionally focused on the technical, however today's engineering graduates are expected to go out into the world and solve problems that are increasingly social as well as technical in nature. Consequently, engineering education is evolving to reflect this and as part of this evolution, there is a larger focus on the student-teacher connection (Bairaktarova, 2022; Davis, 2017; Tormey, 2021; Wilson & Mukhopadhyaya, 2022) as student motivation is linked to educational engagement (Goralnik et al., 2012). Educational engagement is made up of connections between the student with the university, the people, the activities and the values and goals that the education is composed of. Tinto (2017), depicts this in his model of student retention, whereby the students' connectedness to their own self-efficacy, sense of belonging and, perception of the curriculum all affect their motivation . Some of the underpinning factors behind these connections are emotions and emotional engagement, which in turn is fostered by the connection between teacher and student (Goralnik et al., 2012; Hartikainen et al., 2022; Tormey, 2021). This perspective is supported by Deci & Ryan's (1985) Self-Determination Theory, which posits that individuals, in this case students, have a natural orientation to growth and self-organisation. When the surrounding environment fails to meet the needs of 'autonomy, competence and relatedness', the student can become 'alienated, controlled and fragmented'. Consequently, the interaction with the surrounding environment, such as the university and in particular teachers, can either facilitate curiosity, engagement and connection or may result in 'demotivation, in-effectivity and detachment' (Legault, 2017). Research on the effects of teacher's actions on students shows that there is an association between a teachers' expressed enthusiasm and a positive interest on the students' own enthusiasm, so-much so, it can modify the 'motivational quality' of the learning environment and students' 'achievement values and motivation' (Hartikainen et al., 2022). Empathy, understanding, non-judgment and compassion encouraged engineering students to actively seek help, increase participation, consequently improving their learning, motivation, and persistence (Hartikainen et al., 2022).

Explanation

By understanding and connecting with the student population, teachers are better equipped in motivating students through teaching and learning (Bairaktarova, 2022; Seemiller & Grace, 2017). The aim of this workshop is to understand and share experiences; to compare experiences and offer strategies in how to motivate students via the teacher-student connection. Although it may not be possible to know each student individually; gaining knowledge on common factors that are shared by students allows teachers to consider the needs of students in terms of how they like to work, learn and interact with others. This potentially allows for an increase in student motivation, efficacy, learning capacity and persistence in higher education (Seemiller & Grace, 2017).

The purpose of this workshop is:

1. To gain more detailed understanding of the current student cohort through sharing of experiences.
2. To discuss how the student-teacher connection plays a role in student motivation.

Participants in this workshop will explore the role of student and teacher in engineering education through:

1. Background knowledge and introduction (10 minutes)
2. Session 1: Brainstorm to explore and share knowledge on the students of today and what is known about them: (10 minutes in groups)
    - o Are there similarities/differences between students?
    - o Are there differences compared to previous students?
3. Session 2: What are the challenges in teaching today? (30 minutes in the same groups)
    - o What are barriers to connecting with students? What works well?
    - o How can teachers motivate and connect with their students?
    - o What changes do we need to make (if any)?
4. Wrap up: Discussion and conclusion of overall results. (In plenum). (20 minutes)

Expected outcomes/results.
The expected outcome of this workshop is to highlight/emphasise that the role of the teacher as connected to students is important when educating engineers and how this can aid learning.

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Toning courses with sustainability

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ABSTRACT
Keywords - three to five keywords describing your submission: sustainability, entrepreneurship

Please indicate clearly the type of contribution you are submitting: _X__ hands-on, ___explore, ___poster.

Your abstract is limited to **maximum two pages** and should include:

Background (learning problem or –aims to be solved in specified target group)
Climate change, pollution and inequality can no longer be ignored. Thus sustainability and regeneration is ever present in the media, in policy and in extension education. Universities around the globe strive to become a part of the solution through action and education. With a key role to play in societal change engineers too hold a great responsibility for making the world a better place. Through education they must be prepared to take leadership of sustainable changes, therefore sustainability have become an active learning objective in most educations.

However there is not always a clear agenda for how to incorporate sustainability into the different courses and/or educations, and today it is very broad how sustainability integrated. Some courses have focus on SDG's while others have more focus on that the final solution should create sustainable value.

Sustainability is not only the SDG's. System thinking, cradle to cradle and the triple bottom line (people, profit and planet) are just some examples of how sustainability it attempted to be made an actionable. But the challenge of education for sustainability still prevails.

Entrepreneurship and innovation can be the engine for transforming our world and overcome the diversity of the global sustainable challenges (Lans et al., 2014).
In a previous work, Løje and Thomassen (2018) explored how sustainability influence learning objectives in entrepreneurship and innovation courses at higher education in Denmark, it was found that most learning objectives were focus on management and strategy rather than on leading and developing sustainable solutions. Moreover, Brandi and Thomassen (2020) has suggested a conceptual model for how sustainability can become a practice in organisations through corporate entrepreneurship and organisational learning. Both studies will briefly be introduced to inspire the hands-on activity.

Explanation (how this learning activity contributes to activate students and support their learning – incl. theoretical explanation and references (optional for hands-on, mandatory for explore sessions))
Sustainability is defined and measured in different ways. This calls for a contextualization of sustainability education, but also for a discussion of if all courses should have the same focus and understanding of sustainable. Furthermore, we need to discuss how can we measure that we have incorporate sustainability into our courses and educations? When is it sustainable enough?

Hands on activity Set-up (activities and materials, assessment, evaluation)

10 minutes Introduction (setting the scene)
In the introduction, the participants will be presented to an introduction to sustainability in engineering (use learning goal contribution) and an example of how sustainability can be included in an entrepreneurial/innovation process in different ways. Moreover, the effects on student motivation will also briefly be addressed.

60 minutes Hands-on Activity (incl. summing-up)
The 60 minutes of hands-on activities will be scaffolded with a poster and work sheets for the educators.

Part 1: In groups, the participants will be asked to identify how sustainability is relevant in your education and students future career opportunities.
In groups participants will discuss their ideas.

Part 2: The participants will be asked to choose one of their learning design to work with. Based on inspiration materials educators are asked to identify relevant learning objectives and learning activities that can support toning their courses with sustainability can be activated in their course. To sum up, each group should prepare a short presentation to present at the plenum part at the end of the hands-on session.

20 minutes Discussion & Evaluation & Conclusions
Based on the educators work, there will be a plenary discussion about challenges with and benefits of working with sustainability in education, at the end of the session. Questions like, when is it sustainable enough? The authors will discuss the results of the hands-on activity and develop questions for further inquiry.

Expected outcomes/results (possibly data/experience from own practice).
The hands-on session is designed to inspire educators to work with a contextualized activation of sustainability education.

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Lans, T., Blok, V., & Wesselink, R. (2014). Learning apart and together: towards an integrated competence framework for sustainable entrepreneurship in higher education. Journal of Cleaner Production 62 (2014) 37-47

Løje, H. & Lindahl Thomassen, M., (2020). The influence of the sustainability agenda on learning objectives in innovation courses for engineering students? Proceedings of the 48th SEFI Annual Conference 2020, pages: 1346-1353. Presented at 48th Annual Conference, Enschede, the Netherlands 20 – 24 September 2020

Abstracts/Papers
Hands-on Session III
Friday 10.15 - 11.45

Can a score for study group dynamics in the first semester predict student retention? - Anne Louise Vaarby Copenhagen School of Marine Engineering and Technology Management

Continuing Engineering Education New Paradigms? - Ida Marie Lybecker Korning, Bente Nørgaard, Aalborg University

Can a score for study group dynamics in the first semester predict student retention?

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At ETALEE 2023 the authors will conduct a 90 minute hands-on session where a further introduction to the science behind psychological safety will be presented. A round table discussion focusing on explanations of student drop-out and institutional strategies to increase student retention will be facilitated.

Keywords

Psychological safety, student retention, learning environment, group and team dynamics

Background

A trustworthy work environment is key in retaining employees. Recent years have presented research from many social science faculties focusing on how to create a trustworthy workspace and many leadership education programs are likewise including this area in their curriculum (Edmondson et al. 2014; Newman et al. 2017)

Our aim is to investigate whether trustfulness can be applied to retainment of students at higher engineering programs as well. Students at our programs are from the very beginning of their studies placed in study groups. These groups create a group dynamic that to a certain degree establish the degree of trustfulness of each group. A high degree of trustfulness of the study group will impose a positive learning environment (Tsuei et al. 2019), and our question is whether it also might help retain students that potentially are in risk of attrition.

At the bachelor program in Technology Management and Marine Engineering students are in the very beginning of the first semester placed in study groups. Each group consists of 4-6 students. During the first semester each group will be coached and receive advice on how to obtain a better study environment and support each group member. These sessions can have focus on how to solve conflicts, how to organise weekly study meetings and how to rehearse for the exam.

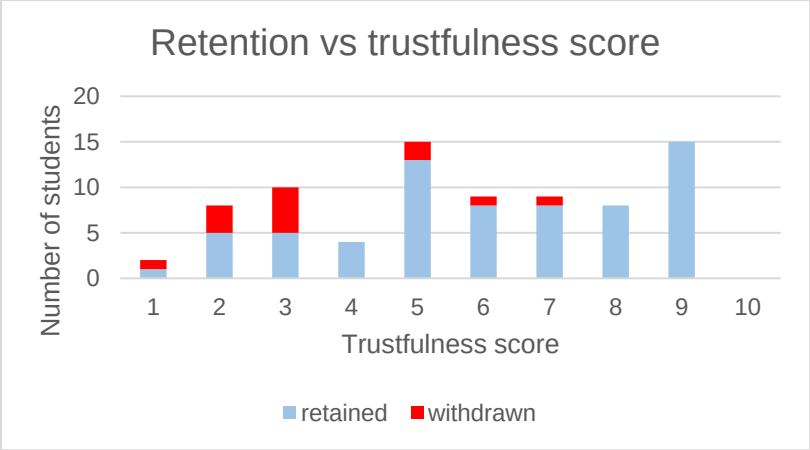
In the spring term 2022 the author was performing these coaching sessions at Copenhagen School of Marine Engineering and Technology Management. Parallel with the coaching each study group was given a score. The score indicated, on a scale from 1-10, the trustfulness within the group.

The overall score of trustfulness were based on three elements. 1) The verbally formulated level of trust, ambience and fellowship. 2) The degree of willingness to engage in social risk taking within the group. 3) The non-verbal communication between group members during the session.

The breakdown of the overall score into the 3 sub-elements has not been validated.

Statistical analysis

From mere observation, it seems there could be a significant correlation between a student's trustfulness score and the probability of that student still being enrolled one year later.



We therefore wish to explore if the trustfulness score can predict the retention status of a student approximately 1 year later.

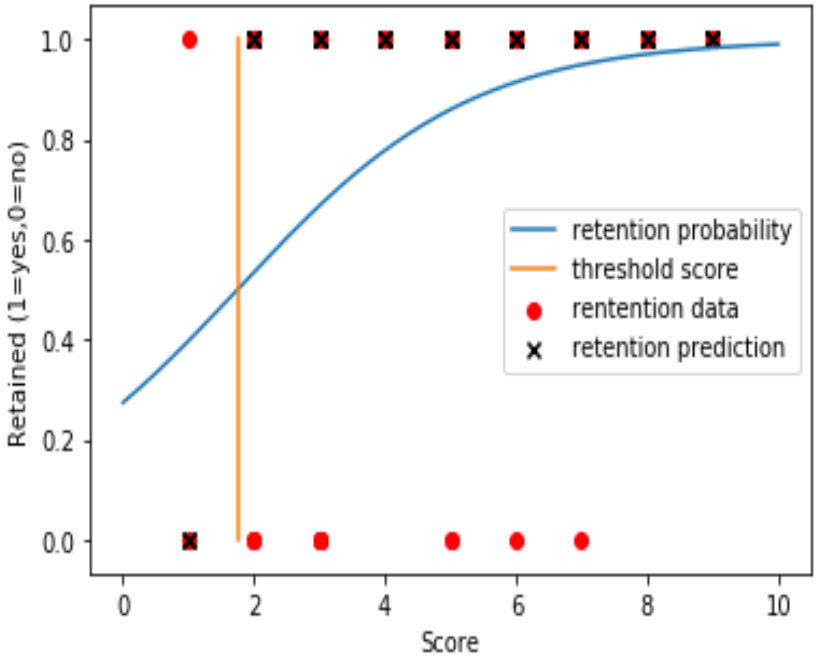
To this end, we perform a binomial logistic regression with the score as explanatory variable and retention status (1=retained, 0=withdrawn) as the response variable. The model is

$$p(x) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x)}}$$

Where x is the trustfulness score and $p(x)$ is the probability that a student is enrolled one year later.

The model is fitted to the data using maximum likelihood estimation. This is carried out using the Python statistics package *statsmodels*.

The result is shown below:



$$p(x) = \frac{1}{1 + e^{-(-0.9753 + 0.5574x)}}$$

Logit Regression Results

Dep. Variable:		y		No. Observations:		81
Model:		Logit		Df Residuals:		79
Method:		MLE		Df Model:		1
Date:		Mon, 06 Mar 2023		Pseudo R-squ.:		0.2045
Time:		21:16:40		Log-Likelihood:		-28.382
converged:		True		LL-Null:		-35.680
Covariance Type:		nonrobust		LLR p-value:		0.0001333
	coef	std err	z	P>|z|	[0.025	0.975]
const	-0.9753	0.755	-1.292	0.196	-2.455	0.504
x1	0.5574	0.173	3.225	0.001	0.219	0.896

As it turns out, the parameter β_1 (named x_1 in the print out) is significant with a p-value of 0.001, and so retention and trustfulness score are significantly correlated. However, the explanatory power of the score is not overwhelming given that the coefficient of determination is merely 0.2045.

According to the model, students who score less than $\frac{-\beta_0}{\beta_1} = 1.75$ have less than 50% probability of being enrolled in the program after one year, i.e. one may regard 1.75 as a threshold score.

The confusion matrix is presented below:

$$\begin{bmatrix} \text{True neg} & \text{False pos} \\ \text{False neg} & \text{True pos} \end{bmatrix} = \begin{bmatrix} 1 & 12 \\ 1 & 67 \end{bmatrix}$$

So the model makes wrong predictions in 13/81= 16% of the cases. Notice however, that the data is *not* linearly separable, i.e. no choice of model parameters would render the model capable of correctly predicting all data points.

Conclusion

We wanted to investigate whether a high degree of trustfulness in the study group would imply a higher chance of student retention. As shown in the previous section the difference in student retention between groups with a low trustfulness and high trustfulness is statistically significant. Of course, at this stage the causal mechanism as to why the retention is higher is not clear. There might exist an unobserved characteristic which leads to both low trustfulness and a high likelihood of student drop out. Further studies will have to investigate this.

Nevertheless, risk taking and non-verbal communication together with the study groups' out-spoken degree of trust and fellowship are assumed to indicate trustfulness. By using this score, either on study groups or on each individual student, at the beginning of the first semester, it possible for university colleges to get the necessary information to be able to intervene in time. From a societal perspective it makes sense to intervene in order to help the student find another relevant education which is better suited for the individual student's capabilities and desires.

Reference

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Newman A, Donohue R and Eva N: "Psychological safety: A systematic review of the literature". Human Resource Management Review 27 (2017): 521-535.

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Continuing Engineering Education New Paradigms?

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Keywords: Continuing Engineering Education; strategy; practice; organization; actors

Submission: Hands-on workshop

I. Background

For decades, lifelong learning has been a well-known concept, which has grown in importance as we gradually move away from the belief of 'learn-earn-retire' to an understanding of up-skilling and re-skilling throughout a life span. This change in beliefs must of course also be seen in the light of rapid technological progress which increasingly calls for new skills and competences. To some extent, providers of continuing education courses and programs meet these needs, but there is growing demand for more flexible and tailored learning activities and micro-credentials. Professional engineers will experience the demand and need to continually assess and close skill gaps as they arise. How are we, - and how will we, as universities respond to it?

II. Explanation

Continuing Engineering Education (CEE) is often referred to as the universities' third mission or outreach activity (Fink, 2002). However, CEE activities are often part of university strategies aiming at e.g., interacting with society; cross-collaboration with companies; research collaboration; knowledge exchange etc. Many universities offer CEE programmes, but the programmes offered differ greatly, and in general, collaboration with public and private companies is a relatively new and limited 'business' for most universities. In recent years, however, new methods and paradigms for continuing education have been developing (Andersen et al., 2021) some initiated by European and national programmes and grants, with the aim of upgrading the workforce e.g., to meet the skills and competence requirements derived from the SDGs and Industry 4.0 (Chakrabarti et al., 2021).

This workshop is based on research conducted in a Strategic Partnership funded by the Erasmus+ programme. The project 'STEM skills and competences for the new generation of Nordic engineers (nordenhub.org) The project conducted a mapping of activities within CEE at Scandinavian universities - based on data from 10 different technical universities in the five Scandinavian countries. The study aimed at mapping the strategies and current practices and identifying trends in cross-collaboration and new paradigms for knowledge flow between universities, industries and professional engineers.
With inspiration from the Nordic engineers (2018-2022), this workshop will facilitate the participants in conceptualizing and sharing knowledge of CEE.

III. During the workshop

This workshop aims to gather academic staff to brainstorm on several paths for the future practice, organization, and strategies of CEE.

The 90-minute workshop will be divided into six sections:

Presentation of the current state of CEE in a Scandinavian context.

Session 1: Brainstorming discussions in groups and the conceptualization of CEE

Scouting and presentation on concept mapping

Session 2: Knowledge sharing session in groups on CEE practice and strategies Presentations

Wrap up: Discussion and conclusion

IV. After the workshop

At the end of the workshop, participants are expected to experience the following outcomes:

- An elaborated understanding of the CEE concept
- Knowledge on how CEE is practiced and organized at various universities
- Knowledge of different CEE strategies

Based on the workshop outcomes and group presentations, we will explore the possibility to write and submit a proposal (paper, project etc.) together with the participating attendees the workshop.

References

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