

Approaches to Designing Social Media-based Learning Spaces

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ABSTRACT

Social media tools have been used in educational settings for several years, with good results with regard to student satisfaction, motivation and/or learning gain. In an attempt to exploit this Web 2.0 potential for education, many researchers have started to design social media-based environments for educational use, enhanced with dedicated learning support features. This paper provides a classification and synthesis of the proposed approaches, offering a comparative review of the design solutions. Three main categories are identified, each of which being analyzed and illustrated with representative systems: i) extending general-purpose social media tools with educational support features; ii) building dedicated stand-alone educational social media tools; iii) integrating multiple social media tools in fully-fledged educational platforms.

Categories and Subject Descriptors

• Information systems~Web applications • Human-centered computing~Collaborative and social computing systems and tools • Applied computing~Interactive learning environments • Applied computing~Collaborative learning

Keywords

social media in education, special-purpose Web 2.0 tools, social learning environments

1. INTRODUCTION

In recent years, social media tools have found their way into the educational landscape, with positive effects on the learning process [7, 25, 30]. These tools can be used to foster communication and collaboration between learners and help create online learning networks, actively engaging students in their learning [24]. Even if not yet part of the educational technology mainstream, social media tools "have reached a high level of maturity and have been increasingly adopted in educational practices worldwide" [18].

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Furthermore, dedicated Web 2.0-based learning spaces have started to be designed, in an attempt to incorporate specific instructional features into the social media tools. These features refer to assessment support, learner tracking and monitoring, collaborative learning facilities, ranging up to complex integrated learning environments. This special and relatively new category of systems constitutes the topic of this paper, which aims at providing a classification and synthesis of the state-of-the-art. More specifically, three main approaches are identified and discussed:

1. Extending general-purpose social media tools with educational support features
2. Building dedicated stand-alone educational social media tools
3. Integrating multiple social media tools in fully-fledged educational platforms.

To the best of our knowledge, this is the first attempt to provide a systematization of the area, surfacing design solutions and trends.

After providing a brief overview of social media use in education (in section 2), the following three sections of the paper are dedicated to a detailed review of the above design approaches; each section discusses one category, providing a catalogue of representative systems reported in the literature. The paper ends with some concluding remarks and perspectives of the field.

2. WEB 2.0 & EDUCATION

With its "2.0 version", the Web has entered a more social and participatory phase. Web 2.0 brings a user-centered approach – designing applications whose content is generated by the users and therefore depend heavily on their contribution (e.g., YouTube, Wikipedia, Flickr, Delicious). Consequently, Web 2.0 is also known as "participatory Web": the user is not just content consumer but also content generator (often in a collaborative manner). Furthermore, Web 2.0 is also called "social Web": with the advent of social networks, it started offering support for users to interact, communicate and collaborate in online communities (e.g., Facebook, LinkedIn) [30]. While the term *Web 2.0* is generally used to describe the "Web as a platform", the framework, the infrastructure, the terms *Web 2.0 tools / services*, *social software*, *social media (tools)* are generally used interchangeably to describe the applications built on it. The social media concept is best depicted by examples [38], which include social networking sites, blogs, wikis, social bookmarking services, microblogging tools or media sharing tools.

Recently, these Web 2.0 tools have been introduced in educational contexts as well. Thus, the term *e-learning 2.0* emerged, being coined by Stephen Downes [9]; it refers to the impact that Web 2.0 has on education, modeling learning communities as social networks. Furthermore, education must

keep up with the ever-changing needs and demands of the current generation of students; these have been strongly influenced by the new digital technologies, having different patterns of work, attention, and learning preferences [44]. A solution would be to provide students with *social learning environments*, which are learner-centered and support learning in context; these environments should help the learner find the right content (e.g., the most suitable resources according to the student's need and purpose), connect with the right people (e.g., peers that the student could collaborate with) and motivate them by making learning more gratifying [44]. In this context, Web 2.0 appears well suited to support this new mode of learning and facilitate the design of social learning environments.

Indeed, social media can be used to enhance the sense of community between learners, which is an important success factor for e-learning [17]. Furthermore, there seems to be a good correspondence between the affordances of Web 2.0 (support for user-generated content, communication and collaboration) and the fundamentals of some effective pedagogical approaches (e.g., socio-constructivism, personalized and experiential learning, communities of inquiry) [7, 42].

Web 2.0 tools have been reportedly used for a variety of educational purposes, in wide-ranging contexts and disciplines of study, following various pedagogical approaches and instructional scenarios and in support of different cognitive processes and learning objectives [30]. In what follows, we synthesize some of the practical ways in which selected Web 2.0 tools can be used for teaching and learning, as described in [7, 12, 16, 28, 30].

For example, **blogs** can support the following set of learning activities: i) create a portfolio from a collection of student assignments, essays and reflections (published as posts) and the corresponding instructor feedback (published as comments); ii) maintain a learning diary, document the progress of the project / learning activity, reporting each accomplished task; iii) publish ideas and interesting findings related to the course; iv) describe problems encountered, ask for help and receive feedback from peers; v) communicate and collaborate with peers working on the same project / assignment and regulate group work.

Similarly, **wikis** enable students to become co-creators of course content, to exchange ideas and share multiple perspectives, enhancing involvement and writing skills and promoting a collective sense of community [7]. Wikis can be used to: produce a collaboratively edited material, incrementally accumulate and organize knowledge, document each stage of a project as well as the final product, provide feedback on peers' writing, publish a summary of readings or a critical review of the literature, annotate lecture notes published on the wiki and share annotations, integrate resources from different Web sources.

Social bookmarking tools can also be used in educational settings for: building collections of resources of interest for the course / project (i.e., a kind of "personal knowledge management tool"); sharing items of common interest with group peers; tagging and organizing the resources in categories; visualizing the tag cloud of an item and compare it with student's own categorization; finding peers with similar interests based on their lists of bookmarks / tags.

Microblogging tools have found their place in education as well, being used by students in order to: follow peers or teachers; post short questions and receive feedback from peers; broadcast

opinions and information related to the course; exchange ideas and comments; share links to various resources; post updates regarding the project status.

Students could also use **social networking tools** as support in their learning for: interacting with peers, sharing experiences and ideas, asking questions and receiving answers from peers and experts, discussing problems encountered during their studies and getting peer feedback.

Media sharing services are a valuable tool for searching educational resources as well as for publishing resources created by students themselves (learner-generated content). A particular type of digital media that can be shared is the **podcast**, which can be used to provide recorded lectures, multimedia step-by-step tutorials, recorded experimental lab sessions etc. Podcasts can serve either as substitutional material (e.g., to replace a lecture that the student could not attend) or supplementary material (e.g., introductory material before lectures, videos with experimental procedures before lab sessions, recordings of native speakers for foreign language learning). Finally, podcasts can also be created by the learners themselves, as an assignment (e.g., to cover a presentation of their work).

These are just some examples of practical uses of Web 2.0 applications in education; however, the range of social media tools and their potential uses in instructional settings is wide and dynamic. The number of papers recently published on the topic of "Web 2.0 and education" is very large and the body of literature is continuously expanding [24]. In a recent review paper, Hew and Cheung [16] identified over 4600 studies published in four international databases, searching for keywords like "Web 2.0 and education", "blog and education", "wiki and education" etc.

In an attempt to exploit this potential, many researchers have started to design special-purpose Web 2.0 tools for educational use, enhanced with dedicated learning support features. These can take the form of extensions / plugins / mashups of branded social media applications or the form of dedicated stand-alone tools, built from scratch.

Table 1 provides a classification of the design solutions identified in the literature. A brief comparison between the three categories of design approaches is also included, in terms of technical solutions, potential functionalities, dedicated learning support features, advantages and disadvantages. It should be noted that the learning environments in the third category could also integrate social media tools from categories 1 and 2 (extended or built for educational purposes), but branded, general-purpose Web 2.0 tools are more popular components.

Each of the three identified categories is illustrated by a few representative systems in the following three sections respectively. Given the breadth of the area and its highly dynamic character, we do not intend to provide an exhaustive catalogue of social media-based learning platforms; a complete coverage would have been impossible. Instead, a few representative examples are chosen, aiming to cover various social media techniques and original design approaches. Each category of systems features also an in-house solution, a prototype developed by our research team at the University of Craiova. The paper does not aim to provide a quantitative analysis of the literature, but more of a bird's eye view of the vast emerging research area; added value is offered by the proposed classification, as a first step to provide a systematization of the field.

Table 1. Overview of design approaches - Category 1: extending general-purpose social media tools with educational support features; Category 2: building dedicated stand-alone educational social media tools; Category 3: integrating multiple social media tools in fully-fledged educational platforms.

Category 1	Category 2	Category 3
<i>Number of social media tools</i>		
Single (e.g., wiki, blog)	Single (e.g., wiki, social bookmarking tool, social networking service)	Multiple (e.g., blog, wiki, microblogging tool, social bookmarking tool, media sharing tool, podcast)
<i>Technical solution</i>		
Plugins, extensions (technology constrained by the base tool)	Design and implementation from scratch (stand-alone tool, developed using any technology)	Mashups of branded tools (technology supporting APIs, RSS/Atom feeds, widgets)
<i>Potential functionalities</i>		
Limited by the base tool	Any functionalities envisaged by the designer	Added value brought by the mashup integration, but constrained by the aggregated tools' features
<i>Examples of dedicated learning support features</i>		
Student group management; social / communication activities; learner tracking; self, peer and teacher assessment	Student group formation; social / communication activities; learner tracking; assignment support; visualization of folksonomies and tag clouds; searching and rating of educational resources	Centralized / integrated learning space; aggregated view of progress / activity updates; possibility to configure the learning environment by selecting the desired social media tools by the student / teacher
<i>Advantages</i>		
Reuse of existing tools; less development effort	Platforms specifically designed and customized for educational use, with all necessary functionalities	Reuse and combination of multiple existing tools; exploiting students' familiarity with popular tools (already used in out-of-school contexts)
<i>Disadvantages</i>		
Extension constraints; potentially unsuitable / undesirable features of the base tool; maintenance issues due to changes or even discontinuation of the base tool	High development load, re-inventing the wheel	Difficulties in the integration and interoperability of tools; potentially undesirable features of the base tools; maintenance issues due to changes or even discontinuation of the base tools

3. EXTENDING GENERAL-PURPOSE SOCIAL MEDIA TOOLS WITH EDUCATIONAL SUPPORT FEATURES

This first category is mainly represented by wikis and blogs, whose functionalities can be relatively easily extended by means of *plugins*.

Wikis are one of the most popular Web 2.0 tools in educational settings; they can be successfully used for collaborative writing tasks among the members of a team, as well as for creating and maintaining learning content, both by students and teachers. Examples of successful empirical reports on using general-purpose wikis for various fields of study are numerous: [21], [34], [35], [47]. However, since wikis were not originally conceived as educational tools, many features that could be helpful in the instructional process are not included. More specifically, the need arises for some features to provide support to the instructor in the evaluation and grading process; not only the final products developed by students must be assessed, but also the overall contribution process, therefore assessment is a major challenge in collaborative pedagogical approaches [7]. Additional features are also needed to provide support to the teacher in the learner tracking process, but also to the student for managing their projects and monitoring their progress. Starting from these needs, several researchers devised educational wiki extensions, whose main features are briefly described next.

Co-Writing Wiki [1] is based on the open source ScrewTurn

Wiki¹ and adds several functionalities for the students: i) view group members' actions feed; ii) visualize own contribution charts and compare progress with other peers; iii) view group members currently online; iv) visualize the differences between revisions (color-coded), comment and rate revisions. Similarly, several enhanced features are provided for the teacher: i) the contributions of each group member are marked with a unique color, so that the activity of each student can be easily explored; ii) a revision player is provided, which displays the color-enhanced revisions of a wiki page as a slide show; iii) useful statistical information is shown, both in textual form and as a chart panel; iv) the teacher has the possibility to send feedback to the students and evaluate their contribution.

Tracking Bundle [20] is available as a MediaWiki² extension and provides several additional functionalities for the teacher: i) create student groups; ii) configure review criteria and the formula used for computing the students' final score; iii) view all page revisions filtered according to various options and add a score and comment for each of the configured criteria; iv) visualize the students' activity and scores in graphical formats.

CoLearn [33] is another MediaWiki extension, built by our research team specifically for supporting collaborative learning. It creates various MediaWiki *special pages*, for creating group projects, adding students to projects, visualizing projects and

¹ <http://stw.codeplex.com>

² <http://www.mediawiki.org>

statistics, monitoring student activity etc. CoLearn provides the possibility to set student and instructor roles, offering various functionalities for both of them. Thus, an instructor can: i) manage courses, setup student groups, create and assign projects; ii) access summary information and graphical statistics about each project, page, group and student; iii) visualize student and project activity reports and project revision history; iv) grade students and provide feedback. Similarly, CoLearn offers students the possibility to: i) create and manage projects for their own group; ii) annotate each page revision with the type of editing performed and the current group activity; iii) add comments and ratings to peers' pages; iv) view summary information about their project, as well as graphical statistics regarding their own activity and comparisons with peers; v) visualize grades and feedback from the instructor [33].

Blogs have also gained a widespread use in educational settings, being seen as a medium in which learners can share ideas and thoughts or publish essays and homework. Due to its time-ordered sequence, the blog can be used as a "learning diary", for reflecting on the learning experience and for tracking the learning progress. Blogs can be used to support various pedagogical scenarios, enhance writing skills, promote critical and analytical thinking as well as creativity and strengthen social interaction (by means of comments) [12]. Recent successful examples of using blogs in educational settings are reported in [40], [41], [46].

While blog platforms can be used "as they are" in the instructional process, the organizational overload for the teacher is quite high, since there are no tools for managing assignments or for tracking students' work. To alleviate this issue, several blog extensions have been proposed in the literature. **LePress** [39], for example, is a plugin which includes a learning flow in Wordpress; it has little interference in the usual blog publishing process, being based on the typical features of blog engines: trackback, categories and sidebar widgets. It allows teachers to create and manage courses, enroll students, publish and manage assignments and provide feedback. Students can use the enhanced blog as a learning portfolio, visualizing assignments and submitting their homework.

Another solution is **EduFeedr** [29], a feed reader for tracking and supporting learning activities in blog-based courses (working on Blogger and Wordpress platforms). Functionalities include setting up the course, enrolling students to the course, aggregating blog posts and comments, visualizing the student progress and interactions. Each course contains six sections: i) course feed (10 most recent posts and comments); ii) course info; iii) list of participants enrolled to the course; iv) assignments (blog posts containing homework tasks); v) progress diagram (showing the assignments completed by each student); vi) social network diagram (showing connections between students based on comments or links to blog posts).

To sum up, the wiki and blog extensions identified above include support for: student group management, social/communication activities, learner tracking and monitoring, self, peer and teacher assessment. By adding these instructional support features, the general-purpose wikis and blogs are transformed into learning platforms. While this plugin approach is relatively simple and efficient, the range of functionalities that can be added is limited and constrained by the base tool design. Therefore, another proposed approach is to build the dedicated educational social media tools from scratch, as discussed in the next section.

4. BUILDING DEDICATED EDUCATIONAL SOCIAL MEDIA TOOLS

This section addresses the category of stand-alone Web 2.0 tools specifically built for educational purposes. We illustrate it with examples from three different areas: wikis, social tagging systems and social networking sites.

Continuing the line of thought in the previous section, we start with a **wiki** built especially for use in educational settings, **ClassroomWiki** [19]. Its aim is to address the limitations of general-purpose wikis, such as lack of support for assessing individual student contributions and for automated group formation. The system is composed of four modules:

- **Wiki** - consists of 2 components: i) assignment component which allows the teacher to create wiki assignments for the students; ii) versioning component which allows the students to view a color-coded history of revisions made by the group peers (based on tracking all changes made to the wiki).
- **Communication** - consists of two components: i) a topic-based forum which allows students to discuss among group members but also to ask questions to the teacher; ii) an announcement system which allows the teacher to send notifications to the students.
- **Tracking and modeling** - tracks all students' interactions with the system and with group members and builds a detailed student model. The following types of information are used: i) active use; ii) passive use; iii) interaction with peers; iv) survey responses; v) evaluation scores provided by the teacher.
- **Group formation** – allows the teacher to automatically form student groups either randomly or by using the student models and the Multiagent Human Coalition Formation framework. This framework assigns an agent to each student, which estimates the student's performance as a group member (i.e., the contribution toward the group's wiki) and then negotiates with other agents to form heterogeneous student groups.

Based on the experimental study performed, the authors conclude that ClassroomWiki provides several benefits: i) improved collaborative learning outcome; ii) support for the teacher to identify free riding students and to perform specific interventions based on the tracked student activities [19].

Social tagging has also received a special attention from researchers, with various systems being built specifically to support learning. For instance, **ASK-LOST 2.0** is a social tagging tool for educational resources [36]. The main functionalities provided by ASK-LOST 2.0 are:

- **Submit and tag educational resources.** Two approaches are offered: i) guided tagging, i.e., the system suggests the user Personal Tags (tags previously employed by that user for describing other educational resources) and Popular Tags (tags most frequently employed by other users for describing that particular resource); ii) auto-suggested tagging, i.e., the system suggests tags employed by other users, that are relevant to the tag currently typed by the user.
- **Browse educational resources via tag clouds** created by all the users
- **Create a personal collection of educational resources**, including resources uploaded by any user and corresponding tags
- **Search, rate and comment educational resources**
- **Social networking support:** the user can add other users to his watchlist and receive updates through RSS feeds of all the

tags and educational resources created by them.

Further social tagging systems for educational use were proposed in [2], [8], [23] and [27].

Another example of dedicated social media tool built for educational settings is **Lintend social networking site**, developed at the University of Craiova [31]. The system offers the possibility to create a virtual presence for educational institutions ("schools") but also to form interest-based groups ("classes"). The main functionalities provided by the platform include:

- Build complex profiles (both for individuals and institutions), create and join classes, add social contacts
- Create and share educational resources (courses, tutorials, articles, solved assignments) which can be recommended and commented on
- Post news and comments, send and receive private messages
- Visualize timeline (collecting recent activity in all joined classes) and receive notifications for events of interest
- Receive suggestions for resources and classes of potential interest.

Students are instantly notified of all the events that happen in their classes and any actions performed by their social contacts, which are all made available on their timeline. Learners can therefore be constantly connected to their peers and receive immediate feedback to their questions or problems; communication and interaction with both peers and teachers are thus facilitated and enhanced. By being able to constantly follow the learning activity of their peers, students are more motivated and engaged [31].

A similar initiative is TUT Circle, a social networking site developed at Tampere University of Technology, Finland [37].

The stand-alone educational social media tools presented above have the advantage of flexibility and wide range of learning support functionalities that can be included. However, since they are built from scratch, they require a high amount of development work. An alternative would be to reuse existing Web 2.0 tools and aggregate them in educational platforms, as discussed in the next section. This would provide the additional advantage of exploiting students' familiarity with the branded tools, from various out-of-school activities.

5. INTEGRATING MULTIPLE SOCIAL MEDIA TOOLS IN EDUCATIONAL PLATFORMS

So far we reviewed case studies of **single Web 2.0 tools** used to support learning, but there have been devised also pedagogical scenarios which involve **multiple Web 2.0 tools** simultaneously. Indeed, using more than one social media tool to support learning was proved beneficial for the students, each such tool fulfilling its own role in the instructional scenario [11, 22]. Nevertheless, having to access, manage and monitor several disparate tools can be burdensome and time-consuming, both for the students and for the teachers. Hence, the need to find ways for integrating these tools in a central learning space.

In this context, Hart [13, 14, 15] proposed three possible approaches for aggregating several Web 2.0 tools to build a social learning environment:

- The first solution would be to select best-of-breed, free, public social media tools to support social networking, tagging content, social bookmarking, file-sharing, communicating with others, collaborating with others,

blogging, podcasting, RSS feeds, microblogging. Next, the integration could be done by aggregating them as **widgets in a dashboard**, for example by using Netvibes³. The main problems with this approach are: the lack of interoperability between the tools, the need for different logins on each tool, the concerns about the privacy and security of data scattered in multiple sites, the limited backup facilities [13].

- The second solution would be to use social media tools from the **Google suite** only, which require a single account and login. Their aggregation can be done through iGoogle⁴, using the corresponding gadgets and customizing the look and feel of the dashboard. However, this means that the users will be required to choose only from Google products and not be able to use their preferred social media tools, that they are already familiar with [14].
- The third proposed solution implies using Elgg⁵, an open source social engine, to build a social learning environment with one consistent interface and one login. The platform is customizable, configurable and extensible, both in terms of functionality and look and feel. The main disadvantage is that the constituent tools do not provide the full extent of functionalities of the stand-alone popular tools [15].

An approach similar to the first solution is reported in [43], which used **Pageflakes**⁶ (a former personalized dashboard) to aggregate students' activity on Wordpress blog (i.e., web feeds) and on Delicious social bookmarking service (i.e., bookmarked resources). This aggregated page provided an overview of the students' activities and progress and also offered participants the possibility to leave messages to the entire group; further optional social media tools could be selected and used by the students.

A different approach is proposed in [3]. The authors used **MediaWiki** as "learning centre", i.e., for organizing learning activities and for managing learning resources and outcomes but also for integrating RSS feeds from the other two social media tools used: CiteULike social bookmarking service and WordPress blogging service. Technically, the integration was done by means of MediaWiki extensions (plugins), which provided updated content from the other Web 2.0 tools directly on the wiki homepage.

A certain degree of integration is already provided by the latest **Learning Management Systems (LMS)**, which currently include several social media modules; however, these tools have limited functionalities as compared to the stand-alone popular tools. **Moodle 2.8**⁷, for example, offers a *Wiki Activity*, as well as *Blocks* such as *Blog*, *Remote RSS feeds* (enabling RSS feeds from external websites to be displayed within Moodle), *Tags* (visualizing tags in a tag cloud), *Flickr* and *YouTube* (which pulls YouTube videos with the same tag words as those in the current *Tags page*). Additional modules could be installed, as server-side plugins, but this requires the intervention of system administrators (it cannot be done by teachers or students). A solution is to enable widgets in Moodle, client-side applications that would be easy to add by the teachers themselves. This can be done by means of the **OpenSocial plugin** proposed in [5], which allows teachers to add

³ <http://www.netvibes.com>

⁴ <http://www.igoogleportal.com> (discontinued from Nov. 2013)

⁵ <http://www.elgg.org>

⁶ <http://en.wikipedia.org/wiki/Pageflakes>

⁷ <http://docs.moodle.org>

widgets either as modules or as blocks. Widgets can be found in the existing widget repositories (e.g., ROLE Widget Store⁸) or teachers can develop their own widgets that provide a deeper integration. Based on OpenSocial API⁹, these widgets can query Moodle and retrieve the currently logged in user, the current course and participants, as well as store various data; they can thus adapt to the specific context of the course (*contextual widgets*) and therefore behave differently when added to another course.

An alternative solution envisioned in [5] would allow students to add widgets as well, to configure, rearrange and resize them in a dashboard added at the bottom of the Moodle page. This dashboard would be available also outside of Moodle by means of a bookmarklet and maintain integration with the LMS by its Web services (and not directly through Moodle database). This would lead to the creation of a Personal Learning Environment, allowing cross-institutional access for the students.

In a broad sense, a **Personal Learning Environment (PLE)** includes "all the instruments, materials and human resources that an individual is aware of and has access to in the context of an educational project at a given point in time" [43]. Social interaction is an essential notion in PLEs, being materialized in widely accepted online interaction paradigms and practices, such as: bookmarking, tagging, commenting, status updating etc. [18]. Since existing PLEs usually integrate social media widgets, we will briefly discuss them here; however, the topic is much broader and an exhaustive presentation is outside the scope of this paper.

From a technical perspective, a PLE can be viewed as "a self-defined collection of services, tools, and devices that help learners build their Personal Knowledge Networks (PKN), encompassing tacit knowledge nodes (i.e., people) and explicit knowledge nodes (i.e., information)" [6]. The actual creation of this PLE by the students is considered an important part of the learning process, a way of taking responsibility for their own learning [43]. The most popular solution for developing PLEs is to combine various Web 2.0 services by means of *mashups*. Two approaches are possible: i) *mashups by aggregation* which support learners in juxtaposing feeds and widgets from different sources in a single interface; these are a kind of personal dashboards and do not require advanced technical skills; ii) *mashups by integration*, which allow for the remixing of content from different sources or combining of different services which can communicate with each other; these are more complex, requiring some programming skills and therefore not yet widely accepted by the students and teachers [18].

In what follows, we present some of the PLE solutions that have been proposed so far in the literature, outlining their approach for social media integration.

MUPPLE (Mash-UP Personal Learning Environment) [45] is a Web application which allows students to create and manage their own learning environments, from aggregated activities. MUPPLE relies on LISL (Learner Interaction Scripting Language), a domain-specific scripting language especially developed for learning environment design. Various social media widgets could thus be integrated in MUPPLE, with some degree of interaction between them. Such a learning scenario is described in [45],

which requires data exchange between VideoWiki and Scuttle bookmarking service (both social media tools developed as part of the iCamp project¹⁰); in this case, a certain degree of interoperability of the two tools is required (based on an API for distributed feed networks).

PLEF is a framework for mashup personal learning environments, introduced in [6]. Its aim is to help learners create PLEs by aggregating various learning services (pulled from different third party service providers) in different formats (media, feeds, widgets). The students can manage these learning elements in the PLE: view, search, add, edit, delete, structure or tag them accordingly. They can also share a learning element with peers or visit other students' PLEs and write comments. Thus the social features supported by PLEF include: social tagging, commenting, and sharing of PLE pages and elements.

Graasp [4] is a Web 2.0 platform which offers PLE functionality and is based on four types of entities: resources, applications, spaces and people. The space is an aggregation unit, which includes a set of applications that are to be used in the learning context, a set of people with different access rights and a set of resources that can be used in the learning context; spaces can be created both by teachers and students. The social media features offered by Graasp include tags, ratings, comments, wikis, and bookmarks. The spaces provide RSS feeds that users can subscribe to, in order to be informed of the ongoing activities. In a space, students can aggregate, share, and organize learning resources; local resources can be added into the space by a simple drag-and-drop from the user's desktop, while institutional and external cloud resources can be aggregated with the featured GraaspIt! bookmarklet¹¹. The same tool allows for the aggregation of widgets, in the form of OpenSocial apps; Graasp thus serves as a widget container as well.

A different solution was proposed by our research team in [32]: the **eMUSE** platform integrates seven popular social media tools (Blogger, MediaWiki, Delicious, Twitter, YouTube, Picasa, SlideShare) and also provides value-added services for both students and teachers: learner tracking functionality, monitoring and visualization features, grading and evaluation support. While PLEs assist learners in assembling various feeds and widgets in a single interface (either manually or by means of learner interaction scripts), in eMUSE the components are chosen by the teacher in the context of a course.

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

- 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
- Summary of each student's involvement, including charts, comparisons with peers, as well as aggregated data
- Preliminary score computed based on the recorded student activity, following teacher-defined criteria.

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

- Configure the course, by setting up the associated social learning scenario and selecting the Web 2.0 tools to be used
- Student management (course enrolment, centralized access to students' accounts on each social media tool, grading

⁸ <http://www.role-widgetstore.eu>

⁹ <https://opensocial.atlassian.net/wiki/display/OSD/Specs>

¹⁰ <http://www.icamp.eu>

¹¹ <http://graasp.epfl.ch/help/tutorials/graaspit.html>

information)

- Collect data on students' activity on the social media tools, search and browse students' actions, configure grading scheme, visualize course statistics, detailed charts of student involvement and comparative evaluation.

From a technical point of view, the integration of the social media tools into the platform was done by means of *mashups*, as reflected also in its name (empowering MashUps for Social E-learning) [32].

To sum up, this third category of Web 2.0-enhanced learning spaces is very heterogeneous, with several distinct approaches: from widgets aggregated in dashboards to social engines, from LMS plugins (as server-side or client-side extensions) to personal learning environments. They all offer the possibility of integrating multiple social media tools in educational platforms, leading to the creation of fully-fledged social learning environments.

6. CONCLUSION

This paper provided an overview of approaches reported in the literature for designing social media-based learning spaces. Three main categories were identified and discussed; to the best of our knowledge, this classification and systematization of the area has not been proposed before. While not attempting to supply an exhaustive list (which would have been impossible due to the breadth and dynamism of the field), a wide range of dedicated educational platforms were inventoried for each category. We also drew upon research conducted by our own team at the University of Craiova, each category of systems featuring also an in-house solution.

Despite the heterogeneous approaches and the distinctive features outlined in the previous sections, several commonalities can be found among these systems. They all provide support for collaborative learning and most of them offer functionalities for both students and teachers. Furthermore, the majority of listed systems are at prototype stage, generally being used in small-scale experimental studies, by the same research team who designed them.

While still far from the popularity and wide-spread adoption of learning management systems, Web 2.0-enhanced learning spaces are definitely on the rise. This is due to two main reasons:

- Increasing adoption rates of social media among students and teachers, both in and out of school contexts [10, 26]
- Rising awareness on the importance played by the pedagogical features and instructional strategies in addition to the technologies [16].

Therefore, the trend is toward the development of dedicated Web 2.0-based learning environments, which incorporate pedagogically valuable features alongside social media tools. Extending the range of available functionalities and encouraging the large-scale use of these platforms are the current directions in the field. More extensive experimental studies will also help uncover the full potential of Web 2.0 for education.

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