Guest Editorial Special Issue on Transforming Engineering Education

***Abstract*—The transformation of engineering education is necessitated by the crucial need to develop students' transversal skills, often referred to as "21st century skills," so they can address complex, global challenges. This special issue accompanies the in-person 9th International Research Symposium for Problem-Based Learning (PBL) on the theme of transforming engineering education, which took place over June 21–23, 2023, in both campuses of Massachusetts Institute of Technology and Harvard School of Engineering and Applied Sciences. The issue features 11 papers selected through a rigorous review process, exploring various approaches and investigations aimed at facilitating the transformation of engineering education. Three themes feature frequently in the special issue, namely, PBL, first-year education, and technology integration in higher education. The guest editors suggest future studies should explore mixed methods research and comparative studies across countries and institutions. They also highlight the need for research into diversity, equity, and inclusion, interdisciplinary education, and pedagogical training for faculty. Overall, the papers in this special issue provide valuable insights and ideas for transforming engineering education, showcasing the global and local efforts being made in this field. The guest editors encourage engineering educators to learn from each other's experiences and adapt innovative solutions to their own educational contexts. The guest editors acknowledge the transformation of engineering education is a complex process, requiring time, effort, and strategic considerations; yet, this special issue demonstrates the potential for meaningful change.**

***Index Terms*—Active learning, education transformation, engineering education, higher education, problem-based learning (PBL).**

I. Introduction

CALLS for transforming engineering education so that alumni can tackle complex global challenges are not new. In recent decades, various international and national organizations have called for the reforming of engineering curricula and pedagogy to develop students' transversal skills, commonly named "21st century skills," such as the lifelong learning, collaboration, creativity, and systems thinking [1], [2], [3]. These skills are different to the more traditional, discipline-specific skills usually emphasized in engineering higher education [4], [5], [6], [7].

The Merriam-Webster online dictionary provides the following primary definition for "transform": "to change in composition or structure; to change the outward form or appearance of; to change in character or condition." Etymologically, the word transform is made-up of "trans-" and "-form," which mean "across, beyond," and "create," "formulate," or "to shape," respectively. Both the primary definition and etymology provide a sense of the substantial task facing those who wish to lead transformations in engineering education: to shape engineering education into something that is beyond what it is currently, to ensure engineering alumni can successfully tackle global challenges.

Two recent global phenomena have amplified the need for transforming higher education: the COVID-19 pandemic [8], [9], [10] and the more recent explosion in the use and public awareness of generative artificial intelligence (AI), such as chatGPT [11], [12]. These drivers, together with others that began prior to them, require transformative changes to both curriculum and pedagogy. From a curriculum that is discipline- and knowledge-focused to interdisciplinary and "know-how"-focused, and from a traditional pedagogy that is lecture-based to student-centered pedagogy involving active learning with more application, discussion, reflection, and teamwork [4], [5], [6], [7], [13].

II. The 9th International Research Symposium for Problem-Based Learning

The International Research Symposium for Problem-Based Learning (IRSPBL) has been taking place biannually since 2008. The Aalborg Centre for Problem-Based Learning in Engineering Science and Sustainability under the auspices of UNESCO in Aalborg, Denmark, has been involved with the IRSPBL series since inception.

During June 21–23, 2023, the 9th IRSPBL on the theme of *Transforming Engineering Education*, acronymized as TEE2023, took place as an in-person conference on the campuses of Massachusetts Institute of Technology (MIT) in Cambridge, MA, USA, and Harvard John A. Paulson School of Engineering and Applied Sciences in Boston, MA, USA. The convening institutions behind TEE2023 were MIT, Harvard University, and Aalborg University. This special issue accompanies TEE2023.

III. Paper Selection Process

Eleven papers in engineering higher education were accepted for this special issue. Each of these papers outlines an approach for or an investigation into topics which could help facilitate engineering education transformation.

The editorial will outline the process for accepting the papers for the special issue, provide a summary of each paper, and briefly discuss thematic connections between them. The

Digital Object Identifier 10.1109/TE.2023.3308668

editorial ends with the guest editors' conclusion and their call for enhanced transformation of engineering education.

A call for abstracts was distributed and submissions opened on 2 May 2022. Authors from around the world were invited to submit short abstracts in English for review. Fifty-seven abstracts were submitted. Each abstract was reviewed by two educators and researchers in engineering higher education and the final decision was given by all three guest editors. Decisions were sent to corresponding authors on 1 September 2022, and included comments from the reviewer.

Thirty-eight abstracts were accepted for the next stage—an invitation to corresponding authors of accepted abstract to submit full papers for the special issue. Full papers had to have the same co-authors and concern the same topic as the accepted abstract, but authors were allowed to change the title of their paper, if they wished. Submitted full papers underwent the standard peer review process for IEEE TRANSACTIONS ON EDUCATION.

Eleven papers were finally accepted for the special issue. Although not preplanned, the final selection represents a diversity of geographic regions and sociocultural contexts, including authors and study populations from Africa, Asia, North America, and Europe.

IV. SUMMARY OF ACCEPTED PAPERS

Here, follows a summary of papers accepted for the special issue, in alphabetical order of last name of the first author.

Article [A1] explores first-year engineering students' efficacy in an online PBL design course in Ghana. Through quantitative research design with multiple data sources from an online survey, the study reported positive results with significant increase of self-efficacy levels in a PBL environment including all majors, modalities, and genders. Nevertheless, no correlation was found between students' self-efficacy levels and design activity levels. More research is called for to further explore PBL impact on students' self-efficacy and learning outcomes.

Article [A2] proposes a conceptual framework for understanding supportive sources of academic well-being among first-year engineering students. A survey was designed and tested, identifying four factors contributing to students' well-being. The study addresses limited research on this topic in engineering education and emphasizes supporting students' well-being for professional development. Research questions explore instrument development and validation for characterizing well-being sources in *problem-based learning* (PBL) and factors fostering well-being in PBL, considering age, gender, and discipline differences. The survey's design included literature review, validity and reliability tests, and exploratory factor analysis. Findings highlight personal values, agentic action, interactions, and external support as well-being sources. Gender, age, and discipline show varying impacts.

Article [A3] examines the application of agile and service-Learning methodologies in a fully online, ninth-semester software engineering-related course, against the backdrop of the COVID-19 pandemic. Employing a mixed-methods approach, combining quantitative and qualitative analyses, the study reveals that this integration improved teamwork, time management, and overall job satisfaction. Students positively evaluated the establishment of clear goal expectations when working with community partners, and community partners expressed greater satisfaction with the delivered products. The study highlights the potential benefits of incorporating the Service-Learning methodology to enhance educational delivery by providing students with practical, real-world learning experiences.

Article [A4] examines the impact of fostering creative thinking in a PBL approach for first-year students with different course characteristics. Two courses were compared: one fully remote and the other a mixed course with both remote and face-to-face interaction. Fostering creativity in engineering education is challenging, and this work combines a creativity framework with PBL (PBL+C) to motivate creative thinking. The intended outcomes include improving creativity, innovation skills, and learning outcomes in first-year engineering. The PBL+C intervention considers the creative process, curriculum alignment, teaching and learning activities, problem types, project progression, support resources, creative tools, learning environments, facilitation strategies, and student assessment. Findings indicate increased creativity factors in the "Person" element, with the mixed course showing better solutions due to increased student interaction.

Article [A5] explores themes of faculty skills considered particularly useful when facilitating interdisciplinary design projects and compiles these into a guide for engineering educators in mentoring first-year interdisciplinary design projects. The authors argue that while there is a growing call to introduce interdisciplinary courses to undergraduate engineering students, the ability of faculty to teach and mentor students from multiple disciplines in such processes and projects is a major concern. The qualitative study is based on semi-structured interviews with engineering faculty and focus group interviews with students and a thematic analysis of their experiences with mentoring in first-year undergraduate interdisciplinary student projects at a university in India. The study highlights the need for faculty training in three interconnected subsets of skills identified in the study, including project management, interdisciplinary, and interpersonal skills; the latter being particularly critical when mentoring freshman students who might not recognize when they need support or openly seek for the faculty support.

Article [A6] highlights PBL, integration, and critical reflection's effectiveness in creating significant learning experiences without increasing course hours. Technology's influence has shifted teaching paradigms to prioritize integration and critical reflection. Engineering education has responded by increasing classroom hours. The paper introduces integrated learning stream (ILS), a project-based approach fostering significant learning through communities, reflection, and skill development. ILS adopts a holistic view, promoting a learner-centered curriculum. Qualitative analysis shows improved efficiency, problem solving, better learning habits, and improved well-being.

Article [A7] is a position paper that examines how to integrate massive open online courses (MOOCs) into traditional,

face-to-face, undergraduate engineering courses. MOOCs have attracted a lot of attention as an innovative approach to online learning with distinctive features, such as ease of access and cost-effectiveness for large audiences, thus potentially contributing to global challenges in engineering education. However, the integration of MOOCs into traditional, on-campus courses and programs in higher education remains an open problem. The study explores MOOC-blending strategies for traditional, on-campus engineering programs through a literature review on the utilization of MOOCs within face-to-face undergraduate education, identifying the MOOC-based flipped (MBF) classroom strategy as the most promising for MOOC-based blending. This is followed by a case study on MBF in a digital signal processing course within an undergraduate electronics engineering program used to illustrate how the MBF design principles can be implemented in practice to support active learning in synchronous face-to-face sessions while fostering the adoption and usage of MOOCs.

Article [A8] investigated the association of student behavioral and cognitive engagement with video contents and learning in a PBL environment in an Indian context. Focusing on explore how first-year student engagement could be studied through reflective practices in a blended mode of learning environment, the study reported no association between student engagement with video content and the content produced by their reflective answers. Such a result calls for further research on this topic.

Article [A9] provides a framework for intended cognitive learning outcomes for students working in narrow interdisciplinary projects. The study is based on related research highlighting different challenges when engineering students work with complex problems in an interdisciplinary setting crossing different disciplinary boundaries, as well as findings from a case study on 18 student groups in engineering and their experiences taking part in a "narrow" interdisciplinary project (interdisciplinary project involving students from different yet related disciplines) in the spring of 2022. Data were collected through eight qualitative group interviews and observations from meetings, status seminars, etc., and categorized according to a model for learning outcomes, providing a list of intended learning outcomes related to interdisciplinary understanding, reflexivity, enactment, and particularly coordination, suggesting more focus on student leadership in interdisciplinary engineering education.

Article [A10] presents a model for knowledge-based recommendations in subject allocation among faculty members. Outcome-based education has gained prominence, and data mining and machine learning tools offer valuable insights for improving teaching pedagogy based on system requirements. The objective is to develop an effective model for subject allocation in engineering studies, considering factors, such as scope, faculty strengths, responsibilities, and interests. The model utilizes artificial neural networks to train and test available data, aiming to allocate subjects for maximum outcome. The system provides percentage-wise correlations among possible subjects and identifies the best-fit subject to allocate. The study highlights individual involvement in academics, administration, and research, qualifications, experience and proposes a user-friendly model applicable at various levels within the institute.

Article [A11] provides a review of collaborative engineering design activities in education, using the cultural historical activity theory (CHAT) framework. It examines their influence on students' collaboration and learning outcomes. The study reviews 111 articles from 2011 to 2021, finding that collaborative learning develops technical and nontechnical skills. Elements like common objectives, rules, and division of labor are vital for effective collaboration, aided by digital tools and educator support. While implementations of collaborative engineering design activities have contributed to learning outcomes, the authors advise caution due to methodological limitations with some of the reviewed articles.

V. Themes of Papers

The authors found three themes to feature frequently in this special issue: PBL (seven papers), first-year education (five papers), and integration of information technology (IT) in higher education (five papers).

Active learning approaches, of which PBL is one, are widely recognized as being effective for fostering students' transversal and 21st century skills [14], [15], [16], [17]. PBL is also included in the name of the conference associated with this special issue (IRSPBL), so it is not surprising this was a prominent category of papers. The papers included in this category are [A1], [A2], [A3], [A4], [A6], [A8], and [A9]. These studies highlight the adoption of PBL in engineering higher education, while seemingly increasing worldwide, is mostly undertaken at the course level and not at the institutional, system-wide level, as reported in a recent systematic review [18]. An example of the latter is one of TEE2023's conveners, Aalborg University [19].

By its nature, first-year education is a crucial stage in any engineer's academic and professional journey. It is also a powerful leverage point for institutions in general and for instructors in particular to affect students' career trajectory and professional development. As such, first-year education is a suitable theme for transforming engineering education. The papers included in this category are [A1], [A2], [A4], [A5], and [A8].

Finally, while the integration of IT in higher education has been a subject of scholarly study for many decades [20], [21], the advent of emergency (online) teaching during the COVID-19 pandemic and the recent explosion in generative AI applications have both placed this topic at the forefront of many educators' minds [10], [22]. It is, therefore, not surprising to find this theme reflected in the special issue. The papers included in this category are [A3], [A7], [A8], [A10], and [A11].

The themes of pedagogical training for faculty and of interdisciplinary education both feature in this special issue as well, in [A4] and in [A4], [A8], respectively. These themes are key to transforming engineering education and therefore should be given due focus in scholarship and practice [4], [8].

While the studies included herein represent a variety of research methods, including qualitative, quantitative, and review, the guest editors propose future studies also focus

on mixed methods research and comparative studies between countries, institutions, and so on. In addition, none of the studies included herein focused on issues of diversity, equity, or inclusion, a topic which also requires substantial attention.

VI. Conclusion

This special issue presents 11 studies in engineering education from a diverse set of countries, educational contexts, and perspectives. The guest editors believe each paper presents insights and ideas for helping to transform engineering education.

It must be acknowledged that transformation, especially at established institutions, takes time, effort, and strategic consideration. However, the guest editors are encouraged by the numerous and diverse efforts for transforming engineering education, some of which are highlighted in this special issue.

The papers in this special issue demonstrate that transforming engineering education is both a global and local endeavor. While educational contexts do indeed vary from country to country and from institution to institution, there also exist many common challenges, and hopefully also many common solutions and insights engineering educators can learn from each other and adapt to their own context.

Acknowledgment

The guest editors would like to thank Dr. Hazan Deniz Marti for participating in the review of abstracts. The guest editors would also like to thank the anonymous reviewers for their help with the review process of full papers.

Appendix: Related Articles

[A1] H. Beem, C. Ampomah, J. Takyi, and G. Adomdza, "Development of an online project-based learning design course for African first year students and its impact on self-efficacy levels," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 410–420, Oct. 2023.

[A2] J. Chen et al., "An exploration of sources fostering first-year engineering students' academic well-being in a PBL environment," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 421–430, Oct. 2023.

[A3] V. Duarte, M. Cleveland-Slimming, C. Vidal, and S. Contreras, "Information system development by using Agile teamwork and service-learning," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 431–441, Oct. 2023.

[A4] O. I. Higuera-Martinez, L. Fernandez-Samacá, and A. Alvarado-Fajardo, "PBL intervention for fostering creativity in first-year engineering students," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 442–449, Oct. 2023.

[A5] U. Koppikar, R. Kandakatla, K. Mallibhat, and G. Joshi, "Exploration of skills required by engineering faculty to mentor freshmen undergraduate students for interdisciplinary design projects," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 450–456, Oct. 2023.

[A6] R. Paul, Y. Jazayeri, L. Behjat, and M. Potter, "Design of an integrated project-based learning curriculum: Analysis through Fink's taxonomy of significant learning," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 457–467, Oct. 2023.

[A7] S. Pertuz, O. Reyes, R. Meier, and M. Castro, "MOOC-based flipped classroom for on-campus teaching in undergraduate engineering courses," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 468–478, Oct. 2023.

[A8] R. Amashi, U. Koppikar, and M. Vijayalakshmi "Investigating the association between student engagement with video content and their learnings," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 479–486, Oct. 2023.

[A9] H. Routhe, J. Holgaard, and A. Kolmos, "Experienced learning outcomes for interdisciplinary projects in engineering education," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 487–499, Oct. 2023.

[A10] N. K. Saxena, B. Chauhan, S. Gauri, A. Sharma, and A. Gupta, "Knowledge-based recommendation for subject allocation using artificial neural network in higher education," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 500–508, Oct. 2023.

[A11] G. van Helden, B. Zandbergen, M. Specht, and E. Gill, "Collaborative learning in engineering design education: A systematic literature review," *IEEE Trans. Educ.*, vol. 66, no. 5, pp. 509–521, Oct. 2023.

References

[1] *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Washington, DC, USA: Nat. Acad. Press, 2013.

[2] K. Ananiadou and M. Claro, *21st Century Skills and Competences For New Millennium Learners in OECD Countries*. Paris, France: OECD Publ., 2009.

[3] *The Future of Jobs Report 2020*, World Econ. Forum, Geneva, Switzerland, 2020.

[4] *Engineering for Sustainable Development: Delivering on the Sustainable Development Goals*, UNESCO, Paris, France, 2021.

[5] R. Lavi, M. Tal, and Y. J. Dori, "Perceptions of STEM alumni and students on developing 21st century skills through methods of teaching and learning," *Stud. Educ. Eval.*, vol. 70, Sep. 2021, Art. no. 101002.

[6] R. Graham, The global state of the art in engineering education, Massachusetts Inst. Technol., Cambridge, MA, USA, 2018.

[7] A. Kolmos, L. B. Bertel, J. E. Holgaard, and H. W. Routhe, "Project types and complex problem-solving competencies: Towards a conceptual framework," in *Proc. 8th Int. Res. Symp. PBL*, Aalborg, Denmark, 2020, pp. 56–65.

[8] S. Pokhrel and R. Chhetri, "A literature review on impact of COVID-19 pandemic on teaching and learning," *High. Educ. Future*, vol. 8, no. 1, pp. 133–141, 2021.

[9] G. Marinoni, H. Van't Land, and T. Jensen, "The impact of COVID-19 on higher education around the world," IAU, Paris, France, IAU Global Survey Rep. no. 23, 2020.

[10] D. Turnbull, R. Chugh, and J. Luck, "Transitioning to e-Learning during the COVID-19 pandemic: How have higher education institutions responded to the challenge?" *Educ. Inf. Technol.*, vol. 26, no. 5, pp. 6401–6419, 2021.

[11] J. Rudolph, S. Tan, and S. Tan, "ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?" *J. Appl. Learn. Teach.*, vol. 6, no. 1, pp. 1–22, 2023.

[12] K. Fuchs, "Exploring the opportunities and challenges of NLP models in higher education: Is chat GPT a blessing or a curse?" *Front. Educ.*, vol. 8, May 2023, Art. no. 1166682.

[13] C. Winberg et al., "Learning to teach STEM disciplines in higher education: A critical review of the literature," *Teach. High. Educ.*, vol. 24, no. 8, pp. 930–947, 2019.

[14] S. Freeman et al., "Active learning increases student performance in science, engineering, and mathematics," *Proc. Nat. Acad. Sci.*, vol. 111, no. 23, pp. 8410–8415, 2014.

[15] A. Virtanen and P. Tynjälä, "Factors explaining the learning of generic skills: A study of university students' experiences," *Teach. High. Educ.*, vol. 24, no. 7, pp. 880–894, 2018.

[16] M. Savin-Baden, "Using problem-based learning: New constellations for the 21st century," *J. Excell. Coll. Teach.*, vol. 25, nos. 3–4, pp. 197–219, 2014.

[17] A. Guerra, "Integration of sustainability in engineering education: Why is PBL an answer?" *Int. J. Sustainabil. High. Educ.*, vol. 18, no. 3, pp. 436–454, 2017.

[18] J. Chen, A. Kolmos, and X. Du, "Forms of implementation and challenges of PBL in engineering education: A review of literature," *Eur. J. Eng. Educ.*, vol. 46, no. 1, pp. 90–115, 2021.

[19] L. Bertel et al., "Digital transformation at Aalborg University: Interdisciplinary problem- and project-based learning in a post-digital age," *Adv. Eng. Educ.*, vol. 9, no. 3, p. 13, 2021.

[20] M. Kadiyala and B. L. Crynes, "A review of literature on effectiveness of use of information technology in education," *J. Eng. Educ.*, vol. 89, no. 2, pp. 177–189, 2000.

[21] K. Madhavan and E. D. Lindsay, "Use of information technology in engineering education," in *Cambridge Handbook of Engineering Education Research*. Cambridge, U.K.: Cambridge Univ. Press, 2014, pp. 633–654.

[22] S. Otto, L. B. Bertel, N. E. Ruan Lyngdorf, A. O. Markman, T. Andersen, and T. Ryberg, "Emerging digital practices supporting student-centered learning environments in higher education: A review of literature and lessons learned from the COVID-19 pandemic," *Educ. Inf. Technol.*, pp. 1–24, May 2023. [Online]. Available: https://link.springer.com/article/10.1007/s10639-023-11789-3#citeas

REA LAVI, *Guest Editor*
School of Engineering
Massachusetts Institute of Technology
Cambridge, MA 02139 USA
E-mail: realavi@mit.edu

LYKKE BROGAARD BERTEL, *Guest Editor*
Aalborg Centre for Problem-Based Learning in Engineering Science and Sustainability
Department of Sustainability and Planning
Aalborg University
9220 Aalborg, Denmark
E-mail: lykke@plan.aau.dk

XIANGYUN DU, *Guest Editor*
Aalborg Centre for Problem-Based Learning in Engineering Science and Sustainability
Department of Sustainability and Planning
Aalborg University
9220 Aalborg, Denmark
E-mail: xiangyun@plan.aau.dk

Rea Lavi (Fellow, IEEE) received the dual B.Sc. degrees in biology and in psychology as part of the neuroscience track from Tel-Aviv University, Tel Aviv-Jaffa, Israel, in 2009, the master's degree in curriculum management (with Hons. and with a thesis) from Bar-Ilan University, Ramat Gan, Israel, in 2013, and the Doctoral degree in science and engineering education from the Technion—Israel Institute of Technology, Haifa, Israel, in 2019.

In 2019, he joined the New Engineering Education Transformation Program with the School of Engineering, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, where he is also a Digital Education Lecturer with the Department of Aeronautics and Astronautics, and an Expert-in-Residence with the MIT Abdul Latif Jameel World Education Lab. During his time at MIT, he obtained educational project grants from the Alumni Class Funds and from the d'Arbeloff Fund for Excellence in Education. His work has been published in IEEE TRANSACTIONS ON EDUCATION, *Journal of Science Education and Technology*, and *Studies in Educational Evaluation*, among other peer-reviewed journals. His research interests include problem structuring, systems thinking, and creative ideation, with specific focus on undergraduate engineering education.

Dr. Lavi is a member of the American Society for Engineering Education. He received several awards for his doctoral research, including but not limited to, the Zeff Fellowship for Excelling First-Year Doctoral Students and the Miriam and Aaron Gutwirth Fellowship for Excelling Doctoral students.

Lykke Brogaard Bertel received the Master of Science degree in information architecture and persuasive design and the Ph.D. degree in human-centered informatics and educational robotics from Aalborg University, Aalborg, Denmark, in 2011 and 2016, respectively.

She is an Associate Professor with the Aalborg Centre for Problem-Based Learning in Engineering Science and Sustainability under the auspices of UNESCO, Aalborg University, where she has been employed since 2017. She is affiliated with the Institute of Advanced Study in PBL and Aalborg Robotics Challenge, Aalborg University. She was previously a Specialist with the Danish Technological Institute, Center for Robot Technology, Taastrup, Denmark, and an External Lecturer with the Maersk Mc-Kinney Moller Institute, University of Southern Denmark, Odense, Denmark. She has published work within human–robot interaction in education, interdisciplinary approaches to problem-based learning in education for sustainable development, emerging digital practices in student-centered learning environments following the COVID-19 pandemic, computational thinking and teacher professional development in K-12 STEM. Her current research interests are in the fields of emerging technology, creativity and complex problem solving in engineering education transitions, capacity building, computational play, and generative AI in education.

Dr. Bertel is a member of the American Society for Engineering Education and a Guest Editor of the IEEE TRANSACTIONS ON EDUCATION.

Xiangyun Du received the master's degree from Linköping University, Linköping, Sweden, and Roskilde University, Roskilde, Denmark, in 2022, and the Ph.D. degree in engineering education and PBL from Aalborg University, Aalborg, Denmark, in 2006.

Having served in academic positions internationally, she is currently a Professor and the Director of the UNESCO Center for Problem and Project-Based Learning, Aalborg University. She has been committed to research in educational transformation through pedagogical change using problem-based and project-based learning methodology—in diverse social, cultural, and educational contexts. Having worked in fields of development ranging from engineering and science, teaching preparation, language teaching, business to health (medicine, dental, and public health sciences) education, etc. She has over 200 relevant international publications, including 10 monographs, over 100 journal papers (SCOPUS, Web of Science, and SSCI), 15 edited books, and over 40 book chapters as well as over 60 conference contributions. Having won multiple teaching and learning prizes herself, she has also been engaged with educational institutions in over 30 institutions cross countries doing substantial work on pedagogy development. Her research topics included change from an inter-/cross-cultural perspective, curriculum and pedagogy development, faculty/staff/teacher development, intercultural learning and teaching, and gender studies.

Prof. Du has also been actively involved in several international academic programs, networks, and editorial works for journals, such as an Associate Editor of *European Journal of Engineering Education*.