

Putting Temporal Analytics into Practice: The 5th International Workshop on Temporality in Learning Data

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ABSTRACT

Interest in temporal analytics—analytics that probe temporal aspects of learning so as to gain insights into the processes through which learning occurs—continues to grow. The relationships of temporal patterns to learning outcomes is a central area of interest. However, while the literature on temporal analyses is developing, there has been less consideration of the methods by which temporal analyses might be translated to actionable insights and thus, put into use in educational practice. Emerging temporal analysis techniques present both theoretical and practical challenges for producing and interpreting results. Synergetic actions are needed in order to support practitioners.

CCS Concepts

•Applied computing → Computer-assisted instruction; Interactive learning environments;

Keywords

Learning analytics; temporality; CSCL; analytics for action; practitioner knowledge

1. WORKSHOP BACKGROUND

Temporal considerations are important in understanding learning, yet understudied in educational research [1, 8], resulting in a gap in resources available for educators. This becomes a missed opportunity as formal and informal learning environments are replete with fine grained temporal data sources such as click streams, chat logs, document edit histories, and motion tracking (e.g., Microsoft Kinect). Despite this abundance of temporal data, there has been a paucity of research on the temporal features of learning, with a tendency to compress, if not totally ignore, the temporal dimension by using “code and count” methods that aggregate over time [10] and operating in “snapshot” mode—showing users

a current picture of the data—which can overlook or misrepresent patterns that change over time [2]. Even less common are studies of how analytics that do consider temporal dimensions could become useful for education practitioners.

This workshop is the fifth in an ongoing series organized around analysis of temporal data generated by interactions between people and tools during learning activities. The first workshop (link), held at the Alpine Rendez-vous in 2009, focused on exploring a particular set of techniques for examining temporality in group learning. The second workshop occurred at ICLS 2010 (link) and focused on the reasons for and challenges of analyzing multiple data streams. The third one (link), at the Alpine Rendez-vous in 2013, sought to map the different dimensions of temporal analyses and to support researchers in interrogating and incorporating different approaches. The fourth workshop (link), the first one at LAK, was specifically focused on learning analytic techniques for temporal data, bringing analytics and learning communities together. Discussion at that workshop focused on new approaches to integrate and analyse data-streams for the purposes of understanding the co-occurrence, interaction, sequence, and dynamic development of learning phenomena over time.

From these earlier workshops, we identified an emerging interest in connecting temporal analytics with educational practice. For instance, there is a critical need to develop effective methods to communicate the information available from temporal analytics in ways that are accessible to practitioners, and to support practitioners and learners in drawing inferences from temporal analysis that lead to action. While interpretation and actionability are important issues for all learning analytics, they are particularly critical for temporal analytics due to their complex and dynamic character. Key to addressing this challenge is (a) the development of theory and tools for temporal analytics, (b) the expansion of practices of sensemaking around temporal data, and (c) the integration of temporal analytics into pedagogic design.

The most basic need for putting temporal analytics into practice is to develop user-friendly tools, using interactive data visualizations and other techniques to engage practitioners in working with learning data at various temporal scales [9]. This includes, for example, moving from “snapshot” visualizations to ones which show flows or sequences over time or allow users to manipulate the time window of the data being visualized. Finding ways to effectively translate the kinds of temporal analyses currently employed by researchers into tools for students, teachers, designers and

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administrators to use offers exciting potential to expand the kinds of insight available.

Beyond the creation of such tools, for learning analytics to achieve real impact, it is crucial to understand and design for the ways in which educators and learners will interact with these tools [7, 11]. The cognitive demands of temporal analytics go beyond general data literacy needs, requiring users to interpret representations of data that are simultaneously complex and dynamic. Techniques are thus needed to scaffold the interpretation process within temporal analytic tools as well as develop temporal data literacy among practitioners more generally.

Complicating the development of temporal analytic tools and sense-making practices is the need to promote collaboration across levels and agents [3]. Collaborative sense-making is needed because of the complexity and high cognitive load imposed by temporal analytics; partnerships across stakeholders (e.g., teacher–student, teacher–administrator) are required in order to “[increase] understanding or insight into a dataset, a consensus, or the ability to make informed decisions” [5, p. 320]. Thus, research on collaborative sense-making [6] with temporal analytics is needed.

Finally, in a larger picture, this work must consider how practitioners adopt and adapt analytic tools as part of their practice, and how their use changes and evolves over time [9]. Learning analytics should be integrated into broader learning design, such that they are sensitive to the particular pedagogic context and cohort for which they are deployed, with a clear grounding connecting analytic devices and learning activity [11]. Important questions to consider include: when does it make sense to consult particular temporal analytics (at what points, with what frequency, how much time need elapse for the analytic to be meaningful); why are the temporal analytics being consulted (what questions can they answer, how can this information be used); and how does the use of the temporal analytics articulate with the rest of the educational processes taking place (what is the local context for making sense of and acting on the temporal information provided). There is thus a need to understand how best to pedagogically ground and represent temporal information to educators and learners. Such a process of design needs to be sensitive to pedagogic context and could consider the role of temporal analytics in supporting teacher and student agency, alongside the provision of reference frames and productive space for negotiation around the meaning of analytic feedback and implying actions [11]. Ultimately, the goal is to provide guidance (in the form of principles or templates, for instance) for how temporal analytics can be incorporated as a regular and productive part of pedagogical design.

2. WORKSHOP OBJECTIVES

The present workshop focuses on issues of educational practice around temporal analyses, with presentations focusing on: temporal analytics tools developed for practitioners; how educators make sense of temporal data; how learning analytics can be aligned with educators’ and learners’ understandings of temporality; temporal considerations in (and absent from) existing analytic tools; and granularity in temporal features across levels of analysis. The workshop discusses themes around:

- Temporal features in analytics for action—understanding

intervention points, and types. For example, continuous versus snapshot analytics, and the role of check-point (i.e., has event ‘x’ happened) versus process (i.e., summaries of processes taken) analytics

- Temporal features in the development of ‘reference points’—appropriate comparators for learner activity
- Participatory analytics design approaches to work with practitioners to support their practice, or to understand their needs related to temporal analyses of learning data
- Temporal considerations with regard to learner agency, including support for (and analysis of) goal setting and monitoring or reflection behaviours over time, and
- The metacognitive and self-regulatory capacities required for students to effectively engage with learning analytic feedback (see e.g., [4])

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