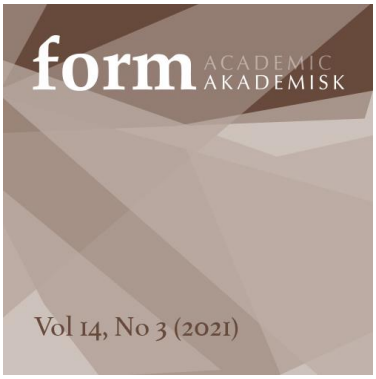

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Editorial

Education for new practice II
– Technology, design and sustainability across

This special issue of FormAkademisk is the second in a series that summarizes the lighthouse project Education for technology, design and innovation (2016–2021). The first issue was published in 2020 (Nielsen et al., 2020). The lighthouse project was funded by the *Faculty of Technology, Art and Design (TKD), Oslo Metropolitan University (OsloMet).* Now that the project has come to an end, it shows two areas where it has contributed to the development of practice. This applies to the development of fruitful collaboration on teaching, technology and research within TKD, and also with external researchers and institutions. Furthermore, it applies to international profiling of design and design education research in TKD through international research networks, publications and conferences.

Cooperation on the development of research-based practice is in line with the Norwegian government's long-term plan for research and higher education for the period 2019–2028. The government states that it aims to strengthen research and higher education in order to further develop a comprehensive and knowledge-based administration that takes into account the environment and climate (Meld. St. 4 [Report to the Storting 4] (2018–2019)). In OsloMet's strategic plan, *Strategy 2024*, both

the welfare perspective and societal relevance are central (Oslo and Akershus University College, 2017), and in the long-term plan for 2019–2021, OsloMet has a stated desire to build education and research on the UN's sustainability goals (OsloMet, 2019, p. 7). Through OsloMet's action plan, *Bærekraftig utvikling for det 21. Århundre* [Sustainable development for the 21st century], the vision for sustainability in education has been concretized as follows: "All studies have defined their role and function in relation to building on and integrating the sustainability goals" (2020, p. 8). Furthermore, OsloMet has listed the programmes that particularly contribute to sustainable development, at bachelor's, master's and PhD levels. The programmes listed in May 2021 are three bachelor's programmes – *Energy and Environment in Buildings*, *Product Design* and *Development Studies* – two of which are affiliated with TKD.

Collaboration across different professions and educational cultures is a challenge – and it takes time. Therefore, this project is only a preliminary last part in a long process. Collaboration between researchers in the *Department of Product Design* (PD) and the *Department of Art, Design and Drama* (EST) has developed over a longer period than the collaboration with the engineering programmes in the *Department of Civil Engineering and Energy Technology* (BE), the *Department of Mechanical, Electronic and Chemical Engineering* (MEK) and the *Department of Computer Science* (IT). The collaboration between EST and PD has been developed through the research network *DesignDialog*, the research journal *FormAkademisk* and early collaboration on the development of plans for a PhD programme at TKD, as well as various writing seminars. A writing seminar in 2014 resulted in the anthology *Design for a Sustainable Culture. Perspectives, Practices and Education* published by Routledge (Skjerven & Reitan, 2017).

RESEARCH AND COLLABORATION FOR BETTER PRACTICE IN TKD

Led by Professor Liv Merete Nielsen, the project *Education for technology, design and innovation* aims to strengthen an interdisciplinary research culture that promotes sustainability goals. The project has contributed to the engineering education programmes inclusion to a greater extent in the collaboration between PD and EST. This applies to collaboration on technological solutions for teaching and development of (among other things) OsloMet Makerspace and a new PhD programme in *Innovation for sustainability*, which is expected to be launched in 2023. Three PhD candidates have been associated with the project. Ingvill Gjerdrum Maus defended her dissertation in 2020, followed by Nenad Pavel in 2021, and Ingri Strand is expected to do so in 2023. In the period 2016–2018, Eva Lutnæs was associated with the project as a postdoctoral fellow through her work on responsible creativity and critical design literacy.

Although the project has been challenging in terms of both similarities and differences in educational cultures and research traditions, it is key to future collaboration. In EST, a specialised teacher training programme in design, art and crafts has a dominant position. Following the introduction of new national curriculum of general education in schools in 2020 (LK20), technology and sustainability have become even clearer as important components and thus in this specialised teacher training programme at EST. TKD's investment in makerspace has become an arena where specialised teacher in design, art and crafts, as well as engineers and designers, more or less informally, meet and exchange experiences. To create this meeting place for practice, several forces in TKD have moved in the same direction, and it is not always easy to decide what is a product of what. Regardless of who has taken the initiative for what, the project *Education for technology, design and innovation* has produced synergy effects, where an exciting collaborative climate strengthens TKD in a way that builds on national and local goals and where education for a future that emphasizes welfare and sustainability is central.

Makerspace in TKD – openness and collaboration across

Makerspace is inspired by the maker movement, which can be traced back to 2005 and the creation of *Make Magazine* and *Maker Fair* in 2006 (Storeggen, 2019). However, the movement has its origins even earlier, all the way back to the Do-It-Yourself (DIY) movement, which was part of the punk ideas of the 1970s (Storeggen, 2019, p. 8). Makerspace is a further development of DIY, where amateurs have gained access to technical equipment that was previously reserved for professionals. Ingenuity and creative joy

have been developed from a sustainability perspective, where reuse and repairs have also found their place. Since its inception, OsloMet Makerspace (Figure 1) has emphasized equipping the workshop well to stimulate collaboration across disciplines and faculties (Güler et al., 2017).

FIGURE 1. Makerspace in OsloMet. Photo: Skjalg Vold.

EST has been concerned about building up makerspace in connection with the specialised teacher training programme in design, art and crafts. The idea of allowing children and youth to access and learn about materials, tools and techniques from the perspective of sustainability is however not new. Material knowledge from the perspective of sustainability has long been a central part of the specialised teacher training programme. This is especially relevant in the course *Material and Environmental Science*. With the new curricula for the subject *Art and crafts* in primary and lower secondary schools (LK20), crafts, technology and sustainability have also been strengthened. Activities in makerspaces incorporate many of the ideals seen in LK20. In makerspaces, creative activities, creative problem solving, and trial-and-error experiments are facilitated in well-equipped studios that stimulate exploration. Students at the specialised teacher training programme in design, art and crafts become familiar with makerspace through their three-year bachelor's course. In the first year, some training is provided, both in OsloMet Makerspace and in programming through the course *Digital Media*. Here, interested students have the opportunity to apply as student assistants, who mentor incoming students in makerspace. Students are also offered the opportunity to explore makerspace on their own; for example, they can use its various available tools when they submit their exams. In the second and the third years of the bachelor's course, makerspace is to a greater extent linked to the other subjects, such as textiles and print. University lecturer Gitte Skjønneberg has linked makerspace to her professional teaching for several years. Second-year students work with textiles and vinyl cutting, and they use three-dimensional (3D) printing for their own spools for sewing machines. Third-year students make (among other things) stencils for printing. An important strategy here is also the recruitment of interested students to become student mentors in makerspace. This means that they obtain jobs as assistants where they (among other things) contribute to the training of incoming students.

Through this lighthouse project, the various departments in TKD have collaborated in several ways, and OsloMet Makerspace has become an arena where an increase in interdisciplinary collaborations has become a reality. User participation is central to the new campus project in TKD, where all the departments will probably be co-located at campus in Pilestredet 35 (P35). In this connection, students from the various departments have collaborated in developing a detailed model of the building. Based on plan drawings and a 3D scan of the building, they have produced a 3D print of a physical model in OsloMet Makerspace, in addition to developing a detailed digital model (Figure 2) that can be displayed virtually (Hagen, 2021).

FIGURE 2. Model of Pilestredet 35 (P35).

Student active learning with Makerspace

In the autumn of 2019, TKD was awarded approximately NOK 5 million through The Directorate for Higher Education and Skills (DIKU)s *Student Active Learning Programme* to integrate makerspace into the education programmes in the faculty. The project was initially led by Vice Dean Marius Lysebo. Its main goal is to establish makerspace as a student active-learning arena. It is not a prerequisite that all teaching should take place in makerspace but that the form of the work should be inspired by the way that the students work in a makerspace.

The project is divided into three work packages that target different education programmes in TKD. The main focus has been on the specialised teacher training programme, selected courses in engineering programmes and the establishment of a new common elective course offered by the faculty. Integrating makerspace in teaching helps strengthen the education programmes in various ways, as they have different existing strengths and work methods as the point of departure. For engineering students, it may not be technology but the introduction of creative problem solving that is central and new. Students at the specialist teacher training programmes' benefits have been described earlier in this editorial. The multiplicity of the study programmes included in the project therefore has a value in itself.

Interdisciplinary student work is a desired benefit of the project. It is discussed in various strategic plans, and the students have described it as something they want to experience further. Its direct consequence is the elective course established in connection with the project. We experience tensions between free, exploratory work and collaboration in makerspace, driven by intrinsic motivation, and pressures in integrating such form of work as compulsory in courses, in teaching and not the least, as part of the assessment. It matters how you proceed. This is described in more detail in an article in the first issue of *FormAkademisk* (Berg et al., 2020).

Collaboration with local organizations

Through the *Oslo Skaperfestival* (Oslo Makerspace Festival) held in Deichman hovedbibliotek (Deichman main public library) in Oslo, arranged by the organization *Norway Makers* (n.d.), EST's professional community contact with the *Norwegian Museum of Science and Technology* about the latter's training of students and teachers in the use of makerspace in schools. Master's students in *Art and Design Education* programme in EST were allowed to attend a day course in makerspace for students from upper secondary schools in Oslo. The training in makerspace was led by the then pedagogical leader in the *Norwegian Museum of Science and Technology*, Rannei Solbak Simonsen, who is now working in the *Naturfagsenteret* (Norwegian Centre for Science Education), responsible for the development of the *Skaperskolen* (Makerspace in Schools) (n.d.), together with the science centres all over Norway. The EST staff contributed as teachers of courses for makerspace teachers. One student wrote a master's dissertation from one of the courses, based on participatory observation and interviews with course participants, who were teachers in Science or Art and crafts (Storeggen, 2019). A survey was also conducted among the participants of three teacher courses in makerspace, which will be presented in an upcoming article (Reitan & Simonsen, in progress). The intention is to develop this course into a creditable further education course for teachers as a collaboration between the *Norwegian Museum of Science and Technology* and TKD in OsloMet. This has also led to ESTs collaboration with civil architect Vibeke Hegg, who has developed *Playuba* (n.d.), a methodological tool for architecture, design and art in schools, together with *K8 industridesign AS* (n.d.) and primary schools in previously Skedsmo Municipality.

ESTs collaboration with Irene Brodshaug, a specialist consultant for practical and aesthetic subjects in the *Agency for Education in Oslo Municipality*, has also been of great importance. This particularly applies to the building of networks for teachers in the school subject Art and crafts throughout Oslo, based on her master's project in EST (Brodshaug, 2016). Her dissertation is based on interviews with members of such networks in Skedsmo Municipality, where she previously worked. The collaboration has resulted in a couple of scientific publications (Brodshaug & Reitan, 2017, 2021). Several members of this Oslo based network also participated in the 2018 Design Research Society (DRS) Conference in Limerick.

Ener lower secondary school and 'Little Big Room' in TKD

Almost 40% of the world's greenhouse gas emissions come from the construction sector (United Nations Environment Programme, 2020). New materials and solutions are constantly being developed to reduce emissions by constructing energy-efficient buildings. However, another focus has been central to this project, which also has an impact on the environment. It is the benefit of making good decisions at the planning stage. Tearing down a wall that is cast in concrete is more expensive and more burdensome for the environment than moving a line on the drawing board. Engineers and architects are not the only participants in the decision-making processes – both builders and users are involved as well. Moreover, before going that far, politicians make decisions about zoning plans, where the choices can be between downsizing and protecting farmland. What all these actors have in common is that they have gone to school. Therefore, teaching in primary and lower secondary schools has an impact on whether the decisions made are sustainable or unsustainable.

In the school year 2020–2021, PhD candidate Ingri Strand completed her fieldwork in Ener lower secondary school, where her professor and supervisor Eva Lutnæs works as an Art and crafts teacher. The 16-year-old students in the 10th grade participated in an architectural competition in collaboration with *Nordbolig* (n.d.) and visualized concepts for common areas for residents in an eco-yard. Strand's fieldwork allowed the students to visualize their ideas in SketchUp, and using simple cardboard virtual reality (VR) glasses (Figures 3 and 4), they explored how the building would function. Through the use of VR glasses, they became aware of weaknesses in the planning, which they could discuss with fellow students and correct.

FIGURE 3 and 4. At Ener lower secondary school, simple cardboard virtual reality (VR) glasses are used, in which the students can integrate their cell phones. In an easy way, they can get an impression of the room.

In the education of civil engineers, the ambitions are higher. The establishment of the 'Little Big Room' in BE, OsloMet has made it possible to simulate the design and use of advanced modelling programs in the planning of buildings. The lighthouse project has contributed to the purchase of powerful desktop computers and VR glasses (Figures 5 and 6); together with large touch screens from the department, they have comprised the equipment for a digital collaboration laboratory. The 'Little Big Room' has enabled work methods that reflect what the construction industry uses when working on and planning building projects. These improvements have benefited all students in the department, from first graders to master's students, and have helped with everything, from advanced simulations in bachelor's theses to advanced quality control with 3D scanning on actual construction sites in connection with master's theses. The lighthouse project has also covered the purchase of two HoloLens units, which have already been the main focus for two bachelor-level projects in two departments – BE and IT.

FIGURE 5 AND 6. 'Little Big Room' in OsloMet. The students can cooperate on building projects. Photo Figure 6: Olav Johan Øye.

The students in the bachelor's degree programme in *Energy and Environment in Buildings* were (as their first group project) assigned the task of planning, designing and modelling a semi-detached house on a given plot in Fornebu. All groups experienced the possibilities of access to the Little Big Room (Figures 5 and 6) as useful for communication in the group. However, they chose different approaches in the meetings. One group used the VR equipment to troubleshoot the model, while the other two observed groups used the large screens in group presentations. These two groups saw the models in VR at the end of the project and commented that this version gave them information about the house's various size options and lighting conditions that would have been useful earlier in the process. This shows the tools' great potential that can be utilized better in the future.

3D printing and user participation in the health sector

In the health sector, 3D printing has opened up new possibilities, but its use in design processes also has challenges. In the design of prostheses, user participation and adaptation pose a major challenge. What is developed is not always used in the way that has been planned. The prosthesis can work as intended, but for the user, it can have a different function. It may be a visible reminder of one's own disability. In such projects, collaboration among the team members and across professions and roles is also of great importance, in which students should already be trained to their advantage in educational situations. They have done this in PD.

INTERNATIONALIZATION

The project has contributed to enabling employees and master's students in TKD to participate in international research conferences and in this way, disseminate the research in OsloMet and develop international research networks. Participation in conferences organized by the world's most influential organization for design research; the Design Research Society (DRS) – has been a priority, particularly in the conferences in Brighton (2016) and Limerick (2018). Furthermore, participation in the Engineering & Product Design Education (E&PDE) conferences has been rewarding. Here, the 2017 E&PDE conference in Oslo, organized by PD, must be highlighted, with almost 40 articles presented by students and faculty members from all departments in TKD, of which a dozen articles were contributed by students from TKD. The title of the conference was *Building Community: Design Education for a Sustainable Future* (Berg et al., 2017). OsloMet was also a co-organizer of the 2019 *Academy for Design Innovation Management* (ADIM) conference in London. Seven employees and three students from TKD participated by presenting papers and chairing a track and a workshop (Figure 7). The Norwegian contributions are included in a special issue of *FormAkademisk* (2021). It was especially encouraging that Eva Lutnæs was awarded the best paper at both the 2019 ADIM conference (Figure 8) and the 2018 E&PDE conference.

FIGURES 7 and 8. OsloMet was a co-organizer of the 2019 Academy for Design Innovation Management (ADIM) conference in London. From the left: Liv Merete Nielsen, Else Margrethe Lefdal, Janne Beate Reitan, Tore Andre Ringvold, Irene Brodshaug, Anita Neuberg, Peter Haakonsen, Randi Veiteberg Kvellestad and Eva Lutnæs (Figure 7). Eva Lutnæs with the award for best paper (Figure 8).

Based on the workshop *Establishing Design Literacy International Network* at the 2019 ADIM conference in London, the *Design Literacy International Network* (DLIN) (n.d.a) was established. Liv Merete Nielsen led the workshop, together with Erik Bohemia, Janne Beate Reitan, Karen Brænne, Ursula Bravo and Catalina Cortés. As a follow-up to the workshop, a thematic issue of the *Chilean journal Creación y Pensamiento* [RChD: Creation and Thought] (2020) was published under the title *Design Literacy for All*. In their editorial, Bravo and Bohemia (2020) describe the importance of the collaboration with researchers from OsloMet. The first article in the special issue is written by Eva Lutnæs (2020). She was also the first to present her research in the DLIN's digital seminar series *Engage with ideas* in September 2020. Later,

Ingvill Gjerdrum Maus and Nenad Pavel presented their research in the same series (Figures 9, 10 and 11). The DLIN is led by Nielsen, Bohemia and Bravo, with technical support from research assistant Malin Tønder from EST. The monthly DLIN digital seminars bring together design and design education researchers from around the world. An overview of the presentations and recordings of the seminars can be seen on the DLIN website (n.d.b).

FIGURE 9, 10 AND 11. Researchers from OsloMet: Eva Lutnæs (EST) (figure 9), Ingvild Gjerdrum Maus (EST) (figure 10), and Nenad Pavel (PD) (figure 11), have presented their research for an international research community through the Design Literacy International Network (DLIN; https://designliteracy.net/activities/).

In April 2021, the *Pupils Attitudes Towards Technology* (PATT)38 (2021) conference was held digitally, one year late due to the COVID-19 pandemic. The theme of the conference was *Technology in our Hands. Creative Pedagogy and Ambitious Teacher Education*, hosted by the University of Turku in Finland. The conference brought together researchers from all over the world. The organizers highlighted the Finnish identity by allowing participants to meet in break-out rooms, such as the 'Sauna' for social gatherings and professional discussions during the conference. From TKD, former master's student Stephanie Hoebeke contributed with the article *Programming as a New Creative Material in Art and Design Education*, together with her supervisors Peter Haakonsen and Ingri Strand as co-authors. Eva Lutnæs presented her article *Competence Goal towards Responsible Creativity*. Janne Beate Reitan contributed as a member of the conference's scientific committee. The papers from the PATT38 conference are published in a special issue of the *Techne Series* (2021).

The European Union (EU) focuses on technology and sustainability in creative subjects. The *Craft Hub* project (n.d.) will collect and exchange crafts and creative uses of new technology in an online database. Together with partners in eight European countries, PD and EST in OsloMet have become partners in this EU project. The OsloMet departments will contribute with advanced digital technology and dissemination of creative methods used in design thinking and artistic methods, among other things. From the perspective of sustainable development, the project contributes to cooperation, good education and the preservation of cultural heritage through the use of digital methods. The *Craft Hub* project helps strengthen user-driven design through increased availability of creative methods and co-creation (Figure 12). It also enriches cross-cultural dialogue. Socially, the project contributes to creative collaboration among people and adaptation to the digital shift. Environmentally, the project contributes to the use of local materials, local production and participation in creative processes, while being involved in an international dialogue. This totally contributes to a new digital infrastructure for learning that will be part of smart cities.

FIGURE 12. The Craft Hub project brings together researchers from eight European countries.

In 2013, TKD/EST organized the *2nd international conference for design education researchers* under the theme *Design Learning for Tomorrow – Design Education from Kindergarten to PhD*, in close collaboration with the DRS and CUMULUS (The Global association of Art and Design Education and Research) (DRS //CUMULUS Oslo, 2013). The sixth conference in this series was organized by Shandong University of Art and Design in Jinan, China in September 2021, also now in close collaboration with the DRS, collectively known as DRS Learn X Design (2021) (Figure 13). TKD has been heavily involved in the scientific development of this conference. Professor Arild Berg led the track *Co-creation of Interdisciplinary Design Education* and Professor Eva Lutnæs led the track *Empowering Critical Design Literacy*. Both were members of the conference's International Scientific Program Committee (ISPC), which was chaired by Professor Liv Merete Nielsen. The conference theme was *Engaging with Challenges in Design Education*, representing a unique collaboration with Chinese researchers in art and design. The conference papers are published in Proceedings 1–4 (Bohemia et al., 2021) (Figure 13).

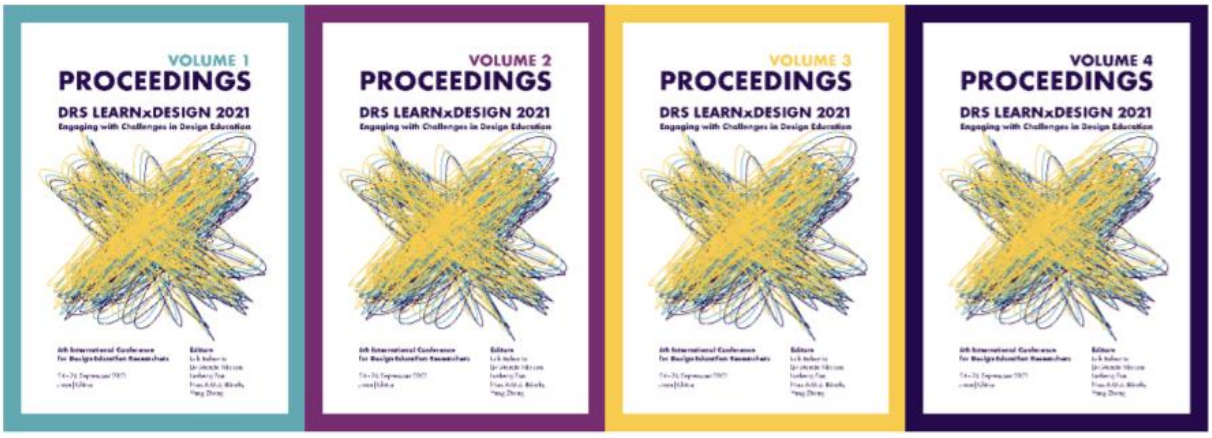

FIGURE 13. Proceedings 1-4 from the DRS Learn X Design conference in China 2021. Read more about the conference at https://learnxdesign.net/lxd2021/.

ARTICLES IN THIS ISSUE

Nenad Pavel builds in his article *Design and learning through technological mediation. Use, adaptation and achievement* on a study of a practical course in the design of assistive technologies in which patients, design students and therapists from Norway and Brazil participated. The study reveals how conception and reception of design play out through mediation processes between stakeholders and artefacts. The study was framed in light of Alain Findeli's writings to challenge and inform current developments in design studio educational practices. To explain solving complex, ill-structured problems

through design, Findeli proposed the systems theory as a holistic philosophical perspective of the design process and design education. By asking what design is and how to teach it, Pavel reiterates Findeli's ideas on design and design education. This article emphasizes the ubiquitous effects of technology from relationalist ontology and postphenomenological perspectives.

In her article *Critical design literacy in primary school. Four narratives in the development of design competence for sustainability,* ***Eva Lutnæs*** takes as her starting point the fact that products of human creativity have altered nature to such an extent that a new geological epoch, the Anthropocene, has been proposed. Design as a discipline brings forth a transformative agenda – always on the way to something new. Will the development of pupils' design literacies at the level of primary and lower secondary education only increase the burden on nature? Here, the question of which roles the pupils are offered through education, as well as how design is understood and practised, is crucial. In this literature review, the transition to a more sustainable society is set as a premise when academic texts are examined. Four narratives are identified as vital for cultivating design literacy and provide a basis for defining what it means to be a design-literate general public in the context of critical innovation.

Janne Beate Reitan and ***Arnab Chaudhuri*** present an ongoing research project on blended education in the article *FlexiDig – Flexible Digital Classroom. Master students 'experiences with simple and flexible blended education.* The article is based on a survey on full-time and part-time students' experiences with blended education in a master's degree programme in Art and Design Education. To optimize educational resources, the lectures for the full-time students were recorded, including the dialogue between the students and the lecturers, and made digitally available for all students. Generally, both the part-time and the full-time students who completed the questionnaire expressed their experience as 'satisfactory' regarding the availability of the recorded lectures. Moreover, the capture of the dialogues in the recording was found to be extremely useful for better understanding and learning, according to the students. This idea forms the basis for developing FlexiDig as simply as possible, with a transfer value to other educational situations, based on the approach of Student-Centred Learning and Teaching in Higher Education (SCLT).

In their article, *Sustainability in professional education. Gap between strategy and program plans?* ***Arild Berg***, ***Alfredo Carella***, ***Marius Lysebo*** and ***Liv Merete Nielsen*** claim that education is a key to long-lasting changes in society. They use theories from sustainability and education to examine the education of product designers, teachers and engineers in *Faculty of Technology, Art and Design* (TKD) in light of OsloMet's overall strategy on welfare and sustainability. The empirical data are based on learning outcome descriptions from the 2019 and the 2020 plans for these professional education programmes and are analysed on the basis of the Goodlad and STAUNCH categories. All analyzed professional education programmes have integrated sustainability in their plans. Sustainability is most clearly articulated in the programme plan for *Product Design*. However, this does not mean that sustainability is unarticulated for teacher and engineering education programmes. These programmes are governed by National Curriculum Regulations, where sustainability is described at the national level. However, the environmental perspective is more clearly articulated in the programme plans at the institutional level than the economic and social perspectives on sustainability.

EXPERIENCES FROM THE PROJECT

The project *Education for technology, design and innovation* (2016–2021) has provided a solid foundation for further collaboration across the TKD departments and collaboration with other organizations. This foundation will benefit the forthcoming interdisciplinary PhD programme *Innovation for Sustainability,* which will hopefully become a reality in 2023. A well-developed international research collaboration contributes to improving the quality of all educational programmes involved, thus making studies at TKD appealing. Many countries face major challenges in the global efforts to implement the green shift. From such a perspective, collaboration on research and innovation in education, design and technology can be an advantage.

A sustainable perspective on the environment and climate has permeated the entire project, among other things, through the establishment of *GrøntMet* [GreenMet], which is a collaboration among the EST and the PD departments in TKD, *Consumption Research Norway* (SIFO) and the *Department of Journalism and Media Studies* at Faculty of Social Sciences (SAM). GrøntMet holds open seminars twice a year. The themes for the seminars so far have been *Green Washing*, *Green Growth?* and *Green Economy and Prosperities*.

Overall, the *Education for Technology, Design and Innovation* project has contributed to a larger long-term plan in OsloMet and will be further developed through strategic research and development in TKD. This includes both the basis in technology with digitization of subjects. It contributes to the interplay among research, education and innovation for sustainability in both user-driven and universal designs, as well as intelligent health and smart cities.

OsloMet, December 2021

Liv Merete Nielsen, Arild Berg, Peter Haakonsen, Marius Lysebo and Eva Lutnæs

Special Issue Editorial Team

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