Towards Teacher Orchestration Load-aware Teacher-facing Dashboards

Ishari Amarasinghe, Milica Vujovic and Davinia Hernández-Leo
TIDE, ICT Department, Universitat Pompeu Fabra, Barcelona
{ishari. amarasinghe, milica. vujovic, davinia.hernandez-leo}@upf.edu

ABSTRACT: In this workshop paper, we report a study conducted to investigate the use of tracking technologies to measure the teachers' orchestration load when conducting co-located collaborative learning activities. We distinguish the orchestration load experienced by the teachers in the absence and presence of teacher supporting tools, i.e. teacher-facing dashboards. Electrodermal activity (EDA) sensor and other multimodal data including observations, log data and subjective responses to questionnaires have been collected to measure the teachers' orchestration load in authentic collaborative learning scenarios. This workshop paper presents the study context, quantitative and qualitative data collection process undertaken and other considerations in detail.

Keywords: Computer-Supported Collaborative Learning, orchestration load, dashboards, MMLA, electrodermal activity (EDA).

1 INTRODUCTION

In the domain of Technology-Enhanced Learning (TEL) the notion of orchestration refers to "how a teacher manages, in real-time multi-layered activities in a multi-constraint context" (Dillenbourg, 2013). In the context of Computer-Supported Collaborative Learning (CSCL), orchestrating collaboration is an essential yet a challenging task which demands teachers' continuous monitoring, guidance and interventions across different social levels (e.g., individual, group and class level). On the other hand, the application of Learning Analytics (LA) tools in the context of CSCL has currently gained heightened attention (Jivet, Scheffel, Specht & Drachsler, 2018). By capturing, analyzing and visualizing data traces that represent students' collaborative interactions in real-time, LA offers the possibility for teachers to obtain a deeper understanding of the process of collaboration and student activity engagement (Jivet et al., 2018). Towards this end, teacher-facing dashboards have been deployed within CSCL environments as a supporting tool with objectives of building awareness and facilitating teachers' productive intervention towards groups that require immediate attention (van Leeuwen, 2015).

However, the number of studies that investigate whether the addition of teacher-facing dashboard applications influence orchestration load of the teacher is scarce. It is essential to study how the addition of such supporting tools contribute to the orchestration load of the teachers, as it will facilitate to elicit useful design guidelines that can guide the development of teacher support tools that may help reduce the orchestration load experienced. Towards this end, this workshop paper presents details of an experiment conducted to study how data collected in different modalities can be used as indicators to measure teachers' orchestration load in co-located CSCL settings.

2 STUDY DESIGN

2.1 Participants

Two female teachers from a Spanish University participated in the experiments. Teachers had prior experience in conducting collaborative learning activities and have used dashboard applications to orchestrate collaboration. Each teacher conducted three collaborative learning activities and students from the respective classes took part in the study with their informed consent. Each collaborative learning activity lasted around nine minutes.

2.2 Procedure

Before the classroom trials, to generate appropriate baseline data, teachers were asked to wear the EDA sensor for two hours for three days and mark the events of those days that were out of the ordinary working activities. The measurement of two hours per day, was taken during working hours when teachers conduct work activities outside of the classroom. In this way workload exists, but it is not affected by the teaching itself and the presence of students and tools used during lessons.

After collecting baseline data, collaborative learning activities were conducted in classroom sessions. A web-based tool called PyramidApp (Manathunga & Hernández-Leo, 2018). that implements the Pyramid pattern based on collaborative learning activities was used to design and deploy collaboration. In the experimental condition, teachers monitored and orchestrated the group activities using a teacher-facing dashboard; whereas the dashboard was not available in the control condition. The experimental condition was subdivided into two conditions based on the presence of certain warnings in the dashboard. For instance, in Dashboard condition I, the dashboard generated several warnings when; 1) students answers does not contain any keyword that was stated by the teacher during activity design time, 2) students skipped answer submissions, 3) students require more time for collaboration, 4) collaborative learning activity reaches the end. In the Dashboard condition II, the aforementioned warnings were turned off, but all the other features of the dashboard were available.

2.3 Data collection and analysis

At the beginning of each collaborative learning session we attached the Shimmer3 GSR+ sensor to the teacher by connecting two electrodes to the wrist and putting arm band that holds the sensor around the teacher's arm. The sensor is placed on the non-dominant hand to avoid discomfort to the teacher and reduce the noise produced by the movement (see Figure 1).

The sensor is mounted before the beginning of the activity and removed right after. Recording begins as soon as the sensor is removed from the docking station connected to the computer, so that the signal captured between this moment and the beginning of the activity, is being removed from the analysis. The same action is applied at the end of the recording. Signal captured between the end of the activity and connecting the sensor back to the docking station (end of recording) is being removed. Data transfer from the device was conducted immediately after the activity. Moreover, teacher's behaviour during every session was recorded either using a video camera or by a researcher taking observation notes based on the unique requirements of each classroom session. In the experimental

sessions teacher's dashboard actions were automatically logged. Teachers' subjective measurements of the cognitive load experienced in both control and experimental sessions were also collected using NASA's TLX questionnaire (Hart & Staveland, 1988). Stimulated-recall interviews were also conducted with the teacher to better understand their orchestration requirements and pedagogical decision-making (see Figure 2).

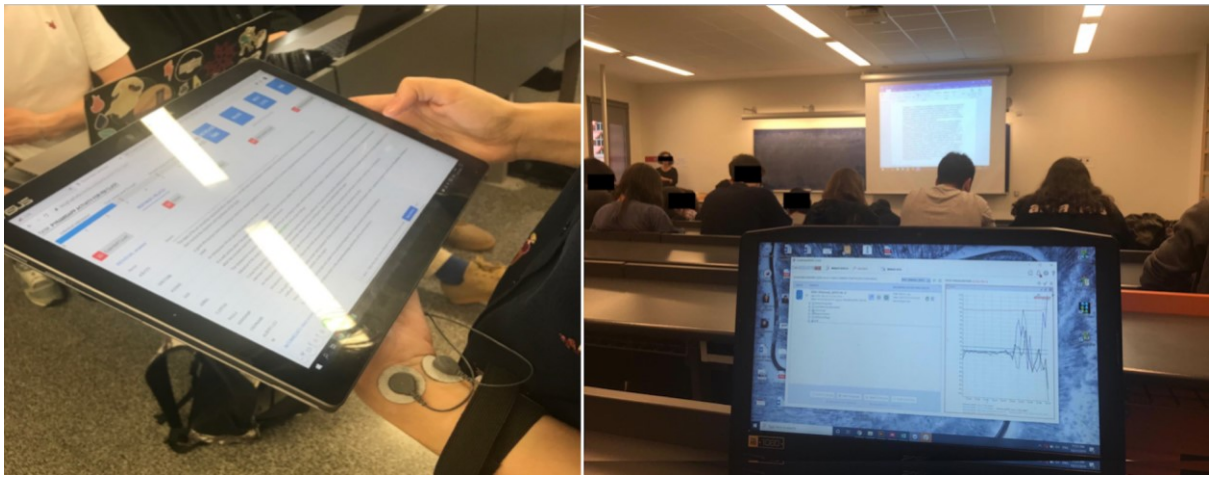

Figure 1: A teacher wearing the Shimmer3 GSR+ sensor during a classroom session (left) and data collection in a co-located collaborative learning setting (right)

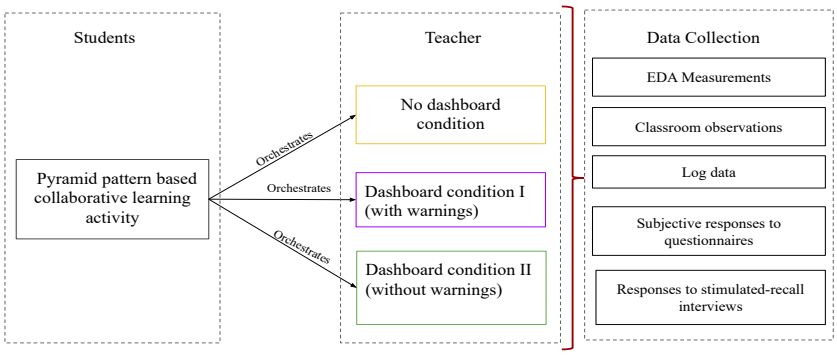

Figure 2: Different experimental conditions and data collection

3 CONCLUSIONS & FUTURE WORK

The addition of supporting tools to synchronous collaborative settings could facilitate teachers to diagnose collaboration (van Leeuwen, 2015). LA dashboards have been seen as a promising tool that can assist to raise teacher awareness, reflection and sense-making on peer learning activity engagement and to impact behavior (van Leeuwen, 2015). In this study we have collected qualitative and quantitative data in different modalities in order to measure orchestration load experienced by the teachers. A mixed-method approach will be used with the triangulation of quantitative and qualitative data to warrant results about the three conditions. We will analyse the collected data to

explore how multimodal data can be used as indicators to measure teachers' orchestration load in order to propose orchestration load aware design guidelines for teacher-facing dashboards.

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