



## Call for Papers

### Learning and Instruction

#### Special Issue entitled “Using Real-Time Process Data of Domain-Specific Learning Processes to Provide Adaptive Support for Learning and Instruction”.

Learning and Instruction is soliciting submissions for a special issue entitled “Using Real-Time Process Data of Domain-Specific Learning Processes to Provide Adaptive Support for Learning and Instruction”.

#### Overview

There are many perspectives, conceptualizations, and aspects involved in the study and development of adaptive support for learning and instruction. Recent reviews and meta-analyses show that adaptive support is generally promising for learning and instruction, but that there are mixed findings across studies (e.g., Belland et al., 2017; Major & Francis, 2020; Major et al., 2021; Van Schoors et al., 2021; Xie et al., 2019; Zheng et al., 2022) as well as varying conceptualizations and methodologies (e.g., Bernacki et al., 2021; Van Schoors et al., 2021).

While research would benefit from unified frameworks and approaches regarding adaptive support, this goal is often limited by the unique requirements of specific domains. In this special issue, we want to focus on these domain-specific challenges and discuss commonalities and differences across domains. This includes the search for feasible unified conceptualizations of the nature of adaptive support, theoretical models and design principles for adaptive support, approaches to collecting and interpreting real-time data as a basis for adaptive support, evaluating the effectiveness of adaptive support for learning, and exploring the potential of learning technologies for implementing adaptive support - all with a clear link to domain-specific learning and instruction.

#### Aims and Contributions

We are interested in papers that contribute to the development of adaptive support for domain-specific learning and instruction by using real-time process data. *Adaptive support* refers to immediate, data-driven adjustments to some aspects of learning and instruction to improve learners’ cognitive, motivational-affective, or metacognitive learning outcomes (Plass & Pawar, 2020; Tetzlaff et al., 2021). *Real-time process data* refers to student data collected during learning that can be used immediately, such as logfile data, physiological data, or automatically coded student input (see also Järvelä & Bannert; 2021). Related frameworks and concepts like *personalized education*, *intelligent tutoring systems*, *adaptive learning systems* and *advanced learning technologies* can be included but should be situated within the terminology used here. All contributions should focus on domain-specific learning and provide a well-founded theoretical background that allows for a clear connection between real-time process data, the



underlying cognitive, motivational-affective, and metacognitive learning processes, and adaptive support.

We are aiming at a special issue that includes papers covering different aspects of this field of research, including:

- Theoretical or empirical papers that explore and outline how knowledge about learning processes can be used for building adaptive support in line with *domain-specific theories of learning*.
- Design studies on the *development and evaluation of adaptive learning environments* that use process data for adaptive support, for example within a digital learning tool.
- Empirical papers that investigate the *effectiveness of adaptive support* for learning and instruction and how this effectiveness differs between individual learners.
- Empirical papers that investigate *new ways of observing domain-specific learning processes* with a clear potential of using these data for adaptive support, e.g., with innovative technology like eye tracking, biosensors, or logfile data.
- Papers that focus on the *assessment of non-cognitive learning outcomes* with a clear potential for adaptive support., e.g., with a focus on affective and motivational processes.
- A meta-analysis related to the topic of the special issue.

We want to merge and discuss these different perspectives in two discussion articles – one focusing on the potential and limits of joint theoretical frameworks and design principles for domain-specific adaptive support and the other one on the use of technology and real-time data for adaptive support.

The special issue may, if relevant, include types of papers that are otherwise not applicable in the journal: (1) one meta-analysis, systematic review, or theoretical positioning study, of the state of affairs in the particular field of the special issue, or (2) one study of the qualities and measurement properties of the instrument used in one/some of the papers in the special issue.

### Theoretical Background and Rationale

Education increasingly appreciates the diversity and heterogeneity of learners. Optimal learning environments are not one-size-fits-all, but adapt to the specific needs of each learner as quickly and efficiently as possible (e.g., Alevan et al., 2016; Cronbach & Snow, 1977). Achieving such adaptation requires observing and understanding learning processes based on all available data sources and in real-time, and making appropriate decisions on the most promising support based on detailed observations and knowledge about domain-specific learning processes. However, collecting more data does not necessarily lead to more knowledge about learning processes: An important prerequisite is to have a clear theoretical rationale for how such data can be interpreted and related to learning (e.g., Gašević et al., 2015). The more information



about learning this real-time data contains and the better the knowledge of its meaning in domain-specific learning processes, the more individualized and effective the support can be for learning outcomes, and the more adaptable the learning environment becomes.

Existing adaptive learning environments predominantly utilize students' cognitive abilities based on performance measures, providing support according to levels of performance (e.g., providing more support for struggling learners). However, various other methods exist to observe cognitive, motivational-affective, and metacognitive learning processes in more depth, including eye tracking, physiological measures, and logfile data. Further developing domain-specific theories of their interpretation, making use of technological developments, and triangulating these data for a meaningful interpretation within a specific content area is a key challenge in the field of adaptive learning environments (e.g., Plass & Pawar, 2020).

Making sense of real-time process data is still a challenge. To interpret process data meaningfully, strong theoretical frameworks are required that describe domain-specific cognitive processes and their relation to observable behavior. For many areas, such cognitive frameworks are not yet developed to meet the increasing possibilities of observing learning processes. When developed, such models should be tested by their ability to predict observable behavior relevant within a specific domain.

Meeting these challenges requires bringing together expertise from different fields of educational research, such as educational technology, digital learning, learning analytics, and subject-specific education. Many of the specific obstacles in integrating complex data and knowledge from these fields are not well understood. Joining forces in a special issue will give scholars the possibility to share their knowledge, initiate critical discussions throughout the review process, and frame and situate the findings through the editorial and commentaries.

#### Timeline

- Open call for abstracts: 01/04/2023
- Abstracts due to Guest Editors: 30/06/2023
- Invitations to submit full manuscripts to selected authors: 01/08/2023
- Full manuscript submission deadline: 31/01/2024

#### Selection Process

After the open call, abstracts will be reviewed by the guest editors and selected abstracts will be included in the full proposal. Selection criteria for this process are:

- The fit of the abstract to the overall topic of the special issue



- The quality of the abstract regarding theoretical embedding, methodological approach, and relevance to the overall topic
- Diversity of the abstracts regarding domains, career stage of the authors and the cultural and geographical background of the study.

After the acceptance of the full proposal, authors will be invited to submit full manuscripts. These submissions will go through the regular review process of L&I. Once the manuscript is accepted, it will go into production immediately and will be simultaneously published in the current regular issue and pulled into the online Virtual Special Issue. Articles from this Special Issue will appear in different regular issues of the journal, though they will be clearly marked and branded as Special Issue articles.

Guest editors

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Preliminary list of contributions:

*Adaptive feedback: the effectiveness of an adaptive digital educational game to enhance fraction understanding*

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*Real-time computational modeling of students' science concepts: basics and applications*

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*Effects of closing knowledge gaps identified automatically by an intelligent tutoring system on mathematical achievement*

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*Using eye movements during mathematical thinking as a basis for adaptive learning: The example of word problem solving*

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Keywords:

Adaptivity, Process Data, Technology, Real-Time Assessment, Adaptive Feedback