



# “LEARNING DOMAIN KNOWLEDGE USING BLOCK-BASED PROGRAMMING: DESIGN-BASED COLLABORATIVE LEARNING”

**Prof. Anders I. Mørch**, University of Oslo, Norway

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## ABSTRACT

Block-based programming languages have lowered the threshold to computer science (CS), providing a powerful (low threshold-high ceiling) arena for early CS education and engagement in STEM subjects. This seminar presents results of an empirical study in three schools; involving 43 pupils aged 12–16 using makecode with microbit (a microcontroller), basic physical objects, and zoom video communication as a shared learning environment. Using design-based research (DBR) together with teachers, we created technology-rich learning materials and tasks in-math, biology, and physics and organized a series of project-based learning activities wherein pupils met three hours per week for 16 weeks during two semesters. Recorded zoom meetings serve as our data. We thematized and transcribed the video material of selected groups' online activities and used verbal interaction analysis and visual artefact analysis as our methods. Our results include a new analytical framework, design-based collaborative learning (DBCL), achieved by adopting concepts from computer-supported collaborative learning (CSCL) and end-user development (EUD), specifically domain-oriented design environments (DODE). Our empirical findings are: 1) block-based programming in a collaborative context, 2) block-based programming as part of a DODE, 3) block-based programming integrated with school subjects, and 4) block-based programming as an explorative design method.



Anders I. Mørch is Professor at the Department of Education, University of Oslo (Norway) and since 2013 is Coordinator of the MA program in Education with specialization in Communication, Design, and Learning. His research interests are human-computer interaction; computer-supported collaborative learning; end-user development; computer-supported cooperative work; virtual worlds; open online education; tools and artifacts to help people learn together (3D virtual worlds, maker spaces, social media, distance education); interfaces supporting learning and computer-based scaffolding (critiquing systems; pedagogical agents; learning analytics); design-based models of collaborative learning; mixed methods research (individual vs. group; group vs. community; technology adaptation vs. knowledge adaptation).