Quality Towards an Expected Harmony: Pedagogy and Innovation Speaking Together About Technology

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ABSTRACT
In this paper, we will try to elaborate, in the field of educational technology in higher education, the following hypothesis: Students learn, teachers learn and furthermore institutions learn. The coherence of these various levels (students, teachers, institutions) around learning may be considered as a guide and as a sign of an expected educational quality. In this case, the general models for learning and for pedagogical setup development may be used to develop new teaching or training methods, to promote innovation in institutions and to assess quality.

After a short presentation of our " objectives – methods – tools " reference model, we will use it to organize and to assess the question of the added value of ICT in learning. These factors of learning boosted by ICT define a learning model consistent with learning factors as proposed by education sciences. Then, the deduced learning model will be used to understand and to foster teacher training and innovation in institutions.

Keywords
Quality, innovation, learning, teacher training, evaluation.

INTRODUCTION
Many descriptive models on quality refer to extensive lists of indicators in order to describe the different facets of the quality concept in education:

- indicators about institutional organization (kind of leadership or representatives, inter-institutional collaboration, pedagogical interest group, equipment, funds, …);
- indicators extracted from curricula evaluations (number of study paths, of graduates, …);
- indicators about the competences acquired by students (communication, self- and others- management, critical thinking, teamwork, …).

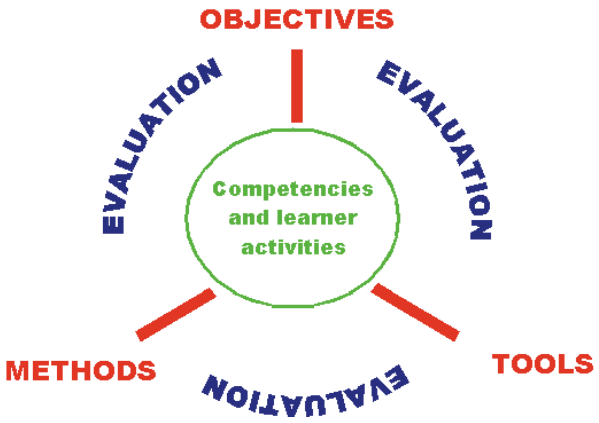
These are all indicators of a ongoing process but it seems always difficult to extract constructive factors of the innovation process: it always stays like a black box and so the analysis is relatively silent about ways of initiating, conducting, supporting and finally really assessing innovations (comparing objectives, processes and outcomes). A very simple comprehensive model is presented here. It is based on the assumption that processes like student teaching, teacher training, innovation fostering are determined by underlying learning processes; in this case, factors of success are correlated with learning factors which can be extracted and adapted from the pedagogical literature. Somehow, it's our way to contribute to the expected "Learning Society".

GENERAL "CONSTRUCTIVE-ALIGNMENT" FRAMEWORK
Work to promote human actions like the development of pedagogical set-ups (and this will prove to be true for innovation activities at an institutional level) needs to refer to meso-level (teaching) organization of objectives, methods and tools [7]. A good teaching system aligns the teaching method and assessment to the learning

[7] Above the micro learning level, three other levels may be proposed: meso-level for the teaching " in classroom " activities, macro-level for the institutionalized teachers training and institutional level for the organizational level.

activities stated in the objectives, so that all aspects of this system are in accord in supporting appropriate student learning. Following Biggs (1999), this system is called constructive alignment based as it is on the twin principles of constructivism in learning and alignment in teaching. Figure 1 shows this meso-level alignment.

Figure 1. Constructivist alignment between objectives, methods, tools and evaluation.



It's interesting to mention that Biggs connects this approach with quality learning and should be reflected on the other various levels: learning, classroom, teacher training, institutional level, etc. We believe that the constructive alignment evaluation refers not only in intra-layer evaluation (internal evaluation) but also has something to do with inter-layer coherence (external evaluation):

- Are the general objectives of the institution coherent with the teacher training objectives and still more in line with the pedagogical objectives (what is really done in the classroom)?
- Are the methods used for teacher training isomorphic with the expected and planned learner's activities?
- Do the "tools" used by the institution to promote good practices (local review, innovation funds, teachers-follow-up, etc.) fulfil the needs encountered at the various others levels?

Educational institutions efforts concerning innovation, teacher training, methods and tools developed in order to foster learning, all are converging to the same ultimate goal: students learning. Going backwards, this paper will focus on educational objectives, on pedagogical methods built to reach objectives and around what we know about learning, on technical tools sustaining methods and finally on teachers training and innovation promotion.

WHAT COMPETENCES FROM SCHOOL AND HIGHER EDUCATION (OBJECTIVES) ARE RELEVANT?

A study (Lebrun, 1999) of the declarations of various society actors (teachers, rectors, EU representants, commissions like ERT – European Round Table of industrialists) shows a rather "innovative" range and also a good convergence of so-called higher order competences: critical thinking, problem solving, communication, teamwork, and citizenship… As an example, Table 1 presents a summary of the ERT perspective (ERT, 1997).

Table 1 Summary of the ERT perspective.

Intellectual aptitudes	Behavioural aptitudes
- learning capacity - mastery of own language - critical assessment - literacy and openness with the three cultures (sciences, humanities, economics & social sciences)	- initiative, curiosity, creativity and innovation - flexibility - commitment to decide, to get things moving, … - professionalism, excellence, … - communication including languages and team work

We underline some competences tightly coupled with the ICT domain like critical assessment (surely needed in the face of the huge quantity of Internet information), communication and team work (as the second letter of promising ICT), creativity allowed by multimedia or hypermedia tools.

In his book, Evers et al., as a result of a research led at the boundary between industry and university, stress the following competences to be developed for employability reasons: managing self, communicating, managing people and tasks, mobilizing innovation and change (Evers et al, 1998).

We detect there a mere movement from inert knowledges to knowledges embedded in reality, in social and work context. Also, they are deeply linked in student's perceptions and projects (study projects, professional projects but also daily life projects). In terms of pedagogical methods, we are very close to situated learning, contextualized learning, discovery or inquiry learning, etc.

Among the elements emphasized in the actors' proposals we have shortly presented, we pick out some whose importance will be revealed when we'll discuss later their congruence with a number of learning models and with conditions for the effective use of technology:

- the importance of gathering correct information and processing it, analyzing and evaluating it;
- the importance of the general context (economic, social, political, etc.) in which learning will be rooted;
- the importance of higher level competences like critical assessment, analysis of complex situation, synthesis of various points of view;
- the importance of factors relating to communication, to working in teams - in short, interaction;
- the importance, finally, of building something personal, of creating, of assessing one's work or the situation, of accepting and inducing change…

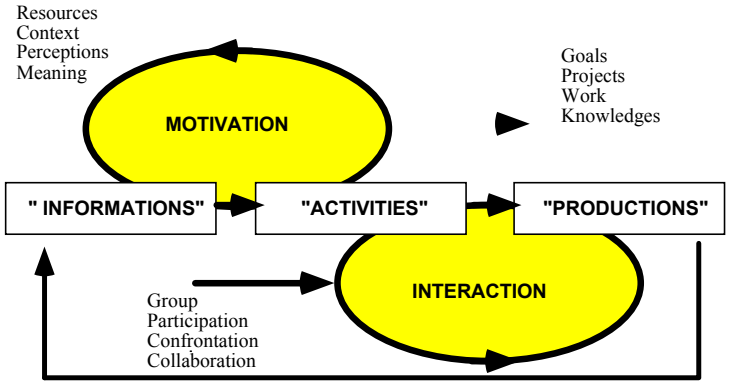
As we will see, these points are strongly in connection with important learning factors as proposed by educational theories. These will ground our pentagonal pedagogical model constructed on the following factors: information, motivation, activities, interaction and production (our IMAIP model standing for "I aM An Innovative Professor model ").

A MODEL FOR LEARNING (AND TO FORGE METHODS)

As learning is in the centre of our model, it seems important now to understand better the factors able to boost it. This may prove useful in the design of ICT tools or in the evaluation of the effectiveness of teaching methods or teachers training activities; these are developed in order to facilitate learning and so they need a learning model in order to be effective.

Searching for a dynamical model for learning, we have investigated a lot of authors (Combs, 1976; Saljo, 1979; Biggs & Telfer, 1987; Savoie & Hughes, 1994) attempting to describe this process. Also we try to federate a lot of "learner-centered" factors coming from the American Psychological Association (APA, 1997). The result (presented as a dynamic adaptation of our pentagonal model) somehow provocating because oversimplified is shown in Figure 2.

Figure 2. Dynamical representation of our pentagonal learning model



As we will see, this figure may act as a check-list in order to properly design or evaluate textbooks (the nature, the structure, the attributes and the lay-out of the information), pedagogical softwares (the context of the proposed activities or the directives to be followed), educative Websites (the activities proposed to the students or the place of the Website in the pedagogical scenario), pedagogical plans (individual and collaborative activities well weighed up), students' outputs or finally to boost, design and evaluate innovation inside an institution (Lebrun, 2002).

In the centre, the three rectangles are inspired by the constructivist approach: roughly, information is transformed in knowledges by the student activities and these new knowledges feed the following process (systemic loop). This process is enabled by motivation factors and sustained by interaction (from environment (functional interaction) or from other students and from teachers (relational interaction)).

It's time to try applying our learning model to teacher training. As stated by the ACOT experiments (Apple Computer, 1995), the teacher entering innovative technological process follows different succeeding steps described in Table 2.

Table 2 Steps followed by teachers learning ICT in ACOT experiments

	Description of the step
Entry	Learn the basics of using the new technology.
Adoption	Use new technology to support traditional instruction.
Adaptation	Integrate new technology into traditional classroom practice.
Appropriation	Focus on cooperative, project-based, and interdisciplinary work—incorporating the technology as needed and as one of many tools.
Invention	Discover new uses for technology tools.

Entry and adoption are often linked with more traditional use like programmed instruction and drill and practice exercises (reactive). Adaptation refers to the use - by the students - of tools like word processors and spreadsheets (proactive). Finally, the teacher goes to new pedagogical set-up where students, teachers and tools interact (interactive). There is a good agreement between this "entering innovation" process and the learning process. The main lesson to be withdrawn from this is the necessity to design pedagogical setups well tuned with the learning process when building ICT tools, when training teachers, when teaching students (Lebrun, 2002). The way innovation penetrates in an institution and the way individuals endorse innovation are also somehow learning embedded processes.

Entering innovations is a learning process. From entry to invention, this resembles the two-sided model of J. Piaget about learning and organization of knowledges (Piaget, 1975): assimilation and accommodation.

ICT IN THE LEARNING PROCESS (ABOUT TOOLS)

In the books already mentioned before (Lebrun, 1999, 2002), an analysis of lot of research concerning the use of technological tools in education was conducted. We remember the conclusions of Kadiyala and Crynes (2000) about the importance of effective pedagogical methods "around" the tool and of the evaluation of the coherence to be met between objectives, methods and tools

Technologies for education did exist before the current ones. Can we find conditions in the recent past for integrating them into the mechanism of teaching-learning so as better to fulfil the needs and objectives mentioned above?

Most of the research on technology for education agrees on the following findings (Lebrun, Vigano, 1995):

1. The real potential for education cannot be found from a technological approach alone; the computer per se *superimposed on traditional forms of teaching cannot improve the quality or productivity of teaching.*

As far back as 1985, R. E. Clark and S. Leonard were expanding on the meta-analysis of J. Kulik and his collaborators (Kulik, J., Kulik, C. & Cohen, P., 1980), and were demonstrating the importance of personal, and especially relational, factors and methodologies that supplanted the intrinsic characteristics of the tool itself. M.J. Atkins (1993), in her critical analysis of various research, attests to the didactic advantages of the substrate offered by the media in contributing to and injecting enthusiasm into information, the simulation of micro-

worlds, the transparency bedecking the walls of the classroom…; it underlines, however, the lacunae in describing the pedagogic context in which the tools are to be used, in the roles devoted to teachers and learners, as well as in the values that mobilize and underlie the educational aspirations of software designers, researchers, and those who are responsible for deciding on curriculums: is the interest for society of an "acceptance / reproduction" nature or one of "challenge / transformation" ? (Atkins, 1993)

2. The benefits one can hope for in the use of technology (in coherent methodologies that are more individualized and more participative) should not be expected only inside the reduced cognitive sphere of knowledge to be recited out "parrot-fashion'.

Some analyses refer to the characteristics of those methods interfering positively with ICT uses. Bagley and Hunter (1992) quoting Collis (1991) propose eight shifts for a synergy between ICT uses and what they call a "restructuring" reform:

- (1) A shift from whole-class to small group instruction;
- (2) A shift from lecture and recitation to facilitation and coaching;
- (3) A shift from working with better students to working with all students;
- (4) A shift toward more engaged students;
- (5) A shift from assessment based on test performance to assessment based on products, progress and effort;
- (6) A shift from a competitive to a cooperative social structure;
- (7) A shift from all learners learning the same things to different students learning different things;
- (8) A shift from verbal thinking to the integration of visual and verbal thinking;

Again, the five keys of the proposed learning process model seem to match correctly with these findings: motivation (3,4), information (7,8), activities (3,4,5,7), interaction (1,2,6) and production (5,8).

In the foregoing, we have presented numerous convergent elements drawn from the needs expressed by various sectors of society (objectives), from consideration of a "complete" and effective learning system (methods) and from conditions so that the efforts made on the subject of technological development can contribute to that learning (this point about tools).

3. Introducing these new technologies will not automatically bring about new forms of teaching and learning.

Despite this good convergence between objectives, methods fostering learning and added-value use of ICT tools, one important element brought to light is that of the time and efforts these in-depth reforms require. Experience shows that these changes from a traditional pedagogical mode to a new one, supported or not by technological tools, go through different phases:

- a phase of "assimilation" in which the new tools are used "like" the old ones (the computer is like a typewriter; initially, cinema films were nothing more than filmed theatre-plays…);
- a phase of "accommodation" in which the new tools find a particular "niche" for themselves, like that which we described when presenting the new modes of education (again a similitude between the innovation process and the Piagetian learning process).

As stated by the ACOT research, the same goes for the way teachers use the new tools. This movement between assimilation and accommodation demands time, effort and a driving force. The availability of the tools and favourable circumstances such as the ones we have described here will not automatically lead to the reforms of which we spoke. Resource centres have work to do in order to boost teachers crossing the gap between traditional teacher-centred methods to really innovative student-centred methods (a condition of success of ICT tools uses).

TEACHER TRAINING AND INNOVATION (OTHERS LAYERS)

This study of the various steps a teacher encounters is very powerful restoring the teacher training in a dynamical and temporal pedagogical process. It's not the only (but also necessary for entering the process) 2 hours seminar about technical tools that matters most. This activity is the "information" pole of our model but it

seems necessary to develop the teacher training on the others poles: starting with knowledges and experiences already acquired by the teachers, defining with them new competences and goals, contextualizing the activities ("motivation"), developing and designing teaching activities and facilitating the "in class experimentation" ("activities"), sustaining efforts with the pedagogical counsellors, encouraging collaboration and practices sharing ("interaction") , giving feedback on real dimension experimentation and promoting innovation by publications or the availability of pedagogical funds ("production").

Writing about change in educational organization, Michael Fullan (2000) provided an image of a new paradigm of change and described it as a dynamic, complex journey: *Change is a journey not a blueprint*. In his paper, Fullan stress the importance of a common, shared vision (in our case a shared pedagogical paradigm as the socio-constructivist model proposed here), the necessity of an intermediary structure (like a resources centre between institution and the teachers whose goals is to train, accompany, sustain and promote them in their efforts), to offer training and help but above all to acknowledge needs, to encourage teams and collaborative work.

A further interesting model to understand teachers evolution and training methods to get them innovating by using ICT is the concerns-based adoption model. The CBAM (Hall & Loucks, 1979) describes the seven levels of concern that teachers experience as they adopt a new practice (see Table 3)

Table 3 CBAM model with stages of concern and their expression

Stage of Concern	Expression of Concern
0. Awareness	I am not concerned about it.
1. Informational	I would like to know more about it.
2. Personal	How will using it affect me?
3. Management	I seem to be spending all my time getting materials ready.
4. Consequence	How is my use affecting learners? How can I refine it to have more impact?
5. Collaboration	How can I relate what I am doing to what others are doing?
6. Refocusing	I have some ideas about something that would work even better.

This model fits particularly well our learning process model and gives ways to organize teachers training promoting so innovation in the institutions.

Some relations are found between the CBAM model (illustrating the way people enters innovation) and the Appreciative Inquiry (AI) approach (Cooperrider, Sorensen, Whitney, Yaeger, 2000), which proposes a very positive approach (a method) to encourage this "learning" process: "Through our assumptions and choice of method we largely create the world we later discover" (Cooperrider, Srivastva, 1987).

Appreciative Inquiry is a theory for organizational development, developed in late 80's and early 90's. Some of the leading theorists behind AI are David Cooperrider, Jane Watkins and Suresh Srivastva. Based on an assumption that human system grow in the direction of what they persistently ask question about, it inquires the best of the past to create a more desirable future. Powerful images of ourselves, our organizations and the world, challenge us to inspired action and innovation. Imagining a positive future outcome is also an important technique for countering initial negative images, beliefs, and expectations. In this way Appreciative Inquiry represents a viable complement to conventional problem-oriented approaches. In this approach, the starting point is not the problem (like in problem solving approach) but the desiderated state (organizations have solutions not only problems). The process of Appreciative Inquiry contains 4 steps: Discover, Dream, Design and Destiny and an attempt to coordinate it with previous models and our learning model is proposed in Table 4.

Table 4 Comparison between different models of innovation advance

Appreciative inquiry (AI)	Description of AI	"I aM An Innovative Professor" model	CBAM Model states
Discover	The best of what is	Information	Informational
Dream	What might be	Motivation	Personal

Design	What should be	Activities Interaction	Management / Collaboration
Destiny (sometimes known as deliver)	What will be	Production	Consequence / Refocusing

This gives precious ways to train teachers for innovation development: information, practices sharing, accompaniment of personal project, encouragement of team work, sustainment of efforts, assessment and valorisation of work … Again, training centres have a great work to do in order to create pedagogical setup where teachers may learn.

In the lines above, we have tried to illustrate the power of a very simple learning model in order to understand, organize and stimulate the innovation development, the teacher training and … the students learning. All of these are learning processes. This paper will be terminated on the point where learning matters most and where all efforts about innovation, teachers training concentrate. Fostering learners learning is an "objective" of the actions assumed in the others layers and this circulation between those layers is our definition of quality.

SUMMARY

Table 5 presents various examples of tools and pedagogical set-ups at the intersection of the proposed pedagogical model and the different layers studied here.

Table 5 Crossing between the facets of the learning model presented here and the various layers studied in this paper

	Students learning	**Teacher training**	**Innovations**
INFORMATION (Context, language, objects, rules, …)	Lectures, references, videos, multimedia, Web sites, …	Conferences, lectures, demonstrations …	Day of …, experts invitations, interest groups …
MOTIVATION (Values, goals, interests, …)	Situations, cases, situated problems, projects, evaluation …	Taste of initiative, professionalization, promotion, funds …	Economical and social needs, institution fame …
ACTIVITIES	Apply, analyze, synthesize, evaluate, critical thinking …	Analyze own practice, create, cooperate, manage, evaluate …	Anticipate, manage, predict, evaluate, promote, valorise …
INTERACTION	Team work, presentation, co-evaluation …	Seminars, practices sharing, team projects, communication…	Collaboration, national and international projects, …
PRODUCTION	Studies, analyses, works, projects, models …	Publications, formations, pedagogical initiatives, pedagogical reforms …	Programs, reforms, conventions, initiatives funds …

As seen in the "Teacher training" column, the frontal traditional training offered initially by the teaching centre becomes more and more individualized encountering teachers' needs and answering specific demands. Again depending of the concerned layer, this model may prove to be useful for students teaching, teachers training, ICT developments, and management of innovation at institutional level. The coherence between these layers and the constructivist alignment inside the layer is a useful definition of quality in education.

REFERENCES

Apple Computer, Inc. (1995). Changing the Conversation About Teaching, Learning, & Technology: A Report on 10 Years of ACOT Research. Cupertino, CA: Apple Computers, Inc.

American Psychological Association (1995). Learner-centered psychological principles: A framework for school redesign and reform. Washington, D.C.: American Psychological Association. (12 p.)

Atkins, M.J. (1993). Evaluating interactive technologies for learning. Journal of Curriculum Studies, 25, 333-342.

Bagley, C., & Hunter, B. (1992). Restructuring, constructivism and technology: forging a new relationship. Educational Technology, 7, 22-27.

Biggs, J.B., & Telfer, R. (1987). The Process of Learning (2nd ed.). Sydney : Prentice-Hall.

Biggs, J.B. (1999). Enhancing teaching through constructive alignment. HigherEducation, 32, 1-18.

Clark, R.E., & Leonard, S. (1985). Computer Research Confounding. Paper presented at The Annual Meeting of the American Educational Research Association, Chicago, Illinois.

Combs, A.W. (1976). Fostering maximum development of the individual. In W. Van Til & K.J. Rehage (Eds.), Issues in secondary education. (NSSE Yearbook). Chicago: National Society for the Study of Education

Cooperrider, D. L., & Srivastva, S. (1987). Appreciative inquiry in organizational life. In W. Pasmore & R. Woodman (Eds.), Research in organization change and development (Vol. 1, pp. 129-169). Greenwich, CT: JAI Press.

Cooperrider, D.L., Sorensen, Jr., P.F., Whitney, D., & Yaeger, T.F. (Eds.). (2000). Appreciative inquiry : Rethinking human organization toward a positive theory of change. Champaign, IL: Stipes Publishing

Dijkstra, S., Jonassen, D., & Sembill, D. (2001). Multimedia learning, Results and Perspectives. Frankfut am Main: Peter Lang.

European Round Table of Industrialists – ERT (1997). Investing in knowledge, The integration of technology in European education. Brussels: ERT publications.

Evers, F.T., Rush, J.C., & Berdrow, I. (1998). The bases of competence. Skills for lifelong learning and employability. San Francisco: Jossey-Bass Publishers.

Fullan, M. (2000). Change forces: Probing the depths of educational reform. London: The Falmer Press.

Hall, G., & Loucks, S. (1979). Implementing innovations in schools: A concerns-based approach. Austin, TX: Research and Development Center for Teacher Education, University of Texas.

Huberman, M. (1989). The professional life cycle of teachers. Teachers' College Record, 91,1, 31-57.

Kadiyala, M., & Crynes, B.L. (2000). A review of literature on effectiveness of use of Information Technology in Education. Journal of engineering education, 89,2, 177-190.

Kulik, J., Kulik, C., & Cohen, P. (1980). Effectiveness of Computer-based College Teaching : A Meta-analysis of Findings. Review of Educational Research, 50, 525-544.

Lebrun, M., & Viganò, R. (1995). De l' " educational technology " à la technologie pour l'éducation [From "Educational Technology" to technology for education]. Les cahiers de la recherche en éducation, 2, 267-294.

Lebrun, M., & Viganò, R. (1995). Des multimédias pour l'éducation : de l'interactivité fonctionnelle à l'interactivité relationnelle [Multimedia for education: from functional interactivity to relational interactivity]. Les cahiers de la recherche en éducation, 2, 457-482.

Lebrun, M. (1999). Des technologies pour enseigner et apprendre [Technologies for teaching and learning]. Bruxelles-Paris: De Boeck.

Lebrun, M. (2002). Théories et méthodes pédagogiques pour enseigner et apprendre : Quelle place pour les TIC dans l'éducation ? [Theories and methods for teaching and learning : Which place for ICT in education ?].Bruxelles-Paris: De Boeck.

Piaget, J. (1975). L'équilibration des structures cognitives [Cognitive structures equilibration]. Paris: PUF.

Savoie, J.M., & Hughes, A.S. (1994). Problem-based learning as classroom solution. Educational Leadership, 52, 3, 54-57.

Saljo, R. (1979). Learning in the learner's perspective IV: Considering one's own strategy (Rep. No. 79). Mölndal, Sweden: University of Gothenburg, Institute of Education.