

# Didactics, ICT and the teacher of the future

Bernard Cornu and Clara Danon

*IUFM, 30 avenue Marcelin Berthelot, 38100 Grenoble, France.*

*bernard.cormu@grenoble.iufm.fr*

*Subdepartment of Educational technology and ICT, Ministry of Education,*

*110 rue de Grenelle, 75357 Paris 07, France.*

*clara.danon@education.gouv.fr*

**Abstract:** France has several specialities, among which the development of didactical research, the way teachers are trained and the national public service characteristics of education. Research in didactics is developing in most countries, and especially in France. Application of such research leads to the elaboration of products, of tools for teaching and learning, of educational environments and of pedagogical strategies (such as co-operative work). The integration of ICT in the school of the future may lead to a uniform education around the world. How can we preserve the diversity and the local specialities? How can we take benefit of the positive aspects of the globalisation, while avoiding the negative ones? In many countries, education is a public service, and the state has the responsibility of equity in education, so that every pupil may have similar chances regarding education. Are we going towards a liberalisation of education? How can the fundamental values of education be preserved? The integration of ICT in education changes the knowledge and the way one can access the knowledge. Therefore, the role of the teacher is changing. What will be the future teaching profession?

**Keywords:** Didactical research, educational environments, cooperative working, knowledge, equity, teacher, teacher education

## 1. INTRODUCTION

We would like to take into account the reflections that are carried out in France and bring them as a contribution to the international reflection. Our

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country has several specialties: the way didactical research is developed and carried out, the way teachers are trained, and the national public service characteristics of education. In this paper we will examine how these specialties can influence the school of the future.

## **2. THE ROLE OF DIDACTICS IN THE DESIGN OF EDUCATIONAL ENVIRONMENTS**

Research in didactics is developing in most countries, and especially in France. The French approach has produced theoretical frameworks, based on the relationships between the pupil, the teacher and the knowledge, and aiming at designing educational situations and didactical situations. This approach is more based on the pupil than on the teacher or the knowledge. But it is always linked with knowledge content. For example, there are lots of studies about epistemological obstacles and the way these obstacles occur for the pupils. There are lots of studies analyzing the errors pupils make as a consequence of the way the knowledge is organized and structured in their mind. Didactical research is also used in order to produce didactical environments. Many researchers apply didactical research for producing tools and resources for teaching and learning and pedagogical strategies.

Due to the simultaneous development of ICT and educational research, there is a fruitful convergence between these two fields. This leads to the design of pedagogical environments, integrating ICT, and to the elaboration of ICT-products based on a didactical approach. Cabri-Geometry, software for learning geometry, is a good example of such a convergence.

Didactical research will influence the school of the future. The teacher of the future will generally not be a researcher, but will have to be able to integrate and apply outputs of research and to put questions to researchers.

There is still a problem in France with didactical research, which is not considered with the same dignity as other fields, and many researchers in didactics feel neglected. There is a tendency to include didactical research in the field of educational sciences, rather than in the field of each discipline. But the strong link of didactical research with the contents of the knowledge make it necessary to keep the didactics of each discipline in the scientific community of this discipline.

### **3. DIVERSITY OR UNIFORMITY?**

The integration of ICT in the school of the future may lead to a uniformed education around the world. The teacher of the future will have to preserve the diversity and the local specialties. But at the same time where there is a risk of uniformity, the access to other cultures, other knowledge and other educational systems is a huge enrichment and can be very fruitful for teachers. We are in a world of diversity. The teaching profession is a profession of diversity, and this diversity may be reinforced by ICT. This diversity can make the school of the future better adapted to each pupil and therefore may be a tool for more equity.

Globalization has many positive aspects. For example human rights have developed around the world not mainly as an effect of local cultures, but as a result of a global culture and philosophy. Similarly, future education can take benefit from the globalization. It enables schools to work together even at a long distance, and to cooperate with schools in developing countries.

In brief, ICT and education must integrate the positive aspects of diversity and the positive aspects of globalization.

### **4. THE SCHOOL OF TOMORROW AND THE PUBLIC SERVICE OF EDUCATION**

In many countries education is a public service and the state has the responsibility of equity in education, so that every pupil may have similar chances regarding education. ICT brings many changes in the knowledge and the way the knowledge is accessible. Knowledge and pedagogy have become merchandise. Are we going towards a liberalization of education? What will we have to pay for in the school of the future? How can the fundamental values of education be preserved?

The state is the guarantor of accessing public services; it is the guarantor of equity in education. Many countries are thinking about decentralization and liberalization. ICT has an influence on the way educational systems are organized and structured. It has an influence on the way knowledge is accessible and is distributed. It makes necessary that a reflection on the role of the state in education is carried out, so that education remains a public service for all. This reflection is necessary for each teacher of the future.

## 5. THE KNOWLEDGE OF THE FUTURE

ICT changes the knowledge and the way one can access the knowledge. Knowledge is now over-abundant, knowledge is no longer stable but has become dynamic, evolving continuously (Spender, 1996). The knowledge which was printed was stable, could be learned and then taught in the same form. Digitized knowledge is now moving and interactive: everyone can act on the knowledge, interact with the knowledge. We have moved from the “chain” model to the network model: in a chain, there is a before and an after; the one who knows transmits to the one who doesn’t. It implies a hierarchy in the distribution of knowledge, and therefore a hierarchy in the organization of educational systems. In the network model, everyone is a node, and the relationship between the nodes is not a hierarchical one. Every one is both a learner and a knowledge transmitter. And knowledge is no longer only in schools and in the teacher’s head; it is now available in many places. This leads to the fundamental question of the specialty of schools in knowledge transmission. The school of the future will have to find its specialties. And the role of the teacher will be profoundly changed, from the one who knows and delivers the knowledge, to the one who helps and guides the pupil in accessing the knowledge, and helps the pupil sorting, making hierarchical structures, organizing the knowledge.

But the knowledge evolves in other ways. The strong link between knowledge and disciplines, the splitting of the knowledge into disciplines, is evolving. A French philosopher, Edgar Morin (1999), has proposed “the seven necessary kinds of knowledge for the education of the future”. He says that rather than teaching disciplines according to classical curricula, the society needs new kinds of knowledge to be taught. His suggestions are:

- Teach the weaknesses of knowledge: what is human knowledge? Teach its errors, its illusions. Teach to know what to know is!
- Teach the principles of relevant knowledge. One must be able to take into account global and fundamental problems, in which partial and local knowledge will then be used. The knowledge cannot be split into disciplines. One must be able to consider the objects of knowledge in their context, in their complexity, in their whole.
- Teach the human condition. Teach the unity and the complexity of human nature. This needs input from biology, from human sciences, from literature, from philosophy. Teach the relationship between the unity and the diversity of what is human.
- Teach the world identity. Teach knowledge at a worldwide level. Teach the history of the planet and the solidarity between all parts of the world.

- Teach how to face the uncertainties. Sciences have established a lot of certainties, but they also have revealed many uncertainties. Teach the uncertainties in physics, in biology, in history.
- Teach understanding. Understanding in all its meanings, mutual understanding between human beings. Teach what misunderstanding is. It is a crucial basis for peace education.
- Teach the ethics of humanity preparing citizens of the world. Teach how democracy relates to the mutual control between society and individuals.

The teaching should not only be organized through disciplines, but also through topics. What will be the concept of a curriculum in the school of the future? More and more society and the economical world demand us to teach competencies rather than knowledge. Knowledge changes very quickly and one can obtain knowledge when needed. But fundamental competencies, in order to solve problems should be taught at school.

Working in the current society means acquire, transmit and produce knowledge. It is no longer the role of the teacher to transmit knowledge, the role of the pupil to acquire knowledge and the role of researchers to produce knowledge. Acquiring, transmitting and producing knowledge is an objective for teachers as well as for pupils. Therefore, the role of the teacher is changing.

## **6. THE NEW TEACHING PROFESSION : THE TEACHER OF THE FUTURE**

In the report “Learning, the treasure within” (Jaques Delors, 1996) the UNESCO Commission for Education in the XXIst century proposed four pillars of education: learning to know, learning to do, learning to live together, learning to be. In implementing these four pillars the role of the teacher was underlined, as an agent for changes.

A working group of the French National Commission for UNESCO, produced a report based on Delors’ work, called: “The new teaching profession” (Cornu, 1999). In this report it is shown that the expectations of society towards teachers have changed and increased. Democratisation of schools have made the pupils more numerous and more heterogeneous. Teachers are facing the increasing complexity of society. And globalisation, with the mixing of cultures, has made the role of the teacher more complex.

So teachers have two major roles: prepare and train citizens and make the pupils acquire knowledge. In order to prepare the citizens of the future, teachers have to help the pupils learn to live together. They have to transmit the fundamental values of society and the universal values of humanity. They must make pupils live according to these values inside the school.

These roles of the teachers have consequences on the way they work everyday, on their official duty, on the way they work in teams.

The evolutions of society and the development of ICT have added lots of new competencies for teachers. The teacher of tomorrow will have to access the knowledge, sort it, organise and give it hierarchical structure. He or she will have to master the teaching and learning processes, to be a guide and a tutor, to contribute to the production of knowledge, to be an agent for policy and equity. The teacher of tomorrow will have to be involved in a life long learning process. He or she will have to work in the future school with the pupils of tomorrow and to find a place in the virtual and global classroom. Listing all the competencies one can expect for teachers, it appears clearly that this is impossible: no one will have all the competencies required.

Therefore we must consider the concept of collective competency, rather than individual competency. In each school the team of teachers must have the required competencies, but not necessarily each of them.

Competency is not a definite acquisition for teachers. They must mainly have an ability to evolve and adapt during their career. In-service training must therefore be a normal component of the teaching profession. Finally, new professions start to appear in schools. ICT makes a lot of new activities emerge, and this leads to the need of new professions.

## **7. TEACHER EDUCATION**

In France a reform of teacher education was set up in 1990. The IUFM's were created ("Instituts Universitaires de Formation des Maîtres). They have to train primary and secondary teachers in the same institution, for the same number of years (as a consequence, primary and secondary teachers are now paid the same salaries). Students who want to become teachers must first take three years at university (up to the "licence" degree). Then they apply for admission at IUFM; at the end of the first year at IUFM, they pass the competitive recruiting exam, through which the state recruits future teachers. If they succeed, they are admitted in the second year at IUFM, with the status (and the salary) of a civil servant. They get a second year of training and the year after they are given a job in a school. IUFM's also perform in-service training and they contribute to educational research.

After ten years some improvement is needed in teachers preparation and recruitment. A reflection about this is being carried out now. It aims at reinforcing the professional dimension in the recruitment exams, at better articulating theory and practice (the practice periods in schools and the more theoretical input at the institute) in teacher education, and at articulating pre- and in-service training. For this purpose it is proposed that new teachers,

during their first year as full teachers, are given free time deduced from their duty for training activities. And it is proposed that every future teacher receives a training for integrating ICT in his or her professional activity (and is evaluated on this topic). The project of such an evolution has reactivated the debate about the balance between knowledge and pedagogy. The main objective in this evolution is to reinforce the professional dimension of teacher training.

Teacher education should take into account some basic principles:

- Do not train teachers as yesterday with today's tools: we are training teachers for tomorrow! ICT allows new strategies, new ways of learning and teaching, and it is not enough (and less efficient) just to implement the old methods with the new tools.
- The profession of a teacher is an intellectual profession, and a profession of freedom. This implies that there is no "official pedagogy", that the "best pedagogical method" does not exist, and that we must provide future teachers with a wide diversity of tools, resources and strategies, so that they can build their professional competency by themselves.
- Knowledge (disciplines to be taught), human and social sciences (psychology, sociology, philosophy), pedagogy and educational concerns, must be well balanced in teacher education. They must not only be juxtaposed, but must be put in interaction.
- Teacher education needs interaction between theory and practice. School practice periods are necessary in teacher education, but they are not efficient if they are not well prepared, accompanied and exploited. Tools for observation and analysis are necessary before going to school practice. Theoretical tools must be used in order to solve real problems encountered in practice. Thus, theory feeds practice and practice feeds theory, in a permanent go and return process.
- It is impossible to provide a future teacher with all the competencies and knowledge he or she needs, for an entire career. No "rucksack"! In-service training is an essential component of the profession of a teacher. Ability to evolve and adapt is an essential component of this profession.
- In teacher education, training methods are as important as content. Teachers will generally teach not the way they are told to do, but reproduce the way they were taught themselves. This "induction" process must be taken into account, both in the strategies and methods used for training, and in the diversity of pedagogical approaches. Regarding ICT, it implies that it is not enough to give courses about new technologies and their integration into education. ICT must be actually used in teacher education, in each subject, and in each component of the training.

The new competencies for preparing the teacher of the future make a need for renewed competencies for teacher trainers. So we must also think about the teacher trainer of the future, who will not have to deliver a fixed knowledge, but who actually practices what he or she teaches.

The school of the future has to be prepared today. This is a great challenge for teacher training institutions.

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## BIOGRAPHIES

Bernard Cornu is the Director of the IUFM (University Institute for Teacher Education) of Grenoble, France. He contributed to the French reform of initial teacher education, leading in 1990 to the creation of the IUFMs, in which all primary and secondary teachers, in all disciplines, are trained. Until 1994 he was chairman of the 29 IUFM's in France.

He studied the influence of computers and informatics on mathematics and its teaching, and also worked in the field of didactics of mathematics. He has been the Director of the Institute of Research on Mathematics Teaching (IREM) of Grenoble and the Head at the in-service teacher training office for the Academy of Grenoble. He is president of the French Commission for Mathematics Education, and a member of the Commission of the French Republic for UNESCO.

As a member of IFIP he chairman of Working Group 3.1 ("Informatics Education at the Secondary Education Level").

Clara Danon graduated at the Ecole Normale Supérieure and the Ecole Nationale d'Administration. She has been the head of several sub-departments at the French ministry of education. She has been in charge of teacher education and she played a major role in the creation of IUFM's. At present she is head of the sub-department of Educational Technologies and ICT for all the levels of education (primary, secondary and university).