



# LD@Taiga: An Embedded Learning Dashboard for Agile Project Management in Student Teams

Carles Farré<sup>(✉)</sup> , Lidia López , Marc Oriol , and Xavier Franch 

Universitat Politècnica de Catalunya, c/Jordi Girona 1-3, Barcelona 08034, Catalonia, Spain  
{carles.farre,lidia.lopez,marc.oriol,xavier.franch}@upc.edu

**Abstract.** We present LD@Taiga, a learning dashboard seamlessly integrated into the Taiga agile project management tool. LD@Taiga provides visualizations of individual and team performance metrics, offering students valuable feedback and aiding their decision-making. A preliminary evaluation revealed enhanced usability compared to a previous version, although there is still room for improvement.

**Keywords:** Learning Dashboard · Agile Project Management · Agile Project Metrics

## 1 Introduction

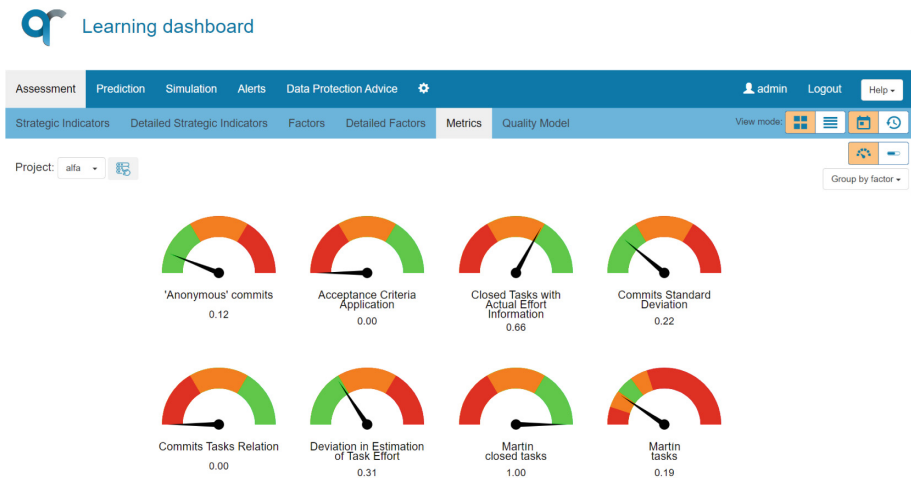
Team-based software development projects serve students as a practical setting to learn about teamwork and project management in near-to real-world scenarios. However, students' experiences may not always align with their expectations, e.g. having to manage uneven contributions from team members, with some team members contributing the bulk of the work [1]. To bridge this gap, we have explored the potential of learning dashboards to assist student teams in software engineering courses [2]. Learning dashboards are visual tools specifically designed to support students and instructors in their learning and teaching activities [3].

In this paper, we introduce our experience with LD@Taiga, a novel tool designed to enhance the dynamics of students' teamwork in agile development projects. Building upon our initial Learning Dashboard (LD) [2], LD@Taiga seamlessly integrates into Taiga's project management tool, thereby facilitating a more intuitive and cohesive workflow for student teams.

The rest of this paper is organized as follows. Section 2 provides the context and background for the development and implementation of LD@Taiga, detailing its predecessor LD, and the initial feedback gathered from its use. Section 3 describes the architecture and implementation of LD@Taiga, including its integration with Taiga and the enhancements made based on previous feedback. This section also presents a preliminary evaluation of LD@Taiga, analyzing usability scores and user feedback. Finally, Sect. 4 concludes the paper with a summary of findings and outlines potential directions for future work, including planned improvements and broader integration strategies.

## 2 Context

In the 2021/2022 academic year, the Learning Dashboard (LD) [2] was introduced in two subjects: Web Applications and Services (WAS) and Software Engineering Project (SEP). These courses are part of the Bachelor's degree in Informatics Engineering at the Faculty of Informatics of Barcelona, Universitat Politècnica de Catalunya (UPC). The aim was to provide student teams and teachers with a tool that delivers accurate and timely feedback to monitor project progress and support task prioritization and planning. LD is an adaptation of another dashboard, the Q-Rapids Dashboard [4], to the teaching context. To this end, LD integrates data from two software development tools that student teams use: Taiga, a project management tool, and GitHub, a well-known code repository management tool. Different metrics, such as the percentage of tasks completed by each team member, are calculated from these data sources to provide a global view and assessment of the project. LD's user interface is a web application that shows these metrics' current state and historical evolution. A screenshot of the LD's user interface is provided in Fig. 1.



**Fig. 1.** Screenshot of the LD

Access to LD was given to roughly half of the teams to have a control group. The feedback they provided through questionnaires and interviews can be summarized as follows [2, 5]:

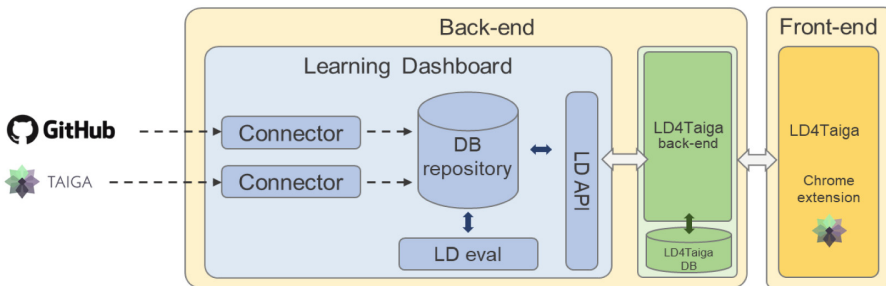
- Students infer the purpose of the metrics but sometimes have difficulty integrating them as part of their workflow.
- While the LD offers a clear user experience, it lacks the visual appeal and engagement necessary to truly captivate users.
- Most students cite time constraints and inadequate LD training as barriers to regular use, feeling overwhelmed by the prospect of having to learn “yet another tool.”

### 3 LD@Taiga

Based on the LD's feedback, we refined our strategy to achieve the full potential of the LD. Our revised approach centers on two key principles: 1) embedding LD metrics within Taiga, the student teams' project management tool used at UPC, to facilitate a more intuitive and cohesive workflow for student teams; 2) improving the clarity and usability of the metrics' visualizations to facilitate easier interpretation and application.

#### 3.1 Architecture and Implementation

The architecture of LD@Taiga is presented in Fig. 2. Data from *GitHub* and *Taiga* are fed into the *Learning Dashboard* through specialized *Connectors*, which retrieve the required raw data and store it in a structured manner in the *DB repository*. Periodically, the *LD-eval* component evaluates the obtained raw data and computes different metrics related to the project development (e.g. number of commits). The Learning Dashboard provides a RESTful API, named *LD-API*, to get the results. The LD@Taiga extends the *Learning Dashboard* architecture with the *LD@Taiga-back-end* and the *LD@Taiga-Chrome-extension*. The *LD@Taiga-back-end* acts as a bridge between the *LD@Taiga-Chrome-extension* and the *LD-API* whilst storing and managing the required information in the *LD@Taiga-DB*, decoupling it from the core components of the *Learning Dashboard* to facilitate its maintainability. Finally, the *LD@Taiga-Chrome-extension* implements the visualizations embedded within Taiga as a Chrome extension. Further details on the implementation are described in [6].



**Fig. 2.** LD@Taiga Architecture.

The set of metrics evaluated by LD-eval could be configured at the level of the student's team. Table 1 includes the complete set of metrics, and their data sources, configured in the Learning Dashboard for monitoring all teams in the mentioned two courses. In this specific case, the set of metrics is related to the quality of documentation in the project management tool (e.g., acceptance criteria, tasks with Estimated Effort), the quantity of work is assigned to the team members (e.g., tasks), and the quantity of coding (e.g., closed tasks, modified lines). Depending on the process scope, we could have metrics for example related to operations (e.g., number of critical issues/bugs closed).

**Table 1.** Available metrics in LD@Taiga.

| Type    | Name                        | Description  | Source          |
|---------|-----------------------------|--|-----------------|
| Project | acceptance criteria check   | % of user stories that include some acceptance criteria                        | Taiga           |
|         | pattern check               | % of user stories following Connextra's template (as a – I want – in order to) | Taiga           |
|         | tasks with EE               | % of tasks with estimated effort information                                   | Taiga           |
|         | closed tasks with AE        | % of closed tasks with actual effort information                               | Taiga           |
|         | deviation effort estimation | Deviation in task effort estimation (estimated vs. actual)                     | Taiga           |
|         | unassigned tasks            | % of unassigned tasks  | Taiga           |
|         | tasks sd                    | Standard deviation of assigned tasks in the team                               | Taiga           |
|         | commits task reference      | % of commits that refer to a task id   | Taiga<br>GitHub |
|         | commits sd                  | Standard deviation of commits in the team                                      | GitHub          |
| User    | tasks                       | % of tasks assigned to a specific team member                                  | Taiga           |
|         | closed tasks                | closed tasks/assigned tasks (per member)                                       | Taiga           |
|         | commits                     | % of commits by a specific member  | GitHub          |
|         | modified lines              | % of modified lines by a specific member                                       | GitHub          |

Figure 3 shows a partial screenshot of the LD@Taiga integrated into Taiga. Full screenshots are not featured due to space restrictions. On the left, the Taiga platform is displayed. On the right, the LD@Taiga displays a chart related to one concrete project-related metric (closed tasks with AE). LD@Taiga displays the metrics grouped based on whether they pertain to the team (Project Metrics) or to the different members (User Metrics).

The tool provides a filtering feature allowing the visualization of concrete metrics and/or team members. If the visualizations are filtered to see all the metrics for a given team member, the kind of chart used is a spider chart, allowing visualization of all the metrics for the same team member in the same chart (Fig. 4, left). LD@Taiga also includes one option (Metrics Evaluation) to visualize all the user metrics for all the team members in a single spider chart (Fig. 4, right).

### 3.2 Preliminary Evaluation

LD@Taiga replaced LD in the Fall 2023 term in the same two subjects (WAS and SEP). Again, feedback was collected through online questionnaires and personal interviews

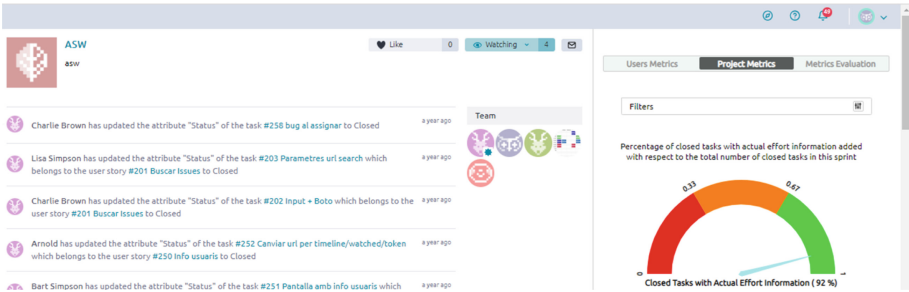


Fig. 3. LD@Taiga visualizations.

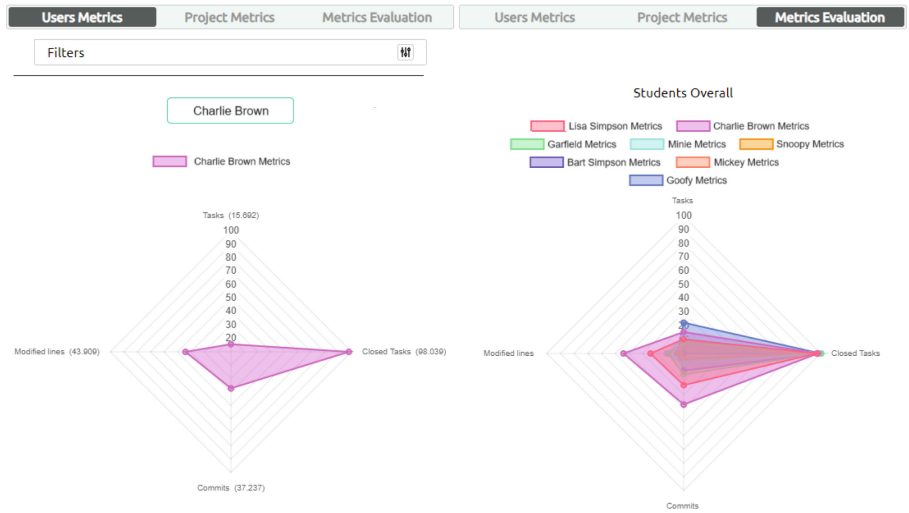


Fig. 4. User metrics visualizations

conducted at the end of the course. This time, questionnaires included 10 questions to analyze the System Usability Scale (SUS), widely applied for assessing usability [7]. The online questionnaires were filled by 10 students from WAS and 22 students from SEP. Personal interviews were conducted subsequently to a subset of 8 students to gather further insights. The feedback is summarized as follows:

- Aggregated SUS scores in WAS and SEP were 64.25 and 61.59, respectively. Considering that scores over 68 (0–100) would be considered above average, the results suggested that, while the acceptance is not bad, there is still significant room for improvement.
- Some students appreciate LD@Taiga’s usefulness in tracking large projects and group performance, whereas others view it as a tool to enhance teacher oversight.
- Generally, user metrics (e.g., tasks completed by a developer) are more appreciated than project metrics (e.g., unassigned tasks).

- User experience and usability are generally well-valued, but some issues and feature requests exist. For instance, users complain about having to scroll down to view all metrics, and that some metrics are still hard to understand. Users also want to visualize specific metrics using advanced filters.
- Students reported being overworked and primarily used LD@Taiga for monitoring rather than decision-making.

## 4 Conclusions and Further Work

By embedding the LD's analytical functionalities within Taiga's versatile project management interface, LD@Taiga aims to improve student engagement, bolster team collaboration and cohesion, and ultimately enhance overall project performance.

Future enhancements of LD@Taiga will focus on refining it based on the early feedback and broadening its functionality. We aim to fine-tune LD@Taiga to address the specific concerns raised in the preliminary evaluation. Additionally, we plan to introduce gamification elements to boost engagement and motivation [8]. Exploring integration with other project management tools, notably Jira, is also on our agenda, although the decision to use Taiga in these courses is out of our control.

**Acknowledgements.** The Universitat Politècnica de Catalunya funds this project under the call for grants for teaching improvement and innovation projects *Galàxia Aprenentatge 2023*. We sincerely appreciate Gerard Álvarez for implementing LD@Taiga and Adrià Espinola and Albert Miñana for their support in collecting and analyzing students' feedback.

**Disclosure of Interests.** The authors have no competing interests to declare that are relevant to the content of this article.

## References

1. Jacob, C., Daily, S.: Exploring the gap between the student expectations and the reality of teamwork in undergraduate software engineering group projects. *J. Syst. Softw.* **157**, 110393 (2019)
2. Farré, C., Franch, X., Oriol, M., Volkova, A.: Supporting students in team-based software development projects: an exploratory study. In: *RCIS 2023*, pp. 568–576 (2023)
3. Verbert, K., et al.: Learning dashboards: an overview and future research opportunities. *Pers. Ubiquit. Comput.* **18**, 1499–1514 (2014)
4. López, L., et al.: Q-rapids tool prototype: supporting decision-makers in managing quality in rapid software development. In: *CAiSE-Forum 2018*, pp. 200–208 (2018)
5. Volkova, A.: Specification and design of a dashboard for monitoring the learning process in software projects developed by teams of students. MSc Thesis, Universitat Politècnica de Catalunya (2022). <https://upcommons.upc.edu/handle/2117/371383>
6. Álvarez, G.: Integració al Taiga d'un sistema per monitoritzar el progrés de Projectes Software d'estudiants. BSc Thesis, Universitat Politècnica de Catalunya (2023). <https://upcommons.upc.edu/handle/2117/396284>
7. Lewis, J.R.: The System Usability Scale: Past, Present, and Future. *Int. J. Hum.-Comput. Interact.* **34**(7), 577–590 (2018)

8. Farré, C., López, L., Oriol, M., Espinola, A., Miñana, A., Franch, X.: GLiDE: integrated gamified learning dashboard environment. In: CAiSE Research Projects Exhibition, pp. 34–42 (2024)

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

