

Social Media for Ubiquitous Learning and Adaptive Tutoring

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In recent years, we've witnessed an increase in the number of available social media services, including Facebook, Second Life, Twitter, and WhatsApp. These tools facilitate a more socially connected Web, where everyone can publish content and interact with each other, create online communities, and share multimedia content. We thus have a social and participatory Web, in which users are not just content consumers but also content generators, often in a collaborative manner.

At the same time, with the fast-growing popularity of Massively Open Online Courses (MOOCs), which grew out of the convergence of distance education and the increasing acces-

sibility of the Internet, previously expensive educational resources (such as university lecture videos) can now reach a virtually unlimited number of learners throughout the world. How to best use such educational resources effectively through social media services is becoming an interesting and important topic for learners, tutors, and courseware providers.

Here, we discuss some of the core issues of this topic by examining applicable techniques and relevant works.

Ubiquitous Learning via Social Media Services

The concept of social media is best depicted by examples,¹ including social networking sites, blogs, wikis, social bookmarking services, microblogging tools, media sharing tools, social rating services, social curation tools, Q&A systems, collaborative filters, and social recommenders. The value of a social media service increases as more people start to use it (the network effect). Such services are thus designed to facilitate mass user participation and foster user-generated content. A service then can improve itself by learning from user data.²

Social Media in Education

In the context of rising social media adoption rates in the overall population, a similarly increasing trend is visible in educational settings, as captured in recent studies.³ Indeed, the affordances of social media technologies (including support for user-generated content and the potential for sharing, communication, and collaboration) make them very suitable for education, given that learning is, in many ways, a social activity, and knowledge is created in social contexts.⁴ It is therefore not surprising that 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.⁵

For example, blogs can be used to maintain a learning diary, document progress of a learning activity, create an e-portfolio, publish ideas and interesting findings, ask for help, or receive feedback from peers. Wikis are useful for co-creating content, producing collaboratively edited material, incrementally accumulating and organizing knowledge, and annotating lecture notes published on the wiki. Social bookmarking tools can support the building of resource collections and

their tagging, classification, and sharing with group peers. Microblogging tools can be used for broadcasting opinions and information related to the course, posting updates regarding the project status, and exchanging ideas and comments. Social networking tools provide support for interacting with peers, sharing experiences and ideas, discussing problems encountered during studies, and obtaining peer feedback. Media sharing services are a valuable tool for searching educational resources as well as for publishing resources created by students (learner-generated content).⁵

In an attempt to further exploit this potential for education, many researchers have started to design special-purpose social media tools, enhanced with dedicated learning support features. These features refer to assessment support, learner tracking and monitoring, collaborative learning facilities, and even complex integrated learning environments.^{5,6} Furthermore, social media technologies have started to be used in conjunction with mobile learning technologies.

Social Media for Ubiquitous Learning

Ubiquitous learning means learning anywhere, anytime;⁷ it involves an environment in which “all students have access to a variety of digital devices and services, including computers connected to the Internet and mobile computing devices, whenever and wherever they need them.”⁸ Mobile technologies are enablers of ubiquitous learning, and their proliferation provides ample opportunities to support learning both inside and outside the classroom.⁹ Moreover, the number of mobile apps for supporting learning has greatly increased;¹⁰ students are systematically using their mobile devices to search for information, interact with each other, and create and share content. Thus mobile technologies offer support for “here and now learning,” fostering on-demand, just-in-time, in-situ, and context-aware learning scenarios.⁹

Further support for social learning can be provided by integrating social media technologies. Jari Multisilta and Marcelo Milrad coined the term “mobile social media” to describe the interplay between these two emergent technologies.¹¹ The combination of mobile devices and social media in education is bridging formal and informal, as well as individual and collaborative learning contexts, leading toward seamless learning.¹²

Joanne Gikas and Michael Grant summarized the practical applications of mobile learn-

The main challenge for the teachers is to integrate these new technologies into traditional learning contexts and curricula.

ing in conjunction with social media,¹³ as reported in the literature:

- *Engage learners with constant connectivity.* Using mobile devices with social media apps, students can access educational resources and communicate with peers and teachers from anywhere, at any time. This constant connectivity helps students to remain engaged in learning and receive continuous feedback and guidance.
- *Foster collaborative learning.* Using mobile devices, students can instantly communicate and cooperate with peers, developing a sense of community. Through permanent access to social media, students can co-create and share content, supporting a socio-constructivist approach to learning.
- *Enable authentic learning on the move.* Mobile social media tools let students perform learning tasks in real-world settings, in authentic contexts; they can create and share images, video, or audio from the field, geotag the content, and immediately microblog about it.¹³

In this context, the instructor is no longer “the grand master of knowledge,” but more a facilitator, mentor, and guide; students engage in many-to-many communication, multidirectional mentorship, and a shared process of exploring and discovering knowledge.¹⁴ The main challenge for the teachers is thus to integrate these new technologies into traditional learning contexts and curricula.¹²

Intelligent Tutoring in Adaptive E-Learning

Traditional methods of e-learning are mainly technology oriented, in which the individuality

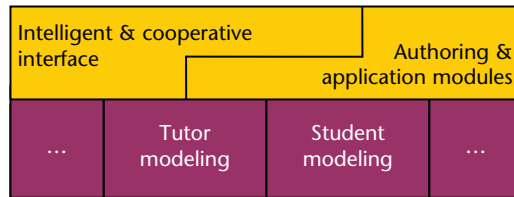


Figure 1. Key components of an intelligent tutoring system (ITS).¹⁶

of the learner is omitted.¹⁵ Intelligent tutoring systems (ITSs) are a generation of learning-oriented systems that include the individuality of the learner in the learning process. Figure 1 shows the reference architecture for ITSs, encompassing several essential modules.¹⁶

Tutor Modeling

For human tutoring, a tutor generally needs to have a comprehensive knowledge of the curriculum and of cognition and tutoring strategies. Similarly, tutor modeling in ITSs should also consist of a few important components, such as mechanisms that modify the tutoring strategies to optimize the learning experience with the student, making the system as adaptive as a good human tutor.

Cognitive theories, or collaborative and social learning theories, are frequently used as the source of tutoring knowledge. These theories mainly include Cognitive Theory,¹⁷ Mastery Learning,¹⁸ Deliberate Practice,¹⁹ and Zone of Proximal Development (ZPD),²⁰ as follows:

- The discipline of cognitive psychology was added to the development of ITSs based on Anderson's theory of human cognition. The intelligent tutors emerging from this approach were called "Cognitive Tutors,"²¹ and the artificial cognitive tutoring agent was defined as an agent built on an architecture that offers structures, features, and functions comparable to the human model.
- The use of mastery learning and deliberate practice teaching strategies can improve learning, and the adoption of deliberate practice is superior to mastery learning in a large course.²² The "tutor-learner" link is explored in these strategies. To facilitate the interaction between the tutor and learners, it is useful for ITSs to incorporate social media services.
- The ZPD is created when two or more people form a collaborative learning partner-

ship in which the more able learners help the less able learners achieve their goals. Because the "learner-learner" link is used in ZPD, and different learners might have some common knowledge about the current problem, an ITS that can adopt the learning partner role can better adapt to the context than other ITSs.

The main functions of tutoring can be modeled according to the cognitivist or constructivist paradigms used and the design of tutoring interactions or dialogues.

Student Modeling

Student models can use topics, misconceptions, student experiences, and stereotypes as student knowledge to encode. Techniques for representing student knowledge are often divided into two categories: cognitive science techniques and artificial intelligence (AI) techniques.²³

Cognitive science techniques include model-tracing and constraint-based methods. The former assumes that students' actions can be presented through rules as student (model) knowledge, and the execution trace of these rules is available for a tutor to infer student states. The constraint-based model assumes that learning cannot be fully recorded and only errors (breaking constraints) can be recognized by a computational system.²³ Some detailed comparisons between the two methods can be found elsewhere.²⁴

Compared to cognitive science methods for modeling student knowledge, artificial intelligence methods can go without any assumption that human learning can be fully modeled. Such AI techniques used for modeling student knowledge most often include Fuzzy Inference and Bayesian networks. For example, Xiangfeng Luo and his colleagues proposed a game-based learning model based on improved Fuzzy Cognitive Maps for better concept representation and reasoning.²⁵ These methods enable intelligent tutors to induce student models, enrich their knowledge, and infer students' learning strategies.

Multimedia-Enabled Social Learning

With the popularity of social media services, individuals are starting to use related technologies to create their own multimedia content and share it with others. These social media technologies can be combined to create a suitable platform for social learning with multimedia

content. Here we focus on two aspects—sharing multimedia content, and annotating and recommending multimedia content.

Sharing Multimedia Content

With the popularity of smart devices, individuals can easily generate multimedia content and share it online. They can participate in knowledge exchange in an asynchronous manner, thus forming Web 2.0. Most blogs contain textual content, but there are also blogs that contain other media content such as videos (vlog) or photos (photoblog). Microblogging sites such as Twitter or Tumblr limit the amount of content posted, but to boost students' concentration and facilitate interaction, Twitter has been used for students to provide answers to the pop quizzes posted during the lectures.²⁶

Wiki is another common example of a Web 2.0 technology. A Web-based collaborative wiki writing tool has been adopted in a history course, using a system known as Classroom-Wiki that supports group formation and tracking of individual students' contributions to facilitate teachers' assessments.²⁷

Some popular websites such as Facebook, Google+, Flickr, Pinterest, and Instagram provide social networking services and let users share multimedia content such as photos and videos. In an introductory Management Information System course, various Facebook features were adopted together with different pedagogic activities to facilitate social learning.²⁸

Annotating and Recommending Multimedia Content

To enable social learning, the acquired multimedia content (often huge in volume) should be searchable such that a learner can quickly find desired information. This means that semantic information should be extracted from the multimedia content to generate the accompanying metadata of use during the searching process. The most direct way to generate the metadata is to let people tag the content with meaningful keywords. However, this can require a lot of manual effort, especially for tagging temporal media such as audios and videos.

Speech-recognition techniques have been applied to generate real-time captions during an online lecture as well as a more accurate transcription synchronized with lecture notes after the lecture.²⁹ In addition, machine-learning techniques have been applied to correct noisy annotated data for multimedia content.³⁰

In an introductory... course, various Facebook features were adopted together with different pedagogic activities to facilitate social learning.

A sophisticated user interface could be designed to support exploratory search such that the content can be navigated according to different criteria.³¹

Relevant topics of interest can also be recommended to the learner based on the learner's own preferences, or the preferences of other users, by analyzing the user attributes and item attributes.³² Sometimes it is necessary to understand the learner's skill to recommend suitable multimedia content. For example, a singing student's voice quality can be evaluated to recommend songs based on the singer's competence.³³

In This Issue

To facilitate the best use of educational resources such as MOOCs, we have discussed some of the core issues of effectively utilizing social media, and we've examined the applicable techniques and relevant works. Now, we present the related articles in this special issue.

The first article, "Social Media Interaction and Analytics for Enhanced Educational Experiences," by Georgios Palaiokrassas, Athanasios Voulodimos, Kleopatra Konstanteli, Nicholas Vretos, David Salama Osborne, Efstathia Chatzi, Petros Daras, and Theodora Varvarigou, presents an innovative system based on social media and high-quality multimedia content delivery designed to enhance the educational experiences of students in cultural centers and museums. In their proposed framework, the multimedia content of a presented movie can be easily reviewed by multiple geographically dispersed individuals. Furthermore, the content can be improved according to the received feedback, thus maximizing the benefit for students, teachers, and content producers alike.

The second article, “Learners Thrive Using Multifaceted Open Social Learner Modeling,” by Lei Shi and Alexandra I. Cristea, introduces multifaceted Open Social Learner Modeling (OSLM) to visualize not only learners’ performances but also their contributions to a learning community. Such a multifaceted OSLM could potentially better cater to social e-learning, where learners are both knowledge consumers and producers. Their experimental study shows that, contrary to previous research, the richness and complexity of this new approach positively affected the learning experience in terms of the effectiveness, efficiency, and satisfaction perceived by the learners.

The next article, “A Computer-Supported Collaborative Learning Design for Quality Interaction,” by Masanori Yamada, Yoshiko Goda, Hideya Matsukawa, Kojiro Hata, and Seisuke Yasunami, investigates relationships among the functional use of computer-supported collaborative learning (CSCL), psychological factors, and learning behaviors related to the application of the Community of Inquiry (CoI) framework, to increase active interaction among learners in both formative and practical evaluation. The results from classroom experiments indicate that the communication tool added functions that support social and cognitive learning and promoted expressive elements of CoI.

Finally, in “Generating Incidental Word Learning Tasks via Topic-Based and Load-Based Profiles,” Haoran Xie, Di Zou, Raymond Y.K. Lau, Fu Lee Wang, and Tak-Lam Wong present a model of incidental word learning to overcome problems in existing e-learning systems, based on intentional word learning. Moreover, they introduce a learner profile construction according to the theory of the Involvement Load Hypothesis—a construct proposed to evaluate the effectiveness of incidental word learning tasks. They verify the effectiveness of their proposed method with experiments on real learners.

We envision social learning being further enhanced through the advancement of multimedia technologies. The sharing of multimedia content might not be limited to photos, audios, and videos; it might also include 3D objects that learners can touch with their hands, thanks to the tactile and 3D acquisition technologies.

Moving from Web 2.0 toward Web 3.0, searching algorithms will evolve to support

input from the learners in multiple formats and perform intelligent analyses to extract important cues and retrieve useful information. Recommender systems will use novel sensors and improved learning algorithms to determine learner interests and preferences and suggest suitable content, further enhancing the social learning experience. **MM**

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