Digital tracing and analysis of collaborative learning with knowledge objects

E-CER founding date: January 1, 2020

E-CER SCOPE

Our E-CER focuses on advancing the digital analysis of collaborative learning with knowledge objects and students' development of collaborative competence. An enriched understanding of complex processes of collaboration will be achieved by exploring the analysis of digital data in combination with traditional data types.

In current education, students engage in collaborative learning that involves joint exploration and inquiry, discussion and negotiation, writing or creating together, and managing collaborative work. Knowledge objects, which are artefacts encompassing knowledge particular to a discipline (assignments, essays, research or project reports, etc.), are often created jointly, as tangible representation of students' individual or collective learning outcomes. These collaborative activities are of importance, as students' learning performance is often assessed based on the knowledge objects produced. Yet, there is little research about the way these object-oriented collaborative activities take place and how they can be supported. While dialogical aspects of collaborative learning have been extensively examined, also by using automated dialog analysis, research on collaborative learning with knowledge objects has been mostly of qualitative nature. Developing methodologies and approaches to trace and analyze data collected digitally enables novel ways to investigate how students engage in the process and how they employ digital technologies to create such objects collaboratively. A specific challenge is represented by the difficulty of scaling up the tracing and analyzing processes rigorously. By scaling up, the rather situational and case-based understanding of collaboration could be expanded to find underlying patterns of interaction and object development as well as the competence required from students to collaborate effectively.

To further the understanding of practices of object-oriented collaboration, our E-CER aims to: a) advance understanding of learning practices involved in students' object-oriented collaboration; b) develop approaches based on learning analytics and automated analysis techniques to trace and interpret object-oriented collaboration at various levels (individual, collective and institutional); and c) contribute to the development of indicators for measuring and assessing competences for object-oriented collaboration.

The planned work will include analytical explorations that combine qualitative approaches with learning analytics and automated analysis techniques. This analytical approach will allow examination of digital traces using: social and epistemic network analysis of network and digital trace data, i.e., online discussions, aggregated collaboration and artefact development contributions, experienced interaction; dynamic Bayesian networks and breakpoint analysis of temporal manifestation in interaction data; automated content analysis of developing knowledge objects, produced collectively, versioning, commenting), inspired by qualitative analyses and text data mining techniques.

The work of the collaborating teams will build on the coexistence of both prior knowledge and newly acquired conceptions and ideas about how collaborative learning can be captured in its

complexity. Future learning and instruction are foreseen to be supported by automated analytical practices, therefore, our E-CER aims at contributing to theoretical, methodological and ethical knowledge on data analytics practices. The team includes interdisciplinary and complementary expertise on qualitative study of collaboration and competence development, and on quantitative techniques, such as learning analytics and automated analysis of learning dialogues.

E-CER MEMBERS

Assoc. Prof. Dr. Crina Damsa is associated with the Department of Education at the University of Oslo in Norway. Her teaching is in the area of university pedagogy and learning design. In her research, she examines the learning of students and work of teachers in various disciplinary areas in higher education, using an ecological perspective and rich, analog and digital, data to capture processes, context features and outcomes. Her learning research focuses on collaborative processes, the way digital technologies aid inquiry and the way learners use various resources in their learning activities. Crina is a member of the EARLI EC and of the International Society of the Learning Sciences, is associate editor of the Frontline Learning Research and board member of several learning research journals.

Prof. Dr. Hanni Muukkonen (Educational psychology, Faculty of Education, University of Oulu, Finland) current research focuses on collaborative learning, knowledge creation, learning analytics, and educational technology development. In the area of educational psychology, she has focused on technology-mediated collaboration and understanding of competence development as a result of engagement in various learning activities. Hanni has been involved in several large scale international educational technology development projects funded by the Academy of Finland, EU, and the Finnish Funding Agency for Technology and Innovation. Muukkonen has also experience in academic leadership e.g., as programme director and vice-dean for academic affairs. She currently leads a large national learning analytics research and development project funded by the Ministry of Education and Culture to support students' study paths, guidance and leadership in higher education (https://analytiikkaaly.fi/in-english/).

Prof. Dr. Dragan Gasevic (Information Technology, Monash University, Australia) is director of the Centre for Learning Analytics at Monash University. He served as the past president (2015-2017) of the Society for Learning Analytics Research (SoLAR) and has held several honorary appointments in Australia, Asia, Europe, and North America. A computer scientist by training and skills, Dragan considers himself a learning analyst who develops computational data analysis methods that can shape next-generation learning technologies and advance our understanding of self-regulated and collaborative learning. Dragan received competitive funding in excess of over AUD $41M (equivalent) from research bodies in Australia, Europe, and North America. Dragan is a (co-)author of numerous research papers and books and a frequent keynote speaker. *The Australian*, a leading newspaper in Australia, identified Dragan as the national field leader in educational technologies based on citations of his publications. He received the best project of the year award (2019) by the Association for Learning Technology for the work on the SHEILA framework that influenced the adoption of learning analytics in hundreds of higher education institutions.

Assoc. Prof. Dr. Jeroen Janssen is associated with the Department of Education at Utrecht University, The Netherlands. His research interests include (computer-supported) collaborative learning, self-regulated learning, and educational technology. Jeroen is associate editor of the Journal of Computer-Assisted Learning. In Utrecht he is involved in projects on Massive Open Online Course, Flipped Classrooms, and self-regulated learning. He received grants for research on collaborative learning and teacher guidance of collaborative learning.

Asst. Prof. Dr. Anouschka van Leeuwen (Department of Education, Utrecht University, the Netherlands) has a background in Artificial Intelligence and Educational Sciences, which she combines in her research into educational technology. Her particular research interests include computer-supported collaborative learning, learning analytics, and blended learning. Anouschka is a member of the executive committee of the Society for Learning Analytics Research (SoLAR), for which she organizes bi-monthly webinars. She is also part of the editorial board of the Journal of Learning Analytics.

Dr. Rachelle Esterhazy is a Postdoctoral Researcher at the Department of Education at the University of Oslo, Norway. In her PhD thesis, she has studied productive feedback practices in higher education using qualitative methodology and sociocultural theories. Her current research interests cover feedback, assessment and pedagogical design practices in higher education as well as collegial approaches to academic development.

Andres Araos is PhD candidate at the Faculty of Education at the University of Oslo (UiO). His background is in Industrial Engineering and Higher Education studies. His PhD research is focused on how undergraduate students engage in learning practices using non-curricular resources available on the Internet and connected to their disciplinary domain. The project examines learning processes from an ecological perspective, by collecting and analyzing multiple data streams, including digital traces, activities in digital environments, surveys and interviews.

Anni Silvola is a PhD student at the Faculty of Education, at the University of Oulu, Finland. Her phD thesis focuses on researching how to support study engagement with learning analytics during university studies. Her research interests are study engagement and competence development during higher education studies, collaborative learning and learning analytics. Currently, she is working on a national learning analytics research and development project, funded by the Ministry of Culture and Education (https://analytiikkaaly.fi/).

Egle Gedrimiene is a PhD student in Oulu University, Faculty of Education. She has a background in psychology and is currently doing research on learning analytics and technology supported transitions in education. Her research interests are career guidance, self-efficacy and learning analytics. Currently, she is working on a national learning analytics research and development project, funded by the Ministry of Culture and Education (https://analytiikkaaly.fi/).

Roberto Martínez-Maldonado is a Senior Lecturer of Learning Analytics and Human-Computer Interaction in the Faculty of Information Technologies at Monash University (Australia). His research focuses on multimodal learning-analytics and human-centred design to support teaching and learning in and across physical and digital spaces. His research work has pioneered a number of new areas including the application of data mining techniques to study face-to-face collaboration, the implementation of a system to add user-identification to a regular large display using a depth sensor, and the first multi-tabletop classroom used to run authentic collaborative activities associated with the learning design.

Rogers Kaliisa is PhD candidate at the Department of Education, University of Oslo, Norway. His primary research interests relate to learning analytics, learning design, and technology enhanced learning. In his PhD thesis, Rogers is studying how learning analytics generated from computer supported collaborative environments (e.g. learning management systems) can be leveraged to support teachers in making timely and informed learning design decisions. In his work, he applies principles from the learning sciences and human-computer interaction through design-based research, to derive learning analytics user and design requirements that favor adoption. He employs quantitative ethnography techniques (e.g. epistemic network analysis), social network analysis, and text mining tools to explore students' learning from online

discussions. Rogers currently serves on the executive committee of the Society for Learning Analytics Research (SoLAR) where he was elected as the student member representative, and later nominated as chair of SoLAR's special interest group committee. He is also a member of the communications committee for the International Society for Quantitative Ethnography (ISQE-CC), where he is engaged in keeping the ISQE community informed about the society's events.

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Mladen Rakovic is a Research Fellow in the Centre for Learning Analytics at Monash University. Mladen's research interests span the fields of natural language processing, predictive modeling, computational linguistics, and educational psychology. He focuses on the development and evaluation of computer-based writing systems that monitor undergraduates' writing activity and generate learning analytics to promote self-regulated learning and deep engagement with disciplinary content. Mladen proposed the methods for automatic identification of knowledge transforming in multi-source writing and fine grained analysis of students' online discussion posts.

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