# Understanding (the use of) microblogging as a virtual environment for teaching and learning in academic courses

**Gabriela Grosseck[1], Carmen Holotescu[2]**

(1) University of the West Timisoara (2) Politehnica University Timisoara/Timsoft
2-4 Bd Vasile Parvan 300223, Timisoara, ROMANIA
E-mail: (1) ggrosseck@socio.uvt.ro (2) cami@cs.utt.ro

## Abstract

*This paper aims to understand the use of microblogging in higher education as a virtual environment for teaching, learning and research. In this way it identifies and discusses some (structural) features / characteristics of how students consume a course stream through microblogging.*

*The practical part of this study focuses on the way didactic activities associate with the microblogging platform Cirip.eu on the following topics: digital content and resources as course materials, facilitation and teaching methods used, student learning and study strategies, evaluation and assessment of experiences gained during courses, diagnosis of critical situations when using microblogging as a social virtual teaching/learning environment.*

*Based on the results of an online questionnaire and statistical analysis of the activity on the platform, our findings suggest an improvement in the teaching-learning process and an increasing quality of courses in academia with the help of the microblogging technology.*

**Keywords**: Microblogging, Social Learning Environment, Higher Education

## Introduction

In the last years, as many articles and studies have indicated, Web2.0 technologies have been used to support innovative approaches in higher education (Conole and Alevizou, 2010; Hamid, Chang and Kurnia, 2011). Blogs, microblogs, social networks, media sharing sites, social bookmarking, wikis, social aggregation, and virtual worlds are more and more used by students and teachers for communication and collaboration, for sharing resources or for building personal learning environments. As the classic learning management systems (LMS) are considered too inflexible, there are many projects/implementations of integrated platforms, in which the social functionality becomes available inside the LMS, thus speaking about LMS2.0, social LMS, Open Learning Environments or Social Learning Environments (Crosslin, 2010; Dahrendorf, 2010; Mott, 2010; JISC, 2011).

For the microblogging technology which will make the case of this article, the approach was from the perspective of integration the facilities of a LMS within social network, thus the microblogging platform becoming a social LMS.

## Cirip.eu features

Since the spring of 2008 the Romanian social media landscape has a new member through the microblogging platform Cirip.eu, developed by Timsoft, a company specialized in eLearning and mobile applications, under the coordination of the second author. The platform allows posting both text-updates in 140 characters and micro-media notes (such as audio and video clips, presentations and files) to be viewed either by anyone or by a group (public or private). These messages can be

submitted/retrieved/updated through a large variety of applications and devices. Students can participate by means of either computers or mobile devices, which allow an interactive participation even outside the classroom walls (Livingston, 2010). One doesn't necessarily need an Internet connection, being possible to send and receive notes from the platform using a mobile navigator (m.cirip.ro) or via SMS.

Besides the features offered by other educational microblogging platforms, such as Edmodo or Twiducate, Cirip integrates a wide range of Web 2.0 applications and social networks organized around educational resources in order to encourage teachers and students to discover and use them, in this way they become active participants in the process of sharing, organising and generating content, which can be seen as „little OER" (Weller, 2010). Thus, Cirip allows the creation of a personal profile / portfolio including ideas, projects, research, informational resources, multimedia objects created individually or collaboratively. All users' activities are developed in a dynamic and complex manner in a continuous evaluation process by communicating with other members. Also groups and feeds monitoring are supported.

The Cirip.eu interface is available in three different language settings: Romanian, English and German, facilitating an international collaboration, around 10% of the 22000 users being foreigners.

**Cirip as a course environment (Social LMS)**

Each course on the Cirip.eu microblogging platform unfolds in a blended manner, in a private and closed group which requires the approval of the discipline coordinator. Such group is structured in observance of the general elements of a LMS:

**Public presentation part** – The *Description area***.**

**Identifying participants.** A personalized microblog provides the opportunity to set up a profile of a student with photo/avatar, name, other personal information (a description of digital identity - having a blog, with optional note importing, setting the Twitter-to-Cirip or Cirip-to-Twitter access), background, the type of the microblog and then to build up a network of other colleagues or other users / other public groups, livestreaming etc. Students can export their micro-posts as a widget on personal blogs or other sites. They can monitor sites, blogs, or activities on other social networks through RSS feeds or search feeds (using the platform specific feature).

A microblog can be seen as a Personal Learning Zone where the student can keep up to date whith university life stuff, find resources to use and learn from, discuss with peers (but also with specialists, other teachers, other Cirip users') their subjects of interests/hobbies, have fun (play week-end games or join all kind of other „informal" activities from public groups).

**A notice board for up-to-date course information** (dedicated to students and updated by teacher) contains information about the development of the course (calendar, location of sessions etc.), digital content in the form of e-books, e-papers etc. on the syllabus topics, details of pre-requisites and co-requisites, lists of bibliographic references, various announcements (for e.g. how to get help) etc. Groups have an *Announcements* section where moderators can post notes, basic teaching materials, additional resources in a variety of formats (LOM/SCORM or multimedia) and links to outside resources in libraries and on the Internet for the course activities.

**Teachers' section**: add/remove students, post announcements (also with the help of an HTML editor incorporated in the *Group news* part), send notifications to participants by email or SMS, create and conduct polls and quizzes (which can be answered online or by SMS), access internal/external search possibilities; visualizing statistics and representations of the users/groups interaction networks etc.

**Student-teacher communication area**: this is the central part of the course, containing the interaction between students and teachers, also between students. Messages can be sent and received via the web, mobile version (m.cirip.ro), through SMS, instant messaging clients (Yahoo, Jabber), e-mail, Firefox/Chrome extensions, API, desktop and other 3rd party applications; notes

can also be imported from Twitter and RSS feeds. A user can embed multimedia objects in the notes, such as images (flickr, picasa albums), video clips (youtube, vimeo, dotsub), audio (deezer, blip.fm, vocaroo) and (live)video files, live-streaming (qik), presentations (slideshare, voicethread, prezi, photopeach glogster etc.), cognitive visualizations like diagrams or mindmaps (mindmeister, mindomo, spicynodes, diagrammr), files (scribd, Google docs, any online file) etc. The notes can be tagged and posted on groups or on public timeline.

**Administrative section of the platform** for activities like student registration, tracking facilities, import, export, settings, polls and/or widgets. Both the *administrative part, through classical „secretarial" activities* (enrollments are done automatically for public accounts and require approval in the case of courses hosted by closed groups), and *the quality of the methodological guidance* are ensured. The course coordinator disposes of feedback any time, through statistics, tables and graphics regarding when/how much/what and how his/her students learn, which helps him/her in case certain pedagogical remedies on the contents are needed, or in case he/she should trace other directions to follow during the learning process.

## Methodology

### *Research goals*

The generic purpose is that of analyzing the way in which didactical actions associate with the microblogging technology used as a social LMS type of course platform:

- *context and digital resources*: how the course content is presented, both through formal *Announcements* for accessing educational information, and by converting multimedia objects in 140 characters packs as materials-learning tool;
- *the teaching/learning methods used* – identifying the didactical directions suitable for the courses run on microblogging platforms, such as: teaching by questions / discourse / conversations, academic controversy, digital storytelling, micro-lectures, case studies, collaborative projects, problem based learning, teaching by collaboration, learning from events etc., by clear direct examples, within the courses developed by the author both in a formal higher education environment and an informal one (adult, continuous education);
- *students' learning and study strategies*: presenting typical learning activities and methodological suggestions for these; identifying the personal learning styles developed by students and analyzing them etc.
- *evaluation of students*: by using e-portfolios, personal learning environments, learning diaries, but also their *real experiences* during courses (either in a blended or only online manner);
- *diagnosis of critical situations (identification of risks)* when using the microblogging as a study technology.

The research question (for the overall study) is: *whether and how does microblogging succeed as an efficient and flexible social LMS?* And how the quality of the learning experience and learning outcomes could be improved.

## Research methods

The examined population consists of students in several years and forms of study, covering a variety of profiles and specializations from three universities, enrolled in formal courses held in private, closed, blended-mannered groups on the platform, during the academic year 2009-2011.

*Table 1* **Courses demographics**

| **Study level** | | | **Specialization** | | | | **Gender** | |
|---|---|---|---|---|---|---|---|---|
| Under-Graduate | Master | Post-graduate | Social | Political | Technical | Other | F | M |
| 129 | 27 | 15 | 54 | 57 | 48 | 12 | 122 | 49 |
| 171 | | | 171 | | | | 171 | |

Our research has two forms:

• *An online survey applied to students*. The survey was made up of various types of questions (open-ended ones included). We had to confine ourselves to essential questions, not only for obtaining a good response rate, but also to save the time needed for filling out the questionnaire (because it is known that long ones lead to students' giving up the completion or to superficiality from the respondent). It was delivered as an online form through a link posted on the course groups. Students could answer either online, either by mobile phone.

• *The analyze of the message corpus* relating to the courses. The resulting archives were analyzed by using quantitative and qualitative methods offered by the platform, such as various statistics (the number of participants, the most active participants, the number of links posted, the number of digital objects included in the notes, the time period, the method / device used / access etc.); tag clouds (in the course we used some specific hashtags to identify topics of interests); visualizations etc.

In order to evaluate how students consume the course stream we have built a list of primary impact elements in using the microblogging technology as social LMS:

• *Student's attention*. How many students participate (online access through web, mobile devices, 3rd party applications, Twitter or instant messaging). How often and when/from where (during the course, in the morning/evening etc.)? How many messages did they write (the frequency)? And which method they use to post (CiripFox, CiripApi etc.).

• *Shares of content*: How many links, blog posts, photos, videos, audios, comments, presentations, files etc. students shared? How many RSS feeds they follow? In how many public groups do students participated? Which is the taxonomy of the students' intentions? Did they use a specific tag? etc.

• *User-generated content created in a variety of formats*: upload of students' papers / other presentations (own), digital stories-telling etc. (Luzón, 2009).

• *Dissemination of suggested class readings.* Did students manage to identify the trending topics? How many redistributed messages to others? And within what time interval? The temporal dimension is often overlooked by teachers (Ross et al., 2010). Do they curate the content course in a personal manner?

• *Exploring notes vocabulary*. By using the platform facility for generating words clouds for microblogs/groups to analyze the vocabulary of students' notes posted in their academic group, it is important to see the relevance to the course topics and leverage the results for a better learning.

• *Peer-to-peer learning and mentoring* enable students to expose their ideas to peers and construct knowledge and understanding.

• *Mobilization among students* - expanding students' PLNs.

• *Formative assessment*. In order to obtain the students' *feedback* for identifying a number of aspects regarding the use of microblogging in their learning experience, we used Kirkpatrick's e-learning evaluation model:

- The first level „*Learner Reaction"* indicates the extent to which students liked the course and its facilitation (*How did they feel during the course?*) Filling out the questionnaire right after the course can offer important information about the relevance of the objectives, the teacher's ability to deliver the content and to maintain students' interest, the interactivity of exercises, the communication with the teacher, the value perceived etc.
- *Learning Results* measure the level of knowledge and skills / attitudes acquired by the students throughout the course (*Did students learn* anything?) In order to quantify these results, an assessment was proposed as a reflection game to students before and after the courses (i.e. the #stiu tag, „I know" in English), the testing modality being conceived within 140 characters. By analyzing the responses of all participants, the impact of the teaching can thus be determined.

- The third level „*Learning Behavior"* examines whether the students makes use of the new knowledge, both in future courses and in daily life (*Do they apply what they learnt?* Did their behavior change?). A new approach should be idealistic, at least 3-6 months after the courses in order to allow for assessing their retention degree and for empowerment evaluation.
- *Learning Results* measure the impact on the educational process resulting from student performances in a larger context (other universities, other courses, trainings at different levels etc.).

**Data analysis**

Of all the questionnaires distributed, a sample of 171 students resulted after validation. Because there are no significant differences from the point of view of gender, specialization, study level between students from the two universities, we shall not examine separately by the demographical characteristics in table 1. The most important findings are presented below.

Paradoxically, the most suspicious about the role of microblogging in educational activities are not teachers, as we might have expected, but students (replies at the question *Did I enjoy the platform?* with answers given on a 1 to 10 scale: 1=not at all, 10=very much). Thus, by analyzing their microblogs (some of them personal, some educational, seen as e-portfolios or mixed) we noticed that students responded differently to the introduction of the new technology in their curriculum and *encountered five type of learners*:

- *The optimistic* – a small part, who used the platform exceedingly (7%).
- *The fascinated* – who tried to discover the way technology itself functions (and what it is used for – 25%).
- *The hostile* – restricted himself to performing work tasks, any task being seen as an effort, a loss of time (2%);
- *The skeptical* – always wanted to have solid arguments in favor of using such a technology instead of a classical LMS, such as Moodle (2%). Most of the times we received questions like: Why do we have to do this on Cirip? Why is this a new learning environment?
- *The daring* – student who understood that microblogging stimulates didactical activities, by breaking the frameworks of a traditional e-learning education (34%).

Hence the necessity to get familiarized with the environment i.e. to acquire the working method and to possess the working skills through a *pre-instruction session (training)* in order to be able to use the microblogging platform as a LMS for disciplines other than the technical ones.

More than half of the students (56%) assessed with the maximum rating the *pedagogical usability* of the platform, 25% students accept Cirip as an environment for organizing the course preparation (for learning and accomplishing the learning objectives) and 10% think that motivation and interest for using a microblogging technology does not depend however on the computational technology itself, but on the interest in examining more thoroughly the studied discipline supported by Web2.0 technologies. Only 10% qualified negatively the platform, these being among those who used the environment only for accomplishing the course assignments.

In order to measure the skills (Trilling and Fadel, 2009) achieved by students we asked how the microblogging platform helped to acquire new knowledge and ideas. At the question *Did I learn what I needed to, and did I get some new ideas?* 55% of the students said Cirip serves learning purposes, 35% that it helps them acquire and transfer knowledge and only 10% (as a cumulative percentage) that it doesn't facilitate learning.

As for the utility of courses on a microblogging platform (*Did my students learn something during my course?*), in relation to the students' real needs, most of the students (33%) are of opinion that the activities developed are appropriate, but the development of an efficient educational act with the help of this technology implies direct experience and exercises (37%).

26% of the students consider that courses should be improved, supported by simulations and practical accommodation exercises.

Some of the investigated aspects to improve a curriculum structure based on microblogging technology was also the effectiveness of the topics presented during the courses. Thus, half of the students (43%) were satisfied with the course content while 24% were thrilled by the topics included. It is encouraging that only 5% considered the course content technology-dominated, without meeting the pedagogical objectives intended (4 students did not answer).

What we intended was not to present a definite and sterile classification of our students' learning styles, but only to find some landmarks, some useful references for developing new competences and abilities to support the already acquired ones, which should assist the student in finding his/her own learning style. Thus it seems our data indicates that a technology-rich environment leads to a bigger impact. More integrated technologies and applications, more (learning) benefits. Table 2 presents how students appreciate and have used during the courses the special features of the platform, such as embedding multimedia objects in messages, RSS feeds monitoring, advanced searches, visualizations, word clouds, statistics, polls and quizzes, and live video.

*Table 2* **Uses of Cirip features**

| **Web 2.0 applications used by students** | **No.** | **%** |
|---|---|---|
| Photos (flickr, picassa, albums, tinypic, any image or picture with a CC license) | 122 | 72% |
| Videos (youtube, vimeo, dotsub etc.) | 120 | 74% |
| Audio (blipfm, deezer, vocaroo, eOK, trilulilu, any mp3 file) | 74 | 44% |
| Presentations and files (slideshare, voicethread, photopeach, glogster, authorstream, prezi, Microsoft and Google format, Scribd, any online file etc.) | 116 | 69% |
| RSS feeds | 33 | 20% |
| Searching (users, groups, events, text etc.) | 53 | 31% |
| Tagging (word clouds, statistics, visualizations etc.) | 32 | 19% |
| Polls / Quizzes / Surveys | 61 | 36% |
| Live Video / Streaming | 48 | 28% |
| Other | 2 | 1% |

As for the utility of communication with other platform members, half of the students approve that the access to information, without the mediation or the counseling of the coordinator is benefic. Extended learning possibilities, without resorting to the discipline coordinator (by avoiding academic language as well), implies also the presence of those elements which are often overlooked when studying: the social specificity and the cultural context.

An important question for involving peers in user-content creation emphasized that the communicative element is essential. *Were students technologically savvy? Comfortable sharing information, knowledge, best practices in an open forum?* 36% of the students state they use the platform only for accomplishing the course assignments. The time spent on the platform besides performing the educational assignments is 5 percentage points lower for the students who stated they spend around one hour (18% half an hours and 14% almost an hour). By analyzing the access differences for students stating they use Cirip more than an hour (32%), we notice that the attention given to the platform comes from students who have blog (19%) and twitter (20%) accounts.

Given that the use of mobile devices has not been foreseen from the beginning in the curriculum, depending in fact on the students' financial support (not all of them can afford an Internet connection on the mobile phone for consulting educational resources or posting multimedia objects etc.), we had to limit ourselves only to using SMS in order to integrate the educational content in an e-learning environment supported by the microblogging technology.

Thus, the extent to which students are aware of the possibilities of using information/documentation, communication and collaboration on the platform with the help of mobile devices, was aimed at directly through two questions where students assess on a 1-5 scale (1=not important, 5=useful): 46% appreciate as useful monitoring via free SMS, while 19% found as not important this feature.

These initiatives could prove crucial in the context of the „4A" vision: Anywhere, Anytime, by Anyone and Anything, and for becoming aware of the key element in the future of the information society: the *ubiquity of networks*.

**Discussions**

According to R. Gagne's Nine Events of Instruction, proper teaching sequences should be followed in order to achieve the learning objectives. Table 3 contains a model with micro-based training events used by the authors, and concrete examples of activities corresponding to each event of instruction and digital strategy can be found by those interested in a spicynodes mindmap (Figure 1).

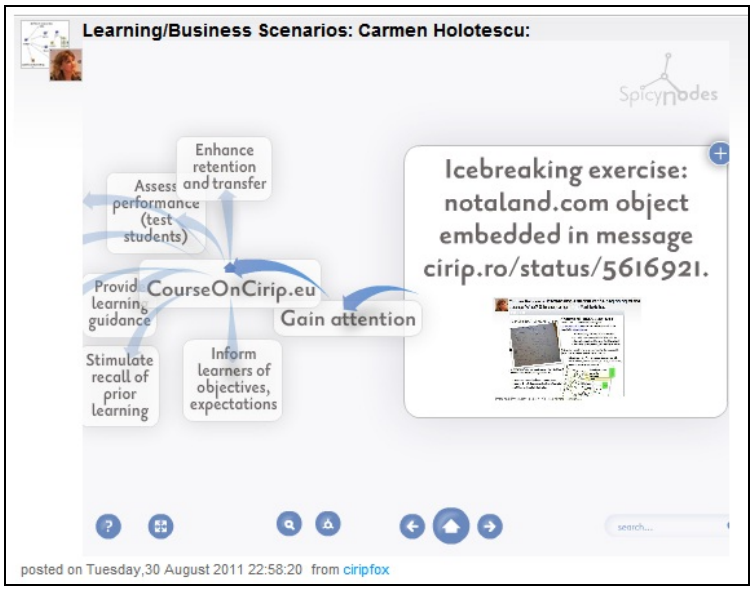


*Figure 1* **Anatomy of a microblogging course as a mindmap, source** http://www.cirip.ro/status/9312507

*Tabel 3* **Anatomy of a microblogging course**

| Event of instruction | Digital strategy |
|---|---|
| Gain attention | It is essential to gain students' interest and curiosity from the beginning. This can be achieved through audio, video, news, animations, questions etc. that will help us understand how students express their (learning) needs (Efron and Winget, 2010). |
| Inform learners of objectives, expectations | Students should be informed about the objectives, expectations, activities, what they will learn and how to get involved in the *Announcements and Materials* section, using multimedia content. |
| Stimulate recall of prior learning | Before starting the course, students are required to complete an assessment of their knowledge (questions or an activity to engage existing knowledge). At the end of the course they are asked again the same assessment, which is compared with that from the beginning. |

| | |
|---|---|
| Present stimulus material | Interactive materials with a variety of (social/Web 2.0) media. |
| Provide learning guidance | Elaborate on presented content by telling (collaborative) digital stories (in 140 characters), explaining examples and non-examples, offering analogies (Gable, 2010) |
| Elicit performance (practice students' skills and knowledge) | Obtaining performance is an important step. The teacher must find questions based on course objectives and to present them as interactive exercises. Asking questions is particularly an important strategy for generating social interaction via microblogs (Efron and Winget, 2010). |
| Provide feedback | Students should be given the correct answers and, if possible, a brief explanation to help shape their behavior to improve performance. |
| Assess performance (test students) | Results can be identified in the profile/e-portfolio of students who develop such initiatives, become self-motivated, flexible, innovative, and realistic, will perform tasks and solve problems, accepting the complexity of life, respecting the diversity of perspectives and viewpoints, and cultivating self-control and desire for lifelong learning. |
| Enhance retention and transfer | Learning content management in university for various programs of study. It provides the means to create and re-use e-content and reduce duplicate development efforts. |

What we have noticed is that the prevailing learning style was the practical one, through active experiment (learning by doing style). The fact that learning units were created through Web2.0 technologies and subsequently encapsulated as multimedia objects both in *Announcements* and as messages posted in the group, the major advantage that the acquisition of experiences occurred through participative methods and practical validations, students themselves testing the new technologies presented.

The key to success in using microblogging as a support technology is the students' motivation – as teachers to become aware of the relationship between the students, the technological environment / platform and his/her learning / education activities. We shouldn't reach the situation when students feel disconcerted.

We also encountered some *limits*:

- *Self-assessment quizzes which cannot be scored automatically* – this feature is not supported by Cirip, but self graded quizzes created with Google Docs and Flubaroo add-on can be easily embedded in messages.
- *Electronic communication* doesn't support a 1:1 private „room" (there are no private, direct messages). Users who want to communicate by private messages should create a dedicated private group with this purpose.
- *Differential access rights* for instructors and students (in a group it would be useful to provide administrative rights for more than one teacher).
- *Production of documentation and statistics* on the course in the format required for institutional administration.

**Final remarks**

Cirip acts both as a microblogging platform and a social network, that engages participatory experiences, collective learning, transform the traditional / blended course learning space in a dynamic, user-centered environment. The student is seen as a participant in the act of learning in a framework with a social structure. For instance, participation in collaborative activities and interactions with other members of the platform are factors that make learning to become a product of participation and collaboration. Figure 2 illustrates a synoptic vision of the various elements used to assist the learning process of the educable in the social environment of Cirip.

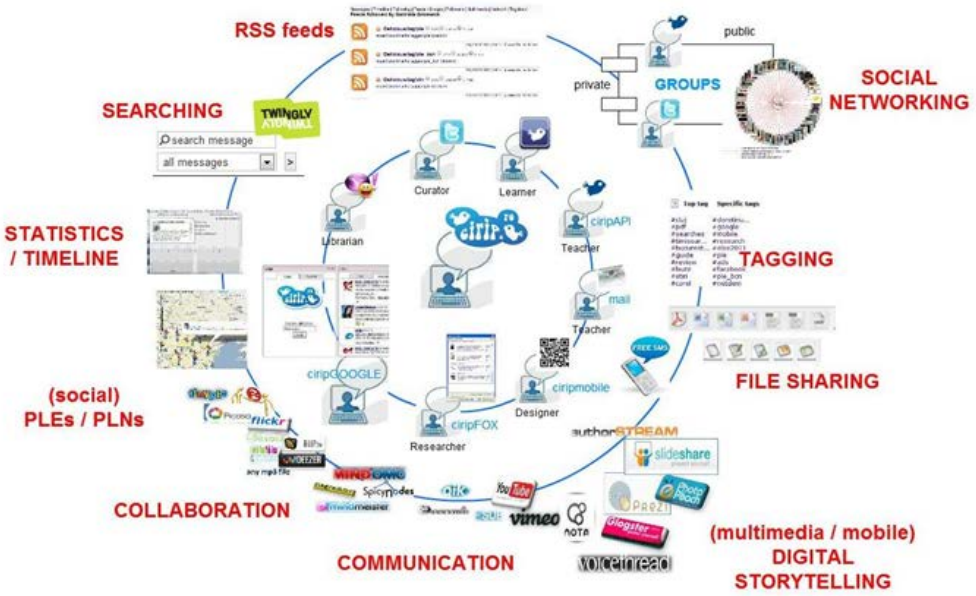


*Figure 2* **Elements of constructing social learning environments on Cirip**

At the end of the course students should know and use social media features in a context or another. But in particular we hope that at the end of a course held on a microblogging platform ubiquity of tools, services, Web2.0 applications has a profound impact on lifelong learning, allowing the establishment of true learning networks and the construction of social PLN. These are networks of people and organizations that create, support and use learning resources.

The authors view the study presented in this paper as a possible solution for developing integrated educational systems based on microblogging, covering both components, learning and evaluation, as an alternative to the institutionally hosted and supported virtual learning environments, having a user generated, activity focus that supports teaching and learning in educational settings. However, we aim at dealing with the various issues raised during the teaching-learning-evaluation process, as follows:

- A preliminary initiation of students is required (and sometimes of the teachers who haves to co-ordinate the platform) – some don't know or fail to implement correctly this technology, while others won't adapt to the new requirements (responsibilization of the teachers).
- Eliminate the effects of incertitude, as in the case of any innovation or change. One of the difficulties is the hierarchisation of knowledge (the difficulty to find and choose the relevant resources to post, to turn information into knowledge).
- Develop a student-centered qualitative model (quality characteristics, measurement indicators, evaluation criteria).
- Elaborate recommendations for applying this technology in higher education environments.

And although we refer explicitly to cirip.eu, conclusions drawn from our study are applicable (can be altered and used on) to other microblogging platforms / services.

**References**

Conole, G. and Alevizou, P. (2010): *A literature review of the use of Web 2.0 tools in Higher Education.* http://tinyurl.com/33ujhfa

Crosslin, M. (2010): *Social Learning Environment Manifesto*. Available at http://tinyurl.com/yed9x9t.

Dahrendorf, D. (2010): *Building Open Learning Environments with OpenSocial*. Available at http://tinyurl.com/3luu5oz.

Efron, M. and Winget, M. (2010): Questions are Content: A Taxonomy of Questions in a Microblogging Environment. Paper presented at *ASIST 2010*, October 22–27, 2010, Pittsburgh, PA, USA.

Gable, S.A. (2010): Anatomy of an eLearning Lesson: Nine Events of Instruction. Blog post retrieved from http://tinyurl.com/3zvz3ce (June 24, 2010).

Hamid, S., Chang, S. and Kurnia, S. (2010): Investigation of the Use and Benefits of Online Social Networking (OSN) in higher education. The 8th Education and Information Systems, Technologies and Applications: EISTA 2010, 29 June – 2 July 2010. Orlando, Florida. http://tinyurl.com/3vfxnp2.

JISC (2011): *Effective Use of Virtual Learning Environments*, http://www.jiscinfonet.ac.uk/InfoKits/effective-use-of-VLEs/index_html.

Keengwe, J. and Kidd, T. (2010): Towards Best Practices in Online Learning and Teaching in Higher Education. *MERLOT Journal of Online Learning and Teaching* Vol. 6, No. 2, June 2010. http://jolt.merlot.org/vol6no2/keengwe_0610.pdf.

Livingston, B. (2010): Using Web 2.0 Technologies. In *Training Technology & E-Learning*. January 2010. Vol. 27 / Issue 1001. ASTD Press.

Luzón, M. J. (2009): Scholarly hyperwriting: The function of links in academic weblogs. *Journal of the American Society for Information Science and Technology*, 60: 75–89.

Mott, J. (2010): Envisioning the Post-LMS Era: The Open Learning Network, *Educause Quarterly* Vol. 33(1), 2010.

Ross, C., Terras, M., Warwick, C. and Welsh, A. (July 7-10, 2010): Pointless Babble or Enabled Backchannel: Conference Use of Twitter by Digital Humanists, Paper presented at *Digital Humanities 2010*, King's College London, Retrieved from http://dh2010.cch.kcl.ac.uk/academic-programme/abstracts/papers/pdf/ab-620.pdf.

Trilling, B. and Fadel, C. (2009): *21st Century Skills: Learning for Life in Our Times*. John Wiley and Sons.

Weller, M. (2010): Big and Little OER. *Open Ed 2010 Proceedings, Barcelona*. Available at http://hdl.handle.net/10609/4851.