

Chapter 5

Students in Focus – Moving Towards Human-Centred Learning Analytics



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5.1 Introduction

As the digitalization of education moves forward, the analysis of the digital traces of both the learning and teaching process uncovers new insights. Learning analytics (LA) is an emerging field that refers to “the measurement, collection, analysis and reporting of data about students and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs” (Long et al., 2011; Ferguson, 2012).

The project “Learning Analytics – Students in Focus” aims to use students-related data to support the teaching and, more importantly, the learning process in a higher educational context. We are an interdisciplinary team of LA and pedagogy researchers, TEL-practitioners, data scientists, and ethics and data protection experts from the Graz University of Technology (TU Graz), the University of Graz, and the University of Vienna. In this article we present the Learner’s Corner which is the learning analytics dashboard at the course level developed by the TU Graz which contain three LA tools aiming at leveraging students’ academic success through the promotion and development of self-regulated learning (SRL) skills (Zimmerman, 1990, 2015; Harris & Graham, 1999; Pintrich, 2000; Zimmerman & Schunk, 2001). Our research focuses on design, develop and evaluate LA tools that

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enable higher education students to make data-informed decisions about their learning process. Moreover, once proven successful, the LA tools will be integrated as LA services in the institutional Learning Management Systems (LMS) in the medium term and available to other higher education institution as open-source Moodle widgets. With this goal in mind, we generally adopted a human-centred learning analytics (HCLA) approach involving students, teachers, and other stakeholders in the iterative process of designing, developing and evaluating our LA tools. 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 usability, usefulness, and utility (Shum et al., 2019). Drawing from fields such as Human-Computer Interaction (HCI), Technology Enhanced Learning (TEL), Learning Experience Design (LXD) and Usability Engineering (UA), recent LA design approaches include the educational stakeholders in the design process to understand their needs, using a rich mix of methods and techniques. The contribution of students, teachers and other educational stakeholders is essential, 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, and ethical and privacy concerns (Dollinger et al., 2019). Various tools and techniques can be used to involve students and other stakeholders in the design process of LA (Prieto-Alvarez et al., 2018) – referred to as human-centred learning analytics (HCLA).

This article (i) describes the design iterations, development and evaluation process of three LA tools for students, i.e., the planner, the activity, and the learning diary; (ii) presents key results from several empirical studies used to evaluate the tools, with implications on the design of the tools; (iii) provides our insights regarding the HCLA approach benefits and limitations in practice.

5.2 Background Work

Learning analytics is, at its core, an interdisciplinary field of research and practice that brings together many disciplines to use educational data to address relevant questions for learning, teaching, and education (Siemens & Gašević, 2012). Gašević et al. (2017) propose a model of LA that refers to the following key characteristics, i.e., a field of research and practice, holistic in nature, and interdisciplinary. This model comprises three interconnected dimensions – theory, design, and data science. These dimensions group the foundational principles of LA, and only when these principles are addressed one can achieve effective results and the highest validity in both LA research and practice. The theory dimension is crucial for selecting the research questions and the hypothesis tested. Also, the theory dimension allows to produce theory grounded actionable insights for practitioners. The design dimension refers to the interaction and visualization design (allow users to interact

and gain insights about learning), learning design (aims at promoting effective learning experience), and study design (research studies and evaluation in practice). The data science dimension refers to the methods and techniques to collect, measure, analyse and report data. Dimitriadis et al. (2021) consider that the design dimension has not yet been explored as deeply as the theory and the data science dimensions, referring to the need to further consolidate the three and to define principles that govern the process of designing LA tools that can be adopted in practice. To evaluate the success or failure of LA tools, one needs to consider different aspects, including the technical criteria and the adoption and effectiveness of the tools. The true challenge lies in the adoption of the LA tools by the educational stakeholders, as the “perfect” LA tool can remain unused. Therefore, embedding LA technology in schools, higher education institutions, and workplaces can be seen as a human challenge. Shum et al. (2019) demand a human-centred perspective in LA to overcome such obstacles.

The human-centredness of a system can be achieved at different levels, e.g., the design of the user interface, the evaluation of the system impact on practices, and the analysis of the shifts in the user’s power and control (Fitzpatrick, 2018). Over the last decades, researchers in the field of Human-Computer Interface (HCI) have investigated and developed approaches, methodologies, and techniques that can be used to support the development of HCLA. For example, the user-centred design approach (i.e., the user as subject) is used to design and develop applications considering the users’ needs. It is an iterative process that includes the analysis, design, evaluation, and implementation phases. Another example is the participatory design research (i.e., the user as a partner), where the users actively participate in the design phase (co-design) (Sanders & Stappers, 2008). The involvement of all stakeholders in the HCLA process is vital to make sure their needs are addressed. Examples of methods and techniques in the context of HCLA are (i) persona profile: help for example in the identification and characterization of the students’ target group of the LA tool or identify teaching profiles; (ii) learner journeys: may 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 for example to address concrete design problems, as it stimulates creativity and allows to express complex ideas. Through HCLA one can expect to improve both usability and usefulness of the LA tools.

5.2.1 Human-Centered Learning Analytics

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5.2.2 Self-Regulated Learning: Learning How to Learn

Accordingly, with Zimmerman (2015), SRL refers to how students become masters of their learning process. It refers to one's ability to understand and control one's learning. SRL includes setting goals for learning, concentrating on instruction, using effective strategies to organize ideas, using resources effectively, monitoring performance, managing time effectively, and holding positive beliefs about one's capabilities (Zimmerman, 2000; Schunk & Ertmer, 2000). While definitions of SRL vary to some extent, they agree on enhancing learning through proactive processes and self-beliefs.

Beyond supporting students to achieve academic success and excellence, higher education institutions aim at creating lifelong learners able to keep up with the challenges of leading a successful career and live in the twenty-first-century society driven by information and technology. In higher education learning and work-related learning, the individual must learn independently and handle diverse demands. SRL and information literacy are keystones of lifelong learning (Serap Kurbanoglu, 2003). Therefore, it is vital to support students to acquire, retain and retrieve new knowledge on their own, as well as assume responsibility for their learning (Shum et al., 2019).

Several SRL models include aspects of metacognition and self-regulation. Panadero (2017) analyses and compares well-known models for SRL, presenting a repertoire that educators and researchers can use to select the appropriate model for their interventions. Our research focuses on Zimmerman's cyclical model of SRL (Zimmerman, 2002, 2008), which consists of three phases: forethought, performance, and self-reflection. Firstly, in the forethought phase, the students analyze the task, define goals, and formulate strategic plans to reach them, considering their self-motivation beliefs. Secondly, in the performance phase, the students execute the learning task involving processes of self-control (e.g., self-instruction, attention focusing) and self-observation (e.g., metacognitive monitoring, self-recording). Lastly, in the self-reflection phase, the students evaluate their performance, which generates self-reactions. This SRL model considers the different stages of a learning cycle, which allows us to investigate LA visual tools, that promote and support SRL practices across the three phases. These LA visual tools are often presented as a learning dashboard.

5.2.3 Learning Dashboards: Perceiving Learning At-a-Glance

The visualisation task is one of communication, which intends to effectively communicate the information contained in datasets using graphical means (Laidlaw et al., 2005). In fact, visualization builds on semiotics (Bertin, 2010), and visual perception (Carpendale, 2003; Healey, 2001; Mackinlay, 1986) to develop visual encoding principles (Munzner, 2011; Ware, 2012) that encourage visual thinking. In

constructing a visualization, it is important to consider what kind of data should be represented and how best to encode it in graphical structures to foster analytical operations. Visualization aims to elicit understanding and insight (McCormick, 1988), relying on the innate perceptual abilities of people to detect patterns, differences, connections or similarities in graphical representations (Shneiderman, 1996). A dashboard is defined as "... a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance" (Few, 2006). Dashboards are used in many contexts and for various purposes, and their design is also very diverse (Sarıkaya et al., 2019). Therefore, dashboards share the goals regarding visual encoding but strive for a compact representation of essential aspects that can be picked up at a glance. In our research, we are interested in the use of dashboards in education, which are often referred to as learning dashboards, educational dashboards, and LA dashboards. A LA dashboard can be defined as "a single display that aggregates different indicators about learner(s), learning process(es) and/or learning context(s) into one or multiple visualizations" (Schwendimann et al., 2017). In higher education environments LA dashboards are increasingly being adopted by students, faculty, and university administrators to support decision making. Clearly, different stakeholders have distinct goals, and the learning dashboards must be designed to address their needs while curating for issues such as privacy, justice, equity, diversity, and inclusion (Williamson and Kizilcec, 2022). Jivet et al. (2020) propose a set of design recommendations for learning analytics dashboards, which include the strategic involvement of students in the design process to increase adoption, promote transparency, recognize and cater to students with different SRL levels. For example, students' LA dashboards typically present data about the student academic progress, e.g., course performance and behaviour (Leitner et al., 2021), as well as LA tools to support SRL, e.g., reflect, time management (Pérez-Álvarez et al., 2017). Faculty's learning dashboards allow teachers for example to monitor students' performance and obtain feedback about the teaching process, and the university staff's dashboards focus on manage and support students and teachers.

5.3 Learner Corner: Co-designing a Learning Analytics Dashboard to Support Self-Regulated Learning

The Learner's Corner is the learning analytics dashboard at the course level developed by TU Graz in the context of the "Learning Analytics – Students in Focus" project. The Learner's Corner dashboard is integrated into the learning management system of our institution (based on the open-source learning platform Moodle, <https://moodle.org>). The dashboard is accessible through the left sidebar menu in the courses where the LMS administrators activate it. The Learner's Corner dashboard comprises tools to support students in regulating their learning process. Self-regulated students are proven to be effective learners that can set goals, plan, monitor their progress, reflect, and define strategies for the future (Zimmerman, 1990, 2015;

Harris & Graham, 1999; Pintrich, 2000; Zimmerman & Schunk, 2001). Currently, the Learner's Corner dashboard includes a planner tool, an activity tool, and a learning diary tool, which aim to contribute to the understanding and improvement of the students' ability to self-regulate their learning process. Even though our project focuses on the students' needs and the students' view of the dashboard, we also investigate the teachers' view to facilitate and support the teaching process and monitor the students' learning process.

As mentioned, we followed a HCLA approach, bringing to the forefront the needs of the users and the will to partner with the users in the co-creation process to design the Learner's Corner dashboard. This approach is an iterative process and typically consists of four steps, the analysis, the design, the prototype implementation, and finally, the prototype evaluation. We started by performing an extensive literature review on related topics such as human-centred design, participatory design research, human-centred learning analytics, SRL, information visualization, dashboards, learning analytics dashboards, data literacy, ethics and legal issues within the context of LA. Grounded on the theoretical foundation and the analysis of available LA tools, we began the design, implementation and evaluation of the different LA tools described in this section.

5.3.1 Analysis: Identification of the Stakeholders and Use Case Definition

We started by identifying the key stakeholders of our project, describing their needs and the context in which they may use the Learner's Corner dashboard. Within the project context, we identified the following main stakeholders: the students, the teacher and teaching staff, e.g., tutors, the dean of studies, the university, and the researchers. We focused on the students and their needs. However, we thought it important to consider the needs of teachers and the teaching staff, as they are responsible for the didactical and organizational integration of the LA dashboard at the course level. Our next step was the definition of students' personas and the description of several scenarios that describe when and with what intent the students may use the LA dashboard to acquire or develop self-regulated skills and how they might act to achieve a goal using the dashboard. The personas and the scenarios were discussed with our experts and later with the educational stakeholders to identify the users' needs and possible constraints. We then decided to proceed with three scenarios that correspond to the current LA tools integrated into our dashboard, i.e., the planner tool, the activity tool, and the learning diary tool. Next, we defined the concrete use cases that describe in further detail the goals of the system (higher level requirements were elicited). The use cases were validated by the didactic, the LA, the ethical and privacy, and the technical team experts. This step is, in our opinion, crucial, as we not only address the needs of the students but also validate them on a pedagogical level and guarantee the trustworthiness and legal compliance of the final tools.

5.3.2 Designing the Learner’s Corner Dashboard Tools

Our next step was to produce design solutions for each of the three use cases. We started the ideation process, where the team experts generated several ideas on how each of the LA tools should look and behave. These broad ideas were realized in low fidelity paper prototypes (see Fig. 5.1) used in a co-design workshop with nine students. The personas, the scenarios, and the initial paper prototypes were used to generate new design ideas and further develop some of the already existing concepts. Next, given the co-design workshop results and insights gained, we created a high-fidelity clickable prototype using a prototyping tool. Also, we presented and discussed the Learner’s Corner dashboard prototype with the participants of a workshop on the topic of time management promoted in collaboration with our university. About 120 students participated in the online workshop, where we collected feedback and ideas using a collaborative board and a questionnaire. Finally, we updated the prototype mock-ups and the use case description accordingly.

5.3.3 Prototype Implementation and Evaluation

Our front-end designer and technical developers implemented three versions of the Learner’s Corner dashboard, which is integrated into the learning management system of our institution. Each version of the dashboard was then evaluated using a multi-method approach, where both qualitative and quantitative data were collected



Fig. 5.1 Examples of initial low fidelity paper prototypes created to discuss ideas about the Learner’s Corner dashboard tools

and analysed. These studies mainly targeted the students but also included interviews with teachers and teaching staff as they are responsible to configure some of the Learner’s Corner tools, e.g., in the planner tool teacher and teaching staff should add the course milestones and set feedback defaults. The Learner’s Corner dashboard was activated in courses explicitly selected based on the course design and the size of the cohort. In the first course class, the researchers presented the Learner’s Corner dashboard and provided online access to further information about the study. Also, the researchers asked the students to participate in the corresponding study voluntarily. The experimental procedure was described to the students as follows; (1) fill out the self-regulated skills questionnaire, (2) use the tools during the semester, (3) provide feedback about the tools using the email and/or the study forum, (4) participate in the calls for interviews and workshops, (5) fill out the final questionnaire at the end of the semester. The results of the conducted studies in each iteration lead to the next improved version of the LA dashboard, as we aim to improve the Learner’s Corner dashboard continuously. Figure 5.2 depicts the Learner’s Corner dashboard design, implementation, and evaluation process, which comprises three iterations corresponding to an academic semester since the start of our project. Figure 5.3 details the conducted studies, e.g., the number of participants and instruments used.

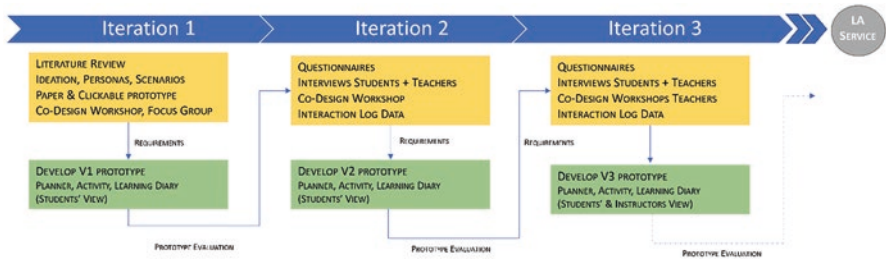


Fig. 5.2 Learner’s Corner dashboard design, implementation and evaluation process

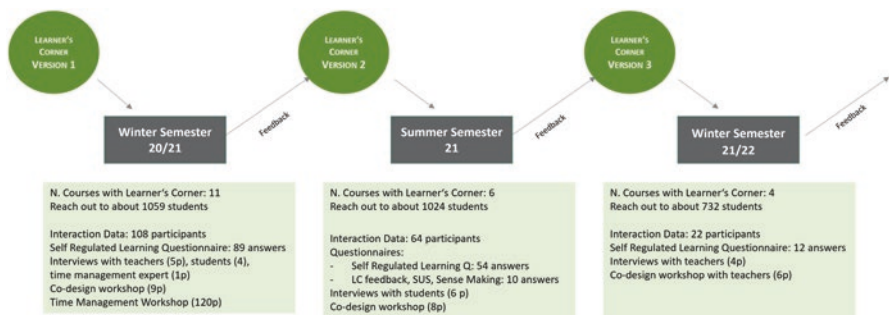


Fig. 5.3 Learner’s Corner dashboard evaluations overview

5.3.4 Learner’s Corner Learning Analytics Dashboard Prototype

The Learner’s Corner learning analytics dashboard is a prototype composed of three visual tools that aim to support students in acquiring or developing SRL skills such as setting goals, planning, managing time, monitoring performance, comparing performance with peers, and reflecting. The three tools included in the students’ view are the planner, the activity, and the learning diary. The tools are being designed and evaluated with the experts that compose the project team, the students, the teachers, and other educational stakeholders, e.g., the students’ union, the technical team supporting teachers using educational technology in our institution. Figure 5.4 depicts an overview of the Learner’s Corner dashboard current version as per the students’ view.

The *Planner* tool’s primary goal is to provide an overview of the course milestones set by the teacher and the personal milestones set by the student. The planer is, at its core, a planning tool and a time management tool. The course’s milestones are placed in a timeline, which allows the students to monitor their progress at one glance. All milestones are characterized by a title, a date/time, and a completion status (completed, not completed), among other properties. Also, milestones can be added, edited, and deleted. The teachers are responsible for creating course milestones according to the course design and didactical approach. For example, in a flip-classroom course, the teacher can create a milestone for each class, informing students about the content that should be covered to prepare the class attendance, a milestone for a quiz, a practical exercise or an exam. Teachers can also set automatic reminders for students to complete the milestone’s work within the time frame. These reminders are delivered by email, LMS notification system, or both. Similarly,

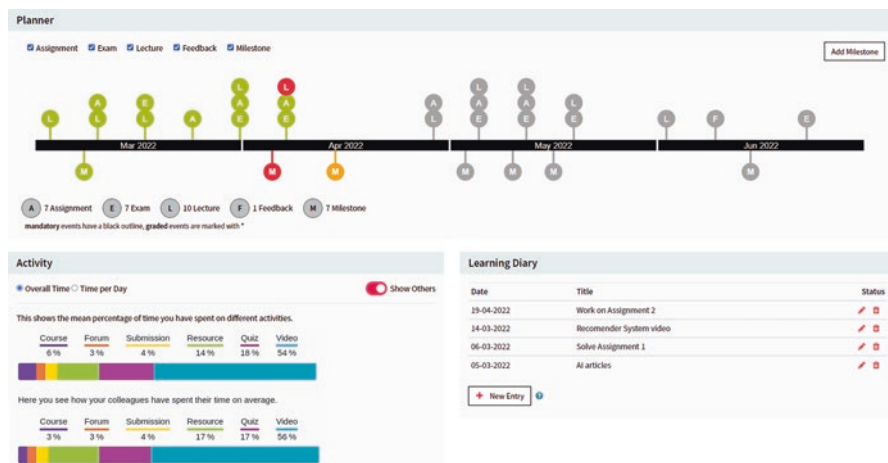


Fig. 5.4 Learner’s Corner dashboard comprises three tools: the Planner (top), the Activity tool (bottom left), and the Learning Diary tool (bottom right)

students can create their personal milestones and set their preferences regarding the reminders. Most importantly, students should keep track of the completion status of each milestone during the semester. A traffic light visual encoding is used to represent the completion status, i.e., a milestone is presented in green colour if the student sets the completion status as completed; a milestone is shown in yellow colour if the deadline is approaching, and the milestone’s status is “not completed”; if the deadline is overdue a milestone is presented in red colour, otherwise the milestone is shown in grey colour. In addition, it is possible to identify the graded milestones (part of the grade) and the compulsory milestones. Students can filter the information presented in the planner, zoom in/out the timeline, consult the legend, and see the milestones summary when hovering the mouse (i.e., date, title, number of students that completed the milestone). Also, the system sends a monthly report to the students that summarizes their progress. Figure 5.5 depicts an example of the planner tool, where one can see the milestones set by the teacher (top) and the personal milestones (bottom).

The Activity tool aims at reporting the students’ main activities for the course and the time spent in each of these activities, which allows students to monitor and perhaps reflect on their learning. The tool offers two visual graphs showing the students’ online activity in the institutional learning management system and other institutional platforms, e.g., navigation, interaction with course resources, video streaming, and forums. Figure 5.6 depicts the two visual representations that students can select from, a stacked bar chart (left) and a line chart (right). Students can also decide to compare their data with their peers by enabling the data visualization about other students. Teachers can monitor the aggregated information about all the students’ activities.

Learning diaries are a self-exploratory, didactical practice to reflect upon one’s own’s learning process. Therefore, the *Learning Diary* tool’s primary goal is to



Fig. 5.5 Learner’s Corner dashboard- Planner tool example of a course timeline (left). The course’s milestones set by the teacher are presented at the top of the timeline, while the student’s personal milestones are presented at the bottom. The different colours inform the completion status of the milestones. The student fills the milestone form (right) when adding a new milestone

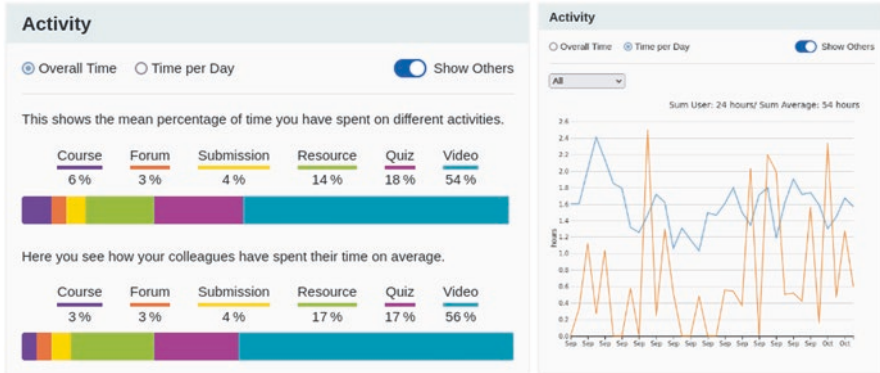


Fig. 5.6 Learner's Corner dashboard – Examples of the two visualizations of the Activity tool. The first shows a stacked bar chart with the student's online activities for the course and time distribution (left). The second shows a two-line chart with the time spent per day (right)

function as an instrument of reflection and enhance awareness of one's behaviour, enabling the individual to change his/her learning habits. This tool can provide insights to both students and teachers. Our Learning Diary tool allows students to add, edit, and delete diary entries. Each diary entry may collect large amounts of data, e.g., details about a learning event, materials, thoughts and feelings, insights and action plans. However, students are free to answer at their will as most fields are not mandatory. Each diary entry comprises five sections that describe the learning event while encouraging students to reflect while answering triggering questions. The first section is called General and collects the basic information about the learning event, i.e., the title, the date, start and end time, and the goals of the learning event. The second section is called the Planner as it allows the student to associate a learning diary event with a milestone in the planner tool or a course resource. The third section is called Activity and collects information about what the student did during the learning event. It presents several options that the student can select from, e.g., read, take notes, organized, and allows the student to add other activities. The fourth section is called Materials and collects information about which materials the student used during the learning event, e.g. course slides, course script, videos. Students can also add references to extra materials and resources, e.g., a link to an online article on the topic. Lastly, the fifth section is called Self-reflection and is composed of a set of questions, such as "what did I learn?", "What was new for me?" "What did I not understand? Why?", "Did I achieve my goals for the learning event? Why?", "What would I do differently next time?". Figure 5.7 depicts the learning diary tool in the students' view. On the left-hand side, we can observe the Learning Diary tool and an example of a diary entry on the right-hand side. Teachers can only see aggregated information about the tool's usage, such as the average number of diary entries per student.

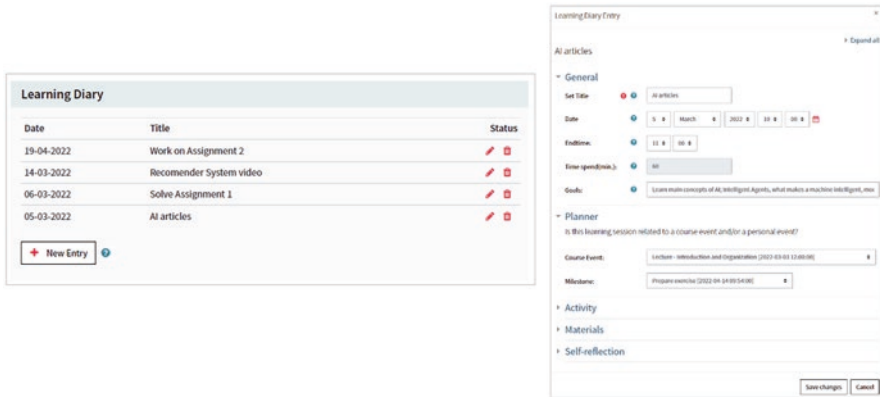


Fig. 5.7 Learner's Corner dashboard – Learning diary tool example depicting the list and management of diary entries (left). A diary entry is composed of five sections (right)

5.3.5 Key Findings with Design Implications

This section summarises the key findings of our empirical studies on the Learner's Corner dashboard, considering the students' feedback collected through the questionnaires, the workshops, the email and forum messages, and the conducted interviews described in previous Sect. 5.3.3.

The planner tool is the students' favourite tool on the Learner's Corner dashboard. Students liked the overview of the milestones of the course distributed through the semester and considered that it is easy to track where they stand and what is to come. Also, the majority of the students appreciated the email reminders of deadlines approaching and the monthly reports about their performance but refer that it is important to be able to personalize the reminders accordingly to their preferences. Some students revealed concerns regarding the number of emails they would receive from all the courses they are enrolled in, which may be overwhelming and cumbersome. Another commonly suggested feature by the students was the creation of a view that merges the milestones of all courses, as this would allow better planning. To address this feedback, the current version of the dashboard already enables the personalization of the reminders, allowing students to change the setting for each milestone. Also, the reminders can now be received via email or the notifications of the learning management system of our institution. Currently, we are investigating how to integrate information about more than one course in the planner view.

Students find the activity tool interesting and useful to monitor how long and how they spend their time in a course. However, several students were concerned with the accuracy of the estimated time for the online activities. Also, the time spent in offline learning activities should be considered to reflect the actual effort. Also, the majority of the students think that this information should be shared with the teachers. Some students said to have mixed feelings regarding the possibility of

comparing their data with their peers, as they refer to feeling stress and pressure to perform as well as their peers. Considering the students' feedback, we included in the current version of the dashboard the possibility to show or hide the peers' data. We decided to use the information collected in the Learning Diary tool to address the issue of collecting information about the time spent learning offline in an accurate manner. However, we are still to incorporate this information in the Activity tool.

The Learning Diary tool was appropriated in different ways by the students. Some students use it as an organizational tool that allows them to make plans, set goals, take notes, and organize files. Other students used it as a reflection tool, and other students saw it as a way to provide quick feedback to the teachers, e.g., regarding materials, the complexity of the topics, doubts. Overall, students liked the tool and offered many suggestions and ideas on how to improve it, e.g., students suggested connecting the learning diary entries with the milestones of the planner tool; students suggested splitting the learning diary into different sections; students indicated that filling out the fields in the diary entry should be optional; students suggested to offer predefined answers to some of the questions allowing them to select the ones that apply, with the possibility of adding new ones. These and other suggestions are already implemented in the latest version of the dashboard. However, the Learning Diary tool raised ethical and privacy concerns, which the students considered can be surpassed with total transparency about who has access to the data and with what purpose.

5.4 Discussion

While the LA field of research has been evolving in the last decade, human-centred learning analytics is relatively new. Human-centred learning analytics refers to the adoption and adaptation of design practices already established in the HCI research field to engage with educational stakeholders during the design process (Shum et al., 2019). The human-centred design approaches are relevant in the context of LA to create tools that support students, teachers, and other educational stakeholders effectively (Dimitriadis et al., 2021). Teachers are typically the educational stakeholders that have been more involved in LA co-design studies. However, LA design projects that engage with other stakeholders emerged in recent years (Shum et al., 2019). Our project focuses on the students, and therefore it was crucial to involve students in the design of the Learner's Corner dashboard. Next, we reflect on the benefits and challenges felt during this process, pointing out strategies that, in our opinion, allowed us to overcome some of the challenges and limitations.

There are several advantages associated with the Human-centred design approach, which in our experience, transfer to the LA context. First, this approach is often associated with the improvement of the usefulness and usability of the system, and it enhances "effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse

effects of use on human health, safety and performance” (ISO: Ergonomics of human-system interaction—Part 210 ISO 9241-210:2019). Indeed, partnering with students, teachers and other educational stakeholders allowed us to understand the students’ needs better, find solutions that address these needs and create a solid basis for developing the prototype, decreasing the barriers to adoption of the dashboard. However, we identified several challenges related to adopting the human-centred design approach. First, we verified that the students willing to participate in our initiatives are typically effective learners who already have developed self-regulated skills and are looking for tools to support their practices. On the one hand, these students bring their rich experiences as effective learners to the table. Still, on the other hand, we think that it is necessary to engage with students that do not reveal self-regulated skills as they are the ones that would benefit the most from using our dashboard. Second, the number of students willing to participate in the studies is significantly low. However, we need to mention that our project, until now, has been running during the CoVid-19 pandemic, which presents several challenges (Ebner et al., 2020), e.g., conditioned access to the students and required that all contacts occur online. Thirdly, students are not the experts in pedagogy or designers and therefore is essential to include teachers and other educational stakeholders in the design process. Fourthly, we recognize that this approach is time-consuming and requires more effort. Lastly, this approach requires an interdisciplinary team, which may be hard to achieve in smaller projects.

One of our projects’ goals is to disseminate and transfer the developed ideas and prototypes from the research environment to the practical application. Technology transfer is a complex process, and quality research results are insufficient to ensure a successful process. Even when LA tools are available, this does not necessarily translate into the adoption of the new technology. Several factors can potentially influence the adoption of LA technology, e.g., perception of usefulness, familiarity with technology, respect for ethical values and privacy requirements. To increase the adoption of LA technology in our institution, it is necessary to develop a common knowledge among all the educational stakeholders about the technology’s benefits and limitations and clarify any ethical and privacy concerns related to the technology building trust. The establishment of an active LA community in our institution is crucial. We consider that embracing the Human-centred learning analytics approach is an important step in creating strong trust-grounded interactions with LA technology.

Moreover, we consider that higher education institutions should offer LA technology as a service that students can decide to use or not. Also, students should control their data instead of assuming the role of data subjects (Gosch et al., 2021). This paradigm shift empowers students and amplifies students’ responsibility to use LA services and manage their data. Even though we validated our use cases concerning ethical and privacy issues, we are still investigating the design and technical implications, as well as the challenges associated with the technology transfer in the long term.

5.5 Conclusions and Future Steps

We adopted the HCLA approach to create our LA dashboard and identified the following key benefits: (i) active involvement of the educational stakeholders is crucial to understanding their needs and the context in which the LA system will be used, (ii) the iterative process allows to progressively improve the design solutions using the users' feedback, (iii) an interdisciplinary team is essential to collect insights and expertise from the different fields collaboratively; (iv) HCLA serves as a promotor of LA trustworthiness, and (v) HCLA can be seen as a first step to establish an active LA community and overcome several challenges in establishing and implementing LA in higher education institutions (Leitner et al., 2019). Given the positive experience with the Human-centred learning analytics approach, we will continue to use it to improve the Learner's Corner dashboard, enriching it with new tools for students and teachers. Currently, we are defining a new use case for a tool that exposes the grading schema of the course and allows students to monitor their progress.

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