

Moving Towards Human-Centered Learning Analytics

Carla Barreiros, Dr.

Graz University of Technology, Austria, carla.soutabarreiros@tugraz.at

INTRODUCTION

The concept of using data to make decisions is not new to educators and learners. However, as the digitalization of education moves forward, the analysis of the digital traces of both the learning and teaching process uncover new insights. Learning Analytics (LA) is an emerging field of science that refers to "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs (Ferguson, 2012).

The project "Learning Analytics – Students in Focus" aims to use learners-related data to support the teaching and learning process in a higher educational context. The project is a cooperation between the Graz University of Technology, the University of Graz, and the University of Vienna. An interdisciplinary team is determined to develop learning analytics tools that leverage learners' academic success. Our research aims to design, develop and evaluate LA tools that enable higher education learners to make data-informed decisions about their learning process.

Moreover, the LA tools proven to be successful will be provided as LA services integrated on the institutional Learning Management Systems (LMS). With this goal in mind, we adopted a Human-centered Learning Analytics design approach involving learners, instructors and other stakeholders in the iterative process of developing and evaluating our LA tools. Also, we consider frameworks such as value-sensitive design and privacy by design.

HUMAN-CENTERED LEARNING ANALYTICS (HCLA)

The design of effective LA tools goes beyond addressing technical and pedagogical issues. The adoption and successful use of LA analytics tools and dashboards greatly depend on human factors, such as, e.g., usability, usefulness, and utility (Buckingham Shum et al., 2019). Drawing from fields such as Human-Computer Interaction, recent LA design approaches include stakeholders in the design process to understand their needs, using a rich mix of methods and techniques. The contribution of learners, instructors and other stakeholders are most important, but it does not come without challenges. Frequent challenges which may deter the generation of ideas and/or suggestions are lack of knowledge and/or expertise, lack of confidence, time constraints, unbalanced power relation between stakeholders, ethical and privacy concerns (Dollinger et al., 2019).

HCLA TOOLS AND TECHNIQUES TO ENGAGE LEARNERS

Various tools and techniques can be used to involve learners in the design process of LA (Prieto-Alvarez et al., 2018). Examples of tools and techniques in the context of HCLA: i) persona profile, help in the identification and characterization of the learners' target group of the LA tool; ii) learner journeys, contribute to understanding the context where the LA tool will be used and what are the tasks involved, leading to a better understanding of the desired features; iii) focus group and interviews, allow to gather details through open-ended questions; iv) sketching and prototyping are helpful to address concrete design problems, as it stimulates learners creativity and allows to express complex ideas.

In the last years, tools such as the LA-Deck of cards have been developed to facilitate co-design process (Prieto-Alvarez et al, 2020). This tool is composed of different types of cards used to mark specific contributions during the dialogue with the learners. For example, suppose a learner talks about a usability issue. In that case, the learner plays a user interface card, and if the learners present an ethical concern, then the learner plays an ethics card.

LEARNERS CORNER – DESIGN PROCESS DESCRIPTION

The Learners Corner is the learning analytics dashboard at the course level being developed by TU Graz in the context of this project. The Learners Corner comprises tools that aim to support learners to regulate their learning process. Self-regulated learners are proven to be effective learners, that can set goals, plan, monitor their progress, reflect, and define strategies for the future (Zimmerman, 1990; Harris & Graham, 1999; Pintrich, 2000; Zimmerman & Schunk, 2001). Therefore, the Learners Corner includes a planner tool, an activity report, and a learning diary, which aim to contribute to the understanding and improvement of the learners' ability to self-regulate their learning process. Even though our project focuses on the learner view of the dashboard, we also consider a instructors view to support the teaching process.

The development of the LA tools is an iterative process consisting of four steps, the analysis, the design, the prototype and the evaluation. Fig. 1 depicts three iterations cycles, and each iteration corresponds to an academic semester since the start of our project. In the first semester, we performed an extensive literature review on related topics such as self-regulated learning, visualizations, dashboards, data literacy, ethics, and law. This literature research allowed us to identify research gaps and frame our research and define the use cases for our project. We then proceeded with ideation sessions, created several paper prototypes and conducted a focus group with stakeholders. The analysis of the collected data was used to refine the tools implementation requirements. The first version of the tools' prototype was evaluated in a study, which findings lead to the second version of the tools. We aim at the continuous improvement of our prototypes.

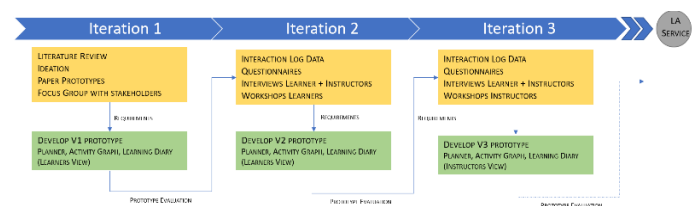


Fig. 1 Learners Corner – Design cycle comprising several iterations.

Next, we present the current version of the three LA tools available in the Learners Corner dashboard.

Planner

The planner tool (see Fig. 2) provides learners with an overview of the course milestones defined by the instructor. It also allows learners to plan and set personal milestones. Learners can use the tools to track their progress during the semester by changing the milestones' status. Instructors can define the courses milestones and specify automatic email notifications for learners, with reminders and personalized feedback.

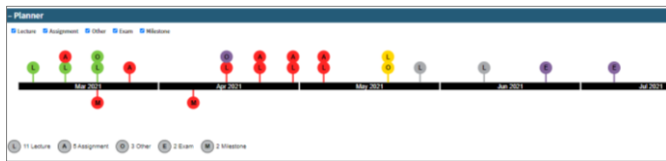


Fig. 2 Learners Corner - Planner tool example of a course timeline. Top: milestones for one course as set by the instructor; Bottom: personal milestones set by the learner. The different colours inform the status of the milestone.

Activity Graph

The students' online activity in the LMS and other institutional platforms, e.g., video streaming, forums, is shown accordingly different filters and visualizations (see Fig. 3). It allows students to monitor their time/activity in the course and compare themselves with peers. Instructors can monitor aggregated information about the class activity.

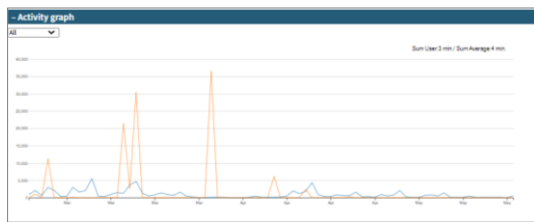


Fig. 3 Activity graph example showing the online activity for one student over time, as well as the average to the class

Learning Diary

The Learning Diary allows learners to register learning events information and guides them through the reflection process (see Fig. 4). Instructors who decide to use the Learning Diary as part of the grade can monitor the learners' diary entries; otherwise, only aggregated information is available.

Fig. 4 Learning diary example depicting the diary entries and management features; Right: Learning diary entry detail.

EMPOWERING LEARNERS THROUGH HCLA

As LA gains new momentum with the extensive use of distance learning during the pandemic, it is necessary to reflect on how LA can transition from a research field to a service offered by educational institutions. This transition raises the demand for practical guidelines to support LA development sustained by ethical and data privacy principles. Gosh et al. (2021) presents a paradigm shift that places the learners in control of their educational data. HCLA design approach empowers learners as they can influence the design of the tools, and it helps to build a LA literacy, which in turn promotes acceptability and trust. Creating active LA communities seems essential to move towards LA as a service.

SUMMARY

Our research has led us to recognize the value of involving the learners, instructors and other stakeholders in the design process of the new LA analytic tools. However, we verified that the learners willing to participate in our initiatives are typically "effective" learners, which already have developed self-regulated skills and are looking for tools to support their practices. We are at the moment devising strategies to engage learners that do not reveal self-regulated skills to evaluate our current version of the tools, and verify if they correspond to the needs of these students. Also, we will involve the instructors in the development of the Learners Corner – instructors view, specifically the design of automated data-driven feedback to learners.

ACKNOWLEDGEMENTS

The developed work presented here was co-funded by the Federal Ministry of Education, Science and Research, Austria, as part of the 2019 call for proposals for digital and social transformation in higher education for the project "Learning Analytics" (2021-2024, partner organizations: the University of Vienna, Graz University of Technology, University of Graz).

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Dipl.-Ing. Dr.techn. Carla Barreiros MSc is a postdoc at the Institute Interactive Systems and Data Science, Graz University of Technology. Also, she is a researcher at the Know Center - Research Center for Data-driven Business and Artificial Intelligence. Her research focuses on learning analytics,

technology-enhanced learning and behaviour change technologies.