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

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In this article we will develop the following hypothesis as it relates to the field of educational technology in higher education: students, teachers, and educational institutions are all concerned with a common underlying “learning model.” The organization 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 a “objectives-methods-tools-evaluation ” reference model, we will use this model to organize and to assess the question of the added value of ICT in learning. These factors of learning enhanced by ICT define a learning model consistent with learning factors as proposed by education sciences. The deduced learning model will then be used to understand and to foster teacher training and innovation in institutions.

Many descriptive models of 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,...); and
- indicators about the competences acquired by students (communication, self-management and management of others, critical thinking, teamwork,...).

These are all descriptive indicators of an ongoing process yet it always seems difficult to extract constructive factors of the innovation process: these analyses remain 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 such as student teaching, teacher training, and innovation development 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. This is our way of contributing to the expected “Learning Society.”

GENERAL “CONSTRUCTIVE-ALIGNMENT” FRAMEWORK

Working to promote human actions such as the development of effective 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 1. A good teaching system aligns the teaching method and assessment to the learning activities stated in the objectives, so that all aspects of this system work together 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.

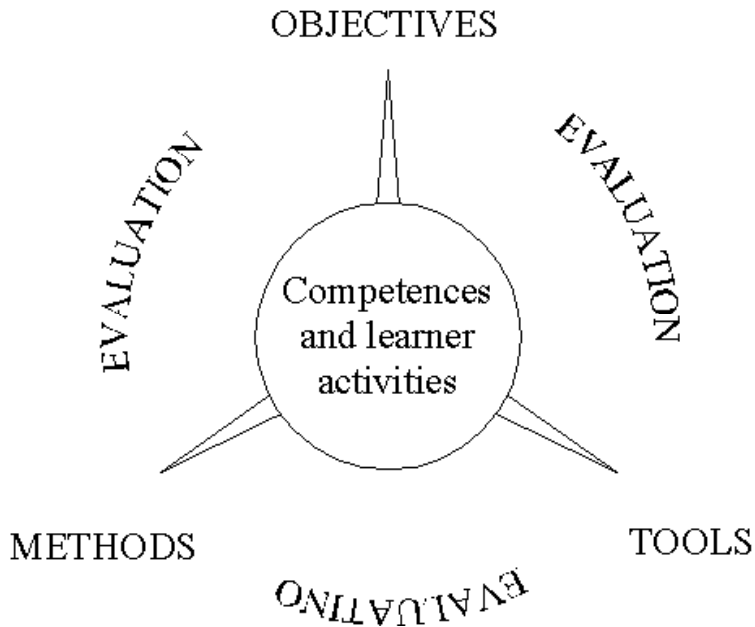


Figure 1. Constructivist alignment between objectives, methods, tools, and evaluation

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

- Are the general objectives of the institution coherent with the teacher training objectives and, more importantly, 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, teacher follow-up, etc.) fulfill the needs encountered at the various levels?

Educational institutions' efforts concerning innovation, teacher training, methods, and tools developed to foster learning, are all converging to the same ultimate goal: students learning. Working backwards, this article 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 teacher training and promoting innovation.

Promoting innovation

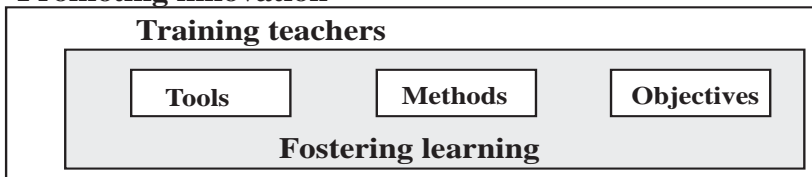


Figure 2. Structure of this article

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

A study (Lebrun, 1999) of the declarations of various interested parties (teachers, rectors, EU representatives, commissions such as the European Round Table of Industrialists—ERT) converge effectively and demonstrate a rather “innovative” range of so-called higher order competences: (a) critical thinking, (b) problem solving, (c) communication, (d) teamwork, and (e) citizenship. As an example, Table 1 presents a summary of the ERT perspective (ERT, 1997).

Table 1
Summary of the ERT Perspective

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

We underline some competences tightly coupled with the ICT domain such as 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), and creativity fostered by multimedia or hypermedia tools.

Evers, Rush, and Berdrow, as a result of research carried out at the boundary between industry and university, stress that the following competences need to be developed for employability reasons: self-management, communication, managing people and tasks, mobilizing innovation and change (Evers et al., 1998).

We note here a movement from inert knowledge to knowledge embedded in reality, in both the social and the work context. Also, such different kinds of knowledge are deeply linked in students' 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, and so forth.

Among the elements emphasized in the interested parties' proposals we have briefly presented, we will highlight some whose importance will be revealed when we later discuss 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 such as critical assessment, analysis of complex situations, synthesis of various points of view;
- the importance of factors relating to communication, to working in teams—in short, interaction; and
- 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 connected to important learning factors as proposed by educational theories. These will ground our pentagonal pedagogical model constructed on the following factors: (a) information,

(b) motivation, (c) activities, (d) interaction, and (e) production (our IMAIP model, standing for "I'M An Innovative Professor" model).

A MODEL FOR LEARNING (AND TO FORGE METHODS)

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

In searching for a dynamic model for learning, we have investigated many authors (Combs, 1976; Saljo, 1979; Biggs & Telfer, 1987; Savoie & Hughes, 1994) who attempted to describe this process. We have also tried to federate a lot of "learner-centered" factors derived from the American Psychological Association (APA, 1997). In addition, learning factors that are particularly well boosted by ICT and derived from educational technology research are embedded in this model (Means & Olson, 1994). Figure 3 shows the results presented as a dynamic adaptation of our pentagonal model (Lebrun, 1999) somewhat provocative because oversimplified.

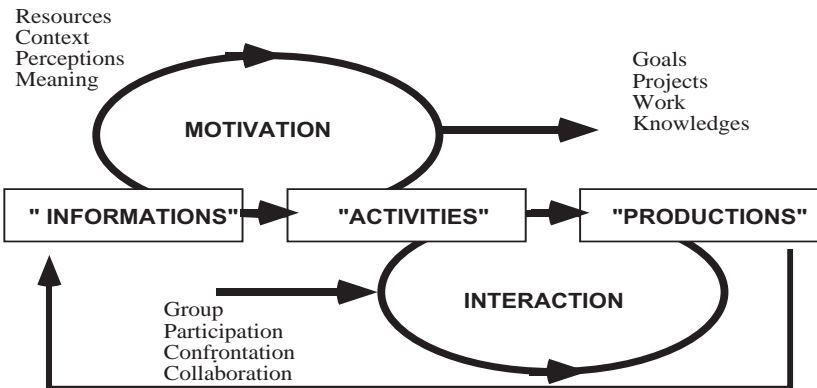


Figure 3. Dynamic representation of our pentagonal learning model

As we will see, this figure may act as a check-list in properly design or evaluate textbooks (the nature, the structure, the attributes, and the lay-out of the information), pedagogical software (the context of the proposed activities or the directives to be followed), educational web sites (the activities proposed to the students or the place of the web site in the pedagogical scenario), pedagogical plans (carefully considered individual and collaborative activities), students' output or, finally, to boost, design, and evaluate innovation inside an institution (Lebrun, 2002, 2005).

In the centre, the three rectangles are inspired by the constructivist approach: briefly, information is transformed into knowledge by the student activities and this new knowledge feeds the following process (systemic loop). This process is enabled by motivational factors and sustained by interaction (from the 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 Apple Classrooms of Tomorrow (ACOT) experiments (Apple Computer, 1995), the teacher entering an innovative technological process follows different succeeding steps, as 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 uses such as programmed instruction and drill and practice exercises (reactive). Adaptation refers to the use—by the students—of tools such as word processors and spreadsheets (proactive). Finally, the teacher adopts a new pedagogical set-up where students, teachers and tools interact (interactive). There is a close congruence between this “entering innovation” process and the learning process (Entry and Information, Adoption, Adaptation, Appropriation, and Activities, Invention, and Production). The main lesson to be

drawn from this is the necessity of designing pedagogical setups that are closely in tune with the learning process when building ICT tools, when training teachers, and when teaching students (Lebrun, 2002). The way innovation penetrates an institution and the way individuals endorse innovation are also in some sense embedded learning processes.

Embarking on innovation is a learning process. From entry to invention (Table 2), this resembles Piaget's two-sided model of the learning and organization of knowledge (Piaget, 1975): assimilation (doing the same as before with new ICT tools) and accommodation (entering pedagogical innovation when using ICT tools).

ICT IN THE LEARNING PROCESS (ABOUT TOOLS)

In the books already mentioned (Lebrun, 1999, 2002, 2005), an analysis of much research concerning the use of technological tools in education was conducted. We note 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 existed 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 fulfill the needs and objectives previously mentioned?

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

1. The real potential of education cannot be found through 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, Clark and Leonard were expanding on the meta-analysis of Kulik and his collaborators (Kulik, J., Kulik, C. & Cohen, 1980), and were demonstrating the importance of personal, and especially relational, factors and methodologies that supplanted the intrinsic characteristics of the tool itself. Atkins (1993), in her critical

analysis of various research studies, attested 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 of the classroom walls allowing students to access information in any domain; it underlines, however, the lacunae in describing the pedagogic context in which the tools are to be used, in the roles ascribed 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 curricula: is the interest for society of an “acceptance/reproduction” nature or is it 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 recited “parrot-fashion.”

Some analyses refer to the characteristics of those methods interfering positively with ICT uses. Bagley and Hunter (1992) quoting Collis proposed eight shifts for a synergy between ICT uses and what they called 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; and
- (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 these findings: information (items 7,8), motivation (3,4), activities (3,4,5,7), interaction (1,2,6), and production (5,8).

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 in the area of technological development can contribute to that learning.

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

Despite this effective convergence between objectives, methods fostering learning and added-value use of ICT tools, one important element brought to light is the time and effort 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); and
- 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 similarity 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 (from Adoption to Invention). This movement between assimilation and accommodation demands time, effort, and a driving force. The availability of the tools and favorable circumstances such as the ones we have described here will not automatically lead to the reforms we have described. Resource centers have work to do in order to help teachers cross the gap between traditional teacher-centered methods to really innovative student-centered methods (a condition of successful ICT tool use).

TEACHER TRAINING AND INNOVATION (OTHER LAYERS)

This study of the various steps a teacher encounters is very powerful in restoring the process of teacher training in a dynamic and temporal pedagogical process. While a two-hour seminar about technical tools is a necessary step for beginning the process, it is not the element that matters most. That activity is the “information” pole of our model, but it also appears necessary to develop teacher training towards other poles: starting with knowledge and experience already acquired by the teachers, defining with them new competences and goals, contextualizing activities (“motivation”), developing and designing teaching activities and facilitating “in class experimentation” (“activities”), sustaining efforts with the pedagogical counselors, encouraging collaboration and practice-sharing (“interaction”), giving feedback on classroom experimentation and promoting innovation by publications, or the availability of pedagogical funds (“production”). All these steps, which again match the different categories of our learning model (from information to production), also fit very closely with the ingredients of the SOTL approach, with the image of the teacher considered as an information provider, a learning promoter, a reflective practitioner, an interactive researcher... (Shulman, 2004).

Writing about change in educational organizations, 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 publication, Fullan stressed the importance of a common, shared vision (in our case, a shared pedagogical paradigm such as the socio-constructivist model proposed here), the necessity of an intermediary structure (such as a resource centre between the institution and the teachers whose goals are 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 in understanding teachers’ evolution and the training methods needed to get them innovating by using ICT is the concerns-based adoption model (CBAM). The CBAM (Hall & Loucks, 1979) describes the seven levels of concern that teachers experience as they (intend to) adopt a new practice (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 our learning process model particularly well (from information to interaction) and provides ways of organizing teacher training and, hence, promoting innovation in institutions.

Some connection can be found between the CBAM model (illustrating the way people enter 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 of organizational development, developed in the late 1980s and early 1990s. Some of the leading theorists behind AI are David Cooperrider, Jane Watkins, and Suresh Srivastva. Based on an assumption that human systems grow in the direction of what they persistently ask questions about, it enquires into 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 (as in the problem-solving approach) but the desired state (organizations have solutions, not only problems). The process of Appreciative Inquiry contains four steps: (a) Discover, (b) Dream, (c) Design, and (d) Destiny. 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	Our “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 provides valuable ways of training teachers for innovation development: information, practice-sharing, accompaniment of personal project, encouragement of team work, support for efforts, assessment and reward of work. Again, training centers have important work to do in order to create pedagogical setups where teachers may learn.

In the previous passage, we have tried to illustrate the power of a very simple learning model to understand, organize, and stimulate innovation development, teacher training, and student learning. All of these are learning processes. This article ends at the point where learning matters most and where all effort concerning innovation and teacher training is concentrated. 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
Interaction Table Between the Facets of the Learning Model Presented Here
and the Various Layers Studied in this Article

	Student 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, reward...
INTERACTION	Team work, presentation, co-evaluation...	Seminars, practice-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 as it encounters teachers’ needs and answering specific demands. Again depending on the layer concerned, this model may prove to be useful for student teaching, teacher training, ICT development, and the management of innovation at the institutional level. The coherence between these layers and the constructivist alignment inside the layer is a useful definition of quality in education.

Students learn, teachers learn, institutions learn...so let’s use our models for learning and for pedagogical setup development to develop new teaching methods and to promote innovations in institutions.

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Note

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