form ACADEMIC AKADEMISK

Vol 13, No 6 (2020)

Utdanning for ny praksis I
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Editorial

Education for new practice I
– Technology, design and sustainability across professions

This special issue of FormAkademisk is a product of the lighthouse project *Didaktikk for teknologi, design og innovasjon* (2016–2020) (*Education for technology, design and innovation)*, which is funded by the Faculty of Technology, Art and Design (TKD) at Oslo Metropolitan University (OsloMet) and lead by Liv Merete Nielsen and by Janne Beate Reitan from July 2020. The project is a contribution to the realisation of the government's long-term (2019–2028) plan for research and higher education (Kunnskaps-departementet, 2018). The government's plans include renewing, restructuring and boosting the technology of the business community and improving quality in higher education, and the lighthouse project helps to achieve these goals, because the key to new practice lies in education.

The basis for lifelong learning in a society that is constantly changing lies in developing new knowledge, new skills and general competence that can be incorporated into all education. This requires new perspectives that promote innovation in new forms of interdisciplinary education. For improving collaboration among professions, who are not normally not educated together, educational adjustment

is required through critical reflections that raise awareness of how different views and educations promote or inhibit collaboration. There is thus a great need for research to identify challenges and point to possible improvements.

Areas from the government's long-term plan that will be promoted in this project are industrial and enabling technologies; advanced production processes; research-based innovation; and strengthening the quality of higher education. The government's long-term plan also states that 'In the EU framework programme for research and innovation, Horizon2020, enabling technologies and advanced production are seen in context under the heading *Leading Enabling and Industrial Technologies* (LEIT)' (Kunnskapsdepartementet, 2018, p. 4). These ideas have been continued in *Horizon Europe,* which replaces *Horizon2020* in 2021 (EU, 2020).

This lighthouse project has led to increased collaboration between the departments at TKD. There are concrete challenges to the collaboration because the TKD faculty's departments range from engineering and a focus on design to teacher education in design, art and crafts. The departments and study programmes have different educational and professional traditions, and education has therefore been at the core of the project, both in terms of educational philosophy and in the use of different teaching methods. Challenges and opportunities in the innovative use of technology and design connect—and are a common denominator between—the articles written across the departments. OsloMet has, through the establishment of *OsloMet Makerspace*, contributed to the development of student-active learning and meeting places for interdisciplinary collaboration, and TKD has ambitions to promote further collaboration between departments through the creation of several interdisciplinary courses.

The lighthouse project is based on a co-learning perspective in which digital tools are expected to contribute to better learning. The theories of Etienne Wenger and Jane Lave about learning in practice communities—'communities of practice'—form the basis for such learning (Lave & Wenger, 1991; Wenger, 1998). Researchers in the lighthouse project have previously written about co-learning and contributed to this field of knowledge (Berg, 2014; Reitan, 2007). The interaction perspective in both education and professional practice, where dialogue with users is central, is not new in principle, and the challenge for this project is how digital tools can contribute to this co-learning perspective.

Developing knowledge through interaction and collaboration can help to make the voices of non-specialists in complex areas heard. Such a view builds on the theories that Paulo Freire (1970) developed as early as the late 1960s, described in the book *Pedagogy of the Oppressed*. In the choice of Freire as a theoretical foundation lies an ethical and democratic principle of education and the sharing of knowledge to achieve a more symmetrical dialogue based on mutual respect and common understanding of the challenges faced (Nielsen, 2000)—not unlike the ideas that the makerspace movement is based on. The project has also contributed to further developing research with an inside perspective within engineering, design and teaching (Dunin-Woyseth & Michl, 2001; Nielsen, 2018).

Design is a collective concept in the project, with both engineering and culture viewed from a sustainable environmental perspective (Skjerven & Reitan, 2017). Herbert Simon's (1996) definition of design is central to the project: 'Engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones' (p. 111). FormAkademisk has built on Simon's theory with great success, and his theory has gathered a multifaceted academic landscape of academics and practitioners who work within a broad and expanded view of design. Simon's definition is also constructive from a sustainable perspective because teachers, designers and engineers can all contribute to solving important challenges in society.

As part of the project, we have conducted specific projects, such as in the *FlexiDig* project, that have contributed to increased interaction and collaboration between several of TKD's professional education pathways. The lighthouse project has contributed knowledge as a basis for reflection on the future use of technology in education; within the project, we have been particularly concerned with dialogue and interaction in both education and professional practice, and the overall research question for the project has been:

How can digital tools promote dialogue, interaction and good learning, and how can knowledge about this contribute to solving societal challenges from a sustainable environmental perspective?

The coronavirus pandemic that struck in 2020 further actualised the challenges and possibilities raised by the lighthouse project. As there was a shortage of visors at the beginning of the pandemic, participants in OsloMet Makerspace 3D-printed components for visors, thus quickly delivering locally produced products for a joint fight against the spread of the virus. Physical meeting points were also limited, creating the need for an increased use of technology in several areas of teaching and collaboration. Home offices and meetings through Zoom and Teams have limitations, but also benefits—for example, it became easier to arrange short meetings in which many could participate, and OsloMet was well prepared for these challenges.

Increased use of digital tools

Digital visualisation tools, such as virtual reality (VR) and augmented reality (AR), are increasingly used both in professional practise and in education at OsloMet. Streamlining of the construction process will save time on construction itself (fewer errors, faster creation) and save both time and the environment through reducing unnecessary travel and conducting building meetings in VR, regardless of the participants' locations. VR is no longer a curiosity at a future trade fair, but a legitimate tool in industry and in workplaces, and interaction in a virtual setting between people with different roles, goals, motivations and knowledge is a challenge for learning and collaboration. Interaction and visualisation is important for users when ordering goods and services from architects, engineers and designers, and the use of 3D printing, VR and AR in such interactions can contribute to a common understanding, so errors can be discovered and corrected during the planning process. It is financially costly to make incorrect decisions at the planning stage, but it is also environmentally reprehensible to dispose of useless solutions once they have been built or materialised. Professional practitioners may also face representatives of the general public during planning processes when decisions are to be made.

All children in Norway study Art and crafts from grades 1 to 10 (age 6–16) in primary and lower secondary schools, and this is where the foundation for their understanding of scale and dimensions in visual representations is formed. As adults, they will also face such imaginative challenges, and the subject content and training of future teachers of design subjects is thus a central piece of the education of the general public for democratic participation in the design of our physical environment. Such democratic participation is referred to as 'design education for citizenship' and 'design literacy' (Lutnæs, 2020; Nielsen & Brænne, 2013). Design literacy is a topic that PhD research fellow Ingri Strand continues to research; her PhD position is a direct result of the collaboration between the departments at TKD, which educates civil engineers and teachers of design subjects in the first part of the lighthouse project. In her PhD project, Strand also builds a bridge between the school system, the business community and the departments at TKD.

ARTICLES IN THIS ISSUE

Ingri Strand, in her article *Virtual reality in design processes – A literature review of benefits, challenges and potentials*, investigates how virtual reality (VR) opens up new possibilities in the fields of architecture, design and engineering. Combined with building information modelling (BIM) or simpler 3D models, it could be possible to walk into buildings not yet built or to examine designed objects in three dimensions before they are made. This literature review examines studies in which VR was used in architecture, design and engineering as part of design processes. The review highlights promising benefits, such as increased understanding of complex issues concerning design tasks, size and dimensions. At the same time, several challenges are revealed, such as the inability of VR systems to offer satisfactory functionalities for sketching and designing. Finally, the author discusses how VR can be implemented in relevant subjects in lower and upper secondary school.

In the article *E-tekstiles: An interdisciplinary approach. Problem-solving in an educational context*, **Kari Saasen Strand, Peter Haakonsen** and **Laila Belinda Fauske** seek to shed light on e-textiles as a fusion of different skills. The empirical starting point is a workshop on e-textiles offered to a group of teachers attending a continuing education course in art and design. The study adopts a self-ethnography approach and, using anonymous reflection notes from the workshop, discusses e-textiles as an arena in which to enhance problem-solving through practical exploration, which involves interdisciplinarity, crafting skills and computational thinking. Focusing on two categories—1) material knowledge and sustainability and 2) electronics knowledge and interdisciplinarity—this study shows that time is an important factor when exploring e-textiles in an educational context. Crafting, circuitry, programming and sustainable thinking can be combined in e-textiles in a productive interdisciplinary mash-up that encourages problem-solving.

Arild Berg, Tengel Aas Sandtrø, Evin Güler, Alfredo Carella, Mali Norvalls, Jenny Helene Haugen Thor and **Marius Lysebo** have in their article *Designing an interdisciplinary course in makerspace*, explored how to develop an elective, interdisciplinary course in makerspace. The study highlights the potential and pitfalls in the transitional space between institutionalised and research-based higher education in relation to the free-maker movement. The success criteria for establishing an elective, interdisciplinary course in makerspace were connected to the central concepts of problem, practice, product, bodies of knowledge, critique, scientific discourse, methods, earlier knowledge, personal experience and organisational processes. The study shows how a makerspace elective course can contribute positively to student life by strengthening inclusion, a feeling of belonging, study enjoyment and interdisciplinarity skills in a professional setting. These qualities form a value-based conceptual framework for students' active learning that enables creativity and collaboration, which are essential 21st century skills for a more sustainable society.

In the article *Makerspace – Flipped classroom and creative processes – A situation study from the higher education sector*, **Peter Haakonsen** and **Gitte Skjønneberg** describe and study a development project at OsloMet Makerspace that was introduced in 2019 as part of specialized teacher education in design, art and crafts at OsloMet. The makerspace was tested as part of teaching during the third year of study, and the theoretical training was offered as a flipped classroom. The central premises were student-active teaching and addressing the curriculum's learning outcome descriptions. The relevant learning outcome descriptions are sorted in the article under creative processes and discussed on the basis of completed and experienced curriculum levels. Based on observations, student evaluations and evaluative conversations, implementation in a makerspace appears to be fast and the student products precise, which in turn appears to give a professional impression. The study suggest that makerspaces open up new ways of achieving learning outcomes. At the same time, it is important to look beyond the fascination that the students express with the professional character and critically reflect on the quality of the products.

SOCIETAL RELEVANCE FROM AN EDUCATIONAL PERSPECTIVE

In its *Strategy 2024*, OsloMet (n.d.) has emphasised the promotion of research-based education and, among other things, the provision of Norway's best teacher education. TKD educates the most teachers of Art and crafts in primary and lower secondary schools and the most teachers of Art, design and architecture in upper secondary education in the country, and it thus has the most influence on the education of teachers in these subjects. Skilful teachers are of the utmost importance for students' learning, and a good foundation in Art and crafts, which is compulsory for all students, can be of decisive importance when they start their professional educations, whether as engineers, designers or teachers of design, art and crafts. In the lighthouse project, we have placed great emphasis on research that contributes to improving practice, just as Herbert Simon (1969) emphasised in his definition of design. The project also seeks to produce research and development work with a societal–ethical perspective on the environment and sustainability, and anchoring the project's values in *Responsible Research and Innovation* (RRI) helps to achieve this.

The lighthouse project will hopefully promote OsloMet's strategic goal of fulfilling its social mission by preparing students, the authorities and working life itself for the future challenges of a welfare society. By being a leading provider of research-based knowledge for such a society, OsloMet wants to be a leader in adopting new technology, innovative solutions and efficient working methods. The articles in this special issue of FormAkademisk contribute research that can form the basis for improved education and practice from a sustainable environmental perspective.

The editorial team for this special Issue is grateful to TKD, authors, peer reviewers and FormAkademisk for support and effort to create this first special issue from the lighthouse project *Didaktikk for teknologi, design og innovasjon (Education for technology, design and innovation)*.

OsloMet, December 2020
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Special Issue Editorial Team

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