ØkoEngineer

A web-based sustainability l

EIU Best Practices 2021

Developing a Learning Platform in Engineering

A Case from **Denmark**

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Foreword

The Education for International Understanding (EIU)/Global Citizenship Education (GCED) Best Practices programme is one of APCEIU's efforts to share diverse experiences, practices, and approaches to bolster EIU and GCED which can inform and inspire education professionals who wish to design and implement policies, activities, and educational programmes on EIU and GCED. A total of 54 EIU Best Practices has been published and disseminated around the Asia-Pacific region and beyond since 2006. This year, Ms. Serena Leka's case has been included with series number 55, focusing on sustainability learning platform created to educate engineering students in Aarhus on sustainability concepts.

In the past few years, APCEIU has encouraged the participants of its capacity-building programmes to share their experiences and stories of promoting EIU and GCED through these series. At the end of each training workshop organized by APCEIU, participants present their own action plans to implement EIU and GCED after returning home. This publication shows the continued commitment and endeavors of APCEIU's training alumni to carry out EIU and GCED after the completion of the workshops. In fact, Ms. Serena Leka's case is the outcome of the action plans established from her learning in the Youth Leadership Workshops in 2017 and 2018.

The EIU/GCED Best Practices Series is unique in that it provides insights into how EIU/GCED is interpreted and put into practice in different contexts by those who are at the forefront of education. Although each case is set in different locations and institutional backgrounds, others can draw practical ideas and

observations and learn from the case contributors' experiences, challenges they faced, strategies used, and lessons learned while striving to overcome those challenges. Due to the COVID-19 pandemic, the programme was discontinued in 2020, but it could be resumed this year thanks to our alumni's great interest and participation. I hope that the EIU/GCED Best Practices will continue to serve as a useful reference for educators, policymakers and practitioners, who share a strong commitment for EIU and GCED.

Lastly, I would like to convey my deepest appreciation and congratulations to Ms. Serena Leka for her continuing efforts to promote EIU and GCED, and creating a synergy effect among themselves by encouraging each other and sharing ideas, which I believe contributed to the successful publication of the EIU/GCED Best Practices 2021.

September 2021

LIM Hyun Mook
Director

EIU Best Practices is…

APCEIU has been committed to the promotion of Education for International Understanding (EIU) since its inception, in line with one of the pillars of education "Learning to Live Together." EIU is a UNESCO initiative to promote a Culture of Peace through education, which is central to UNESCO's mission. EIU aims to foster global citizens with values, attitudes, knowledge and skill sets necessary for learning to live together and overcoming racial, cultural, and religious conflicts. In the recent years, this mission has been reaffirmed by the adoption of the Sustainable Development Goals (SDGs) and Education 2030. The SDG-4 and the accompanying Target 4.7[1] highlights the importance of promoting global citizenship education (GCED).

APCEIU launched EIU Best Practices in 2006 to encourage and support educators, scholars and activists who wish to promote EIU and GCED by collecting and sharing success stories and lessons learned in promoting EIU/GCED in different social and cultural contexts. The EIU Best Practices aim to provide practical ideas and insights on how to design and implement EIU and GCED by sharing specific examples and practices carried out by practitioners on the ground.

The programme is conducted through the following steps: 1) Call for applications: APCEIU sends announcement letters along with application forms and guidelines to the alumni of the EIU/GCED capacity-building training programmes organized by APCEIU; 2) Screening and selection: Submitted applications are reviewed by the Screening Committee, who select the five best practices; 3)Online Monitoring: The selected applicant is required to make his or her programme/project available for online monitoring. The selected applicant

is obligated to cooperate in terms of making arrangements for APCEIU's online monitoring on his/her respective country. 4) Case presentation and award ceremony: Selected applicants present their cases and receive the Global Citizenship Education Award; 5) Submission of the final reports: Selected applicants submit the final reports to APCEIU based on the guidelines; and 6) Publication and dissemination: Final reports are published and disseminated on and offline.

APCEIU encourages educators, scholars, and activists to apply and share their diverse experiences and perspectives. The occurrence of COVID-19 pandemic last 2020, prompted the programme to cease, but finally resumed online and published the series in 2021 due to the keen interest of APCEIU's alumni. It is hoped that the EIU Best Practices will continue to inspire and inform practitioners, generate meaningful dialogue, and serve as useful materials for those who are committed to promote EIU and GCED and contribute to building a more just, peaceful, and sustainable world.

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① Target 4.7: By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

Contributor

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  Arhus University, Denmark

Ms. Serena Leka has a Master's Degree in Economics and Business Administration with a specialization in Strategy, Organization, and Leadership at Aarhus University and a Talent Recognition semester in collaboration with Columbia University Center for Technology Management. She is a candidate for a Doctoral Degree in the Department of Electrical and Computer Engineering, Aarhus University, conducting action research about using artificial intelligence in idea management systems for radical innovation in new product development.

She has been a lecturer for entrepreneurship and innovation classes for the past five years, working with students on developing a creative mindset and practicing to become innovators and entrepreneurs. At present, she is an active member of the Aarhus University Sustainability Network, encouraging the scale of the sustainability platform: ØkoEngineer, to promote Global Citizenship Education (GCED) and Education for International Understanding (EIU) through online classes, case-base pieces of training, and workshops in the MakerSpace, Deep Tech Environmental Hub. She applies sustainability practices through her work

with startups, helping them reach the right audiences, gather supporters for their visions, and seek initial funding. Her most successful partnership is with CELLUGY, the globally award-winning biotechnology startup, developing advanced circular materials to replace plastic. Recently, she co-launched the podcast "HER Frequency" to initiate discussions and suggest actions about opportunities and issues surrounding women in STEM.

Acknowledgement

passion and commitment to ØkoEngineer and its growth. Since the birth of ØkoEngineer, we had on board SetSnail, an experimental development playground agency that helps design exciting and playful interactive experiences across all sorts of digital media.

As we successfully surpass several challenges in establishing educational standards of teaching sustainability on campus, especially our future engineers, we have received tremendous financial support from the grant scheme at Aarhus University, dedicated to Educational IT applications. To make the learnings of ØkoEngineer more tangible for social and global impact, The Fond for Entrepreneurship followed with financial support to design activities of the platform in the MakerSpace at Deep Tech Experimental Hub, Aarhus University. Lastly, special thanks to PTC Education for donating educational materials to our student players.

To conclude, my sincerest appreciation to APCEIU and GCED Youth Network, who shared the in-depth concepts of GCED and EIU through the Youth Leadership Workshops in South Korea, in my position as a participant in 2016 and later as a trainer in 2017-2018. It has been a once-in-a-lifetime opportunity to meet outstanding wonderful young practitioners of GCED and EIU worldwide and get inspired to promote values of living harmoniously through shared leadership.

Summary

ØkoEngineer is a sustainability learning platform created to educate engineering students in Aarhus on sustainability concepts and how they couple with engineering design through the gamification of project-based learnings. The project aims to prepare our future engineers to play their crucial role in the significant global issues that we face. In response to the above challenges, future engineers, today's students are embracing initiatives that stimulate sustainability education. Our students are motivated by the urge to relate sustainability with their domain-specific engineering theories. ØkoEngineer is a web-based game platform designed for integrating sustainability learning in engineering curricula.

The platform of ØkoEngineer has integrated learning certificated, which are in the form of short videos and short text, where students can design their individual learning path according to their studies and preferred areas of sustainability. The learning certificated are followed by case projects that are real-life inspired. Engineering students are provided with instructions on how to solve the cases, with results as sustainable as they can, without compromising the quality of the engineering task at hand.

The development of ØkoEngineer started in March 2020 and is still under development to equip the platform with more case-project from company collaborations and with the ambition to make the platform accessible to students across all departments at Aarhus University.

Table of Contents

ACRONYMS

EIU	Education for International Understanding
GCED	Global Citizenship Education
LTLT	Learning to Live Together
LRM	Learning Resource Material
MOU	Memorandum of Understanding
REAP	Re-entry Application Projects
SDGs	Sustainable Development Goals
UNDESD	United Nations Decade of Education for Sustainable Development

Developing a Learning Platform in Engineering

1. Introduction and Background

A growing number of researchers and academic units acknowledge the need to include sustainability learning in core engineering education programmes. On the other hand, other studies have shown that guided discovery-based learning is suitable for students to learn about essential relationships between engineering concepts and other cross-disciplinary notions, like sustainability. ØkoEngineer is a learning platform designed to mainly familiarize engineering students with sustainability concepts and provide them with an array of possibilities of how sustainability can be linked to the engineering design process.

In 2020, Aarhus University adopted its first-ever climate strategy and where a more focused work for a greener university took its form. It was, however, two years since the Aarhus University Sustainability network was created, and many representatives of students and staff came together to discuss the status of the university's compliance with global initiatives and/or its significant needs for adaptation of sustainable practices on campus. Two colleagues from the Faculty of Technical Sciences, Engineering area, Associate Professor Devarajan Ramanujan and Serena Leka, came together to collaborate in multiple initiatives like:

- Participation in the conference, "Partnerships for a Sustainable Future: The 17 UN Sustainable Development Goals" at Aarhus University, 4 February 2019;
- Organizing fundraising activities to ensure future independence and the financial sustainability of the Makerspace Unit at Mechanical and

Production Engineering Department during 2019-2020; and

- Establishing "Sustainability Days" series of events, with guest lecturers from academia and industry, in Denmark and USA, from the area of mechanical and construction engineering, 2019.

▲ *Devarajan Ramanujan and Serena Leka at the Conference "Partnerships for a Sustainable Future: The 17 UN Sustainable Development Goals" at Aarhus University, 4 February 2019 © Serena Leka*

After many interactions and finding common ground with the ambition of educating staff and students in sustainability, Devarajan and Serena decided to brainstorm about the possibilities of designing new initiatives. This is where ØkoEngineer was born: a sustainability-learning gamified platform.

With the initial financial support of Educational-IT Grants at Aarhus University, the game's development started in March 2020. The team expanded with two bright student assistants, Haitham Abu Ghaida (MSc. in Civil and Architectural Engineering, Aarhus University) and Yana Vashchuk (MA in International Studies, Aarhus University), and later in 2020, Kamila Kunrath (PhD. in Technology and Innovation Management, Danish Technological University) and Arturs Skuntas (Bachelor in Business Administration and UX Design/Visual

Identity, Business Academy Aarhus) joined the team, to drive the dissemination of ØkoEngineer with research output (Photo) and visual content, respectively. In addition, the team gained the support of staff at the Centre for Educational Development and Sustainability Network at Aarhus University, aiming for a broader reach of students across all departments on campus.

Later in the year, further funding was raised through a small grants programme at the Danish Fund for Entrepreneurship, emphasizing sustainability educations' relevance in innovating and developing new products/services with high impact in society. ØkoEngineer facilitates a more effective learning process due to the gamification factor, thus obtaining improved learning results, translating into more student innovations.

▲*ØkoEngineer Team celebrating funding – from left to right: Haitham, Devarajan, Kamila, and Serena 2021*
©Serena Leka

To achieve significant and systemic change in educational programs' content and complement it with sustainability topics, the promotion of ØkoEngineer goals and objectives is necessary across workings groups at the national and central organizational levels. Each entity approached for collaboration provides extensive feedback and other competencies needed to materialize and scale fast the impact of ØkoEngineer across groups of interest in the university and beyond.

The development of ØkoEngineer started amidst the COVID-19 global pandemic, making educational institutions reconsider the communication and learning tools used across staff and students. The situation prompted to change all the campus-based learning activities into an online setting. Such a context helped the case of ØkoEngineer, knowing that students welcomed web-based learning platforms in their daily routines. On the other hand, engineers, among others, were tasked to address the many challenges that COVID-19 brought in societies, i.e., environmental, social, and economical. In response to the above challenges, future engineers, today's students are embracing initiatives that stimulate sustainability education. Our students are motivated by the urge to relate sustainability with their domain-specific engineering theories. ØkoEngineer is a web-based game platform designed for integrating sustainability learning in engineering curricula.

2. Description of the programme

2.1 Goals and Objectives

Integrating sustainability education into engineering courses is a challenging task. It requires creating pedagogical approaches that help students develop a firm understanding of the relationships between the technical performance of systems (e.g., cost, reliability) and sustainability performance. Furthermore, such approaches should equip students with the skills needed to innovate engineering systems from sustainable development perspectives.

Varieties of pedagogical approaches, e.g., project-based learning and problem-based learning, have been previously used to integrate sustainability education into engineering courses. While such approaches have improved students' learning outcomes, the following challenges have significantly limited their success:

ⅰ) they require a significant redesign of existing courses and are therefore met with resistance from faculty/administrators;

ⅱ) there is a dearth of pedagogical approaches that can facilitate learning of tradeoffs between engineering and sustainability performance; internalizing such learning is vital for applying sustainability in the real world; and

ⅲ) they offer little help to students interested in applying their knowledge in innovation-focused and entrepreneurial contexts.

ØkoEngineer aims to address the above challenges by creating IT-augmented learning modules for sustainability education that can be integrated into existing engineering courses or explored by students as an extracurricular activity. ØkoEngineer has its roots at the Department of Engineering, Aarhus University.

The ØkoEngineer platform enables course instructors to create open-ended design tasks that relate a technical domain (e.g., structural analysis, circuit design) to sustainability. Students solve these tasks iteratively and discover implicit relationships between technical performance and sustainability. This project aims to create IT-augmented learning modules that enable the integration of sustainability education within existing engineering courses. The developed modules will be based on previous research by using guided discovery learning and experiential learning for integrating sustainability education into engineering curricula.

The deliverables of this project include the development, implementation, and research-based validation and dissemination of a web-based IT-augmented learning module that enables experiential learning of relationships between sustainability and technical performance with regards to physical experiments, but not only in engineering curricula. ØkoEngineer will use physical resources available in the Engineering MakerSpace, Deep Tech Hub, and be integrated into the Sustainable Design & Production course (10 ECTS). In addition, ØkoEngineeri is gamified with digital learning modules that introduce sustainability, Sustainable Development Goals (SDGs), the role of engineers in achieving SDGs, and tech-

nological innovation for SDGs. ØkoEngineer is offered to about 300 master level students through Applied Innovation in Engineering course (5 ECTS) in their first semester.

2.2 Target Groups

ØkoEngineer targets Master's students enrolled in the Department of Engineering. The learning modules developed in this project will be integrated into two courses: Sustainable Design and Production, and Applied Innovation in Engineering, to assure that there is a very strong likelihood that the target group of students will have continued exposure to the project outcomes. Students are part of the following master programmes:

- Master's Degree Programme in Mechanical Engineering
- Master's Degree Programme in Civil & Architectural Engineering
- Master's Degree Programme in Biological & Chemical Engineering
- Master's Degree Programme in Electrical & Computer Engineering

The overarching goal for the current project is the successful implementation of IT-augmented learning modules for improving sustainability related learning outcomes within engineering courses. Results from the research showed exploration-focused learning modules that facilitate deep learning of inter-relationships between sustainability and engineering performance. Results also showed that framing the exploration process through hands-on, experiential learning tasks improved retention and application of learned concepts. Building on these findings, the current project will develop IT-augmented learning modules to achieve the following goals:

Goal 1 - Contextualizing sustainability and SDGs across engineering disciplines

Engineering students' understanding of sustainability concepts is more effective when contextualized to their technical discipline (i.e., mechanical engineering, electrical engineering). To this end, this project will explore the creation of

digital learning platforms that can support more personalized learning pathways (Fig.1). Achieving this goal is essential as both courses (Applied Innovation in Engineering; Sustainable Design & Production) enroll students across engineering disciplines.
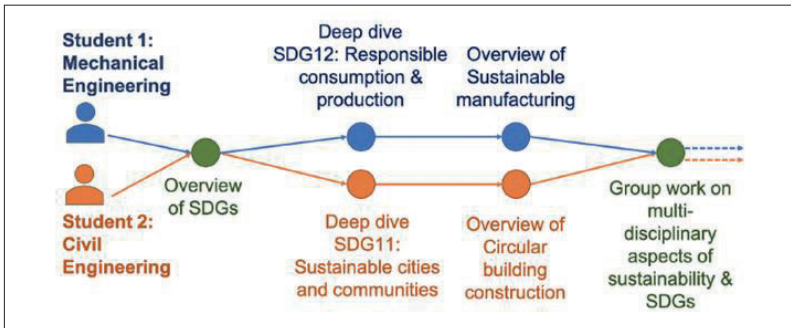
▲ *Figure 1: Example of personalized learning pathways for sustainability concepts that will be implemented in the digital learning module in the Applied Innovation in Engineering course 2019. © Devarajan Ramanujan*

Goal 2 - Enhancing the application of learned sustainability concepts to the real world

Applying sustainability concepts to real world technical systems requires a firm understanding of potential tradeoffs and constraints between cost, technical performance, and sustainability performance. The teams' previous research shows
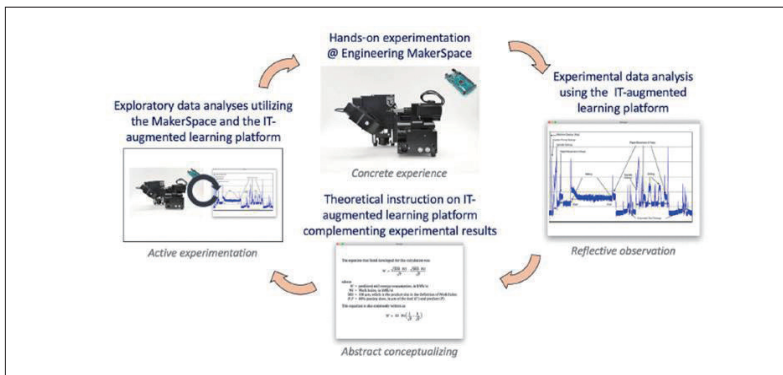
▲ *Figure 2: An example where students explore the energy consumption of milling processes through experiential learning. The proposed IT-augmented learning module will support experimental data analysis, theoretical instruction, and exploratory analyses 2019 . © Devarajan Ramanujan*

experiential learning can facilitate a deeper understanding of inter-relationships among design parameters. We plan to enable such learning through the IT-augmented learning module (Fig. 2) developed for the Sustainable Design & Production course.

Goal 3 - Supporting innovation & entrepreneurship

The synergy of the IT-augmented learning modules, access to prototyping facilities, and industry-oriented project work in the two courses will provide a unique opportunity for students to apply their learning towards the creation of innovative technical solutions focusing on sustainability. The team is linked to funding organizations (e.g., EIT Climate KiC, EIT Raw Materials) that can potentially support the implementation and commercialization of promising solutions. The team believes that fostering a milieu for innovation plays a vital role in enhancing learning outcomes as well as the real-world impact of engineering courses.

2.3 Activities in Detail

ØkoEngineer is an online-gamified platform for engineering students, which is complemented with activities in the MakerSpace, Aarhus University, to study advance knowledge of sustainability and how it ties to the engineering area.

The digital learning part is conducted in the Applied Innovation course in Engineering as follows:

- Purpose: these online earning modules will introduce students to sustainability, sustainable development goals (SDGs), the role of engineers in achieving SDGs, and technological innovation for SDGs.

- Design & Content: The modules will be designed as a series of 'sub-tasks personalized to the student's educational background and self-identified

learning goals. The module will enable the creation of personalized learning pathways and deliver on Goal 1. We work with a consultancy software development company, SetSnail, to implement this learning module. We plan on gamifying the module by structuring the 'sub-tasks as 'quests' that must be completed to reach the ultimate goal of saving the planet. Previous research shows that gamification and the creation of personalized learning pathways can improve learning outcomes in engineering education (Fig.1).

- Implementation in the Applied Innovation in Engineering course: The learning modules will be introduced between Weeks 1 to 5. The course uses real case-based project work, in which multidisciplinary teams provide one or more concrete ideas as inventions based upon technological and engineering skills. This facet of the course will help us deliver on Goal 3. After studying the nature of the company cases provided in the course, we have observed sustainability as the third primary area of interest (33%). The majority of classes are structured with a strategic beginning, following up on the learning from the previous class as well as a theoretical introduction on the day's topic; continued by the tactical part with a general understanding of the what, why and how, and finally an active part is divided into an introduction to the assignments followed by teamwork.

- Validation of improvements in learning outcomes: we conduct pre-and post-intervention studies in the course to validate the efficacy of the developed learning module. We also plan to evaluate improvements in learning outcomes specific to gamification by comparing them with the learning outcomes of a future cohort that will receive a lecture-based or video-based introduction to the same topics. Finally, we will also report the sustainability-focused learning progression of a selected cohort of students that complete the Applied Innovation in Engineering course

and enroll in the Sustainable Design & Production course.

The practical and hands-on learning part is conducted in the Sustainable Design and Production Course as follows:

• **Purpose**: This module will help augment students' learning of relationships between sustainability and engineering performance based on hands-on, exploration-focused engineering experiments in the Engineering MakerSpace. Internalizing such sustainability-related tradeoffs in engineering systems is vital for students to apply their learning in the industry successfully.

• **Design & Content**: The module will be designed as a digital exploration platform that promotes experiential learning of tradeoffs between sustainability and engineering performance (see Figure 2). Students' learning will be scaffolded through an IT-augmented learning system based on Kolb's experiential learning model and will help us deliver on Goal 2. The learning system will support the reflective observation of experimental results and conceptualizing theoretical models for sustainability performance through exploration-focused tasks. We work with SetSnail here, too, the consultancy software development company, to implement the learning module.

• **Implementation in Sustainable Design & Production course**: The Sustainable Design & Production course is project-based and includes laboratory sessions where students work with environmental sustainability assessment software. The proposed learning module will extend the laboratory sessions and be introduced in Weeks 8 to 10 of the course. Students will also be provided with access to the Engineering MakerSpace to work on hardware-related projects during the project (Goal 3).

- **Validation of improvements in learning outcomes**: The efficacy of the IT-augmented learning module will be validated using course satisfaction surveys. The team also plans on conducting detailed research-based studies to explore the influence of various types of exploration-focused tasks (e.g., optimization of sustainability parameters, accessible exploration of parameters) on improvements in learning outcomes. We anticipate that the results from these studies will be published in leading conferences on engineering education.

2.4 Relevance to EIU/GCED

In 2005, a worldwide study survey investigated engineering student's degree of awareness about sustainable development (SD), including 21 high education institutions, with a total of 3132 students joining to share their knowledge and understanding of SD, its relevance, and previous environmental/sustainability education. Results of the study reflected an unsatisfactory degree of awareness and comprehension of SD and more effort will be needed to educate engineering students in this area. Students seem to be reasonably educated about environmental problems; however, there are substantial knowledge gaps about the other two dimensions (social and economic) elements of SD. An encouraging findings of the survey was that all students agreed that SD is rather personal and perhaps more related to them as engineers. Therefore, it should not be challenging to catch their creativity by integrating sustainable development into their current courses [1].

Studies have illustrated the vital role that multidisciplinary principles of problem-based learning played for engineering students. They discuss the value of educating students to link their professional profile to sustainability as a holistic approach. On the other hand, when students are presented with a multidimensional mix of learning activities, they establish strategies for explaining how they interact in a new game environment and how they use new information to concentrate on learnings rather than winning the game. Below in Table 1, you can find the concepts covered in each Certificate of ØkoEngineer.

Table 1:
Learning certificated currently implemented in ØkoEngineer (can be found on YouTube: ØkoEngineer)

	Certificate Title	Concepts Covered
1.	Elements and challenges of sustainability	Sustainability, Future sustainability challenges, Economic instabilities, Good governance challenges, Pollution, Instabilities in natural resource supply, and Climate change
2.	The three pillars of sustainability	Economic sustainability, Social sustainability, Environmental sustainability, Venn diagram and nested model of sustainable development
3.	Essentials of environmental sustainability	Human activities, Role and impact of technology, Planetary resilience, and Circular economy
4.	Sustainable Engineering	World Federation of Engineering Organizations (WFEO) resolution and Sustainable engineering
5.	Grand challenges for engineering	The United States National Academy of Engineering (NAE) grand challenges for engineering, and The United Nations Sustainable Development Goals (SDGs)
6.	Introducing the SDGs and the 2030 Agenda for Sustainable Development	UN resolutions, Core principles underpinning the 2030 agenda, Dimensions of the 2030 agenda (5P's), UN SDGs

GCED, on the otherhand, is approaching several concepts and methodologies in different areas like human rights education, education for sustainable development1, peace education, and more. The overlap with Økoengineer is multifaceted, but to mention just a few [2]:

- develop an understanding of global governance structures, rights and responsibilities, global issues, and connections between global, national, and local systems and processes;
- develop and apply critical skills for civic literacy, e.g., critical inquiry, information technology, media literacy, critical thinking, decision-making, problem-solving, negotiation, peacebuilding, and personal and social responsibility;
- recognize and examine beliefs and values and how they influence political and social decision-making, perceptions about social justice and civic engagement;

- develop attitudes of care and empathy for others and the environment and respect for diversity;
- participate in, and contribute to contemporary global issues at local, national, and global levels as informed, engaged, responsible and responsive global citizens.

3. Conclusion

3.1 Evaluation and Critical Reflection

We expect that the outcomes from the project will demonstrate the ability of the IT-augmented learning modules to improve students' learning of sustainability concepts within the Area of Engineering at Aarhus University. This is significant as Denmark faces challenges in achieving goals relevant to sustainable cities & communities (SDG11), responsible production & consumption (SDG12), and climate change (SDG13), areas that are heavily influenced by engineering industry. Furthermore, the Faculty of Technical Science, Aarhus University, has made sustainability a key element in its strategy. Therefore, every graduating student from the Department of Engineering must be educated in the fundamental concepts of sustainability, and they can apply this learning when they enter the labor market. We also believe that the project's outcomes will contribute to improve pedagogical approaches relevant to engineering education. Additionally, including sustainability learning modules in the courses will allow project collaboration with initiatives like AU Challenge, AU Sustainability Network, Hult Prize, and other similar cases where Aarhus University's agenda comes with the mission to strengthen its presence in this area.

It will also strengthen industry partnership in courses; companies have particular sustainable strategies either in place or in the creation phase and demand students to be more aware of the sustainability concepts. Finally, we are confident that the project will serve as an exemplar for educational IT in engineering education.

3.2 Impact on the Target Groups

Launch of ØkoEngineer:

Beta platform, 25 September: Phase 1 of the project started in February 2020, while on 25 September, we launched the beta version of the ØkoEngineer platform on the 5th-anniversary date UN SDGs Summit of New York, 25 September. We successfully put together a very ambitious and informative webinar agenda, with speakers coming from Aarhus University (i.e., AU's Sustainability Network, Center for Educational Development), City of Aarhus, external industry partners (Onshape, Grundfos), and funding entities (FFE, Denmark). We received strong interest from participants (e.g., LEGO) regarding contributing tasks to the ØkoEngineer platform. Participants across many countries and institutions were involved in the webinar (approx. 90 registrants and 70 active attendees). A full video of the webinar can be viewed here: YouTube Link
[https://www.youtube.com/watch?v=lZ79apfJysQ&t=30s]. Participants in the Launch Day are coming from (see Fig.3): Denmark, Hungary, Germany, USA, Romania, India, Bosnia & Herzegovina, UK, Netherlands, Poland, Serbia, Latvia, Jordan, Croatia, Sweden, Russia, Lebanon, Ukraine Italy, Spain, Canada, France, Albania, Brazil. To open
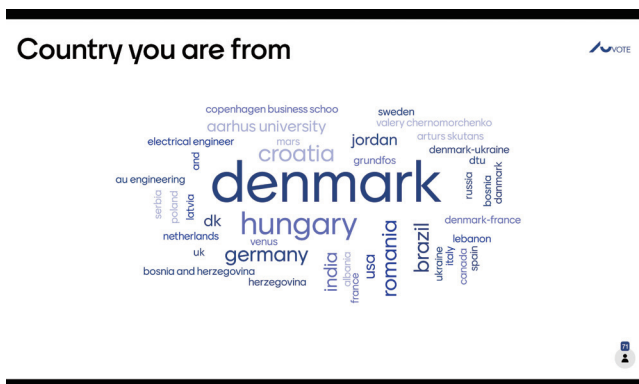
▲*Figure 3: Illustrating answers from the participants in the Launch Day 2020 (Agenda in Appendix.)*
© Devarajan Ramanujan

Collaboration with AU staff, students, and academic faculty:

The projects added to the ØkoEngineer platform in Phase 1 have collaborated with academic staff and students across all engineering disciplines. We have also received inquiries from the AU Kitchen and SDG network staff on the ability to expand the ØkoEngineer platform towards sustainability learning in their respective areas. We have also organized test sessions on the ØkoEngineer platform with students. The platform's success is also reflected by the fact that students in the testing sessions (i.e., David Stamenov, MSc in CAE) have been inspired by the platform and have volunteered their time and skills to create their projects for implementation in the platform (photo). Finally, we have also received interest from the Centre for Educational Development, Aarhus University, regarding contributing to the pedagogical development of the ØkoEngineer platform. Therefore, we have included them as an integral part of the Phase 2 proposal, which by now has been successfully funded and is under implementation until the end of 2021.


▲*Individuals representing different backgrounds and institutions coming together in a collaborative workshop, testing features of ØkoEngineer 2020 .*
© Serena Leka

Long term impact:

We plan to ensure the long-term success of the project through the following means:

- We will work closely with the external consultant to ensure that the software implementation of the learning modules is adaptable to future changes in content (Fig 4). By creating a simple means for editing presented learning content, we will ensure continued use of the modules in the courses. This will also help quickly adapt the modules to other courses in the university.

- The team is part of the AU Sustainability Network that provides inputs on shaping the future sustainability strategy of the university. The current framing of the strategy does not focus on sustainability education. The team plans to use this project's successful implementation as an exemplar to expand the university's funding efforts on sustainability education.

- Funding agencies such as EIT Climate-Kic and Nordic Council of Ministers are increasingly focusing on supporting projects focused on improving awareness of sustainability among youth. The team plans to leverage the outcomes from this project to apply for such calls in the immediate future. We are also actively exploring more extensive funding available at the university level and from the Danish Ministry for Higher Education and Science to expand the research and scale of the developed ØkoEngineer platform.
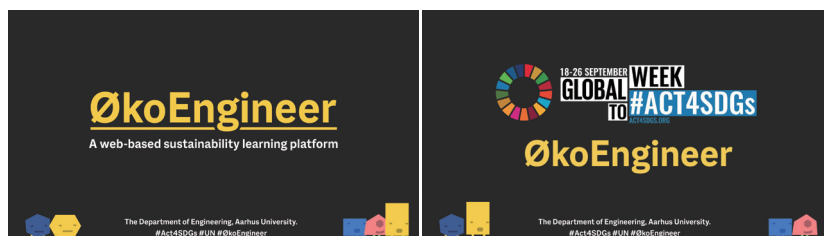
▲ *Figure 4: Illustrating the visual identity of the game, used throughout the platform 2020*
© Serena Leka

3.3 Implications and Suggestions

We would encourage all academics who seek a similar vision like ours: Go for it! Find support internally of your organization first, via working with colleagues and innovation units, without missing student input throughout the whole process. The next step would be to secure funding, develop these activities further, and not expand your team with research assistants and PhDs. Do not miss any opportunity to promote your team's work, as many other educators face the same struggles and challenges. We believe that the journey of ØkoEngineer is to continue and expand the number of learning certificates in the future and further diversify the case-based project portfolio. Using a reference to the feedback from the Launch Day (Fig. 6), sustainability in education will remail an area that requires more remarkable development and innovations.

▲ *Figure 6: Answers from participants at the Launch Day of ØkoEngineer:*
How do they perceive sustainability? 2020 ©Devarajan Ramanujan

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■ Annex

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2. Økoengineer: A Web-Based Game Platform for Guided Discovery-Based Sustainability Learning in Engineering Curricula Technical Paper Publication: ASME IDETC2021-69406 - Special Session: Design Tool Showcase & Design for Manufacturing and the Life Cycle in Response to COVID-19; Haitham Abughaida, Serena Leka, Kamila Kunrath, Rune Thostrup, Devarajan Ramanujan.

3. Identifying Industry Needs for Innovation Skills in Engineering Education: A thematic analysis of cases from Danish Industry; Kunrath, Kamila; Leka, Serena; Abu-Ghaida, Haitha; Ramanujan, Devarajan. SEFI Annual Conference, September 2021.

Agenda of the launch day: Registration Page

The Department of Engineering, Aarhus University, invites you to a presentation of ØkoEngineer: A web-based sustainability learning platform. Date: 25 September 2020, 14:00.

15.09.2020 | SERENA LEKA

Dato	Fre 25 Sep
Tid	14:00 — 16:00
Sted	Online

September is about celebrating all UN Sustainability Development Goals (SDG)! It has been five years since the SDG summit in New York, the USA, where we defined our vision and commitment towards creating a sustainable future. Engineers will continue to have a crucial role in realizing the 2030 Agenda.

Thus, every professional engineer needs to be educated on the basics of the SDGs and develop the skills needed to innovate engineering systems from a sustainability perspective.

The Department of Engineering, Aarhus University (AU ENG) invites you to a presentation of ØkoEngineer: a web-based sustainability learning platform. With funding from the Aarhus University EDU-IT program and the Fonden for Entreprenørskab (Fond for Entrepreneurship), AU ENG and the game development company SetSnail have developed ØkoEngineer as an extensible gamified learning platform that educates students on sustainability and the SDGs via lecture-based learning and discovery-learning. The design of the platform is a product of research led by Asst. Prof. Devarajan Ramanujan from the Lifecycle Design and Manufacturing Group at AU ENG.

Join us on the 25th of September, 14.00 CEST via a live webinar to get an inside peek into the ØkoEngineer platform.

The first students (existing students at AU ENG) to sign up for the game and participate as Beta testers for ØkoEngineer, successfully achieving at least of the projects in the game, will receive a free software license; as a courtesy of our sponsors Onshape PTC Education! More surprises will follow!

• Click here to sign up

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Agenda of the day:

Start 02:00 -Official start
Welcome Note

Lars Ditlev Mørck Ottosen, Head of Department of Engineering, & Serena Leka, Project Manager at Business Relations and Partnership Unit (5 minutes)

"Research and education on sustainability at AU Engineering"
Devarajan Ramanujan, Assistant Professor, Mechanical Engineering, AU ENG
(10 minutes)

"ØkoEngineer: Game Demonstration"
Yana Vashchuk & Haitham Abu Ghaida, Student Assistants of ØkoEngineer
Project. (10 minutes)

OnShape talk: "Examples on supporting engineering education at universities & offerings."
– Surprises for student players (10 minutes)

"Future projects in ØkoEngineer: Opportunities."
SetSnail (5 minutes)
Refill your Coffee/Tea/Water – Break   (10 minutes)

02:50 pm we come back:
Panel discussion: "Strengthening the Ecosystem for Sustainability Education in Engineering." (20 minutes)

We will take Questions for the panel on an ongoing basis. The dialogue will be facilitated by Lars & Serena

Devarajan Ramanujan, Assistant Professor, Mechanical Engineering, AU ENG
Emilie Normann, Head of Research, Analysis and Higher Education Fonden for Entreprenørskab
Badrinath Veluri, Materials Tech (Design & Production), Ph.D. Grundfos A/S
Thomas Mikkelsen, Development Consultant & Project Manager, GoGreen with City of Aarhus

"Research on sustainability education at AU engineering: Needs and Future Goals."
Dr. Kamila Kunrath, Research Consultant AU ENG, & Rune Thostrup, Learning lab Consultant, AU (10 minutes)

"AU Vision in Sustainability: our new climate action."
– Susanne Søes Hejlsvig, Program manager, Climate Initiative, Aarhus University (5 minuts)
Closing remarks by Lars & Serena (5 minutes)

If you have any questions or comments, reach out to Serena (sela@eng.au.dk; +45 93509014)
See you soon and stay safe!

#ACT4SDGs #ØkoEngineer
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① UNESCO (2014). *Education Strategy 2014 – 2021, p.46.*