

Guest Editorial to the Special Issue on Teaching and Learning Conceptual Modeling

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1 Introduction

The field of Conceptual Modeling (CM) has been around for more than 50 years. Over time, several authors have investigated the state of the art and proposed a research agenda. In their formulation of a research agenda on Information Systems and CM, Wand and Weber (2002) focus on the question of “How can we model the world better”, thus focusing on the ingredients needed for conceptual modeling. While their research agenda identifies many research opportunities related to how people model and to the impact of modeling languages, methods and contextual factors on the modeling task, the teaching of CM per se is not explicitly present in the research agenda. The research agenda proposed by Frank et al. (2014) departs from a number of challenges and posits that these can best be addressed by a pluralistic approach to research that integrates knowledge from different research fields of Business and Information Systems Engineering. Again, research on teaching is not explicitly included, but one of the specific challenges mentioned is that the transfer of research results to business practice proves challenging: Apart from individual cases there are no convincingly applied approaches for the further distribution and adoption of research findings so far. Therefore, the expected effects of

university teaching is certainly not to be underestimated. Sandkuhl et al. (2018) elaborated a specific vision on Enterprise Modeling (EM) that the majority of organizational stakeholders would use EM to manage knowledge relevant for their practice in a way that supports cross-concern organizational objectives. While the teaching of CM is not explicitly mentioned, many of the issues and concerns they have raised are related to people: how they use models, what concerns they have, with whom they need to communicate, etc. Recker et al. (2021) argue that conceptual modeling research is more relevant to the IS field than ever, but it requires an update with new theory. However, their review is limited to the area of IS research and does not include the progress made in the field of model-driven engineering. For example, their framework acknowledges that the CM agent can also be digital. With their work, the authors thus substantiate but also join the call of Frank et al. (2014) for more collaboration across disciplinary fields. Storey et al. (2023) surveyed conceptual modeling over the past five decades and shows how its topics and trends as published in (mainly) IS venues continue to evolve to accommodate emerging technologies while remaining grounded in basic constructs. To capture the emerging opportunities, the authors suggest different directions for future conceptual modeling scholarship, amongst which not only applications in non-traditional settings and developing new frameworks and theories, but also

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broadening the user base and focusing on the improvement of the process of developing, deploying and learning conceptual modeling. They posit that as information technologies become even more central to human existence, conceptual modeling emerges as vital and incredibly relevant for the digital world. It is in this context of evolving perspectives on conceptual modeling, the broadening of the user base through information technologies that become increasingly central to human existence and extending the application of CM to non-conventional settings, that the importance of teaching conceptual modeling should not be underestimated. The teaching of a discipline is a good way to get a grip on human factors and gain an understanding of the difficulties of bringing the field of CM to a broader public.

The broadening of the user base can be witnessed by the fact that conceptual modeling constitutes a learning task faced by students of Software Engineering, Business Informatics, Information Systems and related fields, but is also often taught to business students as part of the general introduction to the digital world. Viewed as an activity, conceptual modeling involves an intricate array of cognitive processes and performed actions including abstracting, conceptualizing, associating, contextualizing, interpreting and sense-making, judging and evaluating, drawing and visualizing, and, in group settings, communicating, discussing and agreeing (Strecker 2020; Wilmont et al. 2013). Learning conceptual modeling is, hence, conceptualized as a complex and challenging task for learners that is based on codified & tacit knowledge (Polanyi and Sen 2009) and learning processes involving knowledge acquisition through experience (e.g., Venable 1996). It requires mastering theoretical foundations, modeling languages and methods, applying them to practical problems, and, along the way, critically thinking and reflecting upon the modeling objectives, the universe of discourse and application domain—to create high-quality problem representations, i. e. conceptual models. Teaching conceptual modeling is a likewise challenging task faced by didactic

and practical challenges (Bogdanova and Snoeck 2017).

Research on teaching and learning conceptual modeling forms a diverse body of knowledge involving foci on learning tool support (Sedrakyan and Snoeck 2017), feedback to learners (Serral et al. 2016) and the use of learning theories and methods (Rosenthal et al. 2019). In the light of its relevance for education and practice, research on teaching and learning conceptual modeling takes complementary angles and methodological stances to address the challenges of this multifaceted topic.

This Special Issue on Teaching and Learning Conceptual Modeling includes four contributions discussing various aspects of teaching and learning conceptual modeling. The four papers in this special issue have undergone a rigorous double-blind peer review process. This Special Issue would not have been possible without the diligent reviews of the reviewers, we thank for their thorough and constructive reviews.

The first paper by Jose Ignacio Panach and Óscar Pastor on “A Practical Experience of How to Teach Model-Driven Development to Manual Programming Students” features a comparison of teaching Model-Driven Development (MDD) and a traditional software development method in a Master’s degree program (Panach and Pastor 2023). Based on the observation that students do not recognize MDD as a useful development paradigm, the paper presents an evaluation of the proposed teaching approach in terms of attitude towards MDD, knowledge of MDD, quality of the developed system, and satisfaction of the developer.

The second paper on “Automated Assessment of Conceptual Models in Education – A Systematic Literature Review” has been contributed by Meike Ullrich, Constantin Houy, Tobias Stottrop, Michael Striewe, Brian Willems, Peter Fettke, Peter Loos and Andreas Oberweis (Ullrich et al. 2023). This work is motivated by the observation that an automated assessment of models can improve teaching and learning conceptual modeling.

The authors present results of a systematic literature review and outline paths for future research on the automated assessment of conceptual models.

The third paper by Sobah Abbas Petersen, Farzana Quayyum and John Krogstie addresses “Criteria for selecting an Enterprise Modelling Method – Students’ Perspectives on ArchiMate and 4EM” (Abbas Petersen et al. 2023). This work presents an overview of students’ perspectives on the Enterprise Modelling methods and languages 4EM and ArchiMate. Based on a post hoc analysis of students’ assignments from a course in Enterprise Architecture and Innovation, the authors provide a set of selection criteria and recommendations for educators and students in the field of Enterprise Modelling.

The fourth paper by Chantal Soyka, Meike Ullrich, Michael Striewe and Niclas Schaper deals with a “Comparison of Required Competences and Task Material in Modeling Education” (Soyka et al. 2023). The authors investigate whether typical task material used in modeling education at selected German universities covers relevant competences required for graphical modeling. As results, the paper provides a classification of task types for modeling education and a specification of the competence facets addressed by these tasks. Furthermore, the authors discuss recommendations for developing and assessing student’s competences in graphical modeling.

As the public for Conceptual Modeling is systematically growing, the papers presented in this issue provide avenues that may facilitate understanding the value of CM and generate a positive attitude towards modeling, while helping teachers to shape their courses and assess the competences of their students.

References

- Abbas Petersen S., Quayyum F., Krogstie J. (2023) Criteria for selecting an Enterprise Modelling Method – Students’ Perspectives on ArchiMate and 4EM. In: *Enterp. Model. Inf. Syst. Archit. Int. J. Concept. Model.* 18
- Bogdanova D., Snoeck M. (2017) Domain Modelling in Bloom: Deciphering how We Teach It. In: *Proceedings of 10th IFIP WG 8.1. Working Conference on the Practice of Enterprise Modeling, PoEM 2017, Leuven, Belgium, November 22-24, 2017. Lecture Notes in Business Information Processing Vol. 305.* Springer, pp. 3–17
- Frank U., Strecker S., Fettke P., vom Brocke J., Becker J., Sinz E. (2014) The Research Field “Modeling Business Information Systems”: Current Challenges and Elements of a Future Research Agenda. In: *Business & Information Systems Engineering* 6(1), pp. 39–43
- Panach I., Pastor Ó. (2023) A Practical Experience of How to Teach Model-Driven Development to Manual Programming Students. In: *Enterp. Model. Inf. Syst. Archit. Int. J. Concept. Model.* 18
- Polanyi M., Sen A. (2009) *The Tacit Dimension.* University of Chicago Press
- Recker J., Lukyanenko R., Jabbari M., Samuel B. M., Castellanos A. (2021) From Representation to Mediation: A New Agenda for Conceptual Modeling Research in a Digital World. In: *MIS Quarterly* 45(1), pp. 269–300
- Rosenthal K., Ternes B., Strecker S. (2019) Learning Conceptual Modeling: Structuring Overview, Research Themes and Paths for Future Research. In: *Proceedings of the 27th European Conference on Information Systems, ECIS 2019, Stockholm and Uppsala, Sweden, June 8-14, 2019. Research Paper* 137
- Sandkuhl K., Fill H.-G., Hoppenbrouwers S., Krogstie J., Matthes F., Opdahl A., Schwabe G., Uludag Ö., Winter R. (2018) From Expert Discipline to Common Practice: A Vision and Research Agenda for Extending the Reach of Enterprise Modeling. In: *Business & Information Systems Engineering* 60(1), pp. 69–80

Sedrakyan G., Snoeck M. (2017) Cognitive Feedback and Behavioral Feedforward Automation Perspectives for Modeling and Validation in a Learning Context. In: Proceedings of the 4th International Conference on Model-Driven Engineering and Software Development, MODELSWARD 2016, Rome, Italy, February 19-21, 2016. Communications in Computer and Information Science Vol. 692. Springer, pp. 70–92

Serral E., De Weerd J., Sedrakyan G., Snoeck M. (2016) Automating Immediate and Personalized Feedback: Taking Conceptual Modelling Education to a Next Level. In: Proceedings of the 10th International Conference on Research Challenges in Information Science (RCIS). IEEE, pp. 1–6

Soyka C., Ullrich M., Striwe M., Schaper N. (2023) Comparison of Required Competences and Task Material in Modeling Education. In: *Enterp. Model. Inf. Syst. Archit. Int. J. Concept. Model.* 18

Storey V. C., Lukyanenko R., Castellanos A. (2023) Conceptual Modeling: Topics, Themes, and Technology Trends. In: *ACM Comput. Surv.* 55(14s) Article 317

Strecker S. (2020) Enterprise Modelling Research Group at University of Hagen. In: *40 Years EMISA: Proceedings of the 40th EMISA International Conference. Lecture Notes in Informatics P-304.* Köllen, pp. 195–199

Ullrich M., Houy C., Stottrop T., Striwe M., Willems B., Fettke P., Loos P., Oberweis A. (2023) Automated Assessment of Conceptual Models in Education: A Systematic Literature Review. In: *Enterp. Model. Inf. Syst. Archit. Int. J. Concept. Model.* 18

Venable J. R. (1996) Teaching Novice Conceptual Data Modellers to Become Experts. In: *Proceedings of the International Conference Software Engineering: Education and Practice.* IEEE, pp. 50–56

Wand Y., Weber R. (2002) Research Commentary: Information Systems and Conceptual Modeling – A Research Agenda. In: *Information Systems Research* 13(4), pp. 363–376

Wilmont I., Hengeveld S., Barendsen E., Hoppenbrouwers S. (2013) Cognitive Mechanisms of Conceptual Modelling. In: *Proceedings of the 32th International Conference on Conceptual Modeling, ER 2013, Hong-Kong, China, November 11-13, 2013. Lecture Notes in Computer Science* Vol. 8217. Springer, pp. 74–87

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