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GROUP MENTORING AND COLLABORATIVE KNOWLEDGE MODELING TO SUPPORT EXPERTISE SHARING IN UNIVERSITIES

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ABSTRACT: This paper reports a small-scale experiment of a strategy designed to support the sharing of academic and professional expertise at a Distance Learning University. Two small groups of academic staff members (one of 4 professors and one of 5 instructional designers, both including experienced and new employees) volunteered to meet monthly, over a one-year period, to elaborate a collective knowledge map representing a portion of their professional knowledge. This tool- and peer-mediated mentoring activity created an informal learning context in which participants were encouraged to externalize and thus share some tacit as well as organisational explicit knowledge related to their professional practices.

KEYWORDS: Academic expertise sharing and transfer. Group mentoring. Collaborative knowledge modeling.

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Problem Statement and Objectives

Like in many other organisations in western countries, Canadian universities are currently facing a high employee turnover due to the retirement of post-World War II baby-boomers (AUCC, 2007). Thus, the integration of large cohorts of new faculty as well as other academic staff members represents a great challenge for universities. To take up this challenge successfully, new employees must be supported in their efforts to embrace the academic culture of their universities and to optimize their professional development through their work practices. One way to accomplish this is to put in place the conditions required to support the intergenerational transfer of academic expertise (Bratianu, Agapie, Orzea, & Agoston, 2011; CSÉ, 2003), by encouraging experienced and new employees to meet regularly to discuss their work practice, in the hope that the former will externalize some of the tacit knowledge developed during their university career and that the latter will consequently learn from them. Conversely, these informal meetings can be occasions for newcomers to express fresh ideas that can contribute to breaking some encrusted rules and instill innovative practices in their respective universities.

With this aim of supporting expertise sharing and transfer (especially of tacit knowledge related to expertise), a pilot experiment was conducted with two separate small groups of employees in a French Canadian Distance Learning University. This paper presents the strategy designed to this end, which can best be described as a combination of group mentoring with collaborative knowledge modeling.

Rationale of the Strategy Used to Support Expertise Sharing

To support expertise sharing, tacit knowledge needs to be externalized in some way. However, research has shown that experts have much difficulty verbalizing what they know and explaining their models of action (Sternberg & Horvath, 1999). Experts have developed highly organized mental structures, integrating procedural as well as declarative and strategic knowledge (Chi, Feltovitch, & Glaser, 1981; Ericsson & Charness, 1994; Glaser, 1986; Sternberg, 1997). This knowledge becomes "encapsulated" with experience (Boshuizen & Schmidt, 1992; Hakkarainen, Palonen, & Paavola, 2002) and is, consequently, very difficult to verbalize.

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A possible solution to approach this problem consists of creating situations where experts can co-construct a structured external representation of knowledge related to their professional practice in concert with novices. This requires two conditions: an opportunity to interact verbally in the context of a professional activity and a means to trigger the externalisation of the experts' knowledge, as well as that of the novice's internal representation of professional practices in their fieldwork. We propose that group mentoring combined with collaborative knowledge modeling offers abundant potential for this purpose.

Mentoring is usually defined as a relatively long-term relationship between a knowledgeable individual (the mentor) and a less experienced person (the mentee), the former providing information, advice and encouragement to the latter with the aim of fostering his or her personal and professional development. Group mentoring is a form of mentorship "in which the mentoring function is supplied by a more or less tightly constructed group of professional colleagues" (Ritchie & Genoni, 2002). Research has shown that successful mentoring relationships can assist individuals in ''learning the ropes at the workplace'' (Goodyear, 2006). Many cases have documented one-to-one mentoring programs implemented in universities, especially for faculty (Bernatchez, Cartier, Bélisle, & Bélanger, 2010; Cawyer, Simonds, & Davis, 2002; Feldman, Arean, Marshall, Lovett, & O'Sullivan, 2010; Foote & Solem, 2009; Knippelmeyer & Torraco, 2007; Langevin, 2007), but *group* mentoring remains rare in the academe (Moss, Teshima, & Leszcz, 2008).

Collaborative knowledge modeling consists of elaborating a collective graphical representation of some part of a knowledge domain in a node-link format. Nodes represent the knowledge entities and links represent the semantic relationships established between knowledge entities. A variety of terms is used to refer to this type of external representation of knowledge (knowledge map, concept map, knowledge network, mind map, etc.), although these can differ substantially in terms of the formalism used to develop them (Basque, 2012; Eppler, 2006). The terms "knowledge model", "knowledge map" or simply "model" or "map" are used in the remainder of this paper to refer to the product of a collaborative knowledge modeling activity. Many studies conducted in different educational settings demonstrate that creating such graphical representations in groups is beneficial to learning in formal educational contexts (Basque & Lavoie, 2006). It has also been proposed as a strategy to support the elicitation of expert knowledge and transfer of expertise in organizations (Basque, Paquette, Pudelko, & Léonard, 2008; Coffey, 2006; Coffey &

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Hoffman, 2003). However, to our knowledge, no research has yet examined the potential of this strategy to support the sharing of expertise in universities.

Description of the Context and of the Strategy

Participants

Two small groups of academic staff members working in a Distance Learning University (one of 4 professors and one of 5 instructional designers, both including experienced and new employees) volunteered to meet regularly to participate in the pilot experiment. The first group (Prof Group) included two experienced professors[1] (with 30 and 13 years of academic experience, respectively) and two newcomers with (less than one year of academic experience at this university) in the same discipline. The second group includes 5 instructional designers (ID group) working in different disciplinary departments. The main task of these instructional designers consists of assisting the professors in designing their courses. One of them has worked at the university for more than 20 years and the others between 2 and 6 years. In this project, the title of "experts" is reserved for participants with more than 10 years of experience at the university. Those who have garnered between 3 and 10 years of experience will be called "intermediate" and those with less than 3 years "novices". Table 1 shows the number of participants at each level of expertise in each group.

Table 1. *Number of Participants for Each Level of Expertise in Each Group*

Level of Expertise	Prof Group	ID Group
Expert	2	1
Intermediate	0	1
Novice	2	3
Total	**4**	**5**

The Collaborative Knowledge Modeling Tool Used

[1] One of the two experienced professor is the author, who acts as an observing participant in this action research project.

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The knowledge map is elaborated with the G-MOT software tool developed at the LICEF Research Center (www.licef.ca), which implements an object-type modeling technique developed initially for Instructional Design purpose by Paquette (2010) called MOT[2]. This technique differs from usual concept mapping techniques in that it requires the user to identify the types of the knowledge entities as well as the type of links represented on the map. Knowledge entities include *concepts* (conceptual knowledge), *procedures* (procedural knowledge), *principles* (strategic knowledge), *facts* (factual knowledge) and *actors* (agency knowledge), which are distinguished by different shapes. Following are the link types (represented by their first letters on the map): *Composition, Specialisation, Precedence, Regulation, Instantiation, Input/Product*. Additionally, a set of "grammar rules" defining the valid links that can be established between different types of knowledge entities has been integrated in the software. For example, a *Specialisation* link (A is "a sort of" B) can only be established between two knowledge entities of the same type. Among other interesting G-MOT features, we can mention that users can create "sub-maps", each connected to a knowledge entity appearing in one or other of the upper layers of the map. Furthermore, various types of files and URLs can be attached to knowledge entities, which can then be easily accessed when consulting the map. *Comments* (frame-free texts) can also be added to the nodes and links.[3]

We propose that the G-MOT technique offers a "representational guidance" (Suthers, 2003) that is particularly useful to support the elicitation of tacit knowledge called upon in the professional practice. Indeed, in G-MOT, professional actions are identified in *nodes* (of a procedural type) in the map, rather than in *links* (labelled with action verbs) as is the case in other concept mapping techniques. This feature opens the possibility to decompose each action in "sub-actions" (using the *Composition* link) and/or to specify different types of "sub-actions" (using the *Specialisation* link) that can be taken to realize the action. It also invites the user to specify other types of knowledge entities implied in the professional action and sub-actions: the actors that regulate them (using the *Regulation* link), the internal and/or external resources needed to realize them as well as their products (using the *Input/Output* link), and finally the strategic knowledge implied when performing them. Figure 1 shows how these different types of knowledge entities can be represented

[2] Mot is a French acronym for "Modélisation par objets typés".
[3] For more information on the software and the technique, see Paquette (2010).

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graphically in a G-MOT model. We think that this generic model of what could be called an "action knowledge structure" can act as a powerful mediator of the cognitive activity of the knowledge modeller when creating the map (Basque, 2012; Pudelko, 2006) as well as of social interactions when this activity is done collaboratively (Basque & Pudelko, 2009).

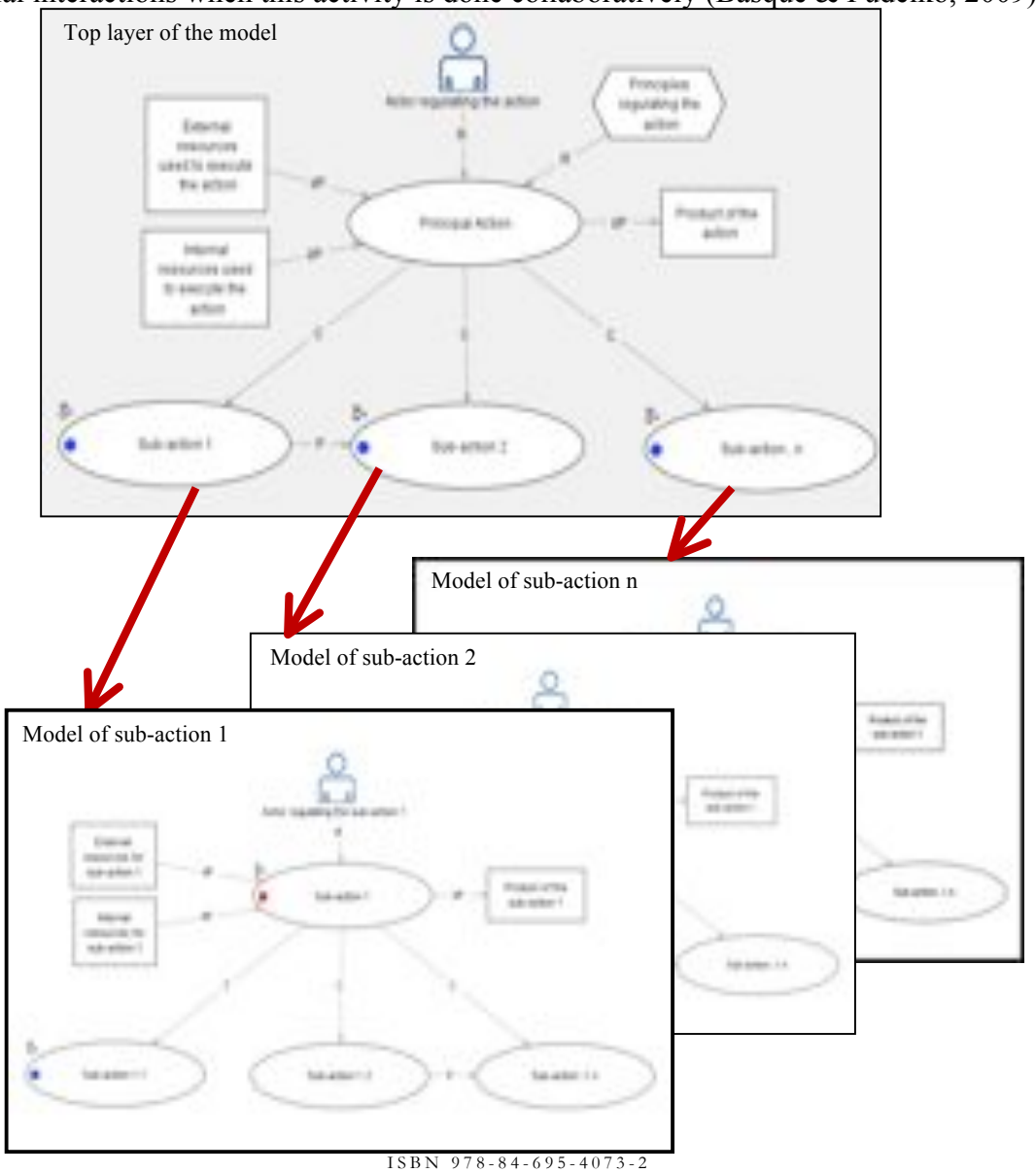

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***Figure 1**. Generic representation of an "action knowledge structure" in G-MOT*

Procedure

Before the beginning of the pilot experiment, all participants were asked individually to specify an aspect of their professional practice they would like to see represented in the collaborative knowledge map of their respective group. They have all chosen to represent the knowledge deployed through the instructional engineering process of a distance course at the university. They were also informed that the project would probably require them to participate in 10 half-day meetings (once a month or two months, depending on their availability), but that their group will be free to resign at any moment or to continue after ten meetings.

In June 2010, the Prof Group held its first meeting and in September 2011, they had their tenth meeting and agreed that this was the last one. Overall, participants in this group met for 23 hours 13 minutes, each meeting lasting an average of 2 hours 13 minutes. The ID Group had its first meeting in June 2011 and its tenth in March 2012. Participants decided to continue for additional sessions. At the moment of this writing (after their 10th meeting), they have met for a total of 26 hours 26 minutes, each meeting lasting an average of 2 hours 38 minutes.

Since the university is located on two work sites in two different cities and participants do not share the same physical location, videoconferencing equipment is used so that they can hear and see each other on a large television screen. Discussions are moderated by one of the participant who is familiar with the knowledge modeling technique. The author of this paper acted as the discussion moderator as well as an active participant in the Prof Group. She also participates in the ID Group as an observer and as a supporter of the designated moderator[4] since the latter has not heretofore led this kind of group activity. In both groups, a Ph.D.

[4] Being one of the instructional designers working at the university, this designated moderator also acts as an active participant in the collaboration knowledge modeling sessions.

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student manipulates the software tool and constructs the map progressively based on the group discourse. All participants can visualize the progression of the construction of the map, since it is projected on a screen at both sites. Each participant may intervene at any time to suggest changes to the map being elaborated. However, a consensus must be established within the group to bring them to the map.

During the sessions, discussions are very intense. It is thus sometimes difficult to capture such richness on a map, on the go. To overcome this difficulty, meetings are audiotaped numerically. The author of this paper listens to the recording between each meeting and, when necessary, adds elements verbalized during the meeting but not represented in the map and suggests some restructuration to improve the overall structure of the map.

The sequence of each meeting follows the same pattern: (1) the moderator briefly reminds the participants of the work done in the previous session; (2) he validates the modifications he had brought to the map with the group, and pinpoints parts that have yet to be elaborated or those that need to be clarified; (3) the group chooses to focus on certain sections of the map; (4) the group pursues the elaboration of the selected parts of the map; (5) a short debriefing period (5-15 minutes) concludes each session. After the session, the map is made accessible to the group through a web content management system recently implemented at the university (*Microsoft SharePoint*), so that participants can consult it at will.

We asked participants of the Prof Group to validate individually the final version of their map. At the time this paper was published, this validation process is not completed. The ID Group's map was still in progress.

Data Collection and Analyses

The following data were collected in both groups: (1) audiotapes of interviews conducted with each participant before and after the experiment[5]; (2) audiotapes of the meeting discussions; (3) the elaborated map; (4) audiotapes of the debriefings.

[5] The post-experimental interview had yet to be conducted with the ID Group at the moment this paper was published since the project is still ongoing with this group.

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Such data are currently being analyzed in order to explore three main research questions within a qualitative research methodology framework: (1) Did the strategy support the elicitation and sharing of professional knowledge during the knowledge modeling sessions? (2) Are there various indications that the strategy supported professional learning of the less experienced participants as well as the consolidation of the professional expertise of the veterans? (3) Can we identify the factors which affect the efficiency of the strategy?

Verbal data are being coded using the qualitative data analysis software *Nvivo* (QSR International) and a semi-emergent coding approach. We began with the main and secondary categories of a coding scheme elaborated in previous projects conducted in non-academic organizations (Basque, Desjardins, Pudelko, & Léonard, 2008; Basque, Paquette, *et al.*, 2008; Basque & Pudelko, 2010; G. Paquette, Léonard, Basque, & Pudelko, 2010) and revised them progressively through the coding of these new field data.

As to the analysis of the maps carried out so far, a quantitative report was automatically generated by G-MOT to assess the number of each type of knowledge entities represented on the maps created in each group.

Preliminary Results

Some of the preliminary results related to the first two research questions are reported here.

Elicitation and Sharing of Professional Knowledge

One indication of the degree of professional knowledge that was elicited during the sessions can be found in the quantitative data generated by G-MOT. Table 1 reports the number of knowledge entities of each type that are represented on the map of each group of participants after ten meetings. This table shows that the maps produced by both groups are quite similar in terms of proportion of knowledge entities of each type. Interestingly, strategic knowledge, which is at the heart of professional expertise (Kavakli & Gero, 2003), is the most represented on both maps, compared to other types of knowledge entities. Indeed, slightly more than half of all the knowledge entities represented are identified as *Principles*. Procedural and conceptual knowledge is represented in similar proportions, i.e., one fifth of the knowledge represented; this is the case with both maps.

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Agency knowledge (*Actors*) seems to be under-represented in both maps. This is not surprising given that participants were asked to describe their own practices so that all the procedures represented in the model are "regulated" by a single actor, that is, an actor labeled "Professor" in the Prof Group and an actor labeled "Education Specialist"[6] in the ID Group. According to the inheritance principle integrated in the MOT technique, an actor linked to the top procedure of the model is considered linked to all of its sub-procedures and thus does not need to be repeated in every sub-model linked to the top procedure. Nevertheless, in "mono-actor" models such as the one elaborated by the groups (that is to say, models representing the perspective of a single actor on his or her professional work), it is sometimes interesting to represent the main actor not only as an agent regulating the procedures but also as an agent linked to a network of other actors. This approach was selected in the model of both groups by creating a sub-model representing the taxonomy of all the actors with whom the main actor is in interaction through the instructional engineering process of a course. This explains why several actors are identified on both maps. They appear in a specific sub-model which identifies the different "sort of" actors (using the *Specialization link*) participating in the whole instructional engineering process. Both groups have identified more than twenty actors (individuals, teams or departments) defined by their respective role. This reflects the fact that the instructional engineering process in this Distance Learning University requires the participation of many departments and employees.

Factual knowledge is not very present in either model. We recall that knowledge entities of this type are instances of other types of knowledge entities. Due to time constraints, participants thus primarily focussed their efforts on identifying strategic, procedural and conceptual knowledge pertaining to the instructional engineering practices. Adding factual knowledge as well as attaching resources (files or URL) to knowledge entities were considered activities that could be realized during a second stage of the project.

In addition, during the co-modeling sessions, participants set forth several recommendations or questions concerning the organizational processes governing their work which they deemed less effective. These recommendations were reported in *Comments*, in order to

[6] This is their official job title at the university but it could have been labeled "instructional designer" if we consider the role they play in this institution.

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eventually input the concerned instances in the academic institution. The Prof Group identified more than 60 comments of this type while the ID Group have identified nearly 40 so far. These comments voiced by the academic staff could represent a significant contribution to improve the work process in the university if only authorities adequately take advantage of this input to re-examine the organisational work rules and processes through a productive dialogue with the different groups of professionals.

Table 1. *Number of Knowledge Entities Represented in the Map of each Group of Participants after Ten Collaborative Knowledge Modeling Sessions*

Types of Knowledge Entities	Prof Group		ID Group	
	N	%	N	%
Strategic Knowledge (*Principles*)	325	51 %	374	54 %
Procedural Knowledge (*Procedures*)	131	21 %	121	18 %
Conceptual Knowledge (*Concepts*)	129	20 %	155	22 %
Agency Knowledge (*Actors*)	30	5 %	24	3 %
Factual Knowledge (*Facts*)	20	3 %	15	2 %
TOTAL	**635**	**100 %**	**689**	**100 %**

These quantitative data show that the knowledge models developed by both groups are quite elaborated. Both include more than 600 knowledge entities. In fact, several participants were surprised by the amount of knowledge that they had been able to spell out through the different layers of the model:

When you open the sub-models, it's like "Wow!" I find it rewarding (...). It really

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> *shows the great quantity of work we have generated. (…). I am impressed.* (Intermediate, ID Group, Meeting 10)[7]

Actually, some even felt that the knowledge entities were too numerous in certain layers of the model, and that it would be best to effect some reductions, or at least to re-organize some knowledge elements into sub-models, in order not to "scare away" new employees who would eventually access the map:

> *That is one of the challenges pertaining to sharing our work with colleagues. Indeed, we must not frighten people who are presented with this complex model we have designed, as they could feel overwhelmed and sense that "there are far too many components in there; I'll never make it!" This is the drawback of having spelled out such a quantity of elements…to have rendered the knowledge much more explicit* (Novice, Prof Group, final interview).

Several participants commented that, in their view, the collaborative knowledge modeling activity combined with that of the mentoring group facilitated the elicitation of knowledge related to their professional practice. Following are two examples:

> *The main advantage* [of the strategy]*, is that it really allows to focus on the essential knowledge. It provides a way to structure it all; it facilitates discussions and yields a clear, structured vision of it* (Novice, Prof Group, final interview).

> *The work is conducted on two levels (…). On the one hand, you can discuss about work practices with colleagues (…). On the other hand, you have the product of such interaction: the model (…). I find it rather interesting that we combine both. If you only had the discussions (…), the danger would be that, at some point, people would say: "Look, we're not getting anywhere. We don't have a finished product." In our case, throughout our discussions, we are consistently asking: "Where does this fit into the model?" (…) Hence, the fact that there is a product to work on allows one to remain focused on the task and it provides a concrete reference point that can be consulted after the meeting* (Novice, Prof Group, final interview)

[7] All participants' comments were expressed in French. They have been translated into English.

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However, participants brought up interesting questions and reservations regarding the knowledge models elaborated. A lack of space on these pages prevents us from reporting them all and discussing their implications. Thus, we will address only two issues that we report from the perspective that the project aims to promote the integration of new employees in the university.

The first issue can be stated as follows: What is the nature of the knowledge that the participants should represent in the map? Three possibilities can be identified: (a) the *prescribed task* as defined in organisational documents and procedures (b) the *practiced task* as conducted in the current work context, including how the participants interpret and cope with the prescribed task, or (c) *the task that should be performed in an ideal work context* (i.e., if processes were improved)? Participants went back and forth between these three possibilities throughout the activity and the models reflect this ambiguity. At this point of our reflection, we believe that option "b" is more consistent with a strategy that aims to integrate the new employees in the university. This hypothesis needs to be explored with further analysis.

The second issue raised by the participants can be summarized as follows: Where shall we draw the line in the elicitation of "good" Instructional Design principles? Must we assume that the new hired employees have the "basics" in this domain? In both groups, participants raised this issue at a certain point during the elaboration of their knowledge map. They finally stated that it was unnecessary to clarify all of the knowledge that newcomers should have acquired prior to being hired. The Prof Group suggested rather that a set of learning resources developed for distance courses offered at the university in the field of Instructional Design should be attached to knowledge entities represented in their map. The map would then serve as a complimentary professional development tool to newcomers. It is important to mention that these professors were all affiliated to the Education Faculty. It would be interesting to see if participants from other disciplines would have behaved similarly, since we know that in general, university professors have no training in course design and in pedagogy in general. Many even ignore that there is an area called "Instructional Design" in the field of Educational Technology. It is possible that these professors would feel the need to discuss in more detail about their instructional design practices. Mixing professors from different disciplines, including Education Science, would be an interesting group mentoring modality to explore in future projects.

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As to the ID group, we observed that participants included more Instructional Design principles in their model, but they also felt the need to "draw the line" at a certain moment. As a guideline, we suggested the group to focus on work practices that are specific to the academic culture of the university and to include the Instructional Design principles that they felt especially significant in their practices.

We are currently completing the data analysis to better pinpoint different issues raised regarding the elicitation of professional knowledge during this pilot project.

Professional Learning

On numerous occasions, participants from both groups and at all levels of expertise have expressed comments regarding the fact that the experiment was beneficial to their professional development. Here are some sample comments:

> *As far as I'm concerned, I have learnt much. (...) If I had known everything that I heard today, I would have done things differently. (...) I'm already learning!* (Novice, ID Group, Meeting 1)

> *Just like in every meeting, I am learning a lot! (...) As our practices differ and as we discuss them, it makes me self-reflect on my own practices.* (Novice, ID Group, Meeting 7)

> *Something has changed in my practice, since the beginning of this experiment. Thus, it is very encouraging.* (Intermediate, ID Group, Meeting 8)

> *My perceived level of competency has improved since we began working on this project (...)* (Novice, ID Group, Meeting 10)

> *It has (...) allowed me to learn about the operations in general. It has allowed me to find my place in the culture of the Department and regarding the issues of designing a course at the university and all of the organizational operations. (Novice, Prof Group, Final interview).*

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> *For me, it's like an important professional development activity, even at the end of my career.* (Expert, Prof Group, Meeting 10)
>
> *I think we learn a lot through such a project. (…) Discussions with others can help people increase their level of competency a little more rapidly* (Expert, Prof Group, final interview)

Conclusion

The data that have been analyzed so far indicate that combining group mentoring and collaborative knowledge modelling is a promising strategy to support the integration of new employees in the university culture. It can also contribute to the improvement of work processes prescribed in the higher education institution. Analyzing all of the collected data will allow us to better define the limits of the strategy as well as the factors that favor or hinder its feasibility and effectiveness.

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