DDART: an Awareness System to Favor Reflection during Project-Based Learning

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1   Introduction

Our research aims to improve learners' reflection and self-regulation in Project-Based Learning (PBL). Actually, we observe that the implementation of PBL in engineering schools, universities or professional training do not benefit from all its capacities, because it is often action (according to the Kolb's learning cycle) which is favored to the detriment of reflection and personal experience [1]. Our approach considers Self-Regulated Learning (SRL) as a major component of PBL to bring learners to self-reflect on their experience and to apply metacognitive skills.

We focus our work on the design and the development of a dashboard based on both reporting and activity traces [2]. The activity traces are automatically produced by the users' actions and recorded directly by the LMS during the learning activities. The reporting traces are information reported by the learners themselves. Most dashboards use only automatic activity traces to produce indicators. We state that the aggregation of these two types of traces allow producing more meaningful indicators for the learners [3].

Most existing dashboards are designed for the tutors to monitor the learners but they are rarely designed for the learners to support awareness during their activities. Furthermore, the indicators are mostly predefined and the users can rarely build their own indicators [3]. In this paper, we present the DDART system, which is composed of two specific tools: a reporting tool that aims at enhancing learners' reflection during project-based learning and a tool to help learners to produce their own indicators for enhancing awareness during their project. These two tools are integrated into a same system (DDART) to enhance learners' self-regulation thanks to personalized indicators presented on a dashboard.

2   A reporting tool and a dynamic dashboard

We developed a Dynamic Dashboard Based on Activity and Reporting Traces (DDART). We chose to implement this dashboard as a plug-in of the Moodle platform. In our context, project members use the Moodle tools (wiki, forum, chat...) to

carry out the project. They are also asked to use a reporting tool to describe and keep traces of the project events.

The reports are composed of semi-structured sentences so that this text information can be collected and analyzed automatically [2]. Two types of reports are possible: the goal report and the activity report. The former is written at the beginning of the project to assist learners to plan their project and to set the goals they want to achieve. The later can be filled in during the project. By completing the semi-structured sentences, learners can describe the ways they carry out the project, their states of mind, their judgments (who do what, when, where, with whom and how), their level of acquisition of knowledge and skills. The semi-structured sentences are more flexible than structured sentences and keep the possibility to collect organized and computable data. By applying this reporting tool, learners can self-reflect on how they carried out activities and learn how to organize their ideas and how to write effective reports.

We designed a specific interface to help learners to build their own indicators (see Fig. 1). This interface is composed of three main parts: (1) the "parameters" part (see Fig. 1.a), on the left side, contains the list of all the parameters which are available for creating an indicator, (2) the "calculation" part (see Fig. 1.b and c), in the center, allows learners to place the parameters and view the indicator results and (3) the "visualization modes" part (see Fig. 1.d), on the right side. This user-friendly interface allows learners to create the indicators by dragging and dropping the parameters and the visualization mode. The calculation function is WYSIWYG: the results can be calculated in real-time so that learners can easily adjust the parameters. At last, the presentation of indicators on a dashboard provides awareness to the learners about the way they carry out the project and also about the building of knowledge and skills.
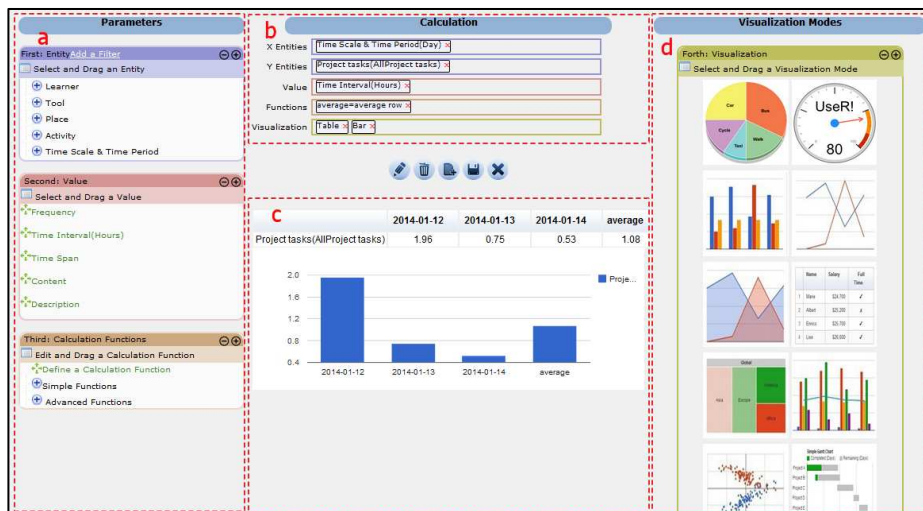

Fig. 1. The interface to assist learners to create personalized indicators

The semi-structured sentences of the reporting tool (reporting traces) and the traces of use of Moodle (activity traces) are respectively recorded in an XML database (BaseX) and in a relational database (MySQL). These two kinds of traces are described according to the same five common entities: Learner, Tool, Activity, Time and Place. They are merged according to a common time basis and are stored into a transformed traces base. The transformed traces are used to produce indicators stored in a dedicated database [2]. An indicator is defined by 5 parameters:

- X entity and Y entity: these parameters can be chosen by the learners among the instances of the five entities extracted from the transformed traces (Learner, Tool, Activity, Time, Place). These entities are used to specify the events the learners want to observe.
- Value: this parameter sets the type of aggregation proposed to produce the data presented into the indicator. Four possibilities are proposed: frequency, time interval, time spent, content.
- Calculation function: the learners can refine the analysis of values by defining other mathematic formula based on sum, difference, comparison and average.
- Visualization: DDART offers eleven visualization modes for learners (pie chart, bar chart, line chart, gauge chart, social network, scatter chart, area chart, table, tree map, combo chart and Gantt).

3 Conclusion

In this paper, we have presented the basis of the DDART system. This system can help learners to collect, analyze and visualize their reporting and activity traces in the form of meaningful indicators. By allowing learners to create their own indicators, we aim at making them learn how to regulate their learning activities. The traces collected in the reporting tool allow the construction of advanced indicators that can help learners to build metacognitive skills. For example, the indicators can support the analysis of behavior by comparing the learners' feeling about their activities (subjective) with the realization mode of the activities (objectively recorded by the system).

References

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