

“FQ em rede” and “e-lab”

Openning the school laboratories

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Abstract — This paper is a reflection on the potential of learning communities in the Web 2.0 in terms of learning (formal and informal) for young people. Specifically, it focuses on the integration of real remote laboratories like “e-lab.ist.eu” in the community of students and teachers of secondary education - “FQ em rede” and how it can expand and flatten the school frontiers, in particular those of laboratories. It generates new opportunities for involvement and new learning around the experimental activities provided by the remotely controlled laboratories, such as “e-lab”.

Keywords- FQ em rede, remote laboratory, e-lab, learning communities, Physics, Chemistry, Web 2.0, Open Educational Resources

I. INTRODUCTION

The context of learning has fundamentally changed with Web 2.0 technologies. The ease of communication and interaction between people are at its heart. The fostering of online networks and communities provide learning opportunities until today never envisioned, outside the control of institutions.

Today, young people live blended lives (offline / online), on networks. Depending on the nature of connections made, they'll have different learning experiences

The school creates opportunities for formal and designed learning, such as attending classes, develop and present papers/projects, performing all sorts of tests and experimental practices or activities. However, there are many studies that indicate that most of the personal learning doesn't come from formal activities, but happens in a haphazard way, even accidental, unexpected and indirect by interaction with others. Often, the subject has no notion that he is learning something or putting it just into practice. We learn through conversations, observing others (in this respect teachers have a responsibility to be good models in terms of their practices in the domains they teach), trial and error or simply working with people with related interests and activities.

“Formal learning takes place in classrooms; informal learning happens in learnscapes, that is, a learning ecology. It's learning without border” [1].

The networks give youth the opportunity to pursue their interests and engage in conversations or activities relevant to the personal point of view. It's not something one chooses, decides or determines for them: they get involved and participate because they want, developing learning that come from that interaction (tacit or explicit).

This is informal learning, the most significant piece of individual knowledge. The emergency of networks has allowed communication and interaction in a way never before envisioned. In them lies a huge potential for learning, because knowledge is distributed through a network of minds and objects; there is no need to waste time reinventing the wheel. We learn from others and not alone. It is important to stimulate optimal quality of personal networks of learning and use these connections to participate successfully in life, at work and in groups that are important from the individual point of view. In this respect, Web 2.0 offers a multitude of opportunities for involvement, without the pressure of formality conveyed by institutions that decide in advance what should be learned by all. School is important for young people and it must continue to be a minds privileged meeting and engagement place. However the school isn't and should not be the only and perhaps not the most important place to access knowledge.

Cross [1] makes the following analogy about formal and informal learning: a bus ride can be useful to start exploring an unknown city. But we can only expect to visit points of interest decided by the driver. The same process happens at school, with the formal learning being in advance structured and decided. However, once acquired the city plan, passengers can choose where to go, even by bicycle. They can stop where they want, which views to admire, their speed and route. The same happens when the learner gains some maturity at school and, on their own initiative, starts to assume responsibility for their learning. They began to create their own learning network based on private contacts, websites, objects and events in which they rely for support, to provide and receive help from others.

The present paper uses these reflections to try to understand this continuum that exists between formal and informal learning, the former taking place in schools and the second taking place in real life.

II. THE "FQ EM REDE" COMMUNITY

The "FQ em rede" is a learning community dedicated to the discussion and sharing of content around Physics and Chemistry. It is intended mainly for students and teachers in secondary education level. But, among its members are also university students and other people interested in science. Therefore, the "FQ em rede" tends to be constituted as a science community, that provides learning experiences which, by its informal nature, tends to become also life experiences, not confining the school to the classroom and especially the science to classroom.

For our purposes, learning is understood in the connectivist sense of the term, "(...) *learning is defined as the creation of new connections and patterns as well as the ability to manoeuvre around existing networks/patterns*" [2].

That is, learning as a process of recognizing useful patterns of interaction and communication in different ways and in different contexts, about scientific and technological content.

It is crucial to explain where it is important to be connected and where it isn't. The sources of information have to be credible and easy to find but the networking among students have to be encouraged having in mind their self-organization. It is also important to know how to use resources created by others in our own advantage (for example, to be able to use resources created by universities or research centers of reference in the classroom). All these possibilities give priority to connections, whose value lies in being linked to certain persons or entities. The links diversity and quality is very valuable.

However, such an unstructured setting as the one of a digital network, presents several dangers, like "(...) *noise and diffusion*" [4]. So it requires a lot of self-direction on the part of learners and "(...) *the ability to distinguish between significance and noise*" [4]. The mastery of these skills is demanding for young people. It's here that communities work plays an important role.

"Learning occurs in communities, where the practice of learning is the participation in the community. A learning activity is, in essence, a conversation undertaken between the learner and other members of the community. This conversation, in the web 2.0 era, consists not only of words but of images, video, multimedia and more. This conversation forms a rich tapestry of resources, dynamic and interconnected, created not only by experts but by all members of the community, including learners" [3].

In terms of education, this perspective brings education out of the classroom, points to several groups and locations where learning takes place and offers educational experiences that integrate technology and pedagogy.

Under this perspective, by opposition to networks, communities tend to be safe places where learners can build

and sustain a learning partnership related to a common domain [4]. This underlies a collective intention, a strong sense of trust and commitment the members side.

"The key characteristic is the blending of individual and collective learning in the development of a shared practice. The learning value of community derives from the ability to develop a collective intention to advance learning in a domain. This shared commitment to a domain and to the group of people who care about it is a learning resource. It tends to make information flows relevant" [4].

To make things going one in a community, several roles need to be played by their core members (teachers / specialists of the domain). Being the most prominent i) a community convener (speaks for the significance of the domain), (ii) a community facilitator (that focuses on social and learning processes and activities within the community) and (iii) technology assistance (focuses on all the technologies and practices around technology that are needed to bring people together).

Back to "FQ em rede", participation in this community is founded on the development of skills, attitudes and values that are envisaged for secondary education in the field of science and are realized in the general objectives of the national program of Physics and Chemistry A, in particular:

- Acquire and understand physical and chemical concepts and their interconnection, laws and theories.
- Develop capacity for teamwork: confrontation of ideas, clarification of views, arguments and counter arguments in solving tasks (in order to increase and improve knowledge in Physics and Chemistry).
- Develop capacity for communicating ideas orally and in writing (using as support the Information and Communication Technologies - ICT).
- Develop the enjoyment for learning.

Students will face in the future similar networking and collaborative environments in their lives as adult citizens according to their academic and/or professional circumstances. Those environments will contribute to increase their scientific and digital literacy and develop the ability to be learners throughout life.

The understanding of "scientific literacy" is both in terms of (i) development and acquisition of substantive knowledge in the areas of Physics and Chemistry (Science Education), (ii) reflection on questions about the nature and processes of science and its social consequences (Education on Science) and (iii) the contribution to the cultural and civic education of the student (for Science Education).

Those members are volunteers and shall use the space only if they recognize the interest to their formation, somehow feeling it will meet their needs. In addition, it hasn't any associated evaluation. The reward is what you learn and the relationships mutually established. Learning by a desire to learn in an authentic context, where the issues under discussion are taken without time constraints and with the guidance or

help from experts who work, study and investigate about the topics.

To sustain a pattern of activity that allow the above purposes, the "FQ em rede", Web 2.0 community for Physics and Chemistry, operates on Ning platform. It incorporate various functionalities to permit multiple online points of interaction, communication and sharing of content. From the author's point of view, this can facilitate and motivate learning about science through (i) video, (ii) photos, (iii) chat, (iv) discussion forum, (v) themed discussion groups, which may be around several criteria, (vi) blogs, (vii) RSS support, (viii) profiles of individual members, (ix) email notification and (x) dissemination of messages to the whole community plus the ability to integrate a number of third-party applications. Being an open community it has however a moderation capability that aims primarily at preventing spam.

It is worth to say that the motor of this community are the people and not the technology behind. As Downes says "*online learning is not about pushing content - it's about Engaging, interacting, doing*" [5]. Therefore, the value of this community does not lie in diversity and potential of technologies embedded, but more in its human capital and the willingness and ability of each member to interact around their personal goals and objectives.

III. INTEGRATION OF "E-LAB" IN "FQ EM REDE"

By adding "e-lab" in the "FQ em rede" the community gain distinction, in terms of offering innovative and interactive science features because "e-lab" operate at the school frontiers bringing a new Web 2.0 object among several already offered by the network.

"e-lab" puts the experimental work at home, on the street, at the cafe, wherever one wants opening the possibility to collaborate, interact and connect around real experiences remotely controlled. This is not to replace laboratory work, but rather to expand and supplement this activity. Similarly, it should be noted that the "e-lab" is not based on traditional computer simulations, but on actual events, observed by video in real time, whose experimental conditions are possible to control at distance. This control and data acquisition is done from any computer with internet connection, simply have installed a media player (VLC media player or QuickTime media player and Java Web Start).

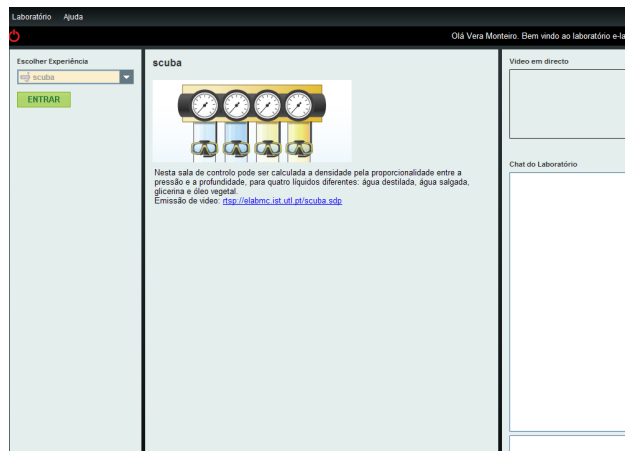


Figure 1. snapshot of "e-lab" software³

Gender [6] lists several advantages that currently are associated with scientific simulations:

- Multiple representations of the problem: photos, graphs, words, equations, diagrams, data tables, maps, etc.
- Visualization of theoretical concepts in concrete situations.
- Place the student in control exploration of phenomena and scientific concepts.
- Help to discover mathematical relationships between the measures carried out, leading to generalizations in the form of equations and physical laws.
- Can be vehicles for collaboration.
- May allow investigation of phenomena which, for various reasons, could not be performed in the classroom or school laboratory.

Although "e-lab" is much more than a simulation because it brings the value of a real event it shares most of these advantages. In the context of this topic, we will focus on the distinguishing and innovative characteristic of "e-lab" as a vehicle for collaboration and communication. Or rather as a laboratory that makes use of Web 2.0 as a platform to interconnect the minds and facilitate the exchange of ideas, insights and issues among students and teachers or other experts.

By integrating the capabilities of Web 2.0, through (i) the chat in the "e-lab" software, itself, (ii) the associated communities ("FQ em rede", on Ning platform and DGIDC, on Moodle) and (iii) Openmeetings, via videoconference, "e-lab" makes use of technology not only as a mere repository of educational content and local educational activities but mainly as providing learning spaces, where users can exercise their mental capacities through challenging experiences involving or not other people.

³ Retrieved from <http://elab.ist.utl.pt/rec.am/Login.faces>



Figure 2. snapshot of “FQ em rede”, highlighting “e-lab” discussion group^b

The “e-lab” chat allows to overcome the distances and sustain conversations in real time as if the players were in the same room. The associated communities allow to diversify and extend the network of contacts associated with each experience. Those open discussion forums around each activity make it a collaborative experience not constrained by the classroom space and time. This feature brings a more personalized and interactive experience relying on a credible network that share and speaks the same user language (with people with expertise to assist in whatever is needed), either for the quality and quantity of resources that are likely associated with the conversations generated this way.

By communicating and putting in writing their observations and understandings users are also organizing and systematizing their ideas and become more mentally agile because they have to analyze and develop arguments (as opposed to having to memorize them).

"e-lab" allows multiple spaces for interaction and multiple forms of data representation and analysis. This is potentially enriching and generates new knowledge. Part of learning process relies (i) in the tutorials exploration, (ii) the on-line obtained resources and (iii) the content produced and granted from the experiment. The learning process in this context is merely the excuse for an experience of connection and collaboration/cooperation among peers based on a distributed human network, through which knowledge is accessed. Knowing how to access it and bring it together to solve problems in more or less complex situations is an essential skill for the future. This is the philosophy of Web 2.0, the personalized web of the new era of social relationships and communication between people. Those communities build that journey track, keeping alive the produced materials to be shared with others or newcomer members.

The rule and the purposes of these activities are therefore not memorize formulas or mathematical equations, but instead using techniques and procedures in order to develop and integrate communication capabilities and linkages to specific nodes. Those abilities are essential to personal, social and professional life (present and future) of active citizens, able to engage in more or less complex problem solving.

In this context, adults, especially teachers, have a crucial role as more experienced and mature models, to exemplify best practices to be pursued by students like (i) collaboration, (ii) participation, (iii) communication, (iv) use of critical thinking and (v) inquiry. Those students observe and then should have the opportunity and time to experiment and practice. People learn by doing, in this case by connecting themselves to sites of interest and knowing how to interact and engage around their needs and availability. This requires a lot of autonomy, a good network of contacts, communication and collaboration skills.

A conservative school, centered around educational content is inadequate in face of the contemporary reality. We must rethink it in terms of its spatial, temporal and curriculum organization. We must rethink (and not just mask) practices. For this we need to bet and invest in new ways of training teachers, bet on their engagement with universities and research centers to update their practices.

We might take people to the Internet, but we can't force them to participate. The spaces provide and facilitate the interaction but they do not ensure by themselves learning. The experience is as rich as the users are willing to engage.

In order to validate (or not) these assumptions and exploit the mentioned possibilities, it's necessary further research, such as case-studies. These need to include both formal and informal scenarios. Having this in mind, there are scheduled, for 2011/2012 school year, two studies about the use of e-lab in formal and informal settings. The former, will consists of previously scheduled classroom events around a experience available at “e-lab”. it will try to assess (i) if that's useful for teacher work and for students learning, (ii) if makes sense to use e-lab as alternative to some school lab experiments and (iii) identify the difficulties that students and teachers face when using “e-lab”. The latter addresses the use of previously scheduled videoconference, for “FQ em rede” members, which volunteer to attend the meeting and to learn about an experiment at “e-lab”. These events will take place once each school trimester, and users are volunteers, amongst teacher and students. The activity (conversations and discussion forums) generated through these events, as well as other kind of analytical data (number of participants, statistics of access to “FQ em rede” website, quality and quantity of content generated, shared resources and online query), will be subject to careful surveillance and research. The goal is to obtain detailed insights about (i) the use of remote-labs as facilitators of learning about scientific events, (ii) the factors that constrains its use and (iii) the role of teachers / other specialists as moderators/ facilitators in this kind of activity and the one of students as autonomous learners.

Finally, another crucial and distinctive aspect of "e-lab" associated to the community "FQ em rede" is that these are located in the emerging category of Open Educational Resources (OER), production and distribution of free access educational materials, presented as the (desirable) trend in future education. By reducing the overhead created by reliance on commercially published content and exploiting the potential of co-facilitation among students and teachers/specialists, OER can reduce the inherent economic and social constraints of teaching based on classrooms centered in the interaction

^b Retrieved from <http://fqnosecundario.ning.com/>

teacher vs student and giving time and voice to all. Free access overrides any barriers to participation. Everything is available for free, and each one uses it accordingly to his/her needs, interests and availability. Everything is customizable, not in the sense of more resources, more features, more content types, but fewer rules, fewer restrictions, a greater sense of empowerment - a new autonomy.

IV. CONCLUSION

In this communication we presented and discussed some of the unprecedented possibilities that Web 2.0 has provided in terms of education in science and, in particular, in terms of the use of remotely controlled laboratories, such as "e-lab".

By integrating learning communities as the "FQ em rede", the remotely controlled laboratories frontiers are flattened. It creates technological opportunities for free scientific resources access, production and distribution. Above all, it provides opportunities for interaction and communication with peers and experts, which hold valuable learning.

From this perspective, learning relies in patterns of participation and communication appropriate and relevant to the learner, depending on their needs and interests. Know where to access them, how to use them for our own benefit and to others, requires autonomy, self-regulation, opportunity and time for observation models (experts, teachers ...) and to practice. In this context, online learning communities, such as "FQ em rede" tend to setup itself as safe and privileged places to experience those practices.

Underlying all this is the need for institutional changes to challenge traditional and formal practices rooted at pedagogical, cultural and social levels. In the era of relations and communication, in which Web 2.0 offers unprecedented possibilities for the production and consumption of information, interaction and collaboration, an alert to the need to review many of the educational practices have been made. If this trend is not well thought-out we may, according to Siemens [7], being preparing young people for a world that no longer exists.

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