

# **Socio digital affordances for the enhancement of pre-service teachers' collaborative reflective practice and knowledge building**

## **Abstract**

The main objective of this design experiment was to examine and analyze the possibilities offered by a hybrid learning environment (onsite/online interactions) in terms of collaborative reflective practice and knowledge building (Scardamalia & Bereiter, 1994) for pre-service teachers doing field experiences in secondary schools. The concept of affordances (Gibson, 1979) was central in our framework as we took an ecological perspective of the human-machine and online human-human interactions that took place among individuals within their hybrid learning environment. Research results show how onsite and online interactions can combine to create a collaborative learning environment enhancing pre-service teachers skills with technology and a constructivist approach to pedagogy. Further design possibilities were identified.

## **Introduction**

The learning sciences (Bransford, Brown & Cocking, 1999) emphasizes both cognitive and social processes in learning thus calling for changes in the way we teach. In the Province of Québec, Canada, an educational reform is also underway, one that promotes socio-constructivist perspectives as an option. Professional development is largely recognized as a key part of any innovation strategy, and ICTs present promising possibilities to this end. Our own attempts are anchored in strong university-school partnerships, using collaborative technologies. These elements contribute to the transformation of the learning environment into a hybrid one – characterized by onsite and online interactions. The goal of our research was to examine and analyze the possibilities of such a hybrid learning environment when pre-service teachers engage in collaborative reflective practice and knowledge building processes. Collaborative reflective practice (Schön, 1983) refers to the process of distancing oneself from onsite experience through online human interactions for understanding teaching and learning to teach for improving individual effectiveness. Knowledge building (Scardamalia and Bereiter, 1994) refers to deliberate idea improvement for an onsite local professional community's collective knowledge and beyond.

## **Theoretical framework**

Socio cultural perspectives on learning (Vygotsky, 1978; Rogoff, 1994; Wertsch, 1998; Lave & Wenger, 1991; Wells, 1999) stress that learning occurs through interactions among individuals, tools, objects and artifacts available in the environment. With the aim of designing a powerful learning environment, we used these perspectives to focus our theoretical framework on the concept of affordances originally brought to our attention by Gibson (1979), and recently refined by Norman (1983), Gaver (1991) and others. It posits that perception is not independent of the environment to which an individual belongs. Perception leads to action and the way an individual interacts with an object is influenced by his or her capability, the characteristics of the object, and the uses it suggests. Thus, an affordance is a relation of reciprocity between an individual and the properties of a specific environment. It stresses the importance of taking into account perception as a key factor in the birth of an interaction.

To understand how pre-service teachers interacted with the social and digital possibilities of their learning environment, we adapted Gaver's (1991) distinction of different types of affordances (perceptible affordances, hidden affordances, and emergent affordances) to describe the interactions that can take place between a designer's intention and a user's perception (Figure 1). A perceptible affordance is a feature of the environment that is perceived in the same way as intended by the designer. A hidden affordance is a designed feature that is not perceived by users, whereas an emergent affordance is a perceived one but one that was not purposefully designed.

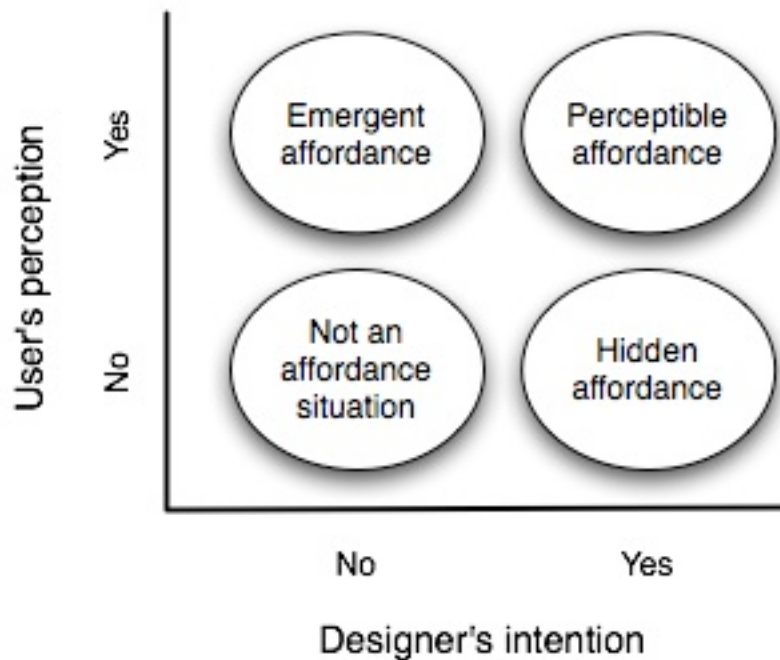


Figure 1: Types of affordances (adapted from Gaver, 1991)

The main assumption of this study was that social interactions are an important aspect of any learning environment, we attributed a social dimension to the concept of affordances although we knew that, in the design field, it usually designates features that support human-machine interactions. We understood the computer as mediating human-human interaction instead of approaching it as a machine interacting with a human. Social affordances surround human-human interactions when onsite/online interactions are present in a hybrid learning environment (Kreijns & al., 2002; Bradner, 2001; Bielaczyc, 2001; Little, 2003; Kozma, 2003). This social view of affordances emphasizes that support is available in the form of scaffolding (Vygotsky, 1978), which is key for online collaborative discourse to occur (Dillenbourg, 1999; Pea, 2004). The aim is then to provide structuring devices to support a particular activity, described in the following section, and to provide explicit models of the process (Pea, 2004).

## Methods

### *A design experiment within a design experiment*

A large design experiment (Laferriere, Breuleux & Erickson, in press) was underway, and this more specific design experiment, i.e. the purpose of this report, took place during the second (out of three) iterations of the larger design experiment. Our own design was also one of three iterations (Table 1). The design research methodology (Brown, 1992; Collins, 1992, 1999) is well suited for educational innovation because the research methodology allows one to build on what was and was not successful. In this case, the design effort was aimed at supporting pre-service teachers' field experiences and practice teaching in innovative classrooms (school-based networked classrooms, that is, classrooms in which each school learner used a personal laptop, and university-based networked classrooms, that is, classrooms in which each pre-service teacher participated in onsite/online interactions (Laferrière et al., 2001). This hybrid learning environment was constructional (Resnick, 1996), and the emphasis was on human-human interaction for orientation, support, and guidance purposes (Casey & Howson, 1993; Pultorak, 1993) in the context of teacher education and professional development (Lieberman & Miller, 2000). As part of the design, this multi-level context presented an integrated approach for pre-service teachers' introduction to the use of digital collaborative tools in secondary classrooms.

Table 1: The situation of our design experiment within a larger design experiment

Iteration 1 of the large design experiment	Iteration 2 of the large design experiment			Iteration 3 of the large design experiment
	Iteration 1 of our design experiment	Iteration 2 of our design experiment	Iteration 3 of our design experiment	

In the first iteration of the large design experiment, however, only half of the pre-service teacher cohort worked within networked classrooms whereas half were assigned to conventional classrooms. In the second iteration, that is, this specific design experiment, two key changes were made on the basis of the results of the first iteration. The first change regarded where pre-service teachers were assigned: For better coherence, all pre-service teachers were assigned to school-based networked classrooms. Researchers had observed that the previous group composition generated much debate-type discourse between those working with school learners owning a laptop and those who did not, and deep understanding of what was happening in networked classrooms was slim. The second important change regarded the electronic forum that supported the university-based networked classroom. We introduced Knowledge Forum® for its diversity of socio-digital affordances, in comparison with the Virtual-U Groups technology that had been used previously. That was the beginning of this study that included three iterations. Those iterations will be detailed below, once the affordances of the hybrid learning environment are presented.

### *Participants to the specific design experiment*

All participants to the specific design experiment did their field experiences or practice teaching in the same secondary school. From the fall session of 2002 to the end of the 2005 winter session, forty-five pre-service teachers (nine cohorts) did their field experiences (10 dispersed days or 5 weeks in a row) or practice teaching (four-month duration) in a networked classroom (Table 2). Besides the conventional objectives attached to such activities, the advanced pedagogical intention was for these pre-service teachers to join a collective endeavour focusing on the understanding of what is going on in highly networked classrooms, such as changes in classroom management. They were invited but not required to join in the latter (onsite/online knowledge building) but they were requested to demonstrate reflective practice in their online discourse.

Table 2: Pre-service teachers' distribution according to iterations

<b>Field experiences/ practice teaching</b>	<b>Iteration 1</b>	<b>Iteration 2</b>	<b>Iteration 3</b>
<b>Early field experience (ten dispersed days)</b>	4 pre-service teachers	7 pre-service teachers	0 pre-service teacher
<b>A five-week long field experience</b>	6 pre-service teachers	5 pre-service teachers	6 pre-service teachers
<b>A four-month duration practice teaching</b>	6 pre-service teachers	6 pre-service teachers	5 pre-service teachers

Sixteen pre-service teachers were part of the first iteration. In the second, there were 18, of which four had already done a field experience in a networked classroom. Finally, 11 pre-service teachers were part of the third iteration, of which three already had some field experience within a networked classroom. Moreover, in this third iteration, graduating teachers were added to the online discussions of the three participating cohorts. Graduating teachers were pre-service teachers with experience in being in, and reflecting upon, a networked classroom and desirous to help incoming pre-service teachers.

### *The socio-digital affordances*

Socio-digital affordances of this specific design experiment are shown in Table 3.

Table 3: The socio-digital affordances of the learning environment

<b>Social affordances</b>		<b>Digital affordances</b>		
<b>Online</b>	<b>Onsite</b>	<b>Before field experiences or practice teaching</b>	<b>During field experiences or practice teaching</b>	<b>After field experiences or practice teaching</b>
Electronic forum - New notes - Build-ons - Annotations - Former pre-service teachers' views - Graduating teachers' participation	Classroom practice - Social constructivist context - Technology oriented context Language practice - Networked classroom discourse	Virtual practica	Electronic forum - Space organization - Problem definition - Keywords - Scaffolds - Quotation	Virtual tours

	- Knowledge building discourse		- Collective notes - Rise above notes - Published notes	
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*Social affordances.* Social affordances were primarily the result of onsite/online interactions in a learning/knowledge building context. There was more coherence than is usually seen between the messages sent by university-based and school-based teacher educators to pre-service teachers (collaborative project-based learning, problem-based or inquiry-based learning, learning community, self and peer-evaluation and, to a lesser degree, knowledge building pedagogy). Pre-service teachers’ collaborative reflective practice and knowledge building was supported by an electronic forum, Knowledge Forum. To these ends, a basic affordance was the contributing of ideas, through written and/or graphical notes, and the building on to each other’s ideas in the course of collaborative inquiry. From one pre-service teacher cohort to the next, participants had access to previous cohorts’ online discourse and other learning/knowledge building artifacts. The design intention was for them to add their own contributions to the understanding of what is going on in a networked classroom.

*Digital affordances.* Digital affordances were on pre-service teachers’ path (before, during and after their field experiences or practice teaching)<sup>1</sup>. For instance, the virtual tour affordance led to virtual practicum affordance. A virtual tour is to be understood as a Web-based digital artifact designed by pre-service teachers once their field experience or practice teaching is over, one reflecting what had happened during online discussions in the electronic forum based on onsite experience in networked classrooms and also reflective of further thinking. Interested pre-service teachers designed virtual tours. Such an activity allowed them more distancing from experience, plus the production of a “heritage artifact” (pedagogical thoughts and ideas, educational activities, tips and tricks, ways of behaving, and other tools)<sup>2</sup>. The university-based teacher educator, supervising the incoming pre-service teacher cohort in this particular field placement, is the designer of virtual practica<sup>3</sup>, a process based on an assessment of pre-service teachers’ prior knowledge and a reading of their intentional learning goals. There are four parts to a virtual practicum, following an onsite visit and an onsite presentation of the supervisor’s goals and expectations regarding pre-service teachers’ participation in the innovative field placement they are to join: 1) reading online materials to understand teaching in a networked classroom and learning to teach in a networked classroom; 2) the consultation of previous’ participants’ notes on the very process of doing a virtual tour before the onset of a field experience or practice teaching; 3) the choice of one virtual tour or more to be explored in depth, 4) the writing of an individual note of a metacognitive nature. Virtual practica are meant to accelerate pre-service teachers’ understanding of the innovative field placement setting.

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<sup>1</sup> Especially when preparing for their practice teaching in an innovative setting pre-service teachers must be as best prepared as possible for themselves and school learners to benefit from their practice teaching.

<sup>2</sup> In the larger design experiment, school learners as well as pre-service teachers are invited to leave “heritage artifacts” to their school-based community, and a similar invitation is made to pre-service teachers – heritage artifacts are to be deposited in a virtual community of support and communication (Laferrière, Breuleux, & Erickson, in press).

<sup>3</sup> The connection between onsite/online activities is what distinguishes such virtual practica from other forms of virtual practica.

Some affordances related to one basic feature of Knowledge Forum, the scaffold sets, support the writing process (Bereiter & Scardamalia, 1982). The idea is to encourage participants to write what they mean and to mean what they write by providing sentence starters such as “My theory” to differentiate problems from theories, for example. Two sets of scaffolds were highlighted: One based on the knowledge building principles (Scardamalia & Bereiter, 2003) and one based on an adaptation of Schön’s (1983) reflective analysis process (Table 4).

Table 4: Sets of scaffolds provided to pre-service teachers

Knowledge building scaffolds		Reflective analysis scaffolds
Our goal	Authoritative source	Intention
My evaluation of the situation	My theory	Action
I call in question	I explore another theory	Results
I improve the idea	I submit a problem	Reinvestment
We learn from one another	My theory changes	
Putting our knowledge together		

Other affordances related to other features of Knowledge Forum were the following ones: participants could visually organize the notes they wrote in Knowledge Forum in neuron-like shapes (as opposed to threading shape found in more conventional forums), a more flexible way to organize the collective discourse (Figure 2); the problem definition feature offered the possibility to identify the problem being investigated; the keyword feature calls attention to the identification of key terms during note writing; the quotation feature offers the possibility to reference another’s contributions; the co-authoring feature offers the possibility for a few authors to co-write a note. To publish a note was also a possibility, thus allowing specific contributions to be recognized. The rise-above feature allows the possibility for synthesis and, therefore, movement beyond current thinking in a dialectic manner (Popper & Eccles, 1977). Finally, at the end of practice teaching, each cohort was offered the possibility to create a virtual tour of its own.



Figure 2: Knowledge Forum interfaces (threading shape vs neuron-like shape)

As regards the differences between the three iterations (Table 5) of our specific design experiment, the first iteration made available the two sets of scaffolds; and a doctoral student participated in the online discourse. These two elements remained present throughout the design experiment. The second iteration made available the views of former pre-service teachers, and virtual tours and virtual practica were designed (Allaire & Laferrière, 2005) and that continued throughout iteration three. The third iteration added graduating teachers joining into the online

discourse. These decisions were made to provide an increasingly richer context, and uncover critical affordances for the renewal of pre-service teacher education.

Table 5: Distinctive features of each of the iterations

Iteration 1 of the large design experiment	Iteration 2 of the large design experiment			Iteration 3 of the large design experiment
<ul style="list-style-type: none"> <li>• 50 % pre-service teachers doing field experiences or student teaching within networked classrooms</li> <li>• Virtual-U VGroups Technology</li> </ul>	<ul style="list-style-type: none"> <li>• 100 % pre-service teachers within networked classrooms</li> <li>• Knowledge Forum Technology</li> </ul>			<ul style="list-style-type: none"> <li>• 100% pre-service teachers doing field experiences or student teaching within networked classrooms</li> <li>• Knowledge Forum Technology</li> <li>• No doctoral student</li> <li>• Views of former pre-service teachers in urban &amp; rural settings</li> <li>• Virtual tours and practica (diversity)</li> <li>• Graduating teachers &amp; pre-service teachers from rural settings joined the online discourse</li> <li>• Knowledge building and professional communities' lexica</li> </ul>
	Iteration 1	Iteration 2	Iteration 3	
	<ul style="list-style-type: none"> <li>• Two sets of scaffolds</li> <li>• Doctoral student's participation</li> </ul>	<ul style="list-style-type: none"> <li>• Two sets of scaffolds</li> <li>• Doctoral student's participation</li> <li>• Views of former pre-service teachers</li> <li>• Virtual tours and practica</li> </ul>	<ul style="list-style-type: none"> <li>• Two sets of scaffolds</li> <li>• Doctoral student's participation</li> <li>• Views of former pre-service teachers</li> <li>• Virtual tours and practica</li> <li>• Graduating teachers joined the online discourse</li> </ul>	

**Data gathering and analysis**

Qualitative and quantitative data were gathered. Individual interviews and participant observations were conducted to inquire into how pre-service teachers perceived their hybrid learning/knowledge building environment. The Analytic Toolkit, a descriptive statistical tool integrated in Knowledge Forum, generated data about how participants used the electronic forum.

After inquiring into pre-service teachers' acknowledgement of the affordances (perception and use of the features as indicators)<sup>4</sup> of the hybrid environment, we investigated the nature of the collaborative reflective (online) discourse generated by the participants. To do so, we first conducted a vocabulary analysis that compared the presence of the field-based lexicon (networked classroom discourse) with one pertaining to theory (knowledge building discourse, Scardamalia & Bereiter, 2003). Next, we performed a content analysis based on Van Manen's (1977) three levels of reflexivity (technical, deliberative, and critical). For deeper understanding of the discourse, and especially its progression (Bereiter & Scardamalia, 1993), we also analyzed specific discourse sequences (notes linked to one another by participants themselves) in an inductive manner.

<sup>4</sup> We prefer the terms "acknowledgement of affordances" to "perception of affordances" as we find the former to be a less redundant expression.

## Results

The results provided here are aligned with our adaptation of Gaver's (1991) understanding of affordances. As regards the perceptible affordances present in the designed hybrid learning environment, results showed that 75% of all intended socio-digital affordances were perceived, of which 64 % were acknowledged from almost the very beginning of the field experience or practice teaching.

### **The acknowledgement of the affordances intended by the designers of the hybrid learning environment**

#### *Perceptible affordances*

##### *Participants acknowledged social affordances in the first place*

Social affordances were acknowledged faster than the digital ones, i.e. at the very beginning of the field experience. This was determined through interviews. Most of the social affordances reported were in relation to the design's following intended results (to raise the bar of pre-service reflective discourse; to de-contextualize individual field experiences or practice teaching).

##### *Participants acknowledged digital affordances that were visually most salient*

Digital affordances related to the most visually salient features of Knowledge Forum were first acknowledged (space organization, scaffolds, keywords).

##### *Participants acknowledged online social affordances as more useful than onsite social affordances for engaging into reflective activity*

Online social affordances were acknowledged as more useful to engage in reflective activity than onsite social affordances. All interviewed pre-service teachers stated that explicitly when asked to compare both dimensions of their hybrid learning environment. For instance, pre-service teachers with more experience in the hybrid environment were perceived by the other pre-service teachers of the cohort as instrumental in accelerating their perception and use (affordance acknowledgement) of Knowledge Forum's features (Figure 3).



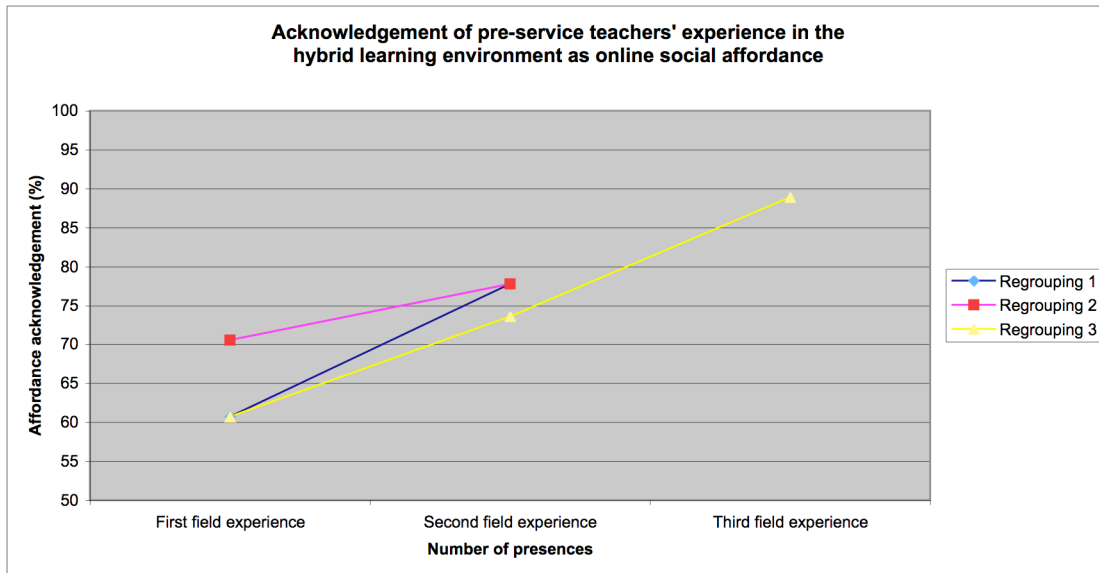


Figure 3: Acknowledgement of pre-service teachers' experience in the hybrid learning environment as a source of online social affordances

### *Emergent affordances*

#### *Participants transformed some of the designers' intentions*

A first case of an emergent affordance, one of a socio-digital nature that manifested itself during iteration one, was that views of former pre-service teachers, one that designers considered almost inert, past cohorts' artifacts in the collective database were found useful by pre-service teachers for the progression of their own online discourse. In iteration two, designers presented them as part of the hybrid learning environment. However, related design issues remained throughout iterations two and three as some pre-service teachers found it difficult to follow the thinking thread of another cohort. As reported by one of them:

We don't really understand the views at first sight... We need to be implicated [in the forum exchanges] to understand it properly. This is my opinion.... [...] visual cues could help understand the views of former pre-service teachers better.

A second case of an emergent affordance, one of a social nature that manifested itself during iteration three, related to the participation of graduating teachers. Although their participation opened up a number of helpful possibilities for newcomers having to integrate innovative classroom settings, some pre-service teachers felt they were being observed and even assessed. There were signs that one cohort in particular began to dislike their presence. The design problem, one that remained challenging through iteration three, is how to minimize the possibility that graduating teachers' comments overshadow those of newcomers, leaving them with a sense of a too limited space in their networked classroom or learning/knowledge building community. One student suggested clarifying the roles of the graduating teachers at the very beginning of

their participation. We didn't have the chance to test it since this event happened during the last iteration of the design.

### ***Hidden affordances***

Affordances that remained hidden to most participants were the following ones: the problem definition one (although a feature as salient than the keyword feature); the note publication one; the co-authoring note one). It needs to be added here that the two last ones were less visible than the problem definition one.

### **Outcomes**

#### ***Participants' interaction with socio-digital affordances***

The virtual practicum was found helpful for the integration of pre-service teachers to the innovations occurring in networked secondary classrooms (45% acknowledged its use to familiarize themselves with innovative practices). Moreover, specific emergent affordances were identified through online discourse analysis of the metacognitive notes pre-service teachers wrote: professional language acquisition (17 %), formulation of pedagogical intents (8 %), identification of a course of action (12 %) and beginning the reflective planning process (18 %). Table 6 presents an example of each of these affordances:

Table 6: Discourse elements that illustrate the affordances of virtual practicum

Familiarization with innovative practice	«I read in the virtual practicum information that confirmed my vision of learning, i.e. each learning activity in the networked classroom should be linked with a problem to be studied. Moreover, this problem has to be significant to students.»
Beginning the reflective planning process	«I questioned myself about how to conduct an activity in the networked classroom. For instance, how much freedom to give to students?»
Professional language acquisition	«To me, to scaffold the learning process means to highlight upcoming steps, offer details, and organize the process in a coherent way».
Formulation of pedagogical intents	«I want to create a learning community with the students. I don't want to be the one that takes all the space. I want to give room to students and foster their agency. I want them to say what they think.»
Identification of a course of action	«We need to surprise students. We need to find new means to keep their interest, their motivation. The more space we give them, the more they feel their participation is required for success.»

The social affordances supported by Knowledge Forum generated a large amount (676 pages; 15 pages per student) of reflective discourse (off topic discourse < 5 %) with few discrepancies between pre-service teachers' participation (writing/reading evenness<sup>5</sup>: 0.9634; 0.9929). The length of the written discourse increased from year to year. The highest rates of reading (90 %) and building-on (76 %) were achieved in the third year. In addition, the scaffolds (digital affordance) of the forum were widely used: 1303 scaffolds found in the 778 notes written. The set of scaffolds most visually apparent, the one based on an adaptation of the knowledge building principles (Scardamalia & Bereiter, 2003), was much more frequently used (85 %) than the reflective analysis set of scaffolds (5 %)<sup>6</sup>. Pre-service teachers generated discourse in accordance with our adaptation of the knowledge building principles, 72 % of the time. Although the reflective analysis set of scaffolds was much less used, reflective analysis was found present through discourse analysis. For instance, one, or more than one, pre-service teacher(s) would raise an authentic problem using the knowledge building scaffold "I submit a problem". Often, the content of the note would also include a description of the action that happened in the classroom even if the pre-service teacher(s) did not use a reflective analysis scaffold (e.g., the "Action" scaffold)<sup>7</sup>.

With regard to the nature of the discourse generated by the acknowledgement of the affordances of the hybrid learning environment, we first noticed the presence of two distinct lexicons: a field-based one (networked classroom discourse) and a theoretically-based one (knowledge building discourse). Although the former was more prevalent, a vocabulary analysis showed a decrease in its frequency of use. Meanwhile, the frequency of the theoretically-based lexicon slightly increased. In addition, we noticed differences in the nature of the reflective discourse in relation to digital affordances: The knowledge building set of scaffolds was more often associated with deliberative and critical levels of discourse (Van Manen, 1977) (Figure 4) than the reflective analysis set of scaffolds (Figure 5).

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<sup>5</sup> Evenness is a measure of equity between individuals. This measure is based on the Shannon index and is integrated to the statistical tool of Knowledge Forum. A measure of 1 indicates there is no difference between individuals.

<sup>6</sup> The remaining 10 % represent notes without scaffolds or notes written with a set of scaffolds made available by mistake.

<sup>7</sup> We are aware that a scaffold is meant to disappear as the writer gets more skillful. However, in this study the use of scaffolds was also encouraged as they are also helpful to readers, and the latter effect does not seem to vanish over time. A specific study would be helpful to explore this occurring more in depth.

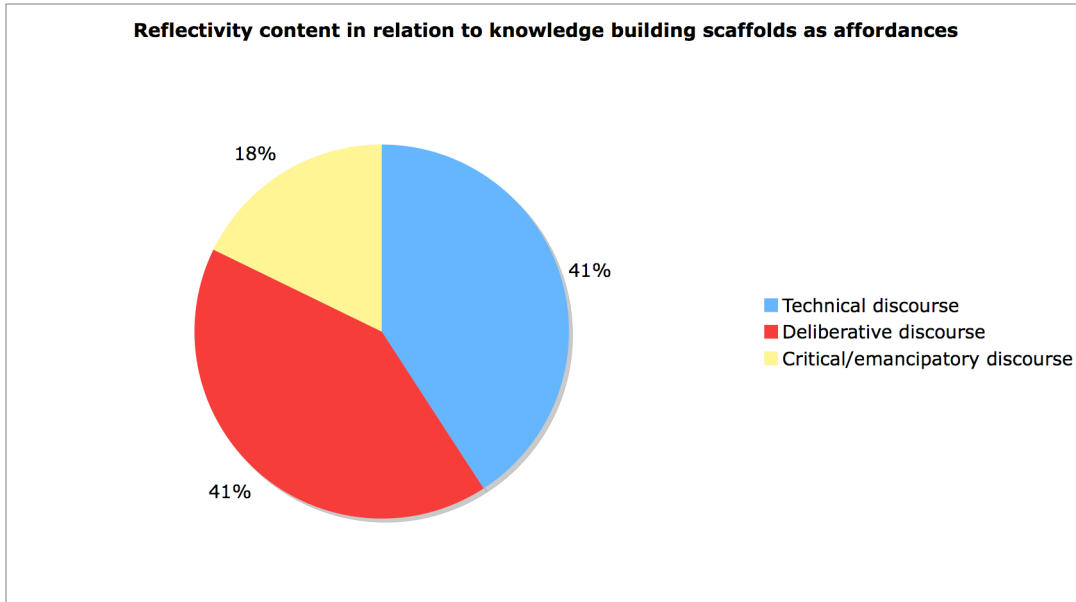


Figure 4: Reflectivity content in relation to knowledge building scaffolds as affordances

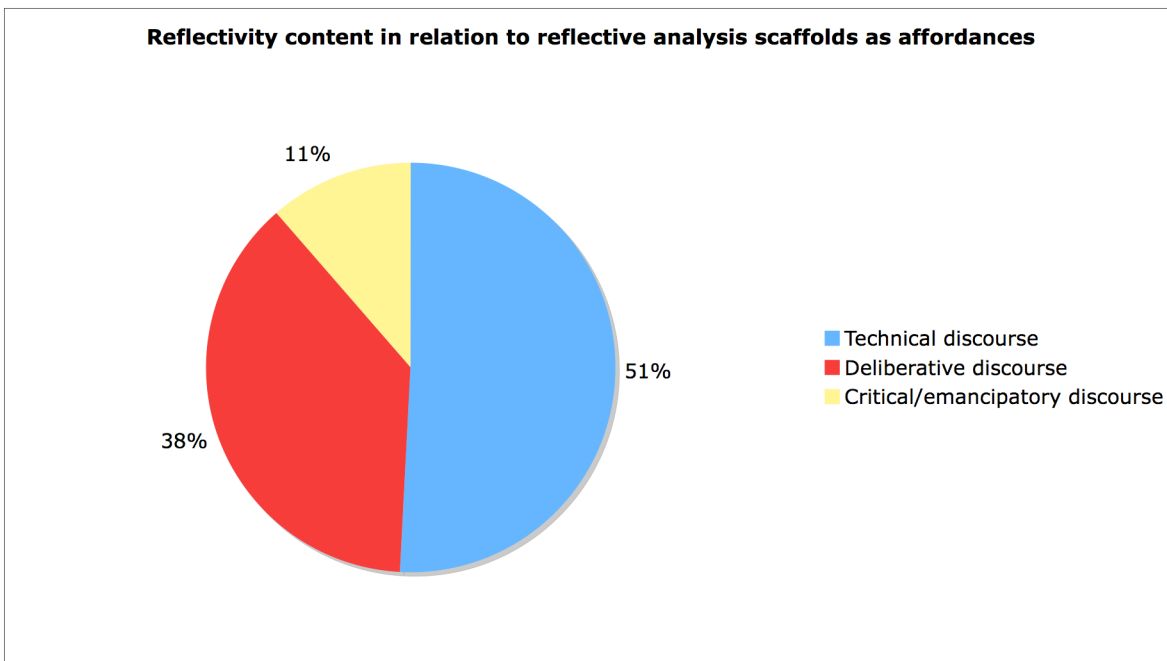


Figure 5: Reflectivity content with reflective analysis scaffolds as affordances

Comparing figures 5 and 6, we are inclined to think that the knowledge building scaffolds helped pre-service teachers reach a higher level of deliberative and critical discourse.

On some occasions, collaborative reflective discourse transformed into knowledge building discourse when pre-service teachers went beyond their own individual reflection and moved to communal advancement. They tackled rather complex pedagogical challenges such as:

- Ways to support metacognition;
- The place of individual work within collaboration;
- How to help teenagers find meaning in their learning;
- Strategies to get into learners' zone of proximal development.

At a more micro level, we noticed that although each discourse thread had its own organizational logic, common patterns could be identified. Figure 6 is such an attempt. It illustrates the presence of socio-cognitive processes in each of the notes of a twenty-note discourse thread.

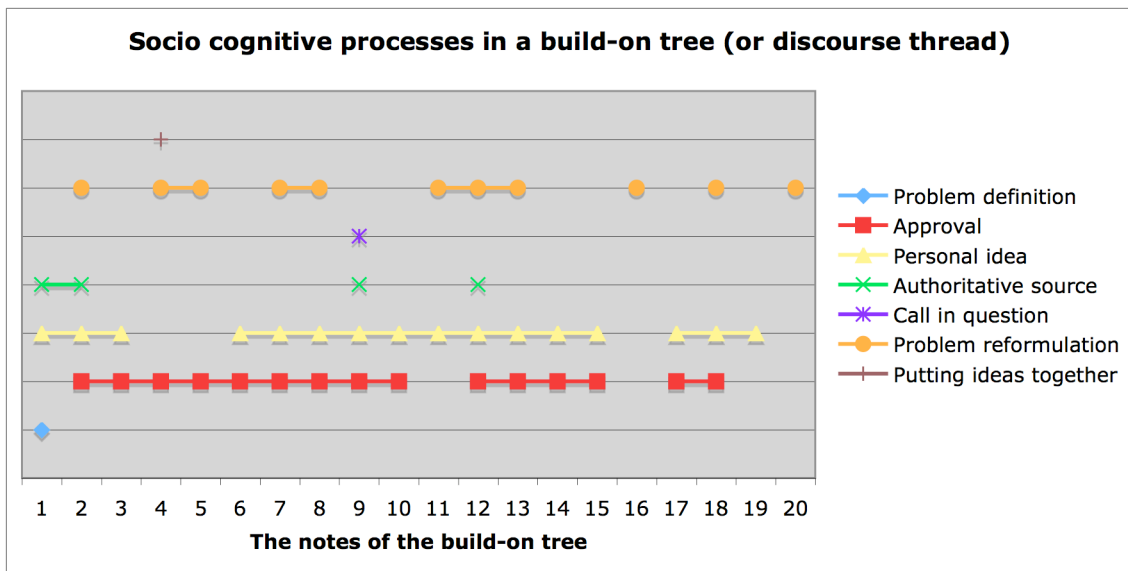


Figure 6: Socio cognitive processes identified in an exemplary build-on tree

Discourse threads began with an authentic question growing out of the field experience. All along the exchange, the initial shared object (question or problem submitted) was reformulated as new details offered more precision and as practice-based evidence was added. Approval-type discourse not only supported but helped link participants' ideas. Authoritative sources were used in a limited manner; but in each, they added depth to idea formulation.

## Discussion

The results of this study point to the possibilities of combining onsite and online activity for teacher educators who want to engage pre-service teachers in rich discourse about innovative teaching practices. The use of scaffolds as digital supports is highlighted. But the caveat is that the very fact of their presence provides no assurance of effect. Socio digital affordances that combine online and onsite supports to create a powerful learning environment is a work of design through several iterations. Results were incremental: online discourse improved as the affordance

effect got stronger. The process proved more successful in terms of depth of collaborative reflective discourse in the last year than in the first and second years.

From a teacher professional development perspective, the results highlight the potential of collaborative technologies to support university-school partnerships, and the improvement of their approach to the preparation of pre-service teachers. A first implication that may be drawn is the anchoring of collaborative reflective practice into real ideas and authentic problems (first knowledge building principle). It brought meaning to pre-service teachers' online participation, thus making the electronic forum a «real» means to support their professional thinking instead of being a simple task to be evaluated.

The design of social and digital affordances to create a coherent context for teacher education and professional development is a second implication of the present research. At a first level of coherence, designed possibilities of interaction took into account a communal object shared by the school and the university, i.e. the imperative of the actual reform context and the contribution of the social perspective of the learning sciences to educational practice. A second level of coherence was achieved by the complementarity of the university's and the school's discourse and practice. Instead of saying something at one place and doing something else at the other, a multiple-view approach was encouraged in a context of "enough" similarity. The affordances of the electronic forum were contributive in this respect: The online activity of the community provided a means to introduce some continuity into what would otherwise have been a student teacher's isolated field experience in innovative classrooms.

A third implication regards the support of pre-service teachers' integration before they start their field experience or student teaching, in complement of the actual university courses structure. To this end, the use of digital artifacts as a lever for learning from one group to another is promising. It suggests the design of the initial phase of learning to teach as a collective ongoing and improvable dynamic that operates in a hybrid mode. By expanding the possibility to learn from the experience of others in synchronous and asynchronous ways, not only can this guard pre-service teachers from entering undesirable field placements; but it can also progressively raise the bar of the profession considering that pre-service teachers can invest their effort a little bit less in understanding and using technology and concentrate more on the improvement of educational practice.

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