Guest Editorial
Continuity and adaptability in design and engineering education for a knowledge age

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In 2020, the world as we knew it changed, and the organisers and participants of the International Conference on Engineering & Product Design Education (E&PDE) had to adapt to this change through a transition to an online conference. 2020 and 2021 will always be unique years for the conference, not only because they were online, but they were the first to be hosted sequentially by the same university host and the same local conference team. We must thank the team at VIA Design + Business, VIA University College in Denmark for their outstanding efforts and success in delivering the conference.

The 22nd and 23rd international E&PDE conferences brought together 126 delegates from over 23 countries for the first time since the COVID pandemic began. 168 papers were published on the themes of *The Value of Design & Engineering Education in a Knowledge Age* and *Continuity and Adaptability in Design and Engineering Education*. The E&PDE conference series has been jointly organised and held annually since 1999 by the Design Society Special Interest Group on Design Education and the Institution of Engineering Designers. We celebrate over 20 years of this collaboration and all who have contributed to the conference over the years. Also, we thank those authors who made the journey with us to prepare extended manuscripts for the DATE journal and the reviewers from the E&PDE community who supported the review process. We hope to continue the special relationship between DATE and E&PDE for many years to come.

This special edition aims to explore how educators will tackle changing engineering and design practices in the coming years in line with the demands of students and industry. This sentiment comes from a need to share knowledge and experiences in engineering and design education and discuss how barriers might be overcome.

In the Knowledge Age, technology and ideas are the main sources of economic growth, and this requires workers with new and different skills. Knowledge is more than what is in the minds of experts or classified within separate disciplines. Knowledge is now defined and valued not only by what it is but also by its potential as a driver for innovation. Within technology education, we should be aware of the future requirements, and support skills development in our students. These changes have major implications for our educational system. We need to empower students to be able to locate, evaluate and work creatively with the knowledge to generate new and improved solutions that can be implemented in practice.

These days, we are witnessing a severe environmental crisis that calls for a greener approach for all industries. Digital and technological development offers new alternative ways to work. We experience global challenges of public societies and healthcare systems that demand close

attention to risk and uncertainty. These environmental, technological and societal changes and challenges have major implications on our educational system within design and engineering. They impact what we teach, the way we teach and why we teach. We need to educate designers and engineers so that, in addition to being proficiently skilled, they can work in cross-disciplinary teams and can contribute to a dynamic and constantly evolving processes and systems in a fragile and unpredictable world.

The special edition was designed to give specific and actionable examples for the Design and Technology Education community. The guest editors Ross and Anne Louise have considered papers from the entire design education experience to give a flavour of the state of the art within the E&PDE community. We aimed to cover the entire design process of Discover, Define, Develop and Deliver, and those aspects important to educators such as course design and feedback. In particular, we have noticed a huge focus on skills and tools discussed at E&PDE, and we have many examples within the special edition. We hope you will enjoy the perspective that we have prepared.

The first paper is *Alone in the sustainable wilderness; transforming sustainable competences and didactics in a design for change education*. In this paper Thomas Østergaard discusses the growing problem with the limited number of interventions when it comes to Education for Sustainable Development. Through evaluation, Thomas discusses the impact that a reflective Decoding Creativity Tool (DCT) tool can have on Education for Sustainable Transformation and the dichotomy between the wishes of UNESCO for better educational environments and the reality of education today.

In *Integrated studio approach to motivate collaboration in design projects,* Virginie Tessier shares a model for learning teamwork skills with the motivation to fill gaps associated with the pedagogical integration of teamwork in design curricula. The proposed model allows for a systemic understanding of teamwork skills that should be acquired during design training. The model encourages a deeper understanding of skills building for more effective and complex design teams.

In *Refining a pedagogical approach for employing design thinking as a catalyst*, Raghavendra Gudur, Deana McDonagh, Maurita T. Harris and Wendy A. Rogers reflect on the impact of the success of STEM and the lessons that design thinking has played as a spark for educational change. From an investigation of a health innovation project, the authors can determine the skill set needed for designers, health and technology professionals to make a significant contribution to its overall outcome.

In *Soft skills in design education, identification, classification, and relations: Proposal of a conceptual map*, Ana Paula Nazaré de Freitas and Rita Assoreira Almedra present an analysis of a worldwide investigation into the importance of soft skills in design. A hierarchy of skills was created identifying those that are gateways skills that act as enablers for high order skills. Practical approaches are discussed to realise the outcomes.

In *Which visualisation tools and why? Evaluating perceptions of student and practicing designers toward Digital Sketching*, Charlie Ranscombe, Wenwen Zhang, Boris Eisenbart and Blair Kuys discuss how digital sketching tools can be characterised within the early stages of the

design process. The authors reflect on the contradiction between the creation of visualisations to gain expert insight and those used to advance the design process.

In *How can comparative judgement become an effective means toward providing clear formative feedback to students to improve their learning process during their product-service-system design project?* Ivo Dewit, Sarah Rohaert and David Corradi reflect on the effectiveness of feedback in higher education. Comparative Judgement is employed as a lens to analyse feedback and as a tool for more effective feedback.

In *A blended approach to design education through clinical immersions and industry partnerships in design for healthcare*, Louise Kiernan, Eoin White and Kellie Morrissey present a hybrid approach in health design education following a bottom-up approach to facilitate design research in a clinical setting. Examples of how this was achieved in a blended model are presented which are relevant now more than ever due to the COVID-19 pandemic.

In *Exploring How Degree Apprentices Experience Their Engineering Identity Through Life Story Interviews and the Twenty Statement Test (TST),* Elena Liquete, Elies Dekoninck and Gina Wisker discuss the process of building an understanding of engineering identity formation in undergraduates studying for an engineering apprenticeship degree. The purpose of the article is to propose actionable changes to engineering education that may better support the development of an engineering identity and therefore encourage graduates towards an engineering profession.

In *Social Connectedness and Online Design Learning Experience in the Indian Context*, Christy Vivek Gogu and Jyoti Kumar report on perceptions of students' social connectedness in virtual classrooms. Students from five design schools were surveyed for a comparative understanding, and although there were many technological issues, the factors that influenced perceived connectedness were those that may impact the same on campus. Then, there are opportunities for pedagogical knowledge transfer between domains.

In *The connectivist design studio*, Miroslava Nadkova Petrova makes the argument that the contents of a higher education class should not be simply adapted to an online version in the transition to online learning, but an entirely new learning experience should be created. The principles of connectivism are used to recognise the impact of technology on the learning processes in the redesign of two online design studio classes and the classes are evaluated.

In this guest issue we also include a reflection article. In *Mechanical engineering design, learning from the past to design a better future?* Martin Edward Sole, Patrick Barber and Ian Turner present a reflection on the change in design education from the perspective of the skills required in aircraft manufacture through the ages and the change in skills into the computer age. Whilst not resisting the change the authors document their argument that we should not lose sight of the educational practices of the past and the benefits for the time compared with modern engineers.