International Society of the Learning Sciences

Co-Designing a Multimodal Dashboard for Collaborative Analytics

Pankaj Chejara, Reet Kasepalu, Adolfo Ruiz-Calleja, María Jesús Rodríguez-Triana, Luis P. Prieto
pankajch@tlu.ee, reetkase@tlu.ee, adolfo@tlu.ee, mjrt@tlu.ee, lprisan@tlu.ee
Tallinn University

Abstract: The understanding of collaboration quality is crucial for teachers to become aware of the activities going on in the groups and also for identifying groups in need to offer support in CSCL (Computer-Supported Collaborative Learning). Multimodal data captured during CSCL activity in the classroom can facilitate a holistic understanding of collaboration behavior. However, part of the problem is an adequate graphical representation of multimodal data that can help teachers to understand the collaboration and its related sub-constructs (e.g., argumentation). This aspect has been scarcely investigated in CSCL research using multimodal data. This paper presents a study with 58 participants co-designing a dashboard using multimodal data to aid teachers monitoring collaboration and supporting students in the classroom. According to our findings, teachers' preferences include: abstract representation over quantitative measures (e.g., showing the group's written contribution with a pen icon and an amount of writing as size of pen), quantitative details on request, and being notified when problems are identified.

Introduction

With the advent of sensor technologies, it has become now feasible to track the physical aspect of CSCL settings, using what is now known as Multimodal Learning Analytics (Ochoa & Worsley, 2016). MMLA utilizes a variety of data (e.g., audio, video, physiological, etc.) to enrich the researchers' analysis and allow them to triangulate their findings about learning. However, the multimodal data complexity makes it difficult to design dashboards for teachers to monitor CSCL activities in the classroom. There is also a need to include the teacher early on in the design process to make the dashboard effective and suitable for the teacher's needs (Ley et al. 2009). In this paper, we present our findings from co-designing a dashboard using multimodal data -audio and logs- with 58 in-service teachers together in an iterative manner.

Methodology

We followed a qualitative research methodology to investigate what forms of multimodal data representation teachers prefer to see in a collaborative analytics dashboard. We began with interviewing eight in-service teachers from three different upper secondary schools in Estonia including English, Russian and German language and Biology teachers to create an initial dashboard paper prototype (refer Kasepalu et al., 2019 for more details). In the next step, we developed an online web-based tool-CoTrack- to conduct collaborative learning activities with a dashboard for real-time monitoring (Chejara et al., 2021). The dashboard visualized group dynamics in terms of group's speaking and writing behavior. As the third step, we organized a workshop with 50 in-service teachers (32 English language teachers and 18 IT teachers). This workshop was intended to gain an insight into their perspective of the dashboard. Participants were distributed in eight groups where they discussed the pros and cons of the dashboard, and provided their feedback in written notes. A researcher present in the workshop also observed the group's discussion. We used the workshop participants' written notes and the researcher's notes to understand what representation of data the participants prefer in the dashboard and what data representation they want to change.

Results

From our thematic analysis of data, we observed the following guidelines for our future development of the dashboard.

Preference of abstract representation over quantitative measures

Three out of eight groups suggested having an abstract representation of a group's contribution in the dashboard instead of a quantitative measure. For example, group-3 suggested including sticky figures holding hands together to show all students actively participating. Group-5 suggested using the icon of a pen and cake to show the group's contribution in the text editor and quality of collaboration, respectively.

Demand for individual contribution against the text produced

This interest is shown by most of the groups, as reported by the researcher. Though the dashboard had a speaking time presentation, the participants in the workshop showed their interest in also finding out what students were talking about during the activity and having a way to map this to the final artifact produced.

Freedom to choose the analytics to see rather than having all analytics at the same time

Group-1 and group-6 suggested showing the analytics on demand rather than showing everything at the same time. Group-1 explicitly stated that the teacher should have the agency over what analytics to see.

Functionality of detecting passivity or off-task students

Most of the groups emphasized the inclusion of some alert mechanism that can notify them whenever students in groups are not working on the given task for a particular amount of time.

Conclusion & Future work

In this paper, we have investigated the teacher's preference for multimodal data representation in the collaborative analytics dashboard. In particular, how data should be presented in the dashboard that can offer more understanding of ongoing CSCL activities to the teachers. Our investigation suggested that teachers tend to prefer abstract representations over quantitative measures and to have quantitative detailed information on request. Teachers are also in need of some alert mechanism in the dashboard which can notify them whenever a problem is detected (student being passive for a particular amount of time). These findings can help CSCL researchers and dashboard developers to offer them an initial guideline to start their design and development. For our future work, we plan to integrate the suggestions obtained from this study into our current dashboard, followed by collaborative learning activities and focus group interviews with the same set of teachers who participated in the workshop to gain a deeper understanding of whether the improvements have increased the understanding of the ongoing collaboration in the classroom.

Acknowledgement

This research has been partially funded by the European Union's Horizon 2020 research and innovation programme (grant agreement 856954), and the Estonian Research Council (Personal Research grant PRG1634).

References

Chejara, P., Prieto, L. P., Rodríguez-Triana, M. J., Ruiz-Calleja, A., Shankar, S. K., and Kasepalu, R. CoTrack2: A Tool to Track Collaboration Across Physical and Digital Spaces with Real Time Activity Visualization. In: Companion Proceedings 11th International Conference on Learning Analytics and Knowledge. (Remote: LAK'11). Available online at: https://www.solaresearch.org/wp-content/uploads/2021/04/LAK21_CompanionProceedings.pdf

Kasepalu, R., Prieto, P. L., and Ley, T. (2019). Providing teachers with individual and group-level collaboration analytics: a paper prototype. In: International Workshop on Collaboration Analytics: Making Learning Visible in Collaborative Settings. (Lyon: CSCL). Available online at: https://collaborationanalytics.files.wordpress.com/2019/06/submission-2-reet.pdf. (accessed January 31, 2022).

Ochoa, X., & Worsley, M. (2016). Augmenting learning analytics with multimodal sensory data. *Journal of Learning Analytics*, *3*(2), 213-219.

Ley T., Kump B., Maas A., Maiden N., Albert D. (2009) Evaluating the Adaptation of a Learning System before the Prototype Is Ready: A Paper-Based Lab Study. In: Houben GJ., McCalla G., Pianesi F., Zancanaro M. (eds) User Modeling, Adaptation, and Personalization. UMAP 2009. Lecture Notes in Computer Science, vol 5535. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-02247-0_32