MATHEMATICS TEACHERS INITIAL TRAINING AND COLLABORATIVE WORK

Pierre André CARON
Laboratoire LAMIA (I.U.F.M. Nord Pas de Calais France) and LILIMATH
pa.caron@laposte.net

Anne MIDENET
Laboratoire LAMIA (I.U.F.M. Nord Pas de Calais France)
anne.midenet@lille.I.U.F.M..fr

ABSTRACT

For several years, Communication Technology has been intensively used by the trainers in mathematics of the training college I.U.F.M. of the North of France. It concerns use of e-mail for maths dissertation papers, of WEB resources for the history of mathematics, an on-line bibliographic data base, a data- base of dissertation papers and web sites created by groups of trainers: C.R.E.A.M, Mathadoc, LILIMATH, FUNCTIONS, GEOWEB, several of them have received national prizes. These groups use a groupware for their work.

In 2001-2002, a new program for the training in new technologies began linked with dissertation papers. The trainers are themselves engaged in the creation of resources and animation of networks, and they work in a collaborative way for preparing and managing the training. They have set up, for trainees, working modalities that are mostly induced by the collaborative way trainers have been working.

After briefly presenting the French educational and teacher training system, this communication will give essential points of this program and will analyze the first year of training.

Keywords: initial training , cooperative and collaborative work, distributed cognition, network.

The first part of this paper gives a presentation of the teacher training colleges in France, called I.U.F.M. (Instituts Universitaires de Formation des Maîtres). It is based on texts written by Pierre Louis, Director of the I.U.F.M. of the Nord-Pas-de-Calais in France and by Eliane Cousquer, head of the LAMIA. In the second part, we present and analyse a teacher training organization in witch we have experimented collaborative work.

Education in France and teacher training at an I.U.F.M.

Organization of teaching in France

One can consider that in France, teaching is organized in three levels:

· primary teaching (1st level) concerns children from 2 to 11, compulsory education beginning at the age of 6. The teachers, called "school professors", have comprehensive skills;

· secondary teaching (2nd level) concerns children and teenagers from the age of 11 to 18. The teachers, "professors of secondary teaching ", have the responsibility for one, sometimes two disciplinary domains (e.g. history and geography, English and French literature);

· higher education is for young people having successfully finished their secondary curriculum. Academic establishments have also a research mission. Most teachers are also researchers and are specialists in one discipline.

What is the I.U.F.M. ?

I.U.F.M. is an academic institute for teacher training. Its first role is that of the vocational training of new teachers, along with training in the discipline the future teacher will teach. Vocational training begins during the first year with an awareness of the teacher's profession and is strongly strengthened in the second year. Most professional training is given during the second year. The main aim of the training is to establish links between necessary information for teaching (didactics of a discipline, child and teenager psychology, sociology and philosophy of education, and so on), practical competence to be acquired (such as management of a class, communication, teamwork), and the real experience of responsibility for a class. The competitive examination, following the training, takes into account three domains:

· general professional and disciplinary training,

· professional dissertation paper,

· practice in responsibility of a class.

The professional dissertation paper is a trainee's personal work on his real experience of teaching. He has to theorize his experience in a written report and an oral presentation in front of a board of examiners.

A strengthened mission : continuing education for secondary school teachers

Since their creation, the I.U.F.M. have been recognized for their participation in continuing education of teachers. By giving this mission to the institutes, the political leaders want:

· to establish a continuity between trainee-teacher education and continuing education, each training becoming a time of global improvement of knowledge along the career,

· to strengthen the academic character of the training in order to maintain teachers at a high level of knowledge,

· to train together all the teachers, of primary and secondary schools, of general or technical or professional schools; the point being to strengthen collaboration between the different parts of the educational system.

Research and pedagogical innovation in the I.U.F.M.

From their birth, the institutes inherited pedagogical research, of an applied type, based on experiments in classes. This activity is particularly emphasized in the general frame of training. Additionally, the I.U.F.M. want to develop research having a real academic status and have created teams with other institutes or universities, led by confirmed researchers.

The teacher trainers of the I.U.F.M.

One of the strong peculiarities of the institutes consists in the variety of their trainers. Primary school teachers, secondary schools teachers, teachers of higher education, heads of establishments, inspectors … trainers come from all degrees of teaching and all parts of the educational system. In order to maintain the quality and the level of their trainers and to recruit new ones, the institutes set up a training for trainers, often linked with research. It takes different forms: lectures, thematic work groups, production teams, workshops …

Creation of the LAMIA

A laboratory for multimedia creation within the I.U.F.M.: what for ?

New tools (hypertexts, hypermedia, animations, virtual reality ...) were developed for other aims than training, in particular for the accessibility on the Internet of large quantities of data. They present, however, a great interest in training, since they can allow the learner to be more active and to take more initiatives. Re ection on the uses of these techniques for training is still at an early stage, but one should bear in mind that some basic ideas can be drawn from research on practices:

· Systems based on knowledge require considerable elaboration. To be really useful, they must be integrated into the training and not placed side by side. We must focus on an active use of hypermedia by trainees to solve problems or to carry out personal work given by their trainers.

· If creation is sometimes due to a minority of teachers, full integration requires interest and implication from a lot of them. This involvement can not be obtained at once. Nothing will be done without the teachers' full cooperation.

The objectives

· To give creative teachers an institutional frame which facilitates and enriches their creative work;

· to lead activities of research and development in the uses of multimedia tools and of information and communication technologies;

· to analyse the possible effects of new technologies on teaching practices, on learning strategies and processes;

· to contribute to the creation of new tools, ready to be used when a need shows, as well as the analysis of the uses and of the practices for implementing them;

· to animate a workshop which has the specific task of validating the capitalization of reflection and production. The workshop has been dedicated to the contributions of cognitive psychology. These last years, it focused on collaborative work.

Research activity at LAMIA

This activity is centered on production because we want to experiment different training organization and environments in real situations. It is the case with the training in collaborative work we wanted to set up. The laboratory financially encourages teams of creation. It organizes for them a network modality of working. LAMIA plays the role of catalyst between the various teams and supports their collaborative work.

LAMIA productions in mathematics

· C.R.E.A.M.: center of pedagogical resources for trainees in mathematics,

· A6-3: *The Electronic Schoolbag* of the secondary school teacher is a downloadable software programme ; it provides an important data base on the curriculum concerning the last ten years in France, with a set of lessons and exercises for four class levels (from the first form to the fourth form). The teacher can develop it and modify it in order to create his own database,

· LILIMATH: discovery workshops for the teacher to use in classes; LiliMath received in 1998 the first prize in a national competition (Cervod) for computer supported learning tools,

· FUNCTIONS: learning of functions in secondary technological schools. This software programme allows an individual follow-up of pupil work and received the fourth prize in the same competition,

· GEOWEB: a web site presenting secondary schools pupils creations. They make up and write up geometry problems and organize access to the concepts needed to solve them. It received the 2001 "Prize for educational innovation".

Another network is financially encouraged by the LAMIA: GÉOMÉTRIX: this software helps to structure writing of demonstrations by secondary school pupils; it is written in prolog programming language and uses artificial intelligence techniques; it received the second prize in the Cervod competition.

Continuation

Networks created by LAMIA for development teams have subsequently become involved in teacher training. A project was launched in 2001-2002 by the head of the LAMIA, also in charge of professional dissertation papers in mathematics. It consists of the creation of the *Math Ring* (workgroup of teacher-creators in mathematics), and in the design of training in new technologies for second year mathematics trainees.

Collaborative work between trainers

Although the *Math Ring* is under the supervision of the head of the LAMIA who organizes the agenda, the scientific program and invites the speakers, the following training principle are applied:

· emergent collaboration: the trainers are registered in the *Math Ring* group, where they make up the content of the training they want to provide, as well as the content of the training from which they want to benefit,

· no prior strong structuration of activities nor role assignment, learning by training: each participant is successively trainee and trainer according to his competences. Little by little responsibilities show up, for example, the final making of a CD-ROM of resources,

· full size experiment: it involves all the trainers (between 40 and 50) participating in the training in new technologies for the discipline.

Tools and technical aspects

Members of LAMIA don't only have training skills, they also have technical abilities needed to implement the collaborative training organization. The environment gradually evolved from email to a complex platform with the following functionalities:

· Email: the exchange of emails allows planning of meetings and exchange of documents.

· LAMIA Web Server: this server is used for submitting large documents. It also allows each document to be put in a proper learning context with links to appropriate information.

· The *Virtual Campus*: it was our main tool during 2000-2001. However it quickly showed its limits. It didn't support more than 50 registrations and his double checking system handicapped communication.

· A Yahoo group: in 2001-2002, our entire organization migrated to *Yahoo groups*. *Yahoo groups* is a free and rather comprehensive collaborative environment. Each group has a zone for file deposits, a diary and a mailing list. The impossibility to create sub groups was finally felt as something positive, because it prevented the setting up of a hierarchy between groups.

· The GANESHA platform (PHP MYSQL): the evolution of computing languages, and free disposal of resources written in these new languages (e.g. PHP and MYSQL) allows the current development of our own collaborative working system. Members of LAMIA are currently working to adapt a GANESHA platform

The *Math Ring* functioning

Trainers meet once a month. At each meeting, one of them presents his work of creation. He clarifies the educational problems he wants to solve and how his method can favor the teaching of mathematics. The other trainers test their colleague's work as pupils and can express their critics. Researchers are also invited to these meetings and their presentation is often followed by a contradictory debate about the motivation of their work and their actual and original contribution to teaching of mathematics.

Additionally, all the trainers are registered in the *Math Ring* group. Summaries of presentations and web links and documents provided during meetings are posted in the Yahoo group in order to continue discussions through the mailing list.

The aim of the group is not only trainer training but also the design of mathematics training in new technologies. As we pointed above, during this process no specific role was assigned among trainers of the group, nor was any prior instruction given. The only structuring element was the common and urgent objective to be achieved. As a matter of fact, some individuals showed leading and organizing skills and took responsibilities as well.

As planned, the group production was the content of the training. But the group, during the process, decided to produce a CD-Rom of various resources to be given to trainees; the showing up of this need was induced by the collaborative organization of trainers work. Another consequence of this collaborative organization was that trainers resolved to have trainees work in a collaborative way.

Training in new technologies for prospective teachers

The staff of the I.U.F.M. decided to experiment a new disciplinary program to integrate new technologies in mathematical training. The head of the LAMIA chose six young and very creative trainers. Their task was to train for twelve hours without a fixed program. They had to show the trainee their own pedagogical use of technology and how to guide a network. Collaboration between the trainers and analysis of practices will allow a more specific training program to be set up in future years.

For who and by who is this training made?

This training is organized for 90 future teachers of mathematics who are going to teach in September 2002. All the trainers are teachers who actually use new technologies in their professional practice. Some of them also create computer supported learning tools and use them in their classes; thus, they have investigated the ergonomic and pedagogical aspect of the tools they

have created. It can often be said that the products they developed are a computer supported solution of an educational obstacle they met with their class.

In what way is this training different, in content, from previous training ?

Previous training in new technologies was essentially cross-disciplinary, consisting mainly of office automation and communication by the internet. The content of the above described training is, on the contrary, essentially disciplinary. It also favors free software packages or resources and singles out software created by teachers to answer an educational problem, rather then non-specialized commercial software package.

Principle of this training

We intended to apply the same principles as those that prevailed in the organization of the trainers group.

· emergent collaboration: trainees are included in distant computer supported working groups. After several weeks, messages circulate in the network and documents are put at the disposal of the group. These interactions actually constitute the content of the training we want to provide;

· no prior roles assigned to trainees when included into the group;

· full size experiments: all the 90 mathematics trainees of the North of France (Académie du Nord Pas de Calais) were involved in this year's experiment.

A main obstacle to overcome: passivity

As former pupils and students, trainees have been used to be rather passive learners. Thus, encounting passivity among trainees is an inherent difficulty for our collaborative way of working. Our concern is that trainee's participation in exchanging is the basis of the training, consequently passive trainees just don't benefit from the training at all. Besides, in distant training, trainees can easily drop out, by not opening emails and not attending meetings any more.

Passivity is not that problematic when the entire course is given with the trainees physically present. The trainee is then taken up in the dynamics of the group in spite of himself. Even if he does not participate, he attends the group session and can reconnect with its work at any time. We identified two main factors to overcome the passivity obstacle in distant training:

· the holding of a minimum number of regular meetings: the whole training can not be made using distant collaborative software,

· a real pedagogical project: although collaborative work is the most important characteristic of the training according to trainers, it is introduced to trainees as the means to prepare and to improve the efficiency of the next meeting's work. It's also the mode set for working on the dissertation paper they will have to return later in the year. As we said previously, the trainers group also had a project, which was to set up the contents of the training.

Conclusion

The collaborative work is set up at several levels in the teacher training institute (I.U.F.M.): between members of the LAMIA, between the teams of production led by the LAMIA, between members of the trainers network, between the various teaching groups of trainees and their members. Whatever the level where it is applied, the collaborative work arises from the same philosophy, that is emergent collaboration (no frame of activity fixed in advance), no prior role assignment and full size experiments. As far as our experiment is concerned, interests of such an organization are:

· favoring learning among peers;

· allowing the realization of a common project;

· stimulating creativity in training design;

· optimizing team competency: using complementary skills, status and functions, enhancing each individual and team competence. The competences concerned are various: designing computer supported learning tools in mathematics, pedagogical uses of computer supported learning tools in mathematics, designing and managing teacher training as well as working in team.

We would like to point out some important characteristics of this organization:

· permeability of sub-networks: one individual can be part of several networks,

· mobility and context-dependency of the network design; the network cannot be drawn, for its representation would depend, among other things, on the person under focuse, the moment, the activity this person is involved in at the concerned time etc.,

· although the organization is set up under an institutional frame, it seems to remain even if the concerned people move out of the institution. For example, it is already the case for former members of production teams. We hope that it will also be the case for trainees next year, when they will be teachers.

ON LINE REFERENCES

-Mathematics departement of I.U.F.M.	http://www.lille.iufm.fr/dep/math/index.htm
-LAMIA	http://www.lille.iufm.fr/labo/prologlabo.html,
	http://lamia.lille.iufm
-C.R.E.A.M	http://www.lille.iufm.fr/labo/cream/entree.html
-A6-3	http://www.lille.iufm.fr/labo/6A3/index.html
-LiliMath	http://www.lille.iufm.fr/lilimath

REFERENCES

-Bourgoin, G. Derycke, A, 2000, A reflexive CSL environment with foundations based on the Activity. *ITS'2000 conference* IEEE, ACM, Montreal, Canada, 20-25 june 2000, Springer Verlag LCNS.

-Cornu, B., 1995, New technologies, integration into education, in Watson, & Tinsley, 1995, *Integrating Information technology into education*, Chapman Hall.

-Cousquer, E, 2002, Collaboration in a Multimedia Laboratory, to be published by Springer Verlag, Worshop: *Multimedia Tools for Communicating Mathematics*, 23-25 November 2000, Lisbon, Portugal http://mtcm2000.lmc.fc.ul.pt/

-D'Halluin, C, Vanhille, B., Viéville, C. A virtual environment to learn mathematics by doing and cooperating, In *Proceedings de Teleteaching 98*, G. Davies ed., August 98, Vienne, Autriche, Chappman & Hall, pp.417-426.

-Dillenbourg, P. What do you mean by " collaborative learning " ? in P. Dillenbourg ed. *Collaborative learning : Cognitive and computational Approaches*, pp. 1-19, Oxford : Elsevier

-Dillenbourg, P. , Baker M., Blaye A., O'Malley C., The evolution of research on collaborative learning, In E. Spada & P. Reiman Eds *Learning in Humans and Machine : Towards an interdisciplinary learning science* pp.189-211. Oxford: Elsevier, 1996

-Johnson, D., & Johnson, R. 1987. *Learning together and alone*. 2nd edition. Englewood Cliffs, NJ: Prentice-Hall, Inc.

-Freudenthal, H, 1983, *Didactical Phenomenology of Mathematical Structures*, Reidel Publishing Company.

-Laborde, C., & Laborde, J.M. 1995, The case of Cabri-géomètre : learning geometry in a computer based environment, in Watson, & Tinsley, 1995, *Integrating Information technology into education*, Chapman Hall.

-Lajoie, S., & Derry, J. 1993, *Computers as cognitive tools*, Laurence Erlbaum Associates Publishers.

Schön, D.A., 1983, *The reflexive practitioner, how professionals think in action*, Basic book.