CASE-BASED LEARNING IN COLLABORATION ACROSS UNIVERSITIES TO ENHANCE STUDENTS' UNDERSTANDING OF

Downloaded from: https://research.chalmers.se, 2026-10-07 19:38 UTC

Citation for the original published paper (version of record):
Eriksson, V., Holma, A., Lind, F. (2023). CASE-BASED LEARNING IN COLLABORATION ACROSS UNIVERSITIES TO ENHANCE STUDENTS' UNDERSTANDING OF SUSTAINABILITY. Proceedings of the International CDIO Conference: 567-580

N.B. When citing this work, cite the original published paper.

research.chalmers.se offers the possibility of retrieving research publications produced at Chalmers University of Technology. It covers all kind of research output: articles, dissertations, conference papers, reports etc. since 2004. research.chalmers.se is administrated and maintained by Chalmers Library

(article starts on next page)

CASE-BASED LEARNING IN COLLABORATION ACROSS UNIVERSITIES TO ENHANCE STUDENTS' UNDERSTANDING OF SUSTAINABILITY

Victor Eriksson

Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology, Trondheim, Norway.

Anne-Maria Holma

School of Management, University of Vaasa, Kokkola University Consortium, Vaasa, Finland.

Frida Lind

Department of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden.

ABSTRACT

Focus on sustainability is increasing in engineering and management education, businesses, and the larger society. In order to cope with sustainability challenges, more holistic pedagogies and practices that foster interdisciplinary and transdisciplinary ways of thinking are needed. Thus, this exploratory paper aims to provide insights into developing a master's-level course module on sustainability in business networks by using active learning through case-based teaching together with collaboration among three Nordic universities (NTNU, Vaasa, and Chalmers). The paper illustrates the multiple facets of designing, implementing, and evaluating three-party collaborative case-based learning based on an active learning approach that enhances students' learning and performance. We conclude that the students are actively involved and learn better with case-based learning and can further empathize and associate with the case contexts. This can be achieved through engagement in cross-border collaboration, a mix of student backgrounds, flexibility in choosing cases, and clarity in case materials. Additionally, we encourage teachers to use a combination of innovative active learning methods to promote students' in-depth understanding of complex sustainability-related challenges.

KEYWORDS

Case-based learning, Active learning, Online learning, Sustainability, University collaboration
Standards: 7,8

INTRODUCTION

Increasing attention has been paid to sustainability in engineering and management education (Figueiró et al., 2022; Malmqvist et al., 2022; Cullen, 2017), businesses (Kiron, 2012; Fontana et al., 2022), and the larger society (Brundtland, 1987). As a result, universities and university programs have worked to integrate sustainability into their curricula (Stough et al., 2018; Howlett et al., 2016), and many courses have separate modules focusing on sustainability (Holt, 2003; Rusinko, 2010). However, sustainability encompasses several aspects and thus needs to be integrated into a wide range of courses so as to prepare future engineers (Thürer et al., 2018) and business managers (Eizaguirre et al., 2019) for their professional careers, regardless of the sector (Howlett et al., 2016; Wamsler, 2020).

Higher education is pluralistic, and universities offer a broad selection of subjects, programs, and courses and are committed to developing students for a sustainable future (Gramatakos & Lavau, 2019). Sustainability topics have proliferated in science, technology, engineering, and mathematics (STEM) education and have been identified as a particular area for teaching and learning. However, a multidisciplinary approach is required, as STEM subjects in isolation cannot provide the depth needed to foster sustainability knowledge (Rogers et al., 2015). Management education and business schools have also seen substantial growth in interest in sustainability and sustainability topics (Cullen, 2017). However, in terms of STEM education, engineers with an eye to sustainability are advised to participate in transdisciplinary activities to develop transdisciplinary knowledge, because traditional engineering programs currently lack such support (Tembrevilla et al., 2023). At the same time, in terms of management and business education, although they have been swift to include sustainability in the curricula, there still remain challenges that must be handled. These challenges are related to the integration of sustainability into the course structure (i.e., as an integrated part versus as an isolated activity) (Figueiró et al., 2022), implementation of responsible and sustainable management (Maloni et al., 2021), the understanding of sustainability (Cullen, 2017), various perspectives on sustainability (wicked) problems (Lönngren et al., 2016; Lönngren, 2017), and how to best convey a sustainable business orientation that fosters a win-win situation for business, society, and the environment (Kolb et al., 2017).

In order to cope with these challenges, more holistic pedagogies (Wamsler, 2020) and practices are needed that foster interdisciplinary (Howlett et al., 2016; Kohn Rådberg et al., 2020) and transdisciplinary ways of thinking, including system thinking (Tembrevilla et al., 2023) and developing capabilities, with the latter defined by Sandri (2011, p. 39) as “holistic sets of attributes and skills that empower graduates to act in differing contexts.” One highly valued and sought-after education track in the Nordic countries lies at the crossroads of technology, management, and economics: university programs under the umbrella of Industrial Economics, Engineering, Management, and Technology. These programs provide a mix of STEM and management education, thus making them cross-disciplinary by design; moreover, systems thinking is ingrained in the management aspects of these programs. Therefore, management courses focusing on how business actors interact, their industrial activities, and the dynamics that are at play in actors’ economic exchanges could be a good site to dig deeper into the contemporary business world that is striving to become more sustainable. Moreover, novel teaching approaches that prepare students to make decisions, think critically, and improve their analytical skills are sought-after (Bezanilla et al., 2019).

The case method is widely used and accepted as a complement to classroom-based lectures (Becheikh et al., 2022). This method includes active learning components based on the notion that students best internalize what they learn by being active (Kunselman & Johnson, 2004).

Druckman & Ebner (2018, p. 359) state that the active component rests on the idea that students "need to bring their knowledge to bear on a case, identify the core problems it presents, and identify key questions that need to be answered." Furthermore, McDonald et al. (2022) argue that active learning strategies (such as case-based learning) assist in enhancing various skills. Nevertheless, Case (2019) argues that it is not necessarily about traditional classroom-based lectures versus active learning components, but rather a combination that focuses on knowledge involving strong conceptual explanations fused with strategies that help foster student engagement.

New approaches to sustainability in education and new ways to frame the teaching environment are imminent. Along those lines, the CDIO syllabus (http://cdio.org/) has been updated to address the "systemic characteristics of societal transformations and the crucial role of engineers in sustainable development" (Malmqvist et al., 2022, p. 23), advocating for a more holistic—i.e., systems-thinking—approach to sustainability, the inclusion of various stakeholder perspectives, and collaboration. In addition, Malmqvist et al. (2022) assert that both the interdisciplinary and international aspects (Säisä et al., 2020) of the CDIO syllabus need to be strengthened.

Overall, we argue that case-based teaching and learning are well-suited for students learning about sustainability, whereby they can help each other, reflect, develop capabilities, and acquire useful cross-disciplinary knowledge post-university. Thus, this exploratory paper aims to provide insights into developing a master's-level course module on sustainability in business networks by using active learning through case-based teaching together with collaboration among three Nordic universities (NTNU, Vaasa, and Chalmers). Building on our aim, the research questions (RQs) were articulated as follows:

- RQ 1: How can we develop a course module focusing on sustainability from a business and management perspective that provides a more holistic/systemic view?
- RQ 2: What are the opportunities and constraints in developing a case-based course module across multiple universities that is based on active learning to enhance student learning?

The structure of the paper is as follows. In the following section, we provide the rationale for developing the course and elaborate on an active learning approach with cases. After that, we provide details on how we approach case-based learning and describe our case-based sustainability module. Next, we describe our method. Finally, we end the paper with a discussion of our findings and some concluding remarks.

FROM RESEARCH TO EDUCATION: DEVELOPING A BUSINESS NETWORK COURSE IN THREE NORDIC COUNTRIES

Courses addressing industrial economics, technology management, and strategic management provide a wide range of subjects, one being the management of businesses in industrial networks. The starting point for understanding industrial networks is that business actors are embedded in networks as a result of their business relationships with other actors. These actors are interdependent, meaning they must rely on and interact with other actors when they carry out their operational and strategic business activities. Awareness of the sustainability efforts of the actors in an organization's business network is becoming increasingly important.

A collaboration among teachers in three Nordic universities to develop a sustainability-related module for master's students started in 2021 as a result of research-related discussions. We found similarities in the content of the courses we were responsible for, so we started to sketch a collaborative course module focusing on a shared interest in business relationships and sustainability. The module was first developed and implemented in the course syllabi (Table 1) during the summer of 2021. The course module, called "Sustainability in Business Networks" or in short the "Sustainability Project," is offered to students enrolled in three MSc courses at the three universities at the beginning of their fourth or fifth year.

Table 1. Courses and ECTS

Management of Business Relationships and Networks	7.5 ECTS	NTNU
Managing Business Networks	7 ECTS / 5 ECTS	Vaasa
Business Marketing and Purchasing	7.5 ECTS	Chalmers

The intended learning outcomes for the three courses include analysis of a firm's business network—that is, how companies can manage their relationships with other companies, understanding marketing, purchasing, and supply chain issues, and relationships' influence on a firm's value creation, innovativeness, internationalization, and productivity. Against this backdrop, the module aims to increase the understanding of the importance of networks and relationships to enhancing sustainability and to enable all students to build professional networks with students from other countries.

TOWARD AN ACTIVE LEARNING APPROACH WITH GROUP-BASED CASES

University student engagement and performance are major concerns, and new pedagogical content is being developed to manage these concerns (McDonald et al., 2020). Passive learning has long been the preferred teaching method, as it directly provides students with the content to be absorbed (Prince & Felder, 2006); moreover, it is convenient and easy, as the instructor-student interface is a one-way interaction (Huggins & Stamatel, 2015). Furthermore, Prince & Felder (2006) state that engineering and science have traditionally been taught deductively, wherein the instructor introduces a topic, illustrates it, and finally tests students' ability to solve a set of related problems in an exam. Students' primary motivation with this type of teaching is that they will need the content later, either during their education or when they start working. However, overusing a passive teaching style may, *ceteris paribus,* reduce students' engagement, understanding of the concepts, internalization of the material, and networking, thus affecting their overall performance (Bonwell & Sutherland, 1996; Prince & Felder, 2006; McDonald et al., 2020). Consequently, course designs, such as active learning approaches (Bonwell & Sutherland, 1996), that facilitate and enhance the extensive required skill sets are needed. In addition, in order to engage students, higher-order learning beyond traditional lectures, fact memorization, fact retrieval, and storing information needs to be facilitated (Van Hoek et al., 2011). Prince & Felder (2006) argue for a more inductive teaching style that is learner-centered in order to counteract deductive teaching. Inductive teaching and learning is an umbrella term for methods that focus on problem-based, project-based, case-based, and discovery learning, among others. These notions compel students to discuss questions, solve problems, and work in groups. Along this line, Scholten & Dubois (2017) discuss an active learning approach to write coauthored books involving supply chain management (SCM) students at the master's level. They found that their course designs "offers unique opportunities to capture and integrate the various skills, competences and perspectives needed for SCM graduates" (Scholten & Dubois 2017, p. 1697). Bonwell & Sutherland (1996)

present a conceptual framework for an active learning environment to help instructors in their endeavors to design and frame courses within an active learning environment where student engagement takes center stage; this framework describes a continuum in four areas (see Table 2).

Table 2. Aspects of the Active Learning Continua by Bonwell & Sutherland (1996)

Focus areas	Left end of the continuum	Right end of the continuum
Task Complexity	Simple tasks	Complex tasks
Course Objectives	Acquisition of knowledge	Acquisition of skills/attitudes
Levels of Interaction	Limited interaction	Extensive interaction
Levels of Student Experience	Inexperienced	Experienced

Bonwell & Sutherland (1996) state that an active learning approach is effective and cannot be ignored as teaching becomes ever-more complicated. However, merely adopting such an approach will not make students learn more: instead, what is essential is how the active learning approach is adopted (Prince & Felder, 2006). At the same time, students are a big part of the success of such approaches. There are many reasons why students learn and engage in more advanced learning. Biggs (1991) developed a three-phased model with integrated components: presage, process, and product. Presage concerns student characteristics (e.g., prior knowledge, abilities, willingness to learn) and the environment in which their learning occurs (e.g., curriculum, climate, assessment). Presage affects the Process (and the approach to the task), which centers on how students learn, given their preconceptions and motivations. Finally, the Product of students' learning relates to how much is learned and how well it is learned (Biggs, 1991).

APPROACHING CASE-BASED LEARNING IN A NEW AND INTERACTIVE WAY

Traditional text-based case learning can remain a single-dimensional analysis process if the case narrative covers one issue or situation to solve and/or highlights the knowledge called for by the instructor (McCarthy & McCarthy, 2006). For example, Emblen-Perry (2022, p. 2) argues that "case-based learning as such does not offer the needed flexibility to engage students in the increasingly complex, multi-dimensional, and transdisciplinary concepts of sustainability." Greater use of different problems within a case, a more interactive approach to the case study analysis, and more focus on the discussion phase may be more effective techniques for learning the complex problems related to sustainability (Emblen-Perry, 2022). In addition, a combination of active learning, learning-by-doing, and project-based learning—which requires students to collect, analyze, and synthesize information—may better increase students' cognitive learning of sustainability (Segalàs et al., 2010). In the following section, we describe how we applied different active learning methods to spark master students' interests and advance their understanding of sustainability challenges in business networks.

Description of the case-based sustainability module

The sustainability module focuses on sustainability in business networks and is a group-based, student-centered case assignment. The students are provided with theoretical articles on sustainability and brief backgrounds on three firms in three industries (textile, manufacturing, and food startup) — i.e., one firm per industry. Industry reports and presentation videos related

to the three firms are handpicked as study material, and the students are encouraged to also search for additional information about the cases. Finally, some study guidance questions are given to help the students get started with the assignment. The students' task was to describe and analyze the sustainability of the firm's business network and how it collaborates with other firms to enhance sustainability in this network. The module has several components: one written report, one oral presentation, one meeting across university groups, and both oral and written peer reviews on the work-in-progress and the final assignment. In this way, the module aims to incorporate learning from practice, collaborative learning within and across courses and universities, and self-directed learning by handing responsibilities to the groups.

The course module was part of the syllabus for the fall semester of 2021 and the fall semester of 2022. In 2021, the year the collaborative project was launched, only students from Chalmers and Vaasa participated, due to timing issues. At this time, the COVID-19 pandemic was causing all teaching at all three universities to move to online formats. As a result, we used a purely online format in 2021, whereas in 2022, we mostly used the online format but managed some aspects of the course on campus at our respective universities. The pandemic-induced online format might also have led to us setting up and implementing this type of collaborative assignment. From the start of the collaboration design, a teaching team was formed; the teachers knew each other before, as they are part of the same academic community. This teaching team has met regularly (primarily online but sometimes in person) during the years, a shared Teams area has been used to share documents. The associated guest lectures have also been coordinated across universities. Still, the assignment needs to fit into each individual course's syllabus, and these courses vary in their requirements for oral assessments of case reports, meaning that the grading of that element differs. Students had approximately five weeks to complete the course module, which ran simultaneously at the three universities. All students had the same assignment syllabus, which introduced the assignment, suggested readings, and the proposed cases, of which the students selected one to work on.

Number of students and throughput

The number of students from each university is summarized in Figure 1 below. The total throughput has been 264 individual students, divided into 44 groups.

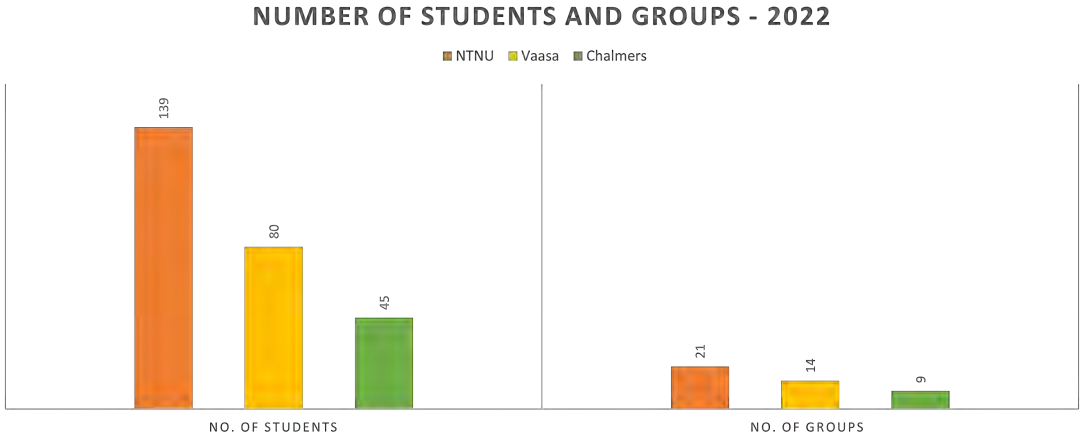

Figure 1. Number of enrolled students and groups at each university in 2022

The module was one part of the three universities' respective courses, and the throughput was very high, considering the group-based nature of the assignment. In addition, most groups completed the assignment satisfactorily (see Table 3).

Table 3. Throughput and distribution of grades

Points / Percentage within each grade category	8–10p	11–13p	14–16p	17–20p
NTNU	15%	18%	52%	15%
Vaasa	-	6%	48%	45%
Chalmers	-	11%	67%	22%

METHOD

We used a qualitative research design to investigate how this case-based module involving collaboration among three Nordic universities could result in an enhanced understanding of sustainability in business network courses. We collected data from students' reflective assignments, students' course evaluation testimonies at the end of the course (including questionnaires), and teacher observations and reflections.

We conducted qualitative comparisons of the students' satisfaction ratings, their experienced workload (self-reported), free text comments from course evaluation forms, feedback received during the module, and teacher reflections on the module itself but also on the collaboration among our respective courses, using qualitative coding and analysis of themes emerging from the data (Miles & Huberman,1994; Maxwell, 2012; Flick, 2014). We also used the Active Learning Continuum by Bonwell & Sutherland (1996) and the three-phase model by Biggs (1991) to analyze how to integrate a sustainability module using active learning and inter-university collaboration.

DISCUSSION OF RESULTS

Student learning and engagement

The results show that the students enjoyed the sustainability module and gained good insights into how firms manage sustainability in their networks. Additionally, students expressed that the approach was new and innovative: many students had previous experience with group-based work, but not in the format provided here, with multiple stages that needed to be completed before the final submission of the report. The feedback indicates that the students obtained much of their understanding through analyzing the firm's sustainability efforts in light of the theory provided in the course, enabling them to see connections between firms and larger systems: for example, "more learning is done through the assignment [in the module] than from the lectures." The students enrolled in the course ranged from moderate-experienced to experienced, and it was clear that the more experienced student groups managed to perform better than those with less experience. The students picked groups themselves, and many were homogeneous in terms of the study program and prior knowledge. However, some suggestions referred to a larger mixing of groups: "Given that the Vaasa students are from a commercial background and NTNU/Chalmers students have a technical background, it could have been interesting to form the groups across universities to gain different aspects and knowledge to the discussions throughout the course work."

Students appreciated the freedom they had and the chance to be involved and contribute to their own assignments. We gave them basic questions to consider and some starting points in the literature, but beyond that, the groups could decide much for themselves. Subsequently, within- and between-groups collaboration worked well, and the groups met several times throughout the module's duration. Even though the group work occurred on campus in each country, it was a positive experience for the students to be able to meet in person in their respective countries (2022) compared to purely online (2021). In this way, we tried to balance the present trade-off between dictating tasks so as to maintain a focus on the objectives and allowing the student groups the autonomy to choose their own approach and angle for the assignment, thereby increasing their motivation (Prince & Felder, 2006).

Students must engage with and take significant responsibility for their learning (Biggs, 1991; Bonwell & Sutherland, 1996); this means they need to know where they need to focus more, where there are gaps in their knowledge, and what information they need to obtain in order to successfully deliver all the assignments in the module. The findings in all three universities show that some student groups were more equipped to deal with the ambiguities and the self-directed learning responsibilities than others. Some groups enjoyed the module, while others did not, and some were more motivated to engage in deep learning than others. This was seen in the peer review and the final report assessment, where it was clear that those who engaged in deep learning showed analytical depth and innovative approaches to the assignment: they not only did what was required but also added their reflections to a larger extent than other groups. The students came from different backgrounds, have different majors and nationalities, and are at different stages in their studies. Collaborative group learning plays a key role in the students' learning process, the slightly homogeneous group formations notwithstanding (Yazici, 2004). Here, peer interaction and constructiveness are key traits, as learning occurs in a social context (Grabinger & Dunlap, 1995).

As such, the groups also met with another group at another university to discuss the assignment. They did not necessarily meet with a group analyzing the same firm, in order to broaden their understanding of the topic; in this way, they shifted focus from comparing how groups with the same company approached the assignment to elevated learning that involved helping each other, which required understanding of the subject matter (Biggs, 1991; McDonald et al., 2022). As such, "we had different companies, which served as a platform for both teams to learn something outside our 'own' company." Since the learning environment is different from encountering real-life problems, students need to be able to transfer their knowledge to new situations (Grabinger & Dunlap, 1995; Bezanilla et al., 2019): for example, "It was great to work on a case of a real company and get to know that well." We found that current and accurate information on a firm's sustainability efforts is vital for students to associate and empathize better, leading to a transition from lower-level to higher-level learning (Van Hoek et al., 2011).

Student satisfaction and workload

Students were satisfied with the module and appreciated the new approach to learning about sustainability, with its various connectors to theory, practice, and responsibility for their own learning: for example, "The chance to collaborate with NTNU was the most exciting part of this module, as it was a whole new experience for all five of us in our group." However, they saw areas for improvement, as reported in the following four quotes:

"We suggest considering giving time to work independently from the other universities as not all the activities have to be managed simultaneously. Leave the meeting, presentation, and

peer review by the time Chalmers and Vaasa start with their assignment; this will help to decrease the workload on NTNU students and improve the time management and the quality of the reports."

"The multi-step nature of the module is one of the things that confused the students."

"The assignment demands much work in a short time."

"Given that the Uni Vaasa students are from a commercial background and NTNU students have a technical background, it could've been interesting to form the groups across universities to gain different aspects and knowledge to the discussions throughout the course work."

Instructors' reflections

Sustainability is becoming a huge part of our teaching environment, with universities rolling out instructions that it should be integrated into all subjects. This is important and challenging, as we need to develop novel approaches to tackling and framing future problems. We tried to achieve this by taking an active learning approach that included collaboration among three universities and many small assignments that served to evaluate the acquired knowledge and provide opportunities for the students to network and learn from peers. From a teacher's perspective, the planning of the module presented a considerable challenge: coordinating learning and scheduling for three courses for the common parts of the module. It was also challenging to frame the module to fit a diverse group of students from various backgrounds. However, following the framework by Bonwell & Sutherland (1996), we designed the module to be positioned toward the right end of the continuum, as the subject requires dealing with relatively complex tasks and theory-heavy notions that must be transferred to practice; as such, the module is about acquiring skills that can be used post-graduation. All in all, the teaching team and the discussion made us concentrate on the sustainability project and learn from each other's courses; in that way, we managed to jointly develop this case-based assignment.

Given the students' Presages, we saw a huge variety in the Processes (Biggs, 1991). This was evident in the Q&A sessions, written peer reviews, presentations, final reports, and self-reported testimonies. It is clear that many students only scratched the surface of their potential learning, as many of the reports only discussed the bare minimum. The achieving approach was also evident, as many students have well-developed study skills at this phase of their studies. Those students with a deep approach saw it as interesting and were intrinsically motivated to learn the subject. To move forward sustainably, we need to activate students' (sleeping) deep approaches to elevate discovery learning (Prince & Felder, 2006) as well as prepare them to think critically and improve their analytical skills (Bezanilla et al., 2019). In addition, those with intrinsic motivation are highly valued in a collaborative setting, as they can engage demotivated students.

CONCLUSIONS

Our conclusions are twofold. The first part relates to our first research question: developing a course module to provide the students with a more holistic and systemic view of sustainability. The second part relates to how to enhance active student learning. In general, we have found that the module has chiefly been beneficial; however, we will develop the content based on the data from the two years it has been taught, wherefore we provide suggestions for each issue on how to develop the course.

Toward providing a holistic view of sustainability

The initiative provides a sought-after addition of sustainability related to managerial issues to traditional engineering education and a more holistic and systems approach to dealing with sustainability. Our findings show that a holistic approach in a case-based sustainability module is warranted and can facilitate and engage student learning and teacher discussions. We thus echo recent suggestions by Malmqvist et al. (2022) as well as McDonald et al. (2022) and Emblen-Perry (2022). Furthermore, we can determine that students are more involved in and learn better through empathizing with the case contexts and associations. This can be achieved through the following practices:

- Having clarity and an undertone of urgency in the case materials, such as information on the sustainability impact of firms and the implications thereof, motivates students to strive and discuss approaches to responding to sustainability issues as 'wicked problems' (Lönngren, 2021) in networks.
- Flexibility in choosing sustainability issues/focus: the students can choose cases they are interested in and empathize with, and thus they will learn better.

A specific focus was placed on how firms, in collaboration, do business, along with the effects of their interactions. Consequently, integrating sustainability into courses like the ones described above is timely, as it provides insight into various aspects of the business environment and gives students professional management skills that the industry has long required (Scholten & Dubois, 2017). This fosters a win-win situation for business, society, and the environment (Kolb et al., 2017).

Towards providing a holistic view of sustainability: Suggestions for future development

One way to give students more freedom is by letting them find and select the case themselves. They may be more interested if they have ownership of the case and if they possibly have prior knowledge of it. This suggestion is also related to our second issue, discussed in the next section. Another tactic could be having a kick-off lecture with a compelling sustainability case given as an example.

Toward enhancing active student learning through case-based teaching

Our findings show that a case-based module based on an active learning approach is warranted in order to enhance active student learning. The timeliness and appropriateness of the module and of the inductive and active learning approach (Kunselman & Johnson, 2004; Druckman & Ebner, 2018) are captured in this testimony: "We believe that the collaborative learning methods will help us develop higher level thinking, oral communication, self-management, and leadership skills to expose and increase our understanding of diverse perspectives." As such, we provide a timely, relevant, and engaging module that allows for higher-order learning (Van Hoek et al., 2011), achieved by:

- Engaging in cross-border collaboration and with students from diverse backgrounds, which enables them to share perspectives that instigate awareness and appreciation around varying viewpoints (given the differences in the country and university cultures).
- Flexibility in choosing cases, wherein the students can choose cases they are interested in and empathize with, therefore learning better.

In addition, active learning emphasizes not only content knowledge but also the development of skills, engagement, attitudes, and values. We also see the pros and cons of student collaboration across universities. Student engagement and learning require a plethora of learning and teaching methods and approaches. Getting students engaged is vital and can be achieved through content-related presentations, peer reviews, formal and informal discussions of work-in-progress assignments, and involving the practical dimension. This can be further achieved by encouraging self-directed learning and handing over more responsibilities to the students, promoting the nature of the instructor as a facilitator of learning instead of an expert.

Toward enhancing active student learning through case-based teaching: Suggestions for future development

1. Combine groups across universities, because this would be new and exciting for students, thereby increasing their eagerness to learn and show their learning to peer groups.
2. Groups could be organized according to the case firm, so that we have groups based on the same firm or set of firms. For this suggestion, we might need more cases so that we do not have too many groups working on the same case. This would also add variety to the reports and presentations. Another alternative would be to have no pre-prepared cases, only general sustainability articles (and a set of lectures); this would allow the students to select a company they are interested in or have prior knowledge of (for instance, as an employee). With this approach, we would guide the students to seek material from annual reports, news articles, etc., thus further adding ownership and the possibility to co-develop.
3. A discussion forum for a set of groups, with the intention that they should meet several times during the course to generate ideas, discuss work-in-progress reports, and evaluate each other's final reports.
4. The student groups could become active parties in the module, in the sense that they would plan, coordinate, and execute the module. This would encourage co-development of the module, focusing on active learning and student ownership and engagement.

In conclusion, we encourage teachers who teach sustainability-related modules to use a combination of innovative active learning methods in order to facilitate students' in-depth understanding of complex sustainability-related challenges. The experiences from our Sustainability Project module presented in this article were chiefly positive and provided the students and teachers with not only positive learning outcomes, but also a welcome change from lectures and traditional written assignments and exams.

FINANCIAL SUPPORT ACKNOWLEDGEMENTS

The authors received no financial support for this work.

REFERENCES

Becheikh, N., Mourad, M., & Tolba, A. (2022). Promoting Case-Based Learning in Business Higher Education in the Middle East and North Africa Region. Journal of Management Education, 46(4), 778-808.

Bezanilla, M. J., Fernández-Nogueira, D., Poblete, M., & Galindo-Domínguez, H. (2019). Methodologies for teaching-learning critical thinking in higher education: The teacher's view. Thinking Skills and Creativity, 33, 100584.

Biggs, J. B. (1991). Approaches to learning in secondary and tertiary students in Hong Kong: Some comparative studies. Educational Research Journal, 6(1), 27-39.

Bonwell, C. C., & Sutherland, T. E. (1996). The active learning continuum: Choosing activities to engage students in the classroom. New Directions for Teaching and Learning, 1996(67), 3-16.

Brundtland, G. H. (1987). Report of the World Commission on Environment and Development:" Our Common Future." United Nations.

Case, J. M. (2019). A third approach beyond the false dichotomy between teacher- and student-centred approaches in the engineering classroom. European Journal of Engineering Education, 44(5), 644-649.

Cullen, J. G. (2017). Educating Business Students About Sustainability: A Bibliometric Review of Current Trends and Research Needs. Journal of Business Ethics, 145(2), 429-439.

Druckman, D., & Ebner, N. (2018). Discovery learning in management education: Design and case analysis. Journal of Management Education, 42(3), 347-374.

Eizaguirre, A., García-Feijoo, M. & Laka, J. P. (2019). Defining Sustainability Core Competencies in Business and Management Studies Based on Multinational Stakeholders' Perceptions. Sustainability, 11(8).

Emblen-Perry, K. (2022). Auditing a case study: Enhancing case-based learning in education for sustainability. Journal of Cleaner Production, 381,134944.

Figueiró, P. S., Neutzling, D. M., & Lessa, B. (2022). Education for sustainability in higher education institutions: A multi-perspective proposal with a focus on management education. Journal of Cleaner Production, 339, 130539.

Flick, U. (2014). An introduction to qualitative research. 5 ed. London, UK, Sage.

Fontana, E., Öberg, C., & Poblete, L. (2021). Nominated procurement and the indirect control of nominated sub-suppliers: Evidence from the Sri Lankan apparel supply chain. Journal of Business Research, 127, 179-192.

Grabinger, R. S., & Dunlap, J. C. (1995). Rich environments for active learning: A definition. Research in Learning Technology, 3(2), 5-34.

Gramatakos, A. L., & Lavau, S. (2019). Informal learning for sustainability in higher education institutions. International Journal of Sustainability in Higher Education, 20(2), 378-392.

Holt, D. (2003). The role and impact of the business school curriculum in shaping environmental education at Middlesex University. International Journal of Sustainability in Higher Education, 4(4), 324-343.

Howlett, C., Ferreira, J.-A., & Blomfield, J. (2016). Teaching sustainable development in higher education. International Journal of Sustainability in Higher Education, 17(3), 305-321.

Huggins, C. M., & Stamatel, J. P. (2015). An exploratory study comparing the effectiveness of lecturing versus team-based learning. Teaching Sociology, 43(3), 227-235.

Kiron, D. (2012). Sustainability nears a tipping point. Strategic Direction, 28(7).

Kohn Rådberg, K., Lundqvist, U., Malmqvist, J. & Hagvall Svensson, O. (2020). From CDIO to challenge-based learning experiences–expanding student learning as well as societal impact? European Journal of Engineering Education, 45(1), 22-37.

Kolb, M., Fröhlich, L., & Schmidpeter, R. (2017). Implementing sustainability as the new normal: Responsible management education – From a private business school's perspective. The International Journal of Management Education, 15(2, Part B), 280-292.

Kunselman, J. C., & Johnson, K. A. (2004). Using the case method to facilitate learning. College Teaching, 52(3), 87-92.

Lönngren, J. (2017). Wicked Problems in Engineering Education: Preparing Future Engineers to Work for Sustainability. Doctoral thesis, Chalmers University of Technology.

Lönngren, J. (2021). Wicked problems i lärande för hållbar utveckling – Vägledning för att ta fram exempel och problembeskrivningar. Högre utbildning,11(3).

Lönngren, J., Svanström, M., Ingerman, Å. & Holmberg, J. (2016). Dealing with the multidimensionality of sustainability through the use of multiple perspectives – a theoretical framework. European Journal of Engineering Education, 41(3), 342-35.

Malmqvist, J., Lundqvist, U., Rosén, A., Edström, K., Gupta, R., Leong, H., Cheach, S. M., Bennedsen, J., Hugo, R., Kamp, A., Leifler, O., Gunnarsson, S., Roslöf, J. & Spooner, D. (2022). The CDIO Syllabus 3.0: An Updated Statement of Goals. Proceedings of the International CDIO Conference, Reykjavík University, 18-36.

Maloni, M. J., Palmer, T. B., Cohen, M., Gligor, D. M., Grout, J. R., & Myers, R. (2021). Decoupling responsible management education: Do business schools walk their talk? The International Journal of Management Education, 19(1), 100456.

Maxwell, J. A. (2012). Qualitative research design: An interactive approach. Sage publications.

McCarthy, P. R. & McCarthy, H. M. (2006). When Case Studies Are Not Enough: Integrating Experiential Learning Into Business Curricula. Journal of Education for Business, 81(4), 201-204.

McDonald, D., Holmes, Y., & Prater, T. (2020). The Rules of Engagement: A Test of Instructor Inputs and Student Learning Outcomes in Active versus Passive Learning Environments. E-Journal of Business Education and Scholarship of Teaching, 14(1), 25-39.

McDonald, D., Iscaro, V., & Posey, O. G. (2022). Active learning strategies in business education: using the law to build critical workforce skills. Journal of International Education in Business, 15(2), 406-424.

Miles, M. B., & Huberman, A. M. (1994). Qualitative data analysis: an expanded sourcebook (2nd ed.). Sage.

Prince, M. J., & Felder, R. M. (2006). Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases. Journal of Engineering Education, 95(2), 123-138.

Rogers, M., Pfaff, T., Hamilton, J., & Erkan, A. (2015). Using sustainability themes and multidisciplinary approaches to enhance STEM education. International Journal of Sustainability in Higher Education, 16(4), 523-536.

Rusinko, C. A. (2010). Integrating sustainability in higher education: a generic matrix. International Journal of Sustainability in Higher Education, 11(3), 250-259.

Sandri, O. (2011). The value of developing professional capabilities for sustainability. Proceedings of the 10th International Conference of Australasian Campuses Towards Sustainability.

Scholten, K., & Dubois, A. (2017). Advancing the skill set of SCM graduates – an active learning approach. International Journal of Operations & Production Management, 37(11), 1683-1699.

Segalàs, J., Ferrer-Balas, D. & Mulder, K. F. (2010). What do engineering students learn in sustainability courses? The effect of the pedagogical approach. Journal of Cleaner Production, 18(3), 275-284.

Stough, T., Ceulemans, K., Lambrechts, W., & Cappuyns, V. (2018). Assessing sustainability in higher education curricula: A critical reflection on validity issues. Journal of Cleaner Production, 172, 4456-4466.

Säisä, M., Määttä, S., Roslöf, J. & Chee, T. (2020). International Cooperation between Two Project Learning Environments–a Case Study. Proceedings of the 16th International CDIO Conference, 203-212.

Tembrevilla, G., Nesbit, S., Ellis, N., & Ostafichuk, P. (2023). Developing transdisciplinarity in first-year engineering. Journal of Engineering Education, 112(1), 43-63.

Thürer, M., Tomašević, I., Stevenson, M., Qu, T. & Huisingh, D. (2018). A systematic review of the literature on integrating sustainability into engineering curricula. Journal of Cleaner Production, 181, 608-617.

van Hoek, R., Godsell, J., & Harrison, A. (2011). Embedding “insights from industry” in supply chain programmes: the role of guest lecturers. Supply Chain Management: An International Journal, 16(2), 142-147.

Wamsler, C. (2020). Education for sustainability. International Journal of Sustainability in Higher Education, 21(1), 112-130.

Yazici, H. J. (2004). Student perceptions of collaborative learning in operations management classes. Journal of Education for Business, 80(2), 110-118.

BIOGRAPHICAL INFORMATION

Victor Eriksson has a Ph.D. in Technology Management and Economics and is a Postdoctoral researcher at the Department of Industrial Economics and Technology Management at NTNU, Trondheim, Norway. His research interests include Purchasing and Supply Chain Management, Triads, Transportation, and Construction. Victor has published in the Journal of Business & Industrial Marketing, Construction Management and Economics, and the International Journal of Logistics Management.

Anne-Maria Holma has a Ph.D. in Marketing and is an Associate Professor at the School of Management at the University of Vaasa, Vaasa, Finland. Her research interests include Inter-organizational Networks, Buyer-Supplier relationships, Triads, Public Procurement, and Circular Economy. Anne-Maria has published in Industrial Marketing Management, Tourism Management, Journal of Purchasing & Supply Management, and Journal of Business & Industrial Marketing.

Frida Lind is a Professor of Industrial Marketing at the Department of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden. Her research interests include Inter-organizational Collaboration, Innovation, Startups, and Business Models. Frida has published in journals such as Industrial Marketing Management, Journal of Business Research, Journal of Business-to-Business Marketing, the European Journal of Innovation Management, and Journal of Business & Industrial Marketing.

Corresponding author

Victor Eriksson
NTNU Norwegian University of Science and Technology
Department of Industrial Economics and Technology Management,
Alfred Getz vei 3, Sentralbygg I,
Gløshaugen, NTNU, 7491 Trondheim,
Norway
victor.eriksson@ntnu.no

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.