Explaining Internal Functioning of Online Teacher Networks: between personal interest and depersonalized collective production, between the *sandbox* and the *hive*

Isabelle Quentin & Éric Bruillard
UMR STEF ENS Cachan – IFE, France
i.quentin6@gmail.com, eric.bruillard@stef.ens-cachan.fr

Abstract: In France, many teachers are involved in professional online networks collectively designing, discussing or sharing educational resources. These online networks occupy now an important place in the educational landscape and will probably have a growing importance in the future. In order to get a better understanding of their internal functioning, we have observed for several years six typical networks and develop research concerning some specific aspects of them. Our results show that functioning rules are critical to explain what do teachers in online professional networks. In this paper, we focused on two very different networks' organizations, located in both extremities of a continuum between flexible and binding rules. The first one (the sandbox) works with very flexible rules and the second one (the hive), with very restrictive rules. For each of them, we highlight main differences and main consequences for teachers involved.

Introduction

In France, for more than ten years, we have observed the existence of almost one hundred online networks created by in-service teachers and aiming at designing and sharing educational resources (lectures, exercises, evaluations, discussions about theoretical aspects of the subject matter or more generally about teaching profession). Some of theses networks include websites, which attract a large audience (for example, the Sésamath association claims 1 200 000 monthly visits on their website), proving that such networks respond to some concerns of teachers.

Few researches have been devoted to these kinds of networks, more about other teacher groups organized through forum and discussion lists. In France, several PHD theses have explored different aspects of discussion lists of teachers (Drot Delange, 2001; Turban, 2005; Villemonteix, 2007; Caviale, 2008; Thiault, 2011). These lists facilitate exchanges between members, but do not easily allow resources sharing. These authors attest that a large asymmetry of participation exists, a small number of players occupying the discussion space, and that these discussion lists have an impact on the construction of a professional identity.

Many US researchers have focused on groups of teachers supported either by an institution or by a training organization in order to design or to share professional resources. Very often they call these groups *communities*. The word "community" refers here to the theory of community of practice developed by Wenger (1998). He defines communities of practice as a group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. All French teachers' groups do not have the whole set of community's features (that is the reason why we decided to use a more neutral term, "*online network*" in this paper). But, we argue that French online networks are fairly close to the communities described by US researchers. These are groups of teachers who organize themselves using web 2.0 technologies in order to share or develop educational resources. According to Grossman & al. (2001), teachers' communities (or online networks) are complex to study. There are constantly changing and can be characterized by some couples of tensions (Barab & al., 2004). They facilitate teacher professional development (Wells, 1993; Goldman, 2001; Barnett, 2002; Daele, 2004). But, as it has been analyzed in several countries, for example in Vietnam (Nguyen, 2012), participation remains scarce and collaboration stays behind.

Considering French teachers networks (not discussion lists or forums, not exactly communities of practice), we think that they play an important role. Some of them design and diffuse textbooks on a large scale. Therefore, they are competing publishers in the textbook market (for example, Sésamath has captured 15 % of this market for low secondary schools). Furthermore, most of them organize training sessions for their peers, in parallel of training

sessions offered by the Ministry of Education. The subject of the PHD of the first author of this paper is to describe these online networks to get a better understanding how they work and their evolution. Can we precise the internal functioning of teachers' networks and identify some specific features? Which connections can be found between these types of functioning and the collaborative design of educational resources? At an individual level, what are doing teachers who are active in these networks? What do they produce, how do they express themselves and how do they present themselves to their peers? In this paper, we will discuss methodological procedure we have chosen, present main results we have obtained, and give some hints about possible future of the online teacher networks.

Methodological issues

Teacher networks are tricky to study. Firstly, they are many (almost one hundred) and each of them is particular. We want to respect their diversity. Our first work has been to identify teachers' networks producing professional resources and among them those which enjoy a great audience. Sésamath, WebLettres, Clionautes and Apses are networks that have the largest audience in their respective school subject, and are well-known in France. We decided to add two other networks. Their audience cannot be qualified as important, but their context and their story deserve some attention:

- Pédago 2.0: at the beginning, members of this network were members of Clionautes. In April 2010, they have quit this *mother* network and have created a new network, so an interesting trajectory to follow.

- ED (management teaching) has been created in a special context, the baccalaureat (high school diploma) reform which led management teachers to re-build most of their educational resources. Furthermore, we could analyze all data since the creation to the closure.

Table 1: Teacher networks studied, may 2012

Teachers networks	Creation date	School subject	Membership, audience	Functioning rules
Sésamath	2001	Mathematics	1 200 000 monthly visits 15 600 subscribers at the newsletter	Very restrictive
Apses	1973	Economic and social sciences	15 000 monthly visits 1 385 subscribers at the newsletter	Very Restrictive
WebLettres	2002	French language	275 000 monthly visits 16 700 subscribers at the newsletter	Restrictive
Clionautes	1998	History and geography	100 000 monthly visits 1 600 subscribers at the newsletter	Flexible
Pédago 2.0	2010	History and geography	511 registered members	Very Flexible
ED	2005	Management	4 500 monthly visits, 1033 registered members, 2221 shared resources	Very Flexible

Studying such networks requires solving two main difficulties.

The first one relates to the constant changes which characterize this kind of organization. It can be a progressive process of evolution to be documented step by step. But sometimes, some changes are non-linear and lead to more or less important disruptions. In these cases, it is not easy to share internal problems with an external researcher. That is the reason why we decided to study them over a long enough period of time (several years). In order to be able to get a comprehensive view of each network, to catch internal elements and very personal views, it is important to develop some relationship with key members, along some period of time and exchange information and ideas with them. So, we need to develop some participant observations. Figure 1 represents a time view of participant observations implemented for each of the six networks. WebLettres has only been studied at the beginning and at the end of our research. Pédago 2.0 has stopped in July 2012 and ED in April 2010. Table 2 below represents analyzed data for each of these six networks.
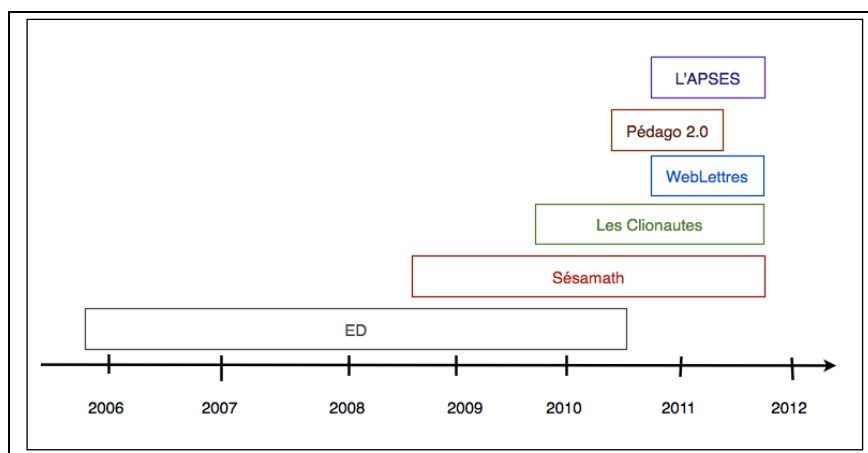
Figure 1: Duration of observations

The second difficulty relates to their complexity. Networks don't provide similar data to analyze. Some networks hide processes of production, online discussions between members are not published on website. In others, all exchanges are considered public and are published on website. This explains why we did not analyze every network exactly in the same way. We made the choice to highlight some specific points in relation with our research questions (type of organization and collaboration and for members, need of recognition, values shared, type of messages and communication).

Table 2. Collected data on teachers' networks studied

Online networks	Types of data analyzed
Sésamath	Website (type of communication), Interview with the person in charge. Interviews with active members (N=13)
Apses	Website (type of communication). Interview with the person in charge (N=3). Online questionnaires (N=23)
WebLettres	Website (type of communication). Interview with the person in charge (N=1)
Clionautes	Website (type of communication), Interview with the person in charge and interviews with active members (N=7)
Pédago 2.0	Website (type of communication, 1 103 exchanges between members, 462 members' presentations). Interview with the person in charge (N=2). Online questionnaires (N= 35) December 2008 – January 2009: 91 discussion threads / 988 messages / 135 speakers
ED	Website, (type of communication, 2 221exchanges between members, 1 033 member presentations). Interview with active members (N=3). Online questionnaires (N=53) August 2006 – July 2009: 1120 discussion threads / 2221 messages / 210 speakers

Concerning two networks (ED and Pédago 2.0), we have launched very specific quantitative studies: existence of a specific language between members, behaviors of active members and lurkers, construction of virtual identities (analysis of 452 member profiles in Pédago 2.0 and 1 033 in ED).

Main results

All teachers' online networks provide training to their members

For all the studied networks, teachers who get involved declare that they have improved their professional knowledge and their skills, having diversified their professional practice in participating.

Colleagues propose some different pedagogical resources. Because I have tried them with my own pupils, I diversify my practice [....]. Finally, it is a sort of competition. We always wanted doing better than others. (ED active member, translated in English)

I started to use computers with my pupils. I changed my way of teaching. For example, I introduced inquiry approach and case study. (Pédago 2.0 active members, translated in English)

Young teachers add that they have taken self-confidence in participating.
I am looking for improving self-confidence in my professional abilities and exchanging and sharing on my personal practice. (Pédago 2.0 active member, translated in English)

In addition to their usual actions, most of teachers' online networks (Sésamath, Clionautes, Pédago 2.0, WebLettres and Apses) offer their members training sessions. During these sessions, university professors are invited to give lectures on some disciplinary aspects and sessions are planned to collectively produce educational resources. Most of teachers' networks are deeply concerned with the training of their peers, and this concern appears to be independent from types of productions realized within teachers' networks

What are producing teachers' networks?

Five categories of individual or collective production by the studied networks' members can be observed (Table 4 summarizes the kinds of production promoted on websites of each network we have studied).
  (1) Bank of professional resources, including the development of hyperlinks libraries and the sharing of educational resources.
  (2) Spaces of exchanges between peers including forums and discussion lists.
  (3) Newsletters
  (4) School textbooks: theses textbooks are produced according to the national prescribed curriculum. Although most textbooks are only published online, some of them are also available in paper format.
  (5) Tools and software to facilitate some teaching aspects, meeting specific teaching needs, such as skills assessment or mathematical formula writing.

Table 4. Types of production promoted by online teacher networks.
Sésamath is the only network offering the 5 types of production.

| Online networks	Individual productions		Collective productions		
	Space of discussions	Bank of resources	Newsletters	School textbooks	Software
Sésamath	■	■	■	■	■
Apses	■		■	■	
WebLettres	■	■	■	■	
Clionautes	■	■			
Pédago 2.0	■	■			
ED	■	■			

All networks propose to their members spaces of discussion. Apses is the only network which does not put forward the construction of a bank of resources. Among the six studied networks, three of them produce resources collectively. It is also these three networks which work with restrictive rules (see table 1). Productions are largely connected to the nature of functioning rules. When rules are flexible, networks are used to mutualize at the same location professional resources which are going to be added to the others. The networks functioning with binding rules succeed in conceiving and in spreading resources produced collectively, like newsletters or textbooks. So, we distinguished two types of functioning organizations located in both extremities of a continuum formed between flexible rules and restrictive rules which we present more in detail in the following section.

Focus on two very different types of organization: the sandbox and the hive

As previously shown, online teachers' networks don't produce the same kinds of stuff and it has some links with the kind of rules (from flexible to restrictive) they have chosen. We decided to focus on two networks functioning with very flexible rules (ED and Pédago 2.0) and two networks functioning, on the contrary, with very restrictive rules (Sésamath and Apses). We have called these two sorts of organization: the sandbox and the hive. We highlighted main differences on both internal organizations. We also described consequences for actors who are involved.

- **Main features of the sandbox organization:** rules are flexible and not always clear, which may make them difficult to understand for newcomers. However, in case of non-compliance, they may be rejected by the group. The analysis carried out on the exchanges between members of the two networks (ED and Pédago 2.0) show a strong asymmetry as traditionally observed in forums. Some members play a central role in the network, while others are very far from the core.

- **Main features of the hive organization:** operating rules are explicit and each actor is assigned one or more specific tasks. For example, concerning the design of Apses' textbook, 30 members are committed to the project. Each textbook's chapter is processed by at least two teachers and reviewed by at least two reviewers. A reviewer cannot be simultaneously a designer to avoid conflicts of interest. Finally, the opinion of a specialist is required before the publishing process. Actually, hives are very close to communities of practice (Wenger, 1998) (on the contrary, sandbox networks cannot be considered as communities of practice). In hive, teachers regularly interact together to reach their common goal.

In figure 2, black circles represent members of the network; dotted lines represent the transfer of information on the rules implemented. In a sandbox, in order to reach the core (blue circle), members should bring other players who are located closer to the core or have a good knowledge of the rules in the network. In a hive network, in order to move closer to the core, members could integrate a project. Members are then judged according to their degree of involvement in it. More important their involvement is higher the probability is that they will be offered core tasks.

Sandbox organization
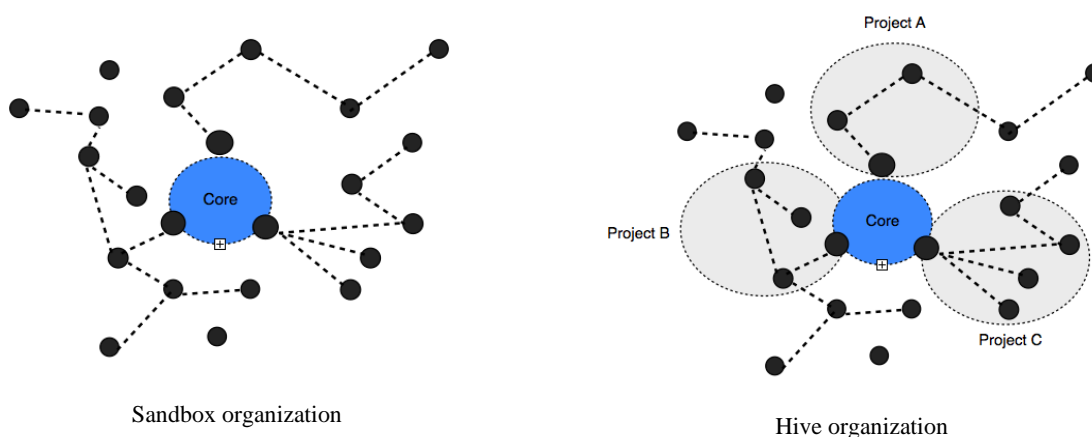
Hive organization

Figure 2: type of organization in sandbox or hive networks

Project organization allows hive-like networks to bring together actors around a common goal. These are permanent organizations that cross time and manage to collectively produce resources. On the contrary, in the sandbox organization, actors can engage and disengage very easily. Furthermore sandboxes are less sustainable. ED and Pédago 2.0 no longer exist.

A collection of individual actions in Sandbox and a place where involved members look for self-recognition

Networks operating with flexible rules do not produce collective educational resources, but only share a set of individual resources, show publicly all exchanges between members, systematically published on their website. All individual actions are highlighted. This point is clearly explicit on the home page of ED network:

*Each member cannot only see all publications. Everyone can participate actively. The resources of this site are the result of what everyone brings. (*Extract from ED website home page, translated in English)

Sandbox-like networks are spaces where expert teachers show their professional(s) practice(s). So, other teachers can find some examples of practices that they can imitate and implement in their own classrooms. A lot of authors (Daele, 2004; Gueudet & Trouche, 2008; Wideman, 2010) think that participating in a network where teachers share teaching resources and best practices fosters professional development. Barnett (2002) and Goldman

(2001) also noticed that new teachers involved in online network might faster acquire necessary skills and knowledge for their professional practice. We also observed that putting forward "best" educational practices allows expert teachers to be spotted either by their superiors or by textbook publishers. Most of them were hired by private publishers and participate in the design of textbooks or were noticed by their superiors for giving training sessions.

Collective actions in hive and a place of challenger on textbooks publishing market

Members accept restrictive rules in the name of shared values. As shows the example below, in this kind of network, what is highlighted is the collective.

For example, I was the creator of the TracenPoche project [mathematical software (dynamic geometry)] and I decided at some point that this project became a Sésamath project. I am no longer the creator and if I disappear, this project will remain in the association. (Jean-Philippe *Vanroyen*, *member of Sésamath,*, translated in English)

In most successful examples, teachers involved are able to create and distribute schools textbooks or educational software. In this type of network, collaboration is effective. It seems that if the question of why to collaborate is solved, if members share the same values, they find how to collaborate. Hive-like organizations require making choices for achieving a consensus and this promotes the collective creation of new knowledge, both professional (pedagogical and didactical) and extra-professional (in conducting meetings for example). We observed that production patterns are similar to those observed in the production of free and open software. Indeed, the marginal cost of reproduction is near zero. It costs almost nothing to serve additional persons. The diffusion of resources is often done by word-of-mouth. This is known as a true key success. Production of free and open software draws on the skills of volunteer innovators. They are paid indirectly. Furthermore, they claim a certain pleasure to be part of a community, especially since it has a very high reputation. (Demazière et al, 2006).

The producers' discourses emphasize their involvement as a key element leading to changes in their professional practice and not just the use of resources made available.

"Textbook design is collaborative, so everyone brings his/ her stone to the edifice. Some colleagues have made proposals and I thought it would never work. Because I had to test them in my class to see if it works, I was in areas that were not necessarily easy for me and when I saw the energy with which students answered questions. I thought, well, ultimately, it is perhaps also by this that I will succeed in hanging up. So working on textbook forced me to change many things in my daily practice." (Active member of Sésamath, translated in English)

This is reinforced by the discourse of resources users. They explain that they use resources as they are, without any adjustment. They only search to save time without seeking to improve them.

"Professionally, I am looking for saving time. Often I know which pages of exercises I want to use." (Sésamath resources user, translated in English)

Users of Sésamath textbooks utilize terms in their discourses related to the concept of consumption. They explain that their choice is guided by a comparison with commercial offers on the publishing market. The resources produced by Sésamath are judged on an equal footing with the productions of textbook publishers.

"Very positive, because it is cheaper, it was one of the reasons why I took it." (Sésamath resources user, translated in English)
"The first book, I waited impatiently, but compared to other books with drawings and colour it was really sad." (Sésamath resources user, translated in English)

Teachers' networks having a hive organization are able to create and disseminate resources on a large-scale. These resources come into direct competition with the private sector. For example, textbooks distributed by Sésamath have captured nearly 15% of the publishing market of mathematics in low secondary schools textbooks. Teachers in such an organization prove that they can not only be users of resources designed by and for others (textbook publishers, software and hardware producers such as digital tablets) but also have the ability to design and distribute the resources they need in their class at a professional level. Sésamath has even already designed a new version of its textbooks working on Apple's Ipad 2, which is not the case for the main private French publishers.

Discussion and perspectives

According to Barab & al (2004), (online) professional networks face six tensions: designed / emerged; participation / reification; local / global; identification / negotiability; online / face-to-face; diversity / coherence. Our research about online teacher networks highlights two other tensions:

- **Self-recognition / collective recognition**: To participate in a *hive* network may require going from self-recognition to collective-recognition. For that purpose, engaged teachers organize themselves in project teams.

- **Private sector/ Public sector**: Because, teachers elaborate some productions shared on a large scale on their networks. It may also require going beyond the borders of public sector and joining the market economy.

Teacher's Networks: Which possible roles in the future of Educational Systems?

Questioning the sustainability of networks of teachers leads to think about the place they could occupy in the future. Such reflection took place in the PREA2K30 project, taking into account various documents (mostly from US, see Quentin, 2011). These texts, published by researchers or pressure groups, draw all a link between the development of digital technologies and probable developments of educational systems. Structures that seem close enough to teacher networks we studied are reported by several authors (Christensen & al, 2008; Collins & Halverson, 2009; Redecker & al. 2010; Horn and Staker, 2011; Berry & TeacherSolution 2030 team, 2011) as entities that will play an important role in 2030 in the education systems, especially with regard to teacher training and production of educational resources. In these documents, the future status of teachers is foreseen very differently. Some authors believe that teachers will carry out more complex tasks and that they will have an effective career management that rewards performance. Other authors suggest instead that the teaching profession will be split into different functions more or less recognized and valued in the labor market. This could lead to taylorist aspects of this business. Various ways are being considered for the training of future teachers: from very formal training managed and organized by the State, to courses offered by various universities and private firms. Several texts (Horn & Staker, 2011; Berry, B & TeacherSolutions 2030 Team, 2011) mention the development of training systems in informal networks managed by some teachers considered as leaders. These entities look very similar to the networks we have studied.

The traditional model of textbook publishing is seen in all of these documents (Quentin, 2011) as being in decline. Several tracks are proposed to replace it. For some authors, educational content will be produced and distributed by private companies, particularly those which distribute digital technologies. They might invade schools and the educational resources market would become a commercial market as any other. For others, educational content offered to students in the coming years will be based on the latest results of neural and cognitive sciences, and designed by experts in these fields. For others, teachers will organize themselves in networks to produce and share their own content and discuss teaching practices they appreciate effective. For textbook production, only Sésamath, Weblettres and Apses are currently engaged in this process. For Sésamath and Apses, this question is closely linked to the concept of academic freedom. Apses network has developed a textbook which consists in a reinterpretation of the official program (national prescribed curriculum) and Sésamath advocates the importance of open and accessible format. As Sébastien Hache, one of the three founders of Sésamath, asserts: Sésamath "aims to (re) give all the keys to the teacher." Sésamath ensures that the resources it provides are fully convertible by teacher users. According to members in charge of Sésamath, the fields of individualization and personalization of learning must be understood and mastered by teachers themselves.

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