International Society of the Learning Sciences

Towards Estimating Classroom Orchestration Load using Physiological and Self-Perception Measures

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Abstract: This poster presents the exploration of a method to estimate the notion of orchestration load using physiological measures in triangulation with self-perception measures in the classroom computer-supported collaborative learning (CSCL) context. Details of a pilot study conducted in which a teacher orchestrated CSCL activities under different supporting conditions are presented. Different facets of the orchestration load were disentangled in light of the study findings.

Keywords: Orchestration Load, Physiological measures, Classroom Collaboration.

Introduction

The notion of orchestration load has been described as the total effort teachers need to put in when using a certain technology for the real-time management of classroom activities (Prieto, Sharma, & Dillenbourg, 2015). Most of the existing studies refer to this notion as a high-level concept without disentangling its multi-faceted elements (Prieto, Sharma, Kidzinski, & Dillenbourg, 2018), due to its complex nature and a lack of robust measures available to assess them in real-time. In this study, we examined how novel technologies, i.e., Electrodermal Activity (EDA), could be used in triangulation with self-perceptions of the teachers (collected using post-activity questionnaires and stimulated-recall interviews) to deconstruct the notion of orchestration load.

Methods

A female teacher from a Spanish University conducted scripted CSCL activities using PyramidApp (Manathunga & Hernández-Leo, 2018). Teachers' orchestration actions under different support provisions namely, no dashboard, mirroring and guiding dashboard conditions were recorded. In the no dashboard condition, the teacher did not have access to a teacher-facing dashboard. In the mirroring condition teacher had access to a teacher-facing dashboard, however interpretation of information and use of dashboard controls were left to be decided by the teacher. In the guiding condition additional guidance, in terms of warnings were generated automatically to upfront critical moments. The teacher conducted nine sessions in the three conditions, having used the PyramidApp also extensively in the past without the support of the LA dashboard. To avoid a novelty effect, data was gathered in the three latest CSCL sessions reflecting the three conditions. Each activity lasted around nine minutes. During the sessions, the teacher was equipped with a wearable EDA sensor to measure and compare affective state under different supporting conditions. By visual inspection of the signal, frequency of peaks were taken into consideration and triangulated with the teacher's self-perception measures. The additional information regarding baseline data collection and calibration of the sensor is described in detail in our previous work (Amarasinghe, Vujovic, & Hernández-Leo, 2020).

Results

Figure 1 shows the graphs that were plotted using the EDA data collected. As shown in Figure 1(a), in the no dashboard condition, the presence of peaks in graphs implies changes in the affective state of the teacher. The teacher's affective state is changing as a reaction to the activity. A visual inspection of signal change indicates that there are some differences between the three conditions. For instance, in the no dashboard condition the signal shows an increase in the number of peaks and skin conductivity towards the end of the activity. In the mirroring condition [see Figure 1(b)], the signal implies that the physiological state was not constant during the whole activity. According to the peaks, teachers' physiological state changes over time, where less arousal can be noticed towards the end. Also, this physiological response declines towards the end of the activity. In the guiding condition [see Figure 1(c)] the signal was more constant and showed that there was physiological response (according to the peaks), but that state remained more-less constant during the whole activity.

In the no dashboard condition, the teacher was frustrated and felt discomfort: "Very difficult to obtain the whole picture. I was stressed regarding the planned time as some students were taking more time and frustrated for not having the means to control the script progressions." We infer that the EDA signal shows arousal which could be related to frustration that increased towards the end of the activity. In the mirroring condition, the teacher

expressed that thinking and making decisions to take orchestration actions became demanding in real-time: "I am more relaxed when I use the dashboard and I can monitor the progression of the activity, but thinking and decision making was somewhat demanding." However, towards the end of the activity, the physiological response declines which means less arousal, and the teacher mentioned that she felt more in control of the activity and became calmer over time. In the guiding condition, the teacher felt comfortable and was in control due to the automatic guidance: "I really felt I was in control, alerts were very helpful, I could relax and read on student's submissions, discussions, etc." We infer that this state remained more-less constant during the whole activity.

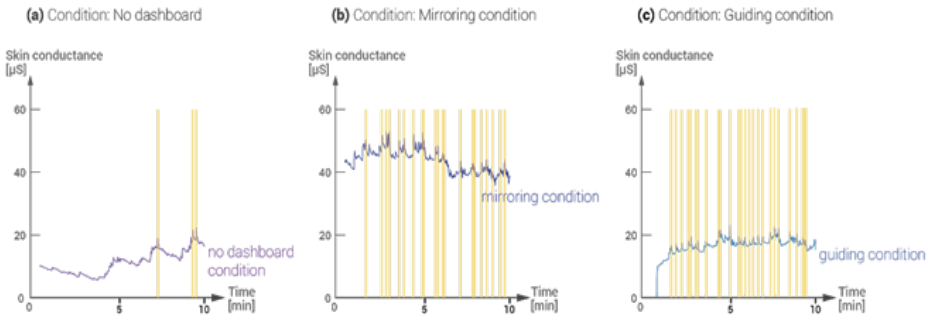

Figure 1. EDA signal (peaks) in three conditions.

Conclusions and future work

This paper presents preliminary work showing that EDA physiological measurements can be tentatively explained in terms of different facets of the orchestration load, i.e., goal formation, situation evaluation and action-taking, through its triangulation with the subjective reflections by the teacher. The obtained data shows that there are differences across the three conditions. For instance, the teacher was less comfortable in the mirroring dashboard condition as the teacher has to formulate goals, evaluate the learning situation and take actions in real-time without additional support-which may add to the orchestration load. However, in the guiding condition, the additional guidance provided using warnings may have supported the teacher in goal formation, situation evaluation and action taking hence resulting in a low orchestration load which created a much more comfortable situation. These results are interesting but should be taken with caution given the limited data set analyzed (only one teacher). In the future, we plan to extend the analysis of EDA and self-perception measurements (also with a bigger sample of teachers) with additional information such as a pre-survey about teachers' contexts (e.g., activities completed before the data collection) and video recordings of orchestration actions.

References

Amarasinghe, I., Vujovic, M., & Hernández-Leo, D. (2020). Towards teacher orchestration load-aware teacher-facing dashboards. *Proceedings of Cross-MMLA in practice: Collecting, annotating and analyzing multimodal data across spaces co-located with 10th International Learning Analytics and Knowledge Conference* (Vol. 49 2610, pp.7–10). CEUR-WS.org. Available: http://ceur-ws.org/Vol-2610/paper2.pdf

Manathunga, K., & Hernández-Leo, D. (2018). Authoring and enactment of mobile pyramid-based collaborative learning activities. *British Journal of Educational Technology, 49*(2), 262–275.

Prieto, L. P., Sharma, K., & Dillenbourg, P. (2015). Studying teacher orchestration load in technology enhanced classrooms. *Design for teaching and learning in a networked world* (pp. 268–281). International Publishing: Springer.

Prieto, L. P., Sharma, K., Kidzinski, Ł., & Dillenbourg, P. (2018). Orchestration load indicators and patterns: In-the-wild studies using mobile eye-tracking. *IEEE Transactions on Learning Technologies*, *11*(2), 216–229.

Acknowledgments

This work has been partially funded by FEDER, the National Research Agency of the Spanish Ministry of Science, Innovations and Universities MDM-2015-0502, TIN2017-85179-C3-3-R. Davinia Hernández-Leo acknowledges the support by ICREA under the ICREA Academia programme.