# eMUSE - Integrating Web 2.0 Tools in a Social Learning Environment

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**Abstract.** Traditional teaching methods should be adapted to accommodate the learning needs of the new generation of digital native students. One approach is to provide support for social learning by integrating Web 2.0 tools in educational settings. This paper focuses on a platform specifically built to this end: eMUSE (**e**mpowering **M**ash**U**ps for **S**ocial **E**-learning), which aggregates several social media components by means of mashups. In addition, the platform provides learner tracking functionality, by retrieving students' actions with each tool and storing them in a local database for further processing. Thus eMUSE offers value-added services for both students and teachers: common access point to facilitate tools' management; help students keep track of their contributions as well as their peers'; a simple way for instructors to monitor the class activity as well as quickly check, visualize and grade each student's contributions. The paper includes a comprehensive rationale underlying eMUSE, a description of the platform architecture and functionalities, as well as an initial experimental validation.

**Keywords:** social learning, Web 2.0, mashups, learner tracking

## 1 Introduction

The generation of students we are teaching today was raised in the context of digital technologies, in a world of communication and wide availability of information. According to [15], these so called "digital natives" have different patterns of work, attention and learning preferences. Therefore, the traditional teaching methods should be adapted to the needs of this new "Internet generation", offering support for social learning.

A simple way to achieve this is the integration of Web 2.0 tools (also known as social software tools, e.g., blogs, wikis, social bookmarking systems, media sharing tools) in the learning process. Up to the present, there are many papers which report on the successful use of these Web 2.0 tools in educational settings [3], [7], [10], [12], [13]. While not all studies are positive, many researchers obtained encouraging results with respect to student satisfaction, knowledge gain and/or learning efficiency. This can be explained by the fact that the principles Web 2.0 is based on (user-centered, participative architecture, openness, interaction, social networks, collaboration) are in line with modern educational theories

such as socio-constructivism [16]. According to it, knowledge cannot be transmitted but has to be constructed by the individual, by means of collaborative efforts of groups of learners. Furthermore, with Web 2.0, the user is not just content consumer but also content generator (often in a collaborative manner). This is in line with contribution-based pedagogies which state that collaboratively creating learning resources and sharing them with others are promising practices through which students can learn efficiently [7].

The majority of the experiments reported so far involve a single Web 2.0 tool and were realized in an ad-hoc manner [10]. However, using a combination of these tools could be more adequate for some learning scenarios, e.g.: i) a social bookmarking application for finding, storing, tagging and sharing links to resources of interest for a project; and 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. 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 scattered 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: common access point to facilitate tool management; help students keep track of their contributions as well as their peers'; 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 led us to conceive, design and build such a social learning environment, which we called eMUSE (**e**mpowering **M**ash**U**ps for **S**ocial **E**-learning). The name comes from the underlying technology: the Web 2.0 tools were integrated into the platform by means of mashups.

A more detailed rationale underlying eMUSE is presented in the following section. Subsequently, an overview of the platform architecture, functionalities and implementation is included in section 3. Section 4 covers the positioning of eMUSE with respect to other Web 2.0-enhanced learning spaces, as well as an initial experimental evaluation of the platform. Finally, the paper ends with some conclusions and future research directions.

## 2 eMUSE Rationale

The eMUSE platform that we envisaged had to offer the following functionalities:

1. provide integrated access to all the Web 2.0 tools selected by the instructor for the course at hand: common access point, detailed usage instructions, summary of the latest activity
2. retrieve students' actions with each tool and store them in a local database
3. offer a summary of each student's activity, including graphical visualization, evolution over time, comparisons with peers, as well as aggregated data
4. compute a score based on the recorded student activity (following instructor-defined criteria)
5. provide basic administrative services (authentication service, enroll students to the course, edit profile etc.).

The main rationale for introducing eMUSE was to cater for the learning needs of digital native students. However, when designing the platform, we also had in mind the needs of the instructor, as well as the researcher, as detailed in the following subsections.

### 2.1 eMUSE for the Learner

The fact that students have a place where they can access their own accounts to all Web 2.0 tools required for the course, as well as the accounts of their peers, provides an **ease of access** as well as a reduction in the time and effort needed for the tool management task.

Furthermore, having all the tools integrated in one platform creates a **sense of community** between learners, which is deemed paramount in academic settings, increasing both student success and student retention rates [6]. Relying on eMUSE as a course support tool provides the necessary social interaction.

Another advantage of eMUSE is that it integrates Web 2.0 tools that learners are already **familiar** with from out-of-school activities [12], like Blogger, MediaWiki, Twitter, Delicious, YouTube etc. Thus, students have the opportunity to use the pedagogically valuable tools in a semi-formal framework, in collaboration with their peers, inside the eMUSE platform. In this sense, eMUSE is somewhat similar to **Personal Learning Environments**, like MUPPLE [17]. Unlike these systems, however, the control over the selection of tools that will be used for a course belongs to the instructor, not to the learner. This can be seen as a positive aspect, relieving the burden on the student, since "too much freedom and lack of structure can create chaos, which hinders the learning process" [9]. Furthermore, even when learners do not encounter problems in choosing the right tools for collaborative work, synchronization of work is difficult and time-consuming [9]. Therefore, having a common access point and a continuously updated overview of the most recent peer activity is beneficial for the students.

One of the meta-skills that students need to learn is to take initiative and responsibility for their own learning [9]. This could be boosted by the opportunity to visualize their own progress, as well as to position themselves with respect to the other peers. eMUSE is thus offering an important support for **self-monitoring and self-evaluation**, which in turn may spur learning.

The scores which can be computed by the system based on students' actions with the Web 2.0 tools provide the necessary incentive for the more result-oriented and exam-oriented students. Since these scores also include some explanations, the students are provided with the necessary **feedback** as well, which is extremely important in informal learning [9].

By providing scores, as well as instant comparative evaluation of learners' work (in quantitative terms), the platform responds to the digital native students' need for "**quick gratification**" [15]. eMUSE is thus in line with Vassileva's recommendations that learning environments should try to "tie learning more explicitly to social rewards in terms of marks and credentials" [15].

Due to the provision of comparative evaluations and continuously updated overviews of latest activity, **competitiveness** is also enhanced; as reported in

[7], students are "pushed" by finding out that a peer has published a blog post and they no longer wait until the deadline to make their contribution.

Furthermore, the platform takes advantage of the fact that many of today's students have a **social motivation for learning** (e.g., finding a piece of information to impress one's peers, offering help in a group task) [15], by encouraging participation and contributions.

### 2.2 eMUSE for the Instructor

First of all, instructors may choose from a **variety of tools** that they can integrate in their course (currently seven Web 2.0 tools are included - Blogger, MediaWiki, Twitter, Delicious, YouTube, Picasa, SlideShare - but more can be envisaged). Thus, a **wide range of pedagogical scenarios** can be designed, corresponding to the particularities of the course as well as teacher's preferences. Clear instructional guidelines can be provided to the students by means of the usage help files associated to each tool.

The platform offers instructors the degree of control needed, providing continuous **monitoring of students' activity**. This is one of the main advantages of our platform versus similar systems, which do not collect and store students' actions with the Web 2.0 tools.

This tracking and monitoring functionality of eMUSE can prove valuable also from an institutional point of view. As Sclater pointed out, "Institutions need to be careful that they do not lose the opportunity to track what students are doing. If they fail to record valuable data on how students are using learning tools and content, it will be far more difficult to enhance the courses and provide remedial assistance to learners with difficulties" [14].

The **suggestive graphical visualization** functionality of the students' actions with the Web 2.0 tools proves very helpful for the teacher. By simply looking at the students' contributions over time, the instructor can get the big picture, spot the problems and follow the class progress. Moreover, since all the data are stored in a local database, they are readily available for **further processing and analysis**; based on the results, teachers may choose to improve the next edition of the course.

Instructors may use the scores automatically computed by the platform as a component in their grading scheme or at least as an orientation. Since these scores are based on quantitative aspects only, they should definitely be doubled by manual analysis of the quality of students' contributions; however, the scores could be a valuable indicator in themselves and a **support for teachers in the evaluation/grading process**.

### 2.3 eMUSE for the Researcher

Despite the growing number of papers on the subject, the full potential of Web 2.0 for education is yet to be established and many questions still lie ahead, as summarized in [8]. The majority of the experiments reported so far involve

a single Web 2.0 tool and were realized in an ad-hoc manner [10]. Hence, the need for a platform which can provide the required **support for systematic research**: i) various Web 2.0 tools which can be integrated in different combinations and pedagogical scenarios; ii) graphical visualizations of the students' activity; iii) collecting and storing students' actions, making them readily available for further analysis and processing (e.g., statistical analysis, data mining). eMUSE meets all these conditions and we believe it will prove very helpful in our systematic research endeavors.

## 3 Implementation Overview

The first step towards the creation of eMUSE was to select the most suitable Web 2.0 tools to be integrated into the system, which meet two requirements: i) have a demonstrated pedagogical value (according to case studies reported in the literature); ii) offer technical support for mashup integration (well documented and maintained APIs, RSS feeds etc.). We therefore decided to add the following tools in the first version of eMUSE: blog (Blogger), wiki (MediaWiki), social bookmarking tool (Delicious), microblogging tool (Twitter), media sharing tools (YouTube, Picasa, SlideShare). Naturally, the range of social media components could be subsequently extended.

The integration of the Web 2.0 tools into the platform was done by means of **mashups**, ensuring a lightweight architecture, with loosely-coupled components. A mashup represents a combination of data and/or functionalities from two or more external sources to create a new Web application. Paper [1] presents a review of mashup applications in various domains; examples of e-learning applications include: [2], [4], [17]. Generally, accessing data and functionalities can be done by several methods: i) APIs (Application Programming Interface) based on REST (Representational State Transfer); ii) RSS (Really Simple Syndication) or Atom feed integration; iii) Screen scraping [11]. In our case, the access to the tools was mostly made by means of open APIs (in case of YouTube, SlideShare, Picasa and Twitter), but also directly through feeds when this was more convenient (in case of Blogger and Delicious) or even by direct access to the database (in case of the locally installed MediaWiki).

According to [11], mashups do more than simply integrate services and content, typically adding value to the user, producing enriched results; it is also the case of our eMUSE system, as reflected in its name (empowering MashUps for Social E-learning). More specifically, the platform integrates a learner tracking functionality, i.e., all student actions performed within the Web 2.0 tools are retrieved and recorded in the platform's database (together with a description and an associated timestamp). The list of actions includes: *post_blog_entry, post_blog_comment, upload_youtube_video, post_delicious_bookmark, add_delicious_friend_to_network, add_slideshare_document, create_picasa_album, post_tweet, revise_wiki_page, upload_wiki_file* etc. These are further processed and offered to the learner and/or instructor in aggregated forms, in a graphical representation. Figure 1 presents a schematic architecture of the integration of tools

in the eMUSE platform, together with the additional learner tracking and visualization functionalities. 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.

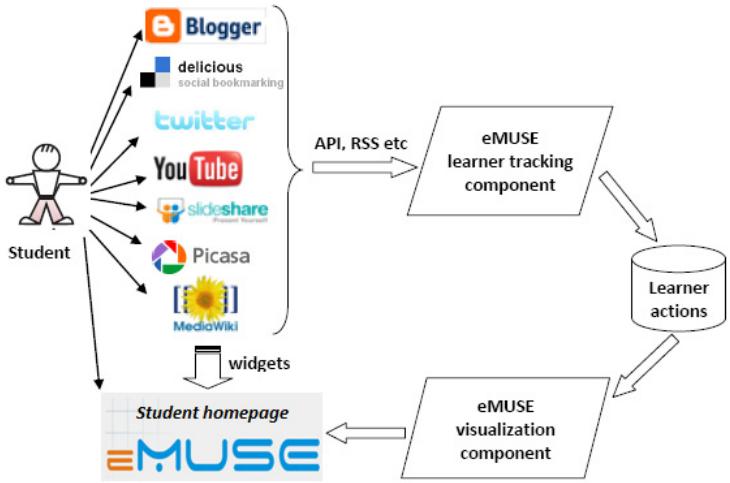


**Fig. 1.** eMUSE schematic architecture - learner tracking module

From the students' point of view, eMUSE offers the following main functionalities:

- an integrated learning space, with a common access point to all the Web 2.0 tools selected by the instructor, including updates of the latest peer activity
- a summary of each student's involvement, including pie/bar/line charts, evolution over time, comparisons with peers, as well as aggregated data
- a preliminary score computed based on the recorded student activity, following instructor-defined criteria.

A screenshot of the platform (representing the student home page) can be seen in Figure 2.

As far as the instructor is concerned, eMUSE acts as a control panel, with the following main functionalities:

- student management (course enrolment, centralized access to students' accounts on each Web 2.0 tool, grading information)
- collect data on students' activity, search and browse students' actions, visualize course statistics, detailed charts of student involvement and comparative evaluation
- configure grading scheme: define grading categories (i.e., individual contributions, peer feedback, communication skills etc.) and assign different weights to each action type inside each category, based on the particularities of the course; the overall score will be a weighted sum of all defined categories.

A screenshot of the platform illustrating a part of these functionalities (i.e., the graphical visualizations of the students' activity) can be seen in Figure 3.

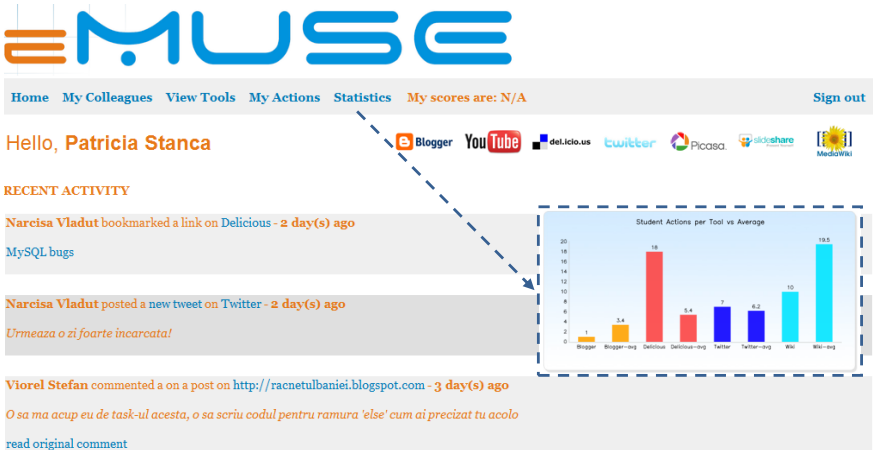


**Fig. 2.** eMUSE student home page, including an overview of latest peer activity. From the top menu, the student may choose to see: i) the list of peers and their corresponding tool accounts; ii) the list of available tools, including detailed usage instructions; iii) the list of her actions, filtered by several criteria; iv) graphical visualizations of her activity (as previewed in the dotted box on the right side)

## 4 eMUSE Validation

### 4.1 Comparison with Similar Platforms

In the introduction section we reported on several experimental studies involving the use of Web 2.0 tools in education; however, most of them included only one social media tool, which was integrated ad-hoc into the course (no dedicated platform was used) [10]. There are nevertheless other initiatives, designed at aggregating several social media tools:

- Some of them are general purpose platforms, such as: Netvibes or iGoogle (personalized dashboards including user-defined social media modules), Elgg [5] (a social engine which delivers building blocks that can be used to create social networks and applications). The main advantage of eMUSE compared to these platforms is that it was specifically designed for e-learning, therefore providing dedicated functionalities (learner tracking, evaluation and grading, etc.).
- Some learning management systems (LMS) nowadays integrate social media tools (e.g., blog and wiki in Moodle or Sakai). However, the range of available components is limited and they are built-in tools, often providing less functionalities than a fully-fledged external Web 2.0 application (which students are already familiar with). Moreover, eMUSE is not aimed at replacing an LMS; it is designed as a dedicated support tool for social interaction and collaborative learning, which could be integrated with any course / project and could be run in parallel with an LMS.

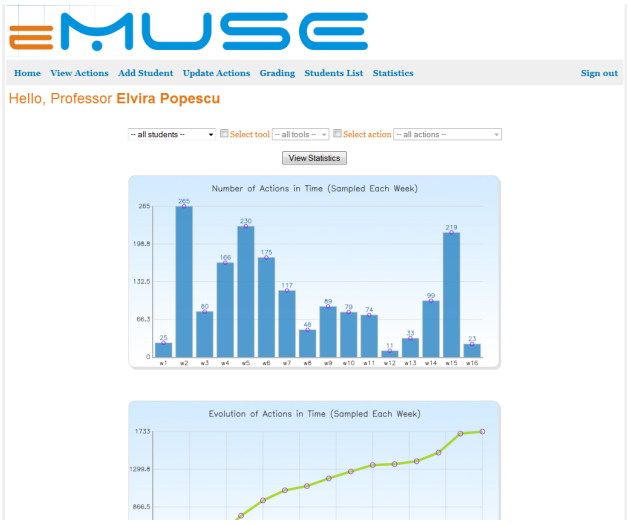


**Fig. 3.** eMUSE screenshot - instructor perspective of course statistics

– Recently, there have appeared the so-called "mash-up personal learning environments", platforms that support learners in building their own PLE; MUPPLE [17] and PLEF [2] are two such examples. These platforms mainly support learners in assembling various feeds and widgets in a single interface (either manually or by means of learner interaction scripts). By contrast, in eMUSE the components are chosen by the teacher in the context of a course. In addition, the platform offers value-added services, by collecting and analyzing students' activity with these tools and providing support to the instructor in the monitoring and evaluation process.

Hence eMUSE occupies a well defined niche in the landscape of Web 2.0-enhanced learning spaces, answering the specific needs outlined in section 2.

### 4.2 Experimental Validation

In order to experimentally validate the platform, we used it as support tool for collaborative learning in the context of an undergraduate course on "Web Applications' Design". 45 students were enrolled in the course, unfolding in the first semester of the 2010-2011 academic year at the University of Craiova, Romania. The project assignment was team-based, performed in a blended mode, with weekly face-to-face meetings and with the requirement to use eMUSE (and the integrated Web 2.0 tools) for the project tasks. At the end of the semester the platform recorded over 1800 student actions. A detailed statistical analysis of the recorded data is currently underway; in what follows, we will report on the subjective data collected by means of the satisfaction questionnaires applied to the students at the end of the study.

The results revealed that 75.55% of the students found the platform "useful" or "very useful"; 88.88% of the students found the platform motivating at least to a moderate extent and 68.88% were enthusiastic about using the platform for other courses. Detailed results are illustrated in Figure 4.

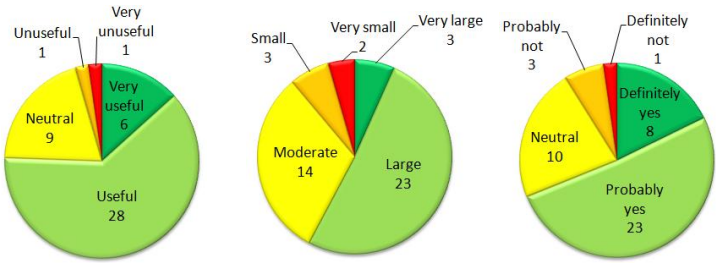


**Fig. 4.** Distribution of students' answers to the following questions: i) *Do you consider the platform useful?* (left chart); ii) *To which extent was eMUSE motivating for you?* (middle chart); iii) *Would you like to use eMUSE for future courses?* (right chart)

When asked to comment on the advantages of the platform, most students mentioned: i) the increased motivation (e.g., "can help motivate one if he sees he's behind peers"); ii) the opportunity to monitor own progress and compare it to the others (e.g., "I get a big picture of all my contributions", "I can see my contribution relative to the others"); iii) better management of the social media tools (e.g., "easier access to accounts", "easier to keep track of all the tools"). The biggest disadvantage spotted by the students was the fact that all the summaries and statistics are quantitative only and this could lead to an inflation of low-quality contributions ("post hunting" as one student put it). However, this actually happened only in a limited number of cases, since students were clearly informed that in the end it will be the quality of their contributions that will matter most towards their final grade.

## 5 Conclusion

The paper described our endeavor to build a social learning environment prototype (eMUSE), starting with a comprehensive rationale, followed by a detailed description of the platforms' architecture and functionalities. A theoretical comparison with other Web 2.0-enhanced learning spaces, as well as an initial experimental study involving 45 students, were performed in order to evaluate the platform.

A more in-depth analysis of the experimental results obtained is our next research direction; we want to investigate the effects of eMUSE on students' activity, on the usage patterns of the Web 2.0 tools, as well as on the learning gain. We also plan to perform more extensive studies, with a larger number

of students from different backgrounds, with various settings and instructional scenarios.

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## References

1. Beemer, B., Gregg, D.: Mashups: A Literature Review and Classification Framework. Future Internet 1(1), 59–87 (2009)
2. Chatti, M. A., Agustiawan, M. R., Jarke, M., Specht, M.: Toward a Personal Learning Environment Framework. International Journal of Virtual and Personal Learning Environments 1(4), 66–85 (2010)
3. Conole, G., Alevizou, P.: A Literature Review of the Use of Web 2.0 Tools in Higher Education. Technical report, The Open University, UK. Available at: `http://www.heacademy.ac.uk/assets/EvidenceNet/Conole_Alevizou_2010.pdf` (2010)
4. Drachsler, H., Pecceu, D., Arts, T., Hutten, E., Rutledge, L., Van Rosmalen, P. et al.: ReMashed-Recommendations for Mash-Up Personal Learning Environments. In: Proc. EC-TEL 2009. LNCS, vol. 5794, pp. 788–793. Springer, Heidelberg (2009)
5. Elgg - Open source network engine, `http://www.elgg.org/`
6. Finkelstein, S.L., Powell, E., Hicks, A., Doran, K., Charugulla, S.R., Barnes, T.: SNAG: Using Social Networking Games to Increase Student Retention in Computer Science. In: Proc. ITiCSE 2010, ACM, New York, NY, pp. 142–146 (2010)
7. Hain, S., Back, A.: Personal Learning Journal - Course Design for Using Weblogs in Higher Education. The Electronic Journal of e-Learning 6(3), 189–196 (2008)
8. Hemmi, A., Bayne, S., Land, R.: The Appropriation and Repurposing of Social Technologies in Higher Education. J. Comput. Assist. Learning 25(1), 19–30 (2009)
9. Herder, E., Marenzi, I.: Trends in Connecting Learners. First Research & Technology Scouting Report. STELLAR project deliverable. Available at: `http://hdl.handle.net/1820/2824` (2010)
10. Homola, M., Kubincova, Z.: Taking Advantage of Web 2.0 in Organized Education (A Survey). In: Proc. ICL 2009, pp. 741–752 (2009)
11. Ort, E., Brydon, S., Basler, M.: Mashup Styles. Available at: `http://java.sun.com/developer/technicalArticles/J2EE/mashup_1` (2007)
12. Popescu, E.: Students' Acceptance of Web 2.0 Technologies in Higher Education: Findings from a Survey in a Romanian University. In: Proc. DEXA 2010 Workshops, pp. 92–96 (2010)
13. Popescu, E., Manafu, L.: Repurposing a Wiki for Collaborative Learning - Pedagogical and Technical View. In: Proc. ICSTCC 2011 (in press)
14. Sclater, N.: Web 2.0, Personal Learning Environments, and the Future of Learning Management Systems. Educause Research Bulletin 13 (2008)
15. Vassileva, J.: Toward Social Learning Environments. IEEE Trans. Learning Technologies 1(4), 199–214 (2008)
16. Vygotsky, L. S.: Mind in Society. Harvard University Press, Cambridge, MA (1978)
17. Wild, F.: Mash-Up Personal Learning Environments. iCamp project deliverable. Available at: `http://www.icamp.eu/wp-content/uploads/2009/01/d34_icamp_final.pdf` (2009)