

Instructor Support for Monitoring and Visualizing Students' Activity in a Social Learning Environment

Elvira Popescu, Dan Cioiu
Computers and Information Technology Department
University of Craiova
Craiova, Romania
popescu_elvira@software.ucv.ro

Abstract—With the recent introduction of social software in education, there is a need for support applications that will help teachers monitor students' activity on these Web 2.0 tools. In this paper we present such an approach for learner tracking and visualization in an integrated social learning environment called eMUSE. The platform collects learner actions from each of the disparate Web 2.0 tools (by means of APIs or RSS feeds), stores them in a local database for further processing and presents them to the instructor in suggestive graphical formats.

Keywords—Web 2.0, social learning environment, learner tracking, instructor support tool, e-monitoring

I. INTRODUCTION

Tracking and monitoring learner activity is an essential part of the instructional process, offering precious information to the teacher, the student, as well as the researcher / educational technologist. The instructor can use the information for following the class progress, for scaffolding purposes (identifying students' needs and evaluating the result of the assistance offered), as well as for quickly spotting inactive students and providing remedial interventions. Analyzing the tracking data can also help understand the complex processes involved in learning and promote reflection [1], [15]; the acquired knowledge can be used by instructors to improve subsequent versions of the learning sessions. Furthermore, studies have shown that learners can also benefit from visualizing their traces and consequently reflecting over their learning experience [5], [8]. Last but not least, teachers monitor students' activity for competence assessment, as well as for evaluation and grading purposes; thus the teacher doesn't see just the outcome of learning (e.g., a project report) but also the unfolding of the whole learning process (e.g., the collaboration activities of the students, each individual contribution, as well as their evolution over time).

Up to the present, there have been proposed many tools to support learner monitoring and/or analysis, such as: [1], [3], [4], [10], [11], [16], [21]. With the recent introduction of social software in education, there is a need for support applications that will help teachers monitor students' activity on these Web 2.0 tools also. In this context, we designed a platform (called eMUSE - empowering MashUps for Social E-learning) which offers the tracking and visualization support needed. Of course, there already exist various systems which monitor and visualize the activity of users on Web 2.0 tools, but our intention was to provide an integrated

platform, especially designed for TEL, which provides social learning support for both students and teachers. More specifically, eMUSE offers an integrated learning space, with a common access point for the Web 2.0 tools selected by the instructor, including updates of the latest peer activity and providing basic administrative services (authentication, enrollment, tool management etc.). Moreover, eMUSE retrieves students' actions with each Web 2.0 tool and stores them in a local database for further processing: providing a summary of each student's activity and an associated score, graphical visualizations, evolution over time, comparisons with peers, as well as various aggregated data. Unlike all the monitoring and analysis systems mentioned above, eMUSE collects data from various sources (each of the disparate Web 2.0 tools), rather than from a centralized system (such as an LMS). Moreover, these data represent tacit student actions (e.g., online social interactions), which are not directly assessed as part of the learner's educational progress (as are the explicit student actions, such as completing assignments and taking exams) [7].

The rest of the paper is structured as follows: in section 2 we give an overview of the learner tracking component in eMUSE, including the types of actions recorded and the retrieving mechanisms. The graphical visualization approaches for the recorded data are presented in section 3. We conclude the paper with section 4 and sketch our future research directions.

II. MONITORING STUDENTS' ACTIONS WITH EMUSE

In recent years, Web 2.0 tools (also known as social media tools – e.g., blog, wiki, microblogging tool, social bookmarking tool, media sharing tool) have started to be used in education, with positive impact on learning gain and learner satisfaction [2], [6], [13]. They have mainly been used as support tools for collaborative learning and socio-constructivist instructional approaches: the learner is seen not just as content consumer but also as content generator, often in a collaborative manner.

While most of the existing studies rely on a single Web 2.0 tool, more complex instructional scenarios could be envisaged, using a combination of several tools, e.g.: i) a social bookmarking application for finding, storing, tagging and sharing links to resources of interest for a project; ii) a wiki for collaboratively writing the project documentation; and iii) a blog for posting about the project progress, experience exchange, help requests, critical and constructive

feedback to peers [14].

Obviously, this places a lot of burden on the teacher, who needs to set up the learning space from scratch and then continuously monitor students' activity on several disparate Web 2.0 tools. Hence the need for a platform that would integrate a wide range of social media components, providing also more support to the students and teachers: i) help students keep track of their contributions as well as their peers'; ii) a simple way for instructors to keep track of the class activity as well as quickly monitor, visualize and grade each student's contributions. This is how the eMUSE social learning environment was conceived, having in mind the needs of the learner, instructor and researcher, as detailed in [14]. Beside the comprehensive rationale underlying the platform, paper [14] also includes an overview of the platform architecture and functionalities. In the present paper we discuss the monitoring and visualization components only, focusing on the teacher's perspective.

The technical solution adopted for learner tracking and data collection is accessing the Web 2.0 tools by means of open APIs or RSS feeds in order to retrieve students' actions. This integration of content from several external sources to create a new Web application, with added value for the user, is known as *mashups* technique [12] - which is reflected also

in the platform name. Please note that currently eMUSE integrates seven Web 2.0 tools (Blogger, MediaWiki, Delicious, Twitter, YouTube, Picasa, SlideShare), but the range can be subsequently extended. The recorded actions refer to various types of learning activities: creating content (*blog_post-entry*, *youtube_upload-video*, *slideshare_add-document*, *picasa_add-photo*, *wiki_revise-page*, *wiki_upload-file*), social interactions (*delicious_add-friend-to-network*, *youtube_subscribe*), organizing content (*youtube_create-playlist*, *delicious_post-bookmark*, *picasa_create-album*), communication and feedback (*blog_post-comment*, *twitter_post-tweet*, *youtube_favorite-video*). It should be mentioned however that the interpretation of the recorded student actions (their pedagogical relevance and the correspondence with various types of learning activities) depends on the particular instructional scenario adopted for each course and the roles assigned to each tool by the instructor.

All these actions are retrieved from the corresponding Web 2.0 tools and stored in the eMUSE database together with a description and an associated timestamp, as can be seen in Fig. 1. The actions are further processed and offered to the instructor in aggregated forms, in various graphical representations, as detailed in the next section.

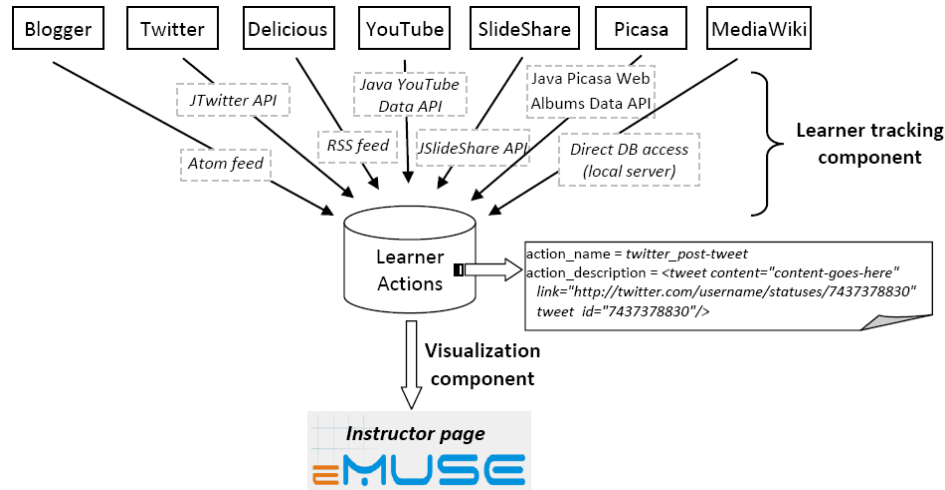


Figure 1. eMUSE learner monitoring mechanism

III. VISUALIZING STUDENTS' ACTIONS IN EMUSE

Visualizing the recorded actions is the next step for assisting instructors in monitoring students' activity. Based on our teaching experience as well as relevant studies from the literature [4], we defined several situations that the teacher needs to be aware of and various types of visualizations that would prove useful, e.g.:

- Have a common access point to students' contributions and be able to quickly retrieve their details
- Easily get a big picture of the class activity and follow its progress over time
- Browse through all student actions and be able to order and filter them by various criteria (time, tool, action, student or range thereof)

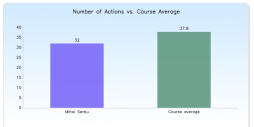
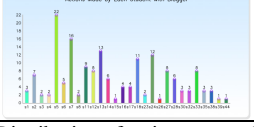
- Get a bird's eye view of the most recent student activity
- View the complete profile of each student and her evolution over the whole semester (individually and compared with class average)
- Identify problem students and offer remedial action to prevent drop-out
- Compare usage levels for different tools / by different students; spot drops in student activity levels and find the cause
- View the distribution of action types and which categories of learning activities are supported; see which tool is under-used and motivate students to use it more.

All these functionalities are included in our eMUSE platform and a few of them are illustrated in Table 1. Of course, all evaluations / comparisons have a quantitative

nature - a qualitative analysis would also be necessary in some cases, so the instructor would have to resort to a manual checking of the content.

The graphical visualizations consist mainly of simple but suggestive chart formats, such as bar, pie or line. These can be classified based on several criteria: i) number of students (an individual student vs. the whole class); ii) number of tools (one tool vs. all tools vs. a particular action type pertaining to one tool); iii) time (aggregated number of actions in the current moment vs. evolution over time). The frequency of the contributions plays an important role, showing the level of involvement of the students with the project/course as well as their progress.

TABLE I. SOME EXAMPLES OF GRAPHICAL VISUALIZATIONS PROVIDED FOR THE INSTRUCTOR IN EMUSE

Students	Tools	Action types	Chart
One	All	All	Total number of actions vs. course average 
One	All	All	Number of actions per tool vs. course average 
One	One	One	Evolution of the specific action type over time 
All	One	All	Comparative number of actions for the specific tool for each student 
All	All	All	Distribution of actions per tool 

As far as the implementation is concerned, Java-based and XML technologies were employed, with MySQL used as DBMS and Apache Tomcat as servlet container; JS Charts library [9] was used for the graphical visualizations of the students' actions, as illustrated in Table 1.

IV. CONCLUSIONS

The paper presented an approach for monitoring and visualizing students' activity with Web 2.0 tools, in a social learning context. The eMUSE learner tracking module was validated by an experimental study, which we could not include here due to space limitations. Suffice it to say that

the teacher used the platform on a weekly basis and it turned out to be a precious help in the student monitoring and evaluation process.

As future work, we plan to perform more in-depth analyses of the recorded student actions, by applying statistical methods, educational data mining algorithms or social network analysis. Additional, more complex, visualization techniques could also be employed.

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