A WEB 2.0 BASED ENVIRONMENT FOR SIMULATION ACTIVITIES IN CONSTRUCTIVIST MEDICAL EDUCATION

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ABSTRACT
The Reflective E-Portfolio (REP) is a collaborative environment developed in the light of Web 2.0, which supports the teaching and learning in constructivist medicine courses. In its first version REP supports educational activities presented through texts created by teachers, this paper presents the evolution of the REP that also supports activities simulated by actors and mannequins. Is presented the use of this environment in a medicine constructive course.

KEYWORDS
WEB 2.0, Learning Virtual Environment, PBL.

1. INTRODUCTION

The medical education encompasses particular features: mainly because a doctor must combine academic knowledge with daily clinical work. The tendency of traditional educational is copy the mindset from experts to students. This can’t fulfill these educational domain requirements [Talbot 2004]. One of the solutions for such limitation is constructivism based educational methodologies, mainly Problem Based Learn (PBL) [Brooks e Brools 1997].

In PBL, knowledge is constructed via interaction of students and environment, during several assimilation and accommodation cycles. This methodology is centered on student groups, and the learning process occurs through practical, integrated and interdisciplinary real-world-based activities. PBL on medical education has the following goals: integrate practice and theory; unleash self-learning; and promote teamwork.

A medicine course based on PBL is normally composed by three main educational activities: Professional Practice (PP), Problem-Situations (PS) and Simulation Stations of Professional Practice (SSPP). The Reflexive E-Portfolio [Santana et al. 2008] is environment that supports the teaching/learning process in constructivist medicine courses and in their first version supported the PS activity. In this paper is presented the second version of this environment that supports the SSPP activity. In the REP implementation were used concepts and tools of WEB 2.0 [O’Reilly 2005].

This paper is organized as follows: section 2 presents a constructivist medicine course and the SSPP activity; section 3 presents Web 2.0 and Education; section 4 presents REP, their components and tools and their evaluation; section 5 compares REP with correlated work; finally, section 6 points some interesting insights and presents the current state of this research.

2. A PBL BASED MEDICINE COURSE

The objective of a constructivist medicine course is from the experiences of real or simulated situations, the students build their own knowledge. These situations are experienced by the students in three main
educational activities: Professional Practice (PP), Problem-Situations (PS) and Simulation Stations of Professional Practice (SSPP) [Varga et al. 2008].

The PP activity is realized in real scenarios of professional practice. In this activity the students participate of Family Health Care Units and are accompanied by teachers and health care professionals linked to health services in which the activities are developed. The PS and SSPP are realized inside the university. In the PS the triggers of the discussions are paper problem-situations, selected by the teachers. In the PPSS from a simulated situation, with a simulated patient, the student produces a content that can be a narrative, clinical history or a patient evaluation and this content is used after as the trigger of the discussion.

3. EDUCATION AND WEB 2.0

Web 2.0 was coined by Tim O’Reilly in order to describe a new generation of applications and services based on Web. As per his definition, Web 2.0 is a shift to Internet as a platform, where applications are improved by the network effect, as far as more people use it [O’Reilly 2005]. In another paper, Tim O’Reilly, stats four rules of a Web 2.0 application [O’Reilly 2006]: a) the software is no longer an artifact, but a commitment from developers to users; b) application data and services should be reused by others applications, and this applications should reuse data and services from other applications whenever possible; c) the applications are not on the client or server, but in the cloud between them; d) in a network environment, open APIs and protocols standards mature; e) data is the most important competitive advantage.

Last rule represents the greatest impact of Web 2.0 and refers to User-Generated Content (UGC) [Koskinen 2003]. UGC has emerged from Web technologies evolution, which not only increased information consumption, but also unleashed expression of non-technical people. UGC is present in comments, forums, mailing lists, blogs, social networks, and collaborative sites as Wikipedia. Web 2.0, enables consumers use available tools (e.g., websites, blogs, email, messaging, cell phones) to disclose, especially, their personal experiences and opinions on products, services, brands, and companies. So, how did word-of-mouth, the UGC tends to have a greater influence over other consumers than traditional media, because tends to more credibility. If used on education, this two-way communication environment will empower traditional methodologies, as its activities migrates from physical place and predefined schedule, to a ubiquitous presence. Collaborative environments facilitate knowledge construction, changing the traditional paradigm of education where students are merely consumers of knowledge presented by teachers.

Web 2.0’s definitions greatly resemble the definition of Constructivism, a conception of knowledge and learning, derived from the genetic epistemology of Jean Piaget [Piaget 1977] and socio-historical research of Lev Vygotsky [Vygotsky 1984]. The main idea is that knowledge is built during individual's interaction with the physical and social environment, by virtue of their action and not by any prior appropriation. In education, this theory includes other trends which have in common dissatisfaction with an educational system that is to repeat, recite, learn, teach what is already done, rather than to act, operate, build, build from the reality experienced by students and teachers [Rego 1984]. These include the knowledge does not translate to attain the absolute truth, but a matter of adapting the organism to its environment. Thus, the subject of knowledge is constantly shaping their actions and conceptual operations based on their experiences. One of the constructivist educational methodologies more used on medical courses is PBL in which learning becomes student-centered, leaving the role of passive recipient to the agent and principal in charge of your learning.

Traditionally, when constructivism is applied to education the main educational tool is called Portfolio. Portfolio collects work done by the student, who can track their development, analyze, evaluate, perform and display products resulting from the activities developed in a given period. Table 1 compares Constructivist and PBL, with Web 2.0, trying to match their similarities and dissimilarities.

<table>
<thead>
<tr>
<th>Constructivist/PBL</th>
<th>Web 2.0</th>
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<td>Groups</td>
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<td>Knowledge Sharing</td>
<td>Network effect</td>
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<td>Real word expirences</td>
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<td>Paper-based</td>
<td>Computer-based</td>
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4. REFLEXIVE E-PORTFOLIO

The Reflexive E-Portfolio combines the concepts of Web 2.0 with the concepts of the constructivism, not just to substitutes the traditional portfolios, whose the media is the paper, but with the intention to increase the collaboration between those involved in the process of teaching and learning. The main element of REP organization is the groups. How is presented in Figure 1, the REP interface was projected to maintain, as is possible, the contact between the participants of a group. Note that the figure pictures of students and professors were taken off.

Figure 1. REP Group.

Currently the REP supports the Problem-Situation and Simulation Stations activities of constructivists medicine courses, in this paper are presented the components and tools developed, highlighting what was developed in the first version and what was developed in the second version.

4.1. REP Components

Figure 2 illustrates the components developed to the REP. The components represented in white were developed in the first version of the environment and don’t suffered any change in the second version, the components represented in blue were developed in the first version, but suffered modification in the development of the second version, and the components represented in yellow were developed in the new version of the environment.

The components of the REP first version are: PersonManager that manages the user authentication, their commitments and their access to the groups and have their services available through the interfaces IPersonManager. GroupManager that presents the users through the provide interface for the PersonManager and have their services available through the interface IGroupManager. Communication, used by the GroupManager to facilitates the interaction between the users. EvaluationManager, used by the GroupManager, to allow the groups, peoples and documents be evaluated.

The components of the REP first version, but modified in this new version are: DocumentManager, that stores the documents like reports, articles, annotations and researches made by the users.
Information Retrieval that helps the documents retrieval considering their subject expressed by key words in natural language and the user context.

The components added in this REP new version are: FileManager, which stores the archives sent to the server, these files can be videos or audio of the simulations made by the students. SimulationManager that manages the information concerning the simulations like, date, context and evaluations.

4.2. Tools of REP First Version

The Web 2.0 tools developed in the first version of the REP, are:

a) PEG: consists of a social network (in Portuguese PEG stands for Electronic Portfolio Group) which allows knowledge sharing of created by small groups. The social networks are now situated mainly on the Internet disseminating a broad way of ideas and grouping people around common ideas (e.g., political, social, economic, psychological). The purpose of PEG is reuse knowledge developed by one group to increase the cognitive ability of other groups working in parallel on the same problems or to groups that later they can learn through this knowledge.

b) Blog-based tool: facilitates knowledge publishing inside a group, on the same extent of the blogs [Rollett et al. 2007]. Figure 3, illustrates a content been created with the support of Asynchronous Javascript And XML (AJAX) technologies. The REP content is enriched with hyperlinks, colors, tables and images. According to Tim O’Realy’s forth rule, since this tool is part on the client (e.g., text edition, image insertion), part on server (e.g., storage, retrieval).

c) Wiki-based tool: allows for collaborative creation of enriched content by adding links, colors, tables and images. Thus, this tool can be considered a Wiki, which are collections of Web pages that can be created, changed and viewed by any authorized user. On the Internet, these pages are mainly represented by Wikipedia [Guth 2007], an online encyclopedia written by its own readers.

d) Tagging and Folksonomy: as presented in Figure 3, this tool links tags and contents, facilitating classification and retrieval. Tagging and Folksonomy used on several sites, for instance: del.icio.us on content recommendation, and Flickr on photography publishing and sharing. Folksonomy, are specialized taxonomies, created by their users [Sinclair e Cardew-Hall 2008]. In traditional taxonomy, categories are first created, them each subject is related on one of its terms. Through the tags, user organizes, analyzes and shares knowledge related to a folksonomy. Each REP’s content can be tagged, and then be retrieved using these tags. Figure 3 presents the results of a search based on tags, and also a tag cloud [Kuo et al. 2007] designed to facilitate access and visualization of issues relevant to the learning process at any given time. The more frequently a word was used as a tag, the bigger will be the size of the cloud.

4.3. Tools of REP Second Version

The Web 2.0 tools developed in the second version of the REP are:

a) Video and Audio: on health courses, practical procedures and guidelines are very important. REP offers a YouTube based-tool allows recording and publishing video and audio into a group. As shown in Figure 4,
this content can be viewed in the application or be downloaded. Such tool aims to enhance the student capacity of reflecting and learning from their experiences.

![Figure 4. Video Tool.](image)

b) Extension of the Blog-Based Tool: the blog-based tool was extended to facilitate the insertion of data in the Simulation Station. For this, were created specific kinds of contents, like, Clinical Story, Exams, so, is already available to the user a default form that facilitates the data insertion.

c) Alerts Systems: through a Really Simple Syndication (RSS) [Cold 2006], this tool warns the participants of a group when a new content is made available in the REP. This tool is used in the SP and ESPP activities.

d) Sharing data with other educational application: REP was developed to exchange information with other educational environments. The current version uses Web Services to receive academic information of students and teachers (e.g., names, grades, year, period), and send information about.

The first and the second version of the REP were developed using Java Enterprise Edition (JavaEE) platform, and the Model-View-Controller (MVC). Layer model (Model) is based on Java Persistence API (JPA). Layer View (View) uses the frameworks Java Server Faces (JSF) and Rich Faces. An instance of the REP is available for review at http://pre.dc.ufscar.br.

4.4. Evaluation

REP was evaluated in Medical graduation course of Federal University of São Carlos (UFSCar). This course uses PBL as the main educational methodology. Basically, practical problems, written by teachers, trigger the process and allow for construction of knowledge in protected scenarios. This process is always developed in weekly sessions involving small groups of students under the supervision of facilitators. To record information built (e.g., annotations, researches, reflections) REP was used as the main instrument.

The current version of the environment was used by a regular group of second year, consisting of a facilitator and 8 students, during the first semester of 2009. Figure 5 presents REP in action.

![Figure 5. REP in Action.](image)
At the end of experiment, a questionnaire was used to discover student perceptions, advantages and disadvantages in use of environment. Since there were not found specific questionnaires for evaluation of environments with characteristics of REP, the authors developed a version comprised four Linkert based questions [Likert 1932], two ranking, and one open question.

Figure 6 plots the statement “The technology use facilitates the teaching and learning process on a medical course”. 71.4% completely agree, while 28.5% agree partially with the phrase.

Figure 7 plots the results for the statement “REP impairs my group activity”. 42.8% believe REP facilitates their activities, 28.5% REP facilitates partially their activities, and to 28.5% REP impaired partially the group activities.

Figure 8 presents the affirmation “REP impaired my individual activities”. 28.5% understood that REP facilitates the activities, 42.8% believes that REP improved partially their activities, and 28.5% REP impaired partially their activities.

Figure 9 plots results for “REP will facilitate the process of teaching and learning when it gets improved”. 57.1% are sure that REP will improve this process, 42.8% believes REP can facilitates the same process.

These charts show that the perception is that despite the problems REP beneficial to the process of teaching and learning, but still room for improvement. From the results, some points must be highlighted:

a) Those involved with the experiments showed (statement 1) that do not have prejudices against the use of technology, this represents a potential bias, since a larger population probably would be a representative group skeptical on technology;

b) The problems in REP were noticed mainly by the group rather than individually (statements 2 and 3), which suggests that collaborative tools needs more attention to become more intuitive;

c) Even with the problems identified in the REP, users have the perception (statement 4) that the REP will benefit the process of teaching and learning;
d) In relation to the benefits, even though the “facility during studies” was expected as an important result, the main objective of REP is to facilitate collaboration between students. Thus, this can be considered a limitation of current version of REP.

e) The biggest problem found was the connection to the Internet, since servers were not properly estimated in order to ensure the required availability for this type of application. It was expected that equipment provision on the table would be named as one of the biggest problems in the experiment. However it was pointed out as the smallest problem among those presented.

From these results research efforts were refocused on suitability of software, postponing the studies related to physical education environment.

Figure 10. REP’s advantages

Figure 11. REP’s disadvantages

5. CORRELATED WORKS

Gillet work’s [Gillet and Helou 2008] introduced eLogbook Web 2.0, social software which the purpose is support practical group learning, and be customized by users for managing tasks and facilitate their interaction. The eLogbook also has scenarios to support the interaction between laboratories or self-organized teams, which are integrates both actors (e.g., students, teachers) and non-human actors (e.g., equipment and staff software). In relation to this work the REP has in common the organization self-organized team, but these teams are formed only by human actors. In addition, the REP has advantages such as providing tools for editing of individual and shared content, and the facilities for content recovery.

The work of Tijerino [Lockyer and Patterson 2008] presents academic support system, which aims to overcome cultural and communication barriers, providing collaboration and exchange of scholarly materials in Japanese institutions. This system, called Academixer Juice, offers user interaction through a set of features including: self-organized groups, sharing resources, academic and personal assistants for semantic content annotation. The recorded content is made available to software agents through the ontology-based Learning Object Meta-data (LOM). In relation to this work, REP has the advantage of shared editing of content and integration with other academic environments.

6. CONCLUSIONS

This paper presented the REP extension to support simulation activities. REP is a collaborative environment, which supports the teaching/learning process on Constructivist Medical courses. This environment have the following Web 2.0’s tools: (a) social network, which creates a virtual environment for teachers and students interaction; (b) creation tools based on Blogs and Wikis, which facilitates collaborative content development and publishing (c) store and retrieval tools based on tags and folksonomy, which offers a indexing based on the knowledge of students, avoiding the necessity of the students fits on a pre-structured knowledge
classification; (d) video and audio publish tools, enhancing the knowledge reflection; (e) information sharing with other academic applications via Web Services; and (f) a alert service, based on a RSS Feed.

REP was evaluated during first half of 2009. Through a questionnaire it was found that individual perception is that a collaborative environment can be beneficial to the learning process and that the main drawbacks in the implementation of the ERP are technical in nature, that must be resolved in future releases.

As future work, we can mention: the creation of an ontology-based medical terms to facilitate the search for content, thus linking this ontology to the existing folksonomy; assessment of usability of the interface of the REP; and quantitatively determine what is the gain in performance caused by the use of the REP in the teaching and learning (e.g., increased academic performance, reducing the number of failures). From the IT perspective, transform REP into a framework, enabling the results of this research been reused in any way to use constructivist methods in their teaching and learning.

REFERENCES

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