ART AND MECHANICS OF INFORMATION : A NEW PEDAGOGICAL PARADIGM

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Abstract *¾ With the rise of the ICT (Information and Communication Technologies) the two dimensions of the art and mechanics of information become closely dependent. Moreover, the new teaching paradigm which appears with the rise of the ICT must support the virtues of a "socratic school" and the social appropriation of the ICT by the various social categories. From this point of view, the European Commission launched the Form-Ami project (Training in Art and Mechanics of Information) during the period 1999-2001. Radical teaching innovations characterize the Form-Ami project: social diffusion, consortium, use of the ICT inside the pedagogy (in particular distant learning and realization of multimedia products).*

Index Terms ¾ Information and Communication Technologies, Information Society, new pedagogical paradigm, Socratic method.

INTRODUCTION: CONTEXT OF THE FORM-AMI PROJECT: EUROPE AND THE INFORMATION SOCIETY

In a little less than one decade, the global information society has been affirmed, as in the past had been carried out the industrial revolution; sudden and inexorable, a deep change of our societies takes place. The contemporary communication networks make it possible to store, seek, copy, filter, process, visualize, transmit and receive information to a scale never reached up to now, and will make still exponential great strides. New industries are emerging, others are changing and citizens' lives are deeply modified. The changes will affect everyone, everywhere. The INFO 2000 program adopted by the Council of the European Union in 1996 aimed at stimulating the development of a multimedia European industry and at encouraging the use of multimedia content in the emerging information society. At the end of 1999 the European Commission launched the initiative *e*-EUROPE to give all Europeans access to the information society: everyone in Europe - every citizen, every school, every company - must access and use the Internet, the information technologies.

Form-Ami (Training in Art and Mechanics of Information), has been a pilot project of the European Commission which began in March 1999. So, Form-Ami has established a bridge between INFO 2000 and *e*-EUROPE with a view to promoting new university training courses in the specialized skills required by the information industries, through the socratic method and on the basis of a very important consortium which has included prestigious academic institutions and information firms.

Beyond the technical and economic radical changes linked to the Information and Communication Technologies – ICT – in the contemporary world, the stakes related to education are considerable since it is a question of training the citizens of tomorrow. In this context, the social diffusion of the new multimedia tools which carry knowledge and favor the « socratic » training methods is essential. Obviously it is appropriate that this diffusion is ensured through a high level popularization. First beneficiaries of this popularization, the teachers must become the vectors of this teaching approach, made available to all the citizens of all social origins.

Form-Ami has answered to various needs of the information society and, more precisely, developed modules in the specialized skills in « Art and Mechanics of Information ».

NEW TRAINING IN « ART » AND « MECHANICS » OF INFORMATION

With the rise of the ICT the two dimensions of the art and mechanics of information become closely dependent. Moreover, the new teaching paradigm which appears with the rise of the ICT must support the virtues of a « socratic school » and the social appropriation of the ICT by the various social categories. From this point of view, the European Commission launched the Form-Ami project. Radical teaching innovations characterize the Form-Ami project: social diffusion, consortium, use of the ICT inside the pedagogy (in particular distant learning and realization of multimedia products).

In the context of the global information society resting on Information and Communication Technologies (The ICT are synonymous for the European Union with "so deep economic and social changes that one can already speak

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about a third industrial revolution (...) This revolution will finally lead to the information society. The context of this product which is information is carrying in the long term many new trades and jobs"; see the report of Mr. Martin Bangemann [4]) it is urgent to train many specialists in the multimedia information systems at the Post Masters level. It is advisable to develop training specialities which combine scientific and technical expertise in the field of communication systems and expertise within the scope of the information systems which implies to be interested in the contents, their use, their value, their protection and their meaning.

Now the courses of higher education remain marked by the borders of art or science, which often make difficult or even impossible any simultaneous approach in the two fields. However, with the rise of the ICT, it appears that the two dimensions of the art and the mechanics of information become closely dependent. To control at the same time the contents, i.e. to be able to create software, CD-ROMs, *on-line* products and the containers, i.e. to know information technologies, is one of the significant challenges of the global information society. The art and the mechanics of information become inseparable. From this point of view it has to be stressed that the Form-Ami project (Training in Art and Mechanics of Information) has been founded on radical teaching innovations.

General Organization of FORM-AMI

Form-Ami has aimed at developing training modules in the field of multimedia and information technologies and at extending the use of new technologies to the greatest number of people. This project has included a new post-Masters degree, an international Conference, a cycle of videoconferences, the realization of multimedia on-line teaching products. The Form-Ami backgrounds were defined by D. Deberghes, Principal Administrator, European Commission, Information Society DG.

Thanks to Form-Ami the EJCM (" Ecole de Journalisme et de Communication de Marseille"» - School of Journalism and Communication in Marseilles), which has been the head of the project, has established relations with Swedish, Finnish, German, Portuguese Universities, has acquired skills in the realization of multimedia on-line products. Moreover, partnerships have been reinforced with industrial firms (CEGETEL, CISCO…), other European universities and organizations specialized in the educational multimedia field.

A new diploma (Post Masters degree): learning thanks to the multimedia tools

The project has aimed at training specialists at the Post Masters level (corresponding to the French Baccalauréat + 5/6 years) in multimedia systems and information technologies, and at promoting the diffusion of these new technologies. The training content has associated two dimensions of the art and the mechanics of information:

- control of the contents (multimedia creation and production),
- knowledge of information technologies (networks and telecommunications).

The training was open to young holders of a Master's degree and to adults with an advanced technician's diploma and a quite long professional experience. The recruitment of the students was made on the basis of on-line applications; about thirty students coming from all Europe and outside Europe and having very diverse university backgrounds were trained in three specialities: Geographical Information Systems, Multimedia Pedagogy and Security.

An Intranet reserved to the members of the Consortium has allowed a fast diffusion of information (monthly reports in particular) and experience sharing in real time. Remote teaching and the realization of multimedia products have been essential in the Form-Ami pedagogy.

This higher training combined general theoretical teaching – 360 hours –, specialized teaching – 240 hours in each of the 3 options – and practical realizations – projects, memories... –.

Diffusion: realization of multimedia products, a Colloquium and ten videoconferences

In addition to the training objectives, Form-Ami has had also as an ambition to promote the social diffusion of the new multimedia tools and applications.

The diploma has allowed the diffusion of the ICT to all social categories thanks to a high level popularization, with a physical and virtual tour of Europe, with the use of remote teaching, and through the realization of on-line multimedia products by the students themselves.

Moreover, to ensure a broad diffusion among various public Form-Ami included a cycle of 10 videoconferences simultaneously retransmitted on various sites of reception and a colloquium on the topic: "Information and Education, Cement of the Nations, from INFO 2000 to *e*-Europe".

The colloquium was held in Marseilles on October 12 and 13, 2000 under the High Patronage of Mr. Jacques Chirac, President of the Republic, and the Presidency of Mr. Robert Verrue, General Director of the Information Society D. G., represented by Mr. V. Parajon Collada, Assistant General Director.

The cycle of videoconferences included 10 videoconferences simultaneously retransmitted on several locations and leading to a multimedia product (6 videoconferences in France, 2 in Finland, 1 in Germany and 1 in Portugal); the videoconferences aimed at increasing public awareness of communication and information technologies and their use.

The consortium

The Form-Ami consortium has answered the need for articulating artistic, cultural and social competencies with the technical and scientific control of the ICT. So the management of Form-Ami by a consortium has insured both coherence and complementary competencies in the fields of the art and the mechanics of information.

The Form-Ami project has been managed by a European Consortium made up of academic institutions (Main partners: EJCM/Université de la Méditerranée, Ecole Supérieure d'Ingénieurs de Marseille, Ecole des Mines d'Alès, University of Tampere, University of Koblenz-Landau, Fernando Pessoa University), companies in the new technologies sector and cultural and social associations; it has relied on ICT in the education field to support a new pedagogy and to ensure the broadest social diffusion of the ICT. The consortium puts into a network a broad set of institutions and competencies on a European scale.

RADICAL PEDAGOGICAL INNOVATION: THE "SOCRATIC" TEACHING METHOD

Knowledge is a key factor of the firm competitiveness in the new economy based on information. Consequently, work and knowledge which were two relatively distinct values in the taylorist universe are mixing. Then training and the control of knowledge become a new stake. Acquired knowledge is becoming obsolete almost instantaneously and any individual must learn throughout his life. Taking into account the economic importance of the stakes, it is not astonishing to observe that, beyond the traditional places of knowledge, the Schools and the Universities, new training places are set up: companies develop training structures, which are named Universities, such as for example Motorola University, Hewlett Packard or Sun University; one also sees, for example, Microsoft diffuse its own certification labels, equivalent to professional diplomas.

Technological progress thus modifies radically the relation between man and information and induces a considerable demand with respect to the education systems (On this point see for example J. Richardson [10]). **Virtues of a "socratic school"** resting on four pillars:

- to learn how to know,
- to learn how to make,
- to learn how to live together,
- to learn how to be (On this topic see the publication of the European Commission [7])

must be accessible thanks to the use of ICT. Indeed, ICT must help the teachers to set up a teaching approach supporting not only training but also an hypothetico-deductive reasoning mode which will permit the learners to acquire an autonomy vis-a-vis the life events ([7], page 11). It is on this condition that the Knowledge Gap will be surmounted.

The socratic approach

"[…] research and knowledge are on the whole only reminiscence"
PLATO, Menon, translation based on the edition in French, Les Belles Lettres, tome III, 2, 1923.

Form-Ami has been a pilot project with a view to promoting new university training courses in the specialized skills required by the information industries, through the socratic method. The socratic approach refers to the philosophy of education and to the teaching method presented by Plato. One will retain in particular the idea of the socratic "maïeutique", which is an art of obstetrician, and the conditions of the knowledge learning: the role of the teacher is that of a guide and the learner is responsible for his learning, which cannot be an accumulation of knowledge, but rather a search of knowledge by reminiscence.

To learn how to learn: a process or "the art to be confined"

Within the framework of the Form-Ami project the socratic approach is implemented gradually, so that the students adapt to work as a group, by using more and more the multimedia tools and while trying more and more to solve by themselves the problems which they encounter. Thus two stages can be distinguished each one corresponding to a part of the teaching and to the realization of multimedia products:

- In the first stage (approximately 4 months) all the students attend the same courses which give them the bases in art and mechanics of information; two multimedia products are carried out on the basis of work divided into two groups: the students more interested by "mechanics" carry out the multimedia product on information theory, the others realize the product devoted to the information market.
- In the second stage (approximately 5 months), the students follow specialized courses in the option which they have chosen: Security, Geographical Information Systems or multimedia Pedagogy. So they are very few in each option (between 5 and 12) and the follow-up work by the teachers is very effective. Each group of students carries out a multimedia product corresponding to the contents of the option. Obviously it is during the second stage that the socratic approach is the most applied, but the first stage is essential for a transition between a traditional teaching and a teaching based on the socratic approach with the intensive use of ICT.

Implementation of the socratic method

Five multimedia products linked to the courses were realized in 2000-2001. The subjects of these products are the following:

- Theory of Information
- Information market
- Security

- Geographical Information Systems
- Pedagogy

The socratic method is in the heart of the teaching and of the realization of the multimedia products. From a pedagogical point of view the thread rests on a flexible process during which the students learn how to learn by working in group and with the multimedia tools. Of course, the students benefit from the help of the teachers and in particular from the content of research and work carried out for many years by the teachers-researchers-experts.

For the academic year 2000-2001 among 500 European candidates finally 28 students obtained their diploma in September 2001. The students were of 11 different nationalities; they represented largely the European Union and there were also non European students.

Principles of the implementation of the socratic method for the realization of the multimedia product "Pedagogy"

For this multimedia product, realized during the second stage of the Form-Ami project, the socratic approach is reinforced, because the students are accustomed to work together, have better ability to use multimedia tools and also because of the number of students (only 12 students: it is very interesting for the teachers as well as for the students).

So the teachers ask the students 12 questions to define progressively the outline of the multimedia product with the students. Questions are the guideline for the construction of the multimedia on line product and socratic exercises.

Examples of questions:

- Draw up a comprehensive list of media and techniques available for e-learning; explain the advantages and disadvantages of each from the provider and the user point of view.
- Among the authoring tools available to you, choose the one you consider the most user-friendly and effective. Provide an overview of the principal functions and a step by step user manual that would enable a teacher to use with students.
- Choose one of the pedagogical platforms available to you to construct an e-learning module, explain your choice in terms of user-friendliness and effectiveness. Provide an overview of the principal functions and a step by step user manual that would enable a teacher to use with students.

The students define themselves 4 groups of 3 students and then work together; each group works on 4 questions, of course with the permanent help of different teachers (from the University of Aix-Marseille II -Université de la Méditerranée/EJCM-, the University of Tampere, the University of Koblenz-Landau and the CJD Maximiliansau). There is a high level of interactivity between the students and the teachers. The students benefit also from a specific and recent bibliography on the theme of pedagogy and multimedia tools.

THE NEW PEDAGOGICAL AND KNOWLEDGE PARADIGM

We will show why Form-Ami can be considered as a reference for the diffusion of a new pedagogical paradigm. Thanks to the theory of innovation we will compare the old and the new pedagogical paradigms and will show how the new pedagogical and knowledge mediation is a key for the future (Sources: P.-Y. Badillo, communications to different conferences and Final Form-Ami Report [1]).

The previous pedagogical paradigm can be defined as a knowledge push (by analogy with the technology push corresponding to the "schumpeterian" approach of innovation). In this framework, which is dominant since the beginning of the Gutenberg's Galaxy, teachers are the holders and have the monopoly of knowledge; they produce and diffuse knowledge with a specific place in the society.

But today this paradigm is questioned by the changes which affect the universities in the world. It is the whole university world which will switch over tomorrow; according to P. Lévy : "There will be more and more competition between the on-line and local universities, then between the on-line universities when the local ones will be obliged to close (...) it is also possible that the planetary universities, after a series of takeovers and mergers, will be no more than four or five in the world" ([9], page 97, our translation). Such an analysis is certainly perhaps somewhat "in advance", but it does not change the fact that taking into account the reduction in the public subsidies, "the universities will depend more and more exclusively on their customers (...) [while, today] the students can now learn elsewhere (...) by shopping around in cyberspace where the on-line training offers are daily becoming more varied, more precise, better organized" ([9], page 95).

The Socratic approach is a new pedagogical model with the realization of multimedia on-line products: **Form-Ami can be considered as a reference because it is perfectly adapted to the new information and knowledge society.**

We define Form-Ami as a new interactive knowledge mediation paradigm: in the context of the new pedagogical paradigm teachers share knowledge and produce knowledge in collaboration with students and enterprises or training organizations.

A key for the future: the new pedagogical and knowledge mediation

In this new interactive knowledge mediation paradigm the learning process becomes more and more a common construction and collaboration: "*Young people will be guiding their teachers to new kind of learning models*", predicts Mr. Juha Lipianen from Nokia (Ed-MEDIA 2001, Hypermedia Laboratory, University of Tampere, June 2001).

"Knowledge is not delivered; it grows in unpredictable ways because learners move through this space according to their own needs, intentionally connected to others. Participation in this space makes it grow for you, over time and through your use and interaction. For each learner, the space becomes what it is because each learner uses it in the ways that make most sense to them" [5].

Form-Ami is a useful reference because its pedagogical principle, defined about five years ago, anticipated the more up-to-date present research. According to D. Jonassen [8] a learning process is efficient if it is organized as a "solving problem" system; in other words students are confronted to a problem and they have to solve it; the only professional legitimated goal of everybody is "problem solving" (decision making, modeling...). Form-Ami has been a rich pedagogical experiment because the students, of course with the help of the teachers, have had to solve problems: how to apply in practice the courses, how to produce a multimedia product, how to organize their practical training.

With this goal teachers have also to adapt their pedagogical approach and the educational organization to help the students to solve the problems. This new pedagogical paradigm is also described, for example, by B. Collis [6]: "What is our first aim? Learning from experiences, from one's own and from those in one organization, and building upon these experiences.... ".

CONCLUSION: THE NEW PARADIGM OF KNOWLEDGE TRANSMISSION: COST AND CATALYTIC ROLE OF TECHNOLOGY

The new pedagogical model means:

- very high intensive work of the learners (in Form-Ami: evening until 9.00 p.m. and some Saturdays, intense exchanges by e-mail)
- high investment in software, material,
- high investment of the teachers anywhere, anytime…
- a lot of help by tutors.

So the Socratic model is a success, but its "industrialization" would be very expensive and needs an intensive involvement of all the actors.

The Socratic approach based on information and communication technologies permits the following results:

- **The Internet is a vast set of knowledge resources for the students. Developing activities that use existing Web sites to accomplish learning objectives is a good objective: students often learn more effectively by discovery (constructivism) and by interaction (collaboration) than by lecture (direct traditional training).**
- **The students learn to work together, to be together and to collaborate in the context of different nationalities, different scientific backgrounds, but with a common objective and a common work: they learn to realize multimedia on-line products.**
- **But we have also to highlight the fact there is a danger: students can be hypnotized by new technologies; it is imperative to ask them to work on the content and to produce content through exercises, with an important participation of the teachers.**

New technologies multiply the knowledge, learning and diffusion possibilities but also the cost; new technologies in pedagogy are submitted to the well known network effect: to launch a network is at the beginning very expensive, then it is cheaper and cheaper. We can also precise that e-learning is a complex product with not only multimedia on-line products but also a pedagogical platform, a book, a teacher who has to be very present and the help of a tutor.

In conclusion, with its Socratic organization Form-Ami has introduced a new pedagogical model; in particular multimedia on-line products were realized. Form-Ami must be considered as a reference; this project was several years in advance and is fully adapted to the new pedagogical paradigm based on problem solving pedagogy and learners experience.

The richness, the relevance and the range of the socratic method are obvious; the multimedia tool can be regarded as an environment, a pretext for exchange and the "ludic" character makes the students more dynamic, more autonomous, more creative and more engaged.

However, it is necessary to moderate this "technological" optimism. First it is clear that the means which must be devoted to this type of method are considerable. For example, in Form-Ami for the specialization "Pedagogy", not only were needed tutorials at the request from a technical point of view, to help for the control of the multimedia tools, and tutorials to help for understanding the contents, but also of course a sufficiently spacious workspace, in fact a computer per student and rooms especially dedicated to this project. It is thus obvious, for cost reasons, that the generalization of this method to standard courses is impossible. On the other hand we will recommend to adopt this method for specializations for which today the needs are essential.

The dynamics of knowledge diffusion and sharing rests mainly on pedagogical organization and human relations, and not on technologies: technologies appear as a pretext or a catalyst but it seems to us that they are not central in the learning and knowledge transmission process.

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