The 3A Interaction Model: Towards Bridging the Gap between Formal and Informal Learning

Sandy El Helou, Na Li, Denis Gillet
Ecole polytechnique fédérale de Lausanne (EPFL)
Lausanne, Switzerland
{first.lastname@epfl.ch}

Abstract—This paper discusses the adoption of bottom-up social software tools in formal learning environments. This is believed to enhance the learning experience of today’s young generation characterized by being technology savvy and keen on social networking. As a first step towards this objective, the 3A interaction model that aims at aiding the design of personal and collaborative learning platforms is presented. It accounts for interaction paradigms widely used in Web 2.0 applications and builds on Distributed Cognition and Activity Theory while remaining at the right level of abstraction to be easily “translatable” into tangible applications supporting both formal and informal learning.

Keywords—collaborative learning; CSCW; CSCL; Web 2.0; interaction model, social software

I. INTRODUCTION

To cope with today’s changing world, learning should be pursued actively throughout life rather than be mainly acquired in early life stages and within standard educational systems. “Lifelong, lifewide, voluntary, and self-motivated” [1] learning has become a necessity to ensure a fast and flexible knowledge and experience transfer and sustain personal and professional development. While formal learning is intentional, occurs within organized and structured context and often leads to a formal recognition (e.g. diploma, certificate), informal learning can rather be considered as accidental learning, as usually it is not intentional, occurs in environments that are not essentially learning-oriented, and is not structured in terms of learning objectives, material, time and support [2].

The Internet plays a very important role in sustaining life long learning. In particular, the role of Web 2.0 social software in supporting informal as well as formal learning is very promising. In fact, unlike traditional LMS (learning management systems), CSCL (computer-supported collaborative learning) and CSCW (computer-supported collaborative work) tools, bottom-up Web 2.0 applications successfully trigger contribution incentives, foster user-generated content and facilitate information dissemination. Their wide acceptability especially among the digital-native generation constitutes a motivation to use it not only for supporting informal but also formal learning. It is believed that its adoption in formal educational and professional institutions will increase the efficiency and effectiveness of the learning experience, especially that it goes hand in hand with the expectations and attitudes of today’s generation “Y”. The latter involves people who were born between 1985 and 1995, characterized by being technology savvy, image-driven, expressive, good at multi-tasking and keen on social networking. Moreover, this generation hardly takes de-facto authorities, hierarchies and monolithic sources of information for granted, and values flat structures, diversity and teamwork [3].

In this paper, we present the 3A interaction model that bridges the gap between traditional formal learning systems and trendy Web 2.0 applications in order to improve the learning experience for Generation Y. It can be considered as ontology for designing personal and collaborative learning platforms. Also it consists of a first step towards building a common “vocabulary” that eases data import/export across different platforms.

The rest of the paper is organized as follows. Section 1 summarizes the relation of the 3A interaction model with existing CSCW theories. Section 2 presents the 3A interaction model and explains how and why it takes into account trendy Web 2.0 features. Section 3 shows how the structure of a formal learning environment, namely Moodle, can be represented and extended using the 3A model. Section 4 discusses related work. Section 5 concludes the paper and discusses future work.

II. RELATION TO EXISTING THEORIES

The 3A interaction model is specifically dedicated for the development of collaborative applications. It is highly influenced by two broader theories adopted in the CSCW literature to understand how studied groups of people interact with each other. They are Activity Theory and Distributed Cognition. On one hand, Activity Theory takes the “activity” as its main unit of analysis. Every activity involves subjects, who use tools to produce and transform objects. The latter carry in them the intention behind the existence and the continuation of the activity. Every activity is positioned in a historical context, and consists of several conscious actions, which should be performed in order to achieve the main goal. With practice, actions themselves turn into quasi-automatic operations. Inversely, operations can become actions requiring a conscious effort [4]. On the other hand, Distributed Cognition tries to understand how cognitive
systems are organized in order to reach cognitive achievements. It claims that the activity of a socio-cultural-technical system can be described by identifying its processes, how they are controlled and how its representational states are created, transformed and propagated. While the first theory has a high rhetorical power because it names its constructs (community, subject, rules, division of labor), the latter focuses on lower level-processes, representational states and their meaning which is particularly significant for designers as it allows them to zoom into the low-level processes of a system. Still, one cannot obtain system requirements directly from those theories [5].

Inspired by Activity Theory, the 3A model is activity-centric and focuses on naming constructs. This facilitates the latter’s manipulation as the model’s discussions between designers, developers and target end-users. The 3A model further increases its descriptive and application power by accounting for how exactly its basic concepts are related. By this, the 3A model also helps in facilitating feedback and closing the gap between researchers from the cognitive science field that study the domain and the collaboration context, the actual designers that translate the analysis into system requirements, and the actual target group that (will) use the system.

The 3A model takes from the Distributed Cognition theory the idea of looking at the general socio-technical context rather than focusing the theory only around the subject itself. This can be best understood in the next section, in which the constituents of the 3A interaction model are described.

III. THE 3A INTERACTION MODEL

The 3A model takes advantage of existing theoretical models while at the same time positioning itself at an adequate formalization level to be able to represent different forms of interactions and still remain easily translatable into an actual individual and collaborative learning environment. Moreover, it is domain independent and explicitly incorporates the bottom-up philosophy of the Web 2.0 realm. In this section, the main constructs of the 3A interaction model, their attributes and inter-relations are described. Then the potential impact of incorporating Web 2.0 features in the model and adopting a flexible lightweight structure rather than a rigid and systematically hierarchical one is discussed.

A. The 3A main constructs

The 3A interaction model consists of three main constructs also referred hereafter as concepts or entities: **Actors** represent entities capable of initiating an event in a collaborative environment. An actor can consist of a human or an agent that send requests on behalf of him/her. For instance, an agent can consist of a doodle widget (http://www.doodle.com/) sending a request to add a date to a shared calendar, or a smart device sending measurements to a group space.

The concept of **Activity** is borrowed from Activity Theory. It is based on the idea that individuals and groups conduct activities in order to achieve their goals. For instance, members of a community of practice (CoP) gather in a main group activity with “sharing good practices” as their chief objective. Each activity is conducted within its dedicated space where actors can have different roles. A role consists of a label and a set of rights, helping members to find their place in the community, and learn how they could contribute to it. As an example, the activity space of the Automatic Control laboratory course given at EPFL involves “students”, “tutors”, “course assistants”, “technical assistants” and “simulation tools” [6]. An application based on the 3A model, should be flexible enough to allow communities spaces to evolve, if required, from a flat structure consisting of only one main activity space, to a more fine-grained structure where the different community interests and projects are subdivided and explicitly mapped into different sub activity spaces.

The concept of **Asset** includes any kind of resource that is produced, transformed, annotated, assessed and shared by actors. In the vocabulary of Activity Theory, it mediates the relation among community members, and between them and their final product. The proposed definition includes textual documents, images, RSS feeds, audio and video files, discussions threads and wiki pages. The figure below summarizes the 3A model, showing its 3 main constructs and examples of what they could consist of. Events are stamped in time and are triggered by actions represented in the model by two acronyms SALT and CRUD. The latter is an acronym used in relational databases or at the user interface level to refer to the four main actions of creating, reading, updating and deleting that could be performed on assets, actors as well as activities. SALT is discussed in details in the next section.

![Figure 1. The 3A interaction model](http://www.doodle.com/)
B. SALT: introducing Web 2.0 features in eLearning

SALT (Share, Assess, Link, Tag) is an acronym for Web 2.0 features that encourage opinion expression and active participation. Actors, activities, and assets of the 3A interaction model can be shared, assessed, linked and tagged. In the following lines, the usage and potential usefulness of these features in learning contexts is discussed.

First, “S” stands for Sharing. The model accounts for different levels of sharing, designed after a careful examination of the different sharing policies adopted in formal learning platforms such as Moodle (http://moodle.org/), and informal social software applications such as Facebook (http://www.facebook.com), Google groups (http://groups.google.com/), LinkedIn (http://www.linkedin.com) and eLgg (http://elgg.org/). The results of interviews conducted within the participatory design of the Palette Project (http://palette.ercim.org/), show that students in the Learn-nett CoP (http://learn-nett.org/) expressed their need for having private spaces where they can interact without feeling that the “teacher” is spying on them. The 3A model follows a bottom-up approach that does not enforce any rigid structure or predefined hierarchy. Hence, there can exist activities with a complete flat structure where all members share equal rights, and there could be top-down hierarchical activity spaces. In addition, a person can be a “guide” or “tutor” in one space and a “learner”, or a simple “member” in another. Just as tutors can create an activity space dedicated for a particular course and governed by specific access rules, students are also entitled to create their own activity spaces, within or outside the course space, and define their own sharing rules. The sharing policies incorporated in the 3A model are described hereafter. To start with, as far as invitees are concerned, any actor can join a public activity space, while only explicitly invited individuals and groups are made aware of private spaces. A group of individuals can consist of members of another activity space or actors related to the space creator by a specific relation such as “colleagues”. With respect to access and participation policies, a survey of existing applications supporting the creation of collaboration spaces leads to the identification of 3 main access and participation policies. In an activity space of type I, all invitees are offered a full view, and are allowed to perform actions without necessarily having to join it. In an activity space of type II, full access is granted to all invites but active participation is restricted to its members only (i.e. those who accept to join it). Last but not least, in an activity space of type III, only a preview is granted to its invitees, while full access and contribution is limited to its actual members. Participation in an activity space consists of performing one or more of the following actions: posting assets, sharing (inviting other members), assessing (rating, commenting, social bookmarking), tagging the activity and relating it to other ones. In the case of an activity space of type I, anyone can do any of these actions, while in the other two cases, only members can do all or a subset of them depending on their role. In addition, two default roles exist for every activity space: Admin and Member. The admin can do all CRUD and SALT actions, while members can only access the activity’s content, assess it, tag it, link it to other activities, and create (post) assets in it. Table I consists of a classification of different platforms according to the taxonomy described above (i.e. depending on the participation and access policies offered and the possibility to have public or private spaces, as far as the intended audience is concerned).

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Type I - Full access &amp; participation allowed to all invitees (Without having to confirm membership)</th>
<th>Type II - Full access for all invitees Participation restricted to members</th>
<th>Type III - Full access &amp; participation restricted to members (May depend on their role)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>Elgg “wire”</td>
<td>Elgg Moodle Google groups</td>
<td>Linkedin</td>
</tr>
<tr>
<td>Private Space</td>
<td>Doodle</td>
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</table>

In the same way, actors can choose to show their profile to a selected list of individuals and groups or to everyone. They can also decide how much profile information to show to each of them and whether to allow them to assess, link and tag it. By default and following usual conventions, everyone is granted a preview of the profile, and only related actors are permitted to access the full profile and be able to assess, link and tag it. As far as assets are concerned, there are 3 different access rights: readership, editorship, and ownerships. Readers, editors and owners can access the asset and do SALT actions. Editors can in addition update the asset and owners can delete it. Any of these three different rights can be granted to everyone (if an asset is public) or to a specific list of individual or groups, as it is the case for spaces and actors.

Second, A stands for “Assessing”. In the realm of Web 2.0, assessment or feedback can either be quantitative (rating or voting) or qualitative (commenting, bookmarking). It consists of an indirect communication mean allowing an actor to express his/her perceived “stickiness factor” of an activity space, an asset and/or another actor. One direct advantage of having such features in a formal learning
environment, is being able to provide collaborative-based recommendation [7] allowing resources, actors and group activities that have been commented, bookmarked and highly rated to be brought to the surface. This is especially motivating for Generation Y that prefers bottom-up and peers opinions to top-down monolithic sources of information. Giving the learner the opportunity to easily express his views, discuss and share his/her learning experience regarding a course activity or a learning resource, leads to a better appropriation of the learning platform as well as the learning materials. Furthermore, these bottom-up classification and expression modes help the tutor assess the course outcome and identify the best resources for reaching the learning objectives based on their usage and evaluation.

Third, “L” stands for Linking or relating resources, actors or group activities. This feature is popular in many Web 2.0 applications: related videos in u-tube (http://www.youtube.com), friends in Facebook colleagues in LinkedIn, related products on eBay (http://www.ebay.com). In formal and informal learning, it helps discover connected assets, actors and group activities.

Last but not least, “T” stands for tagging assets, activities as well as actors. There is a distinction between two different categories of tags. The first one, which is referred to by “content tag” is widely used nowadays. It consists of labeling an entity by describing its content using one or more keyword(s). Compared to the traditional way of classifying files into folders, this is a bottom-up approach of clustering information by labeling them with similar tags. The second category of tags is used to describe the entity type rather than its content. In the case of activities, it allows to identify the activity level that researchers, designers and/or users are considering at any point in time. As an example, a sub-activity conducted within a community can be tagged as a “topic discussion”. In the same way, an asset can consist of a “discussion archive” or a “project deliverable”. Tags can be shared and reused by different actors. Tagging helps learners and tutors easily find relevant resources and/or group activities discussing specific topics of interest using tag-based search and tag clouds. Tagging actors have also proven to be useful in formal contexts. For instance, in a recent IBM study, employees were allowed to tag each other’s profile page [8]. They used this feature to express the competence of a colleague in a specific field, which was not always aligned with the position of that colleague in the company. Finally, sharing tags facilitates the emergence of folksonomy that can be exploited and can evolve easier than top-down domain ontology, helping a community to incrementally build a common vocabulary and externalize its shared memory.

IV. MAPPING A FORMAL LEARNING FRAMEWORK TO THE 3A MODEL

In this section, Moodle is mapped into the 3A model and then a brief description of how it can be extended to take advantage of the 3A model features is presented. The structure of Moodle is composed of user, resource, and different modules for course, group, forum, quiz, feedback and assignment. Users in Moodle are defined as three different roles: teacher, student and guest. Each role owns a certain set of pre-defined access rights to resources. Course is an important module that involves both teachers and students. Students can enroll in the course, access the course content, post in the forum discussions and turn in assignments, while teachers in the course module are able to edit the content of the course, distribute grades and feedback. Guests can only look at the course content and read forum posts. Each course may come with several inside forums. The forums not only allow teachers to post messages to announce administrative information, but also provide a platform for students to coordinate work in groups. Another useful module in Moodle is assignment, which is used to collect students’ exercises, deliverables in project-based courses, reports and other documents produced by the students for an exam. It’s possible for teachers to define several types of assignments for individuals or groups and provide grades as well as comments to them. Students use assignment module to submit files before deadlines. Finally, the quizzes and feedback module is used to check knowledge and collect feedback using questionnaires.

<table>
<thead>
<tr>
<th>TABLE II. MAPPING MOODLE TO 3A MODEL</th>
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<tr>
<td><strong>3A Model</strong></td>
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<tr>
<td><strong>Actor</strong></td>
</tr>
<tr>
<td><strong>Asset</strong></td>
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<tr>
<td><strong>Activity</strong></td>
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<td><strong>Role</strong></td>
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This structure can indeed be mapped into 3A model that is more flexible and general. User in Moodle can be considered in 3A Model as actor who is capable to initiate an event in a collaborative environment. Moodle resource can be simply mapped as asset that doesn’t have to be limited to a text file but can also include RSS feeds, wikis, archived discussions threads, videos and audio files. Furthermore, course, group, forum, quizzes and feedback modules in Moodle can all be seen as group activities of different types created by actors to reach specific objectives. The 3A model allows actors in the activities to have different roles such as « teacher », « student » and « guest » each with a predefined set of rights. As an alternative to creating an assignment module, teachers can add submission dates on the shared activity calendar of the course. The mapping scenario can be like this: a teacher creates a private activity space (of type II) for his/her course. He/She invites his/her students to join the space and take the role « student ». The teacher is able to post course materials because he/she is the only one allowed to post assets in this main course activity space. The teacher also creates a sub-activity space of type « discussion » where students are allowed to post questions and another one where they are expected to post assignments as assets.
Using a platform based on the 3A model, the teacher or tutor can decide him/herself whether to allow and encourage students to post relevant materials in the course space itself, knowing that assets can always be filtered by their owners. He/she can also allow them to tag, link, and rate the different resources. Moreover, students can create their own private or public spaces, where they can share and discuss relevant materials. As discussed in section 3.2, empowering learners by letting them create their own spaces, and incorporating the SALT actions motivates contribution and expression, actively engages them in the learning process and leads to a better appropriation of the learning platform and content.

V. RELATED WORK

The application of social software for formal learning is still in its early phases and has not yet gained in popularity. A previous study [9] aimed at examining the role of social software in education reveals that students often use social software for sharing media files with their friends, but rarely for educational purposes. Another study [10] shows that the most popular medium adopted in formal learning contexts for distant communication is still the email, and that wikis and blogs are not yet widely used. The authors of the studies argue that, for social software to be adopted in education, new learning models and fine-tuned tools with clear added values are needed. As far as educational modeling is concerned, the IMS Learning Design specification is presented in [11]. This model is learner centered and mainly targets interoperability, but it doesn’t account for Web 2.0 features. Mupple is a prototype aiming at facilitating end-user development and achieving semantic interoperability. It is based on a domain-specific language referred to as LISL [12] that allows a learner to associate an action with a particular tool and a corresponding outcome. However, it doesn’t model groups, assets and activities.

VI. CONCLUSION AND FUTURE WORK

This paper presents the 3A model that bridges the gap between formal and informal learning environments. It discusses the advantage of applying the Web 2.0 philosophy in learning, encouraging active contribution, allowing and facilitating the sharing of ideas, opinions, activities and resources. This approach, that is believed to have a strong positive impact on the learning experience, faces several challenges. One such challenge lies in the development of adequate recommender systems that take into account the learner, his/her learning context and goals as well as the reputation of the recommended items at the global and/or local level (i.e. within the learner’s “trusted” networks). This is particularly important in open learning environments where there is no monolithic top-down source of information and where “any” potentially useful contribution is encouraged. Finally, in-lab experiments and longitudinal studies should be performed in order to assess how learners will use the different features offered and how it will affect learning in practice.

REFERENCES