Editorial: Joint Proceedings of the Sixth Multimodal Learning Analytics (MMLA) Workshop and the Second Cross-LAK Workshop

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Abstract. Learning is a complex, mostly invisible process that happens across spaces, occurring in the physical world but also increasingly in virtual worlds or web-based spaces. In order to explore what happens in such blended learning experience, there is a need for multiple data sources that bring evidence from these different spaces. The present proceedings bring together two workshops co-located at the Learning Analytics and Knowledge (LAK'17) conference in Vancouver (Canada): the 2nd Cross-LAK and the 6th Multimodal Learning Analytics (MMLA) workshop. The two workshops tackled the analysis of this complexity, from complementary perspectives. Our aim is to promote dialogue and the alignment of these research efforts across both subcommunities. Moreover, this collaboration is the seed of a Special Interest Group (SIG) that will be part of the Society of Learning Analytics Research (SoLAR). The goal of this SIG will be to advance the understanding of the learning process no matter where and how it happens.

Keywords: Multimodal Learning Analytics, Learning spaces, Virtual worlds, Sensors, Blended learning.

Learning is a complex, mostly invisible process that happens across spaces, occurring in the physical world but also increasingly in virtual worlds or web-based spaces. In order to explore what happens in such blended learning experience, there is a need for multiple data sources that bring evidence from these different spaces, including logs, learning resources, or even physical sensors [1]. The combination of different data sources often generates multimodal datasets, with data representing different views of the same learning event. Moreover, multimodal analyses can be applied, contributing to a richer, triangulated view of the learning process [2].

Two workshops co-located with LAK'17 in Vancouver (Canada) -the 2nd Cross-LAK and the 6th Multimodal Learning Analytics (MMLA) workshop- tackle the analysis of this complexity, from slightly different perspectives. While the former focuses on the challenges imposed by the multiplicity of learning contexts (i.e., spaces), the latter explores different data sources and solutions that may help address those challenges.

The goal of the 2nd Cross-LAK workshop was to gather the sub-community of LAK researchers, learning scientists and researchers from other communities (e.g. artificial intelligence in education, educational data mining, intelligent tutoring systems, etc), interested in ubiquitous, mobile and/or face-to-face learning analytics. An overarching concern tackled by this series of workshops is how to integrate and coordinate learning analytics to provide continued personalised support to learning across digital and physical spaces, i.e. considering the ecologies of devices and learning (and non learning tools) that are used in real-world contexts. The particular goal of this second workshop was to define the 5-year vision of learning analytics. Participants were prompted to move away from the assumptions and constraints commonly imposed by current learning analytics solutions (e.g. which often focus on clickstreams to model student's behaviours) to embrace a more holistic view of learning, which occurs a different spaces, both physical and digital. The workshop received 7 participant submissions, 5 of which were accepted. A total of 25 people attended the workshop.

In turn, the MMLA sub-community has had as its overarching goal to explore and understand how to go beyond the current state of learning analytics that derives insights from only clickstream or other *single* data source [1]. The aim of this particular MMLA workshop was twofold: to chart the landscape of this research area and collaboratively identify a set of grand challenges to be addressed by the MMLA community. The workshop received 12 submissions, all of which were accepted. Eleven of them are included in the present volume. A total of 21 people attended the workshop. Inspired by the proposals submitted to the workshop, during the event the participants ideated MMLA solutions devoted to support key problems of different learning contexts (individual and collaborative learning in primary-secondary school, university and workplace settings). From the discussion about these solutions and the participants' own experience, MMLA challenges were identified regarding the data gathering (e.g., synchronization, lack of standards for data representation, integration of third-party data, and physical intrusiveness), the data analyses (conceptual and technical integration problems, extraction of high level indicators from raw data, and later modelling, training and segmentation), the feedback to the stakeholders (data literacy, actionability of MMLA across stakeholders), and the adoption (privacy, ethical, cultural challenges, sustainability, and data literacy).

There exist several commonalities and differences between the multimodal (MMLA) and across-spaces (Cross-LAK) approaches to learning analytics. The across-spaces approach highlights scenarios where student's learning activities are *not constrained to a single physical or digital environment* [3]. Students may interact face-to-face or remotely, and use diverse (educational) tools, depending on the context, subject

matter or the informal learning opportunities. Pervasive and mobile technologies can be used to allow learners to get remote access to educational resources from different physical spaces (e.g. ubiquitous/mobile learning support) or to enrich their learning experiences in the classroom in ways that were not previously possible (e.g. face-to-face/blended learning support). The MMLA approach is focused on capturing, integrating and analysing learning traces *from different sources,* even if the event occurs in just one space*,* in order to obtain a deeper understanding of the learning process, wherever it happens. In this case, the spotlight is on the diverse sensors, different frequencies of data collection, and the sophisticated machine learning and artificial intelligence techniques that can be used to interpret such complex data. So far, the majority of MMLA studies have been conducted under semi-controlled conditions [4].

Furthermore, Cross-LAK approaches often take a top-down approach, in which the first step is to understand the complexity of the learning situation in its totality (which commonly occurs in the wild). Only then the approaches would consider the application of means for capturing data and applying analytics techniques to discover insights (often including multimodal analytics techniques). In contrast, MMLA approaches tend to take a bottom-up perspective that starts from multimodal data and tools. Then, based on the insights from the analysis of these data, the aim is to provide a more complete view of the associated learning and teaching situation.

The following joint proceedings volume aims to promote the dialogue and the alignment of research efforts across both sub-communities. Moreover, this collaboration is the seed of a Special Interest Group (SIG) that will be part of the Society of Learning Analytics Research (SoLAR)[1]. The goal of this SIG will be to advance the understanding of the learning process, no matter where and how it happens.

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