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ICT competencies, for Students and Teachers: dilemmas, paradoxes and perspectives - The French case

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ABSTRACT: *This paper aims at briefly discussing issues linked with ICT representations and competencies. After briefly analyzing the case of informatics as a school subject in France. it considers the case of ICT competencies, for K-12 students, and teachers. Finally, it analyses some of the paradoxes of the new systems designed to assess these competencies.*

Informatics: a disappearing school subject

A first linguistic warning is in order. In French "informatique", a word invented in the sixties, has had a great fortune. Hinting at something like a science (on account of the "ique", like in "mathématique or "physique"), it has been used in practise to cover both computer science and information technology, according to contexts and persons. As an adjective, "Informatique" can be associated with another noun to specify it (like in "techniques informatiques"). Because of the wide dissemination of software tools, "outil informatique" (*informatic tool*) has come to be (abusively) used to refer to any form of computerized device.

ICT (TIC in French) has now been for several years a common expression to refer to the broad spectrum of computerized systems and has tended to supersede "informatique", adding to it the idea of communication technologies. We'll conform to current usage and use both "informatics" and ICT with similar meanings, depending upon the period that we consider.

In France, two main lines of thought have co-existed since the late sixties regarding informatics. To simplify, the first one, expressed by scientists like Jacques Arsac, have hold that informatics is a science of its own, with algorithmics at its heart, which deserves to be taught in secondary education, as others are. The other, mainly influenced by people working in the field of data processing but also by thinkers like Jacques Hebenstreit, have stressed the technical characteristics of informatics and the use of different tools in order to produce something (Baron, 1989). It is skills and practise that are in the foreground. Concepts are necessary, but only inasmuch as they offer a way to understand the common underlying structure of different practical problems.

A remarkable phenomenon has occurred in the past 15 years: as new software tools have been invented and disseminated, programming, as a problem solving method, has come to be no longer considered as a promising possibility (as was the case with LOGO). New software tools are supposed to be so easy to use that a few hours of practise are sufficient to master them. Thus, informatics has tended to disappear in school curricula (except in vocational and technical curricula), transforming itself into a practical field, taken in charge by existing subject matters.

Correlatively, research in the field of didactic of informatics, rather active in the late eighties and in the beginning of the nineties, slowed down very much. In the French speaking communities, for example, the flow of conferences initiated in Paris in 1988 on this topic (EPI, 1988) came to an apparent end with the Monastir conference in 1996 (AFDI, 1996). Associations grouping practitioners and researchers in this field have also cooled down and apparently stopped their activities. However, research work on

students and teachers representations and competencies regarding ICT have proceeded. Recently, a global awareness that things might be more complex has recently appeared, as shows the implementation of diverse systems aiming at assessing different levels of ICT competencies.

Competencies and Representations of ICT: an Overview

Necessary competencies?

The idea that competencies related to informatics are going to be part of the common culture and must therefore be known to every student is not new at all and has produced much debate in the last thirty years[1]. One of the key questions, still open, has to do with the concepts that might be needed to make good use of computers, and that cannot easily be learned through mere practise. Indeed, determining concepts that have to be transmitted to a new generation is always a difficult exercise; it is only possible when general finalities concerning what the school system should transmit have been agreed upon among decision makers. A thorny problem with ICT is that computers have proved to be very flexible objects indeed, with rapidly changing functionalities. It is therefore not surprising that answers, concerning curricula and contents to be taught, have periodically varied.

In fact, only partial and unstable solutions have been reached, corresponding to distinct segments of the school system. To give an example, in France, in the early eighties, considering the need for people working in administrations to have some knowledge of the newly appeared micro computers, a new vocational diploma was designed, with a curriculum focused on the learning of the BASIC language. But it was soon superseded and replaced by other curricula. At the same time, in general senior secondary education, an elective curriculum, obtained by a rather direct didactic transposition from the bachelor degree in computer (and hence with an emphasis not on a particular language but on algorithmics) was also introduced, and abandoned ten years later when it seemed clear to decision makers that learning to program in an imperative language was probably not the first objective to be pursued by the school system in a world where only a few people would ever have to use these languages (Baron & Bruillard, 1996).

Since then, things have evolved mainly in the same direction: computer tools are supposed to be so simple that anyone can learn to use them by practising them. Yet experience shows us that computers are not yet like automobiles, washing machines or even video tape recorders. Software is complex, allows a very wide range of usage and often has a bizarre and unexpected behaviour. Users are then seldom able to explain or at least to conceptualise the process at work.

Students: rudimentary and static representations

Studies have been led in France and in Europe in the past ten years regarding students' representations of informatics at the end of primary education and at the end of junior secondary education. If they differ with the ages of students, they converge in several respects: students certainly do acquire some operative representations of computers and

[1] As soon as 1970, for example, a conference organised by OECD in Sèvres emitted the idea that informatics had to be taught at secondary level and an official French circular maintained that those who would not know informatics would be handicapped. At that time, what informatics was mainly considered as a reasoning process?

usual software, but their representations tend however to be very contextualized and limited. Concerning more specifically children finishing primary education, a European research led in 1999 and 2000 (Representation, 2000) suggested that students' representations of computers were often centred on the external parts they acted upon and tended to ignore the processes going on when software runs.

These representations, however, were shown to be dependent upon teachers' actions: when specific learning activities were organized, students had different representations, school-related, more dynamic, etc. This result, in itself all but surprising, concurs with previous work led in the nineties about grade 8 children attitudes towards ICT (Baron & Harrari, 1994). It confirms that explicit teaching about ICT may have an impact on students' representations.

Concerning private usage, all existing studies have stressed the importance of games in children's representations. Recently, Efthallia Giannoula has investigated the changes that occur in children's representations when they quit primary education and enter junior secondary school. She has observed and interviewed children during two years, both at home and within the classroom. Her first results (Giannoula & Baron, 2002) suggest that three phases can be observed in developing an understanding of computers applications: the first one is characterized by the respect of fixed procedures (even if they are not optimal or even ill adapted to the situation). In a second phase, children concentrate on functions to be performed and try to apply them by using what they understand of the functionalities of the systems they use. In a third phase, schemes of action are formed, that allow to a certain extent to cope with problems. The relation to ICT also has a social dimension: networks of solidarity exist among youngsters, and more able peers can help for some of the practical problems encountered. However, mere practise seems to lead to little conceptualization, which poses the problem of the forms of formal instruction that may be needed. Another problem then directly arises: if instruction be needed, what competencies should teachers master in the field of ICT?

Teachers' Attitudes and Competencies Regarding ICT

A robust finding, well established worldwide (see for example Cuban, 2001), is that teachers are generally not techno-phobic: their rates of computer ownership are higher than the average and an overwhelming majority of them know how to use classical productivity tools at home, for preparing their classroom work. However, using ICT in front of students appears to be less developed, even when equipment is available in sufficient quantity. Among the plausible explanations, he mentions the theory of contextually constrained choices

A recent survey carried out by the French ministry of education among 368 primary teachers and 1922 teachers of either human sciences or natural sciences (DEP 2003) offers similar results.

In the sample, almost 9 teachers out of 10 said they used computers outside of the classroom. A majority of them claimed also to use computers in front of students, more or less regularly. The figure was near 90% for primary teachers. This high ratio is probably linked with the fact that there were in schools, when the survey was realised, educational auxiliaries that have played a great role in the operation of computers. Concerning secondary education, ratios were 71% for natural science (where using computer assisted experimentation explicitly figures in the syllabi) and only 50% for human science. This last ratio even drops to 32% when it comes to using ICT in front of students. The lack of adequate training came at the first place (more than 60% of answers) among the obstacles to using ICT with students. The study also shows the

importance of self-training and in-site peer-mentored activities in order to gain confidence in using ICT in the classroom.

Different works have described several dimensions teachers' ICT competencies. For example Coughlin &Lemke, 1999 distinguished five main domains (core technology skills; curriculum, learning and assessment; professional practise; classroom and instructional management; administrative competencies), and three stages (entry, adaptation, transformation). A cooperative research was led in France on this topic in the end of the last decade (INRP, 2001). It led to rather concurrent findings, distinguishing four main kinds of competences: epistemological, technical, "didactical" (linked with real teaching and learning situations) and pedagogical (linked to the practical management of student activities).

During the research, it had been initially decided to track competencies by elaborating a matrix relating teachers' activities (production of multimedia documents, information research…) and situations (private use, collective presentation in classroom, evaluation…), competencies thus appearing at the intersection of both. This approach, even if it might be useful as a description means, however led to multiple and instable divisions. Furthermore, it gave no hint about the genesis of competences, i.e. how to acquire them.

An important point is related to what institutions in charge of training teachers (IUFM) can do. On account of constraints regarding the organization of studies, available time for formal ICT training is short. In fact, many pre-service teachers have to acquire ICT competencies mainly by using computers. This situation is not really surprising, since, until recently, it was considered that ICT could easily be mastered by mere practise.

Interestingly, maybe for productivity reasons, the idea that, after all, some competencies must be mastered in order to be efficient with computers has progressively gained popularity, notably outside of school systems and several systems for assessing these competencies have been developed.

Assessing ICT competencies: Issues and Paradoxes

Assessing competencies is generally a problem, the solutions of which always have an ad-hoc character, particular to the system where they have been implemented (consider for example the reluctance in France to use standardized tests that are so common in the US).

The case of ICT presents a specific character, because it is impossible here to rely on previous traditions. It is remarkable that the most known system of ICT certification right now is probably the European computer driving license (ECDL), implemented in several European countries. Aren't we in an original situation in Europe where private foundations (instead of national governments) are going to define what should be assessed? Isn't something changing?

However, this certification is not the only one on the market. Countries, like Belgium (Vandeput, 2004) and France have created their own system. The French certificate (Computer Science and Internet Certificate - *Brevet Informatique et Internet*, or B2I http://bd.educnet.education.fr/B2i/) aims at providing a formal recognition of the extent to which pupils use multimedia tools effectively (Baron & Bruillard 2003).

This certificate, considers several levels (the most important being at the end of primary education and at the end of junior secondary school[2]). It lists a number of more or less elementary competencies organized in several domains (e.g. organizing numerical process with a spreadsheet, producing, creating and using a document, communicating using an electronic mailer…). What is considered, as in ECDL is also the assessment of skills, related to different classes of software, rather than forms of knowledge and concepts that would be useful in order to form pertinent representations of what is at stake with operating computers.

But, contrary to ECDL, B2I does not so much seek to certify skills but is rather intended to give teachers and parents signals about what is expected from youngsters. Interestingly, social issues of ICT are rather well taken into account. It can be considered, in a way, as a lever for facilitating ICT infusion. Teachers are encouraged to implement situations allowing students to acquire and show their ICT competencies.

Quite innovatively (for France), there is no curriculum, nor one subject matter involved, nor formal exam, but position sheets that are to be filled, incrementally, under the control of a teacher. The idea is that through exposition to situations in the different subject matters, students will become able to solve the tasks that are asked in the B2I. This idea, that may be easily implemented in primary education, where teachers are polyvalent, is unlikely in secondary education.

In the French context, secondary subject matters must fulfil general goals and give the elements of a culture. At the same time, they must abide by strong constraints, among which the necessity to prepare students for a specific part of a final examination, with canonical exercises and problems that shapes the activities asked of them. So didactic cooperation between subjects is generally essentially limited and is principally observed when there are good reasons for it (e.g. an obligation of complementarity at the final exam). In the case of ICT, there are no powerful reasons for such inter-didactic cooperation.

In practise, two areas only, at junior secondary level, have a special interest for ICT because it is an integral part of their teachers' identity: technology and documentation. Now, these two areas do not consider ICT in the same way. The first one rather sees it as the technology of information, information being the raw material that is being transformed in order to produce a finished product. Documentation is rather sensitive to the problems of information retrieval.

Studies led about the implementation of B2I show that it is far from being straightforward and is subject to reinterpretations in some school districts, according to local realities.

A notable paradox is that a majority of teachers are probably not very familiar with the competencies that are asked from students. The ministry of education has announced in 2002 the creation of another certificate, concerning higher education (C2I), currently under experimentation http://www.educnet.education.fr/superieur/C2i.htm. The second level of this certificate would be compulsory for teachers to become tenured. But the practical modalities of this certificate are not yet clear.

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[2] Another level, trying to better take into account concepts is currently being experimented by the ministry of education for senior secondary education.

Perspectives

France may see the perpetuation of a situation where the responsibility of ICT teaching is much diluted and where no specific curricula exist, at least in secondary education. This would mean in practise a great difficulty to identify a body of knowledge or even specific competencies. The assessment of simple behaviours scattered around multiple software tools, instrumenting document production and human communication, as exists today, might even have a short existence since the reasons for perpetuating B2I a certification difficult to install, are finally not very strong. What alternative may exist right now is open to debate.

The situation so far described reflects a given state of a balance of power in a centralised educational system. But the situation is manifold. There do exist countries where informatics (or ICT) has given rise to national curricula. Besides, it is noteworthy that international organizations like UNESCO keep on working on the issue of ICT and produce curricula that try to take into account the different facets of ICT (see for example Unesco 2002).

Even when there is no formal curriculum, interesting didactic problems directly linked with the use of ICT do exist. Word processing (and more generally document processing) is such a field (André & al, 2004). To give another example, B. Faure-Vialle (2002), studying computer assisted experimentation in biology, has shown that using such computerised devices had noticeable impacts on learning activities: students do not study the same things, their attention is focused on using a chain of treatment. According to teachers' choices and available software, they may even feel they have become servants of a system narrowly guiding. B. Faure-Vialle's work has also suggested that a preliminary training of students in the ways those technological systems work induces different activities afterwards.

So, besides research directly linked with specific informatic curricula, there is also an opportunity for didactic research to concentrate not so much on concepts and notions specific to informatics but rather on didactical problems occurring while using software to instrument common activities (e.g. using a spreadsheet at the end of junior secondary education, or using chat systems in primary education). This form of didactics relies on the study of classes of instruments (and not on a given instrument); it is of course not linked with *one* existing discipline. Therefore, it is quite unusual and must build its own references, with an interesting perspective linked with the study of systems of instrumented activities. Besides it corresponds to a domain where problems really arise and concern both practitioners and researchers. So it seems to be a promising field.

References

In English

BARON Georges-Louis, BRUILLARD Eric (2003). Information and communication technology, which models of evaluation in the French educational context, in Spector J. Michael and de la Teja Ileana (eds.), Issues in the Evaluation of Educational Technology: International Perspectives, special issue of Evaluation and Program Planning, 26.2.

BRUILLARD, Eric & BARON, Georges-Louis (2003). - Acquiring ICT Competencies for Pre-Service Teachers: Question of Adding Some New Skills or Changing a Professional Culture? SITE conference 2003, p. 656-660.

COUGHLIN Edward C., LEMKE Cheryl (1999). Professional Competency Continuum. Professional skills for the digital age classroom. Milken exchange on education technology. Milken Family Foundation, Santa Monica (http://www.mff.org/publications/publications.taf?page=159).

CUBAN Larry (2001). - Oversold and underused: Computers in the classroom. - Cambridge (Mass., Etats-Unis): Harvard University Press.

MOURSUND David, BIELEFELDT Talbot (1999). - Will new teachers be prepared to teach in a digital Age ? A national survey on Information technology in teacher education. - <http://www.milkenexchange.org>, . - [52 p.]. - Milken Exchange on Education Technology.

REPRESENTATION (2001). - deliverables of the REPRESENTATION project: http://hermes.iacm.forth.gr.

Unesco (2002). – Information and communication Technologies in teacher education: A curriculum for schools and Programme of teacher development. UNESCO, Paris, 148 p. On line at: http://portal.unesco.org/education/ev.php?URL_ID=18592&URL_DO=DO_TOPIC&URL_SECTION=201.

In French

AFDI (1996). - Rencontre francophone sur la didactique de l'informatique. 5. 1996. Monastir (1996). - Les actes de la 5ème Rencontre Francophone sur la Didactique de l'Informatique. – Tunis : INBMI ; Paris : AFDI. - 510 p. - ISBN : 9973-906-63-2.

ANDRÉ, Bernard, BARON, Georges-Louis, BRUILLARD Eric (dir). – Didactique des progiciels. Actes des journées francophones, INRP-GEDIAPS, à paraître. Preprints a : http://orion.inrp.fr/didapro.

BARON Georges-Louis (1989). - L'informatique, discipline scolaire ? (le cas des lycées). - Paris : PUF. - 230 p. - (Pédagogie d'aujourd'hui). - ISBN : 2-13-042095-8.

BARON, Georges-Louis, BRUILLARD, Eric (2000). Technologies de l'information et de la communication : quelles compétences pour les enseignants ? Education et formations, n° 56, avril-juin 2000. - pp. 153-159.

BARON Georges-Louis, HARRARI Michelle (1995). - School environment and students' opinions on informatics. - In : WATSON Deryn, TINSLEY David. Integrating information technology into education. - London : Chapman & Hall. - p. 270-273. - ISBN : 0 412 62250 5.

BELISLE, C., LINARD, M. (1996). Quelles nouvelles compétences des acteurs de la formation dans le contexte des TIC ? *Éducation Permanente* n° 127 Technologies et approches nouvelles en formation. – pp. 19-48.

Collectif (2001). Usages éducatifs des technologies de l'information et de la communication : quelles nouvelles compétences pour les enseignants ? Séminaire national du 7/6/01 http://www.inrp.fr/Tecne/Savoirplus/Rech40003/Sympcomp01.htm.

DEP (2003). - Les TIC : éléments sur leurs usages et sur leurs effets. - ftp://trf.education.gouv.fr/pub/edutel/dpd/noteeval/ne0301.pdf

EPI (1988). - Actes du colloque francophone sur la didactique de l'informatique : Université René Descartes, Paris 1, 2 et 3 septembre 1988. - Revue de l'EPI ; . - 312 p.

FAURE-VIALLE Brigitte (2001). - L'Expérimentation assistée par ordinateur dans l'enseignement des sciences de la vie au lycée : Aide et obstacle à la rénovation de l'approche expérimentale. - Doctorat d'universite : Didactique des disciplines, Université

de la Réunion. - 226 p. : ill., index, bibliogr. + cédérom. - La discipline de la thèse est complétée par Sciences de la vie.

GIANNOULA Efthalia, BARON Georges-Louis (2002). - Pratiques familiales de l'informatique versus pratiques scolaires : représentations de l'informatique chez les élèves d'une classe de CM2. - Sciences et techniques éducatives ; Vol. 9, n° 3-4/2002. - p. 437-456.

MEN 2003. - les attitudes des enseignants vis à vis des technologies de l'information et de la communication. -

VANDEPUT, Etienne (2004). - Evaluation des compétences en TIC. - in Didactique des progiciels. Actes des journées francophones, INRP-GEDIAPS, à paraître. Preprints a : http://orion.inrp.fr/didapro/vandeput/vandeput.htm.