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Three Epistemological Foundations for e-Learning models

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Abstract— Research on epistemological foundations is fruitful to understand the different e-learning models and not just to describe them. We develop here the idea that education is fundamentally a process of Communication. And then we can find the three major epistemological perspectives: instrumental perspective (where education is primarily a Transmission), relational perspective (where education is primarily a Exchange) and socio-constructivist perspective (where education is primarily a negotiation of Meaning). In these three perspectives the different e-learning models are then discussed: “just in time” model, “self-service” model and “industrial reuse” model.

Keywords- epistemology; e-learning model;

I. INTRODUCTION

As for e-Commerce and soon for e-Health, e-Learning has become an important field of research in Information Systems (I.S). Thus we can gradually see the development of the three conventional issues of the I.S. discipline : first the **development** of Learning Management System LMS (issues of resource access and resource design), then the **control** of LMS (issues of performance, animation and evaluation of e-Learning devices: Leidner and Jarvenpaa [11]), and finally the **strategy** of LMS (issues of strategic alignment and new markets: Webster and Hackley [23]).

So, **Organizational theory** has its conventional tools to analyze the development of e-Learning:

- at the individual level, it is mainly those of **the use analysis** (TAM Technology acceptance model, Media richness theory, Social influence theory ..): so Leidner and al. [11] analyze the coherence between the features of a system and used pedagogical models, Jawad and El Akremi [9] test the TAM model for e-Learning...

- at the organizational level, it is mainly those of **the strategic analysis** (Organizational knowledge creation, Value chains, Resource based view, Theory of contracts, Institutional theory..): so Peters [17], Campion [3] and Rumble [19] describe the industrial approach, Garrison [7] describe the transactional properties of the postindustrial era of distance education...

- finally, at the social level, the tools are those of the **sociological analysis** (theory of social capital, structuration theory...) to take into account both the new structural contradictions that appear (division of labor, intellectual property, knowledge market, knowledge goods ...) and the daily interactions that change in e-Learning (hyperText,

mentoring, evaluation, annotation of Web documents..): for example Noble [13] [14] describes the commoditization of higher education.

As for **Educational Sciences**, they distinguish three types of perspectives to describe the learning process:

- **teaching methods of transmission**, for which Bereiter [1] evokes the metaphor of « container » and for which Paavola and al. [16] use the metaphor of « acquisition » ;

- **cognitive pedagogies**, with the metaphor of « participation » : individuals in situations develop new structured knowledge (Piaget [18]);

- **pedagogies through work**, that focus on the social creation of knowledge. Freinet [5] [6] has suggested three basic principles: free expression, experimental trial and error, cooperation : the student as well the group build their knowledge.

But upstream of the different approaches of organizations and the different educational approaches, we develop here the idea that education is fundamentally a process of **Communication**. And then we can find here the three major epistemological perspectives:

- the instrumental perspective, behaviorist and positivist (that of **Transmission**, for which the channel is important);

- the relational perspective, connectionist and constructivist (that of **Exchange**, for which the key is the relationship with the environment);

- and finally the socio-constructivist and collective perspective (that of the **negotiation of Meaning**, for which social action organizes the roles and rules of behavior).

We will see that this research on epistemological foundations is fruitful to understand important issues related to e-Learning today : effective vs digital divide, individualism vs autonomy, education vs tutoring, course vs monitoring, standardization vs cultural diversity ...

II. THE INSTRUMENTAL AND BEHAVIORIST PRESPECTIVE : EDUCATION IS A TRANSMISSION

In the instrumental perspective (behaviorist and positivist), learning is primarily a “**Transmission**” by stimulus/response and reinforcement. Skinner (citation in Smith,[21]) is often presented as the most illustrious representative of the behaviorist view of learning: “*It is possible to teach the high jump by raising the bar just a millimeter after each successful jump*”. From an epistemological point of view, the

assumption is made here that the meaning is set before transmission and that knowledge is considered to be transferable.

In communication sciences, this approach is clearly founded on the Shannon model [20], where the concept of "quantity of information" appears for the first time: if the quantity of information (coding problem: number of signs, appearance probability...) remains below the channel capacity (bandwidth problem), then the losses tend to zero. This channel model, often regarded as "simplistic", is however at the origin of all encryption algorithms and data protocols on the Internet.

In organizational sciences, the media richness theory (MRT, Daft and Lengel [4]) expands the Shannon model of the quantity to the ambiguity of the message: the different media are classified along a continuum, from "rich" to "poor", and the "rational" manager will choose the good medium which best corresponds to the ambiguity of the message to be transmitted.

In educational sciences, the pattern of transmission is for example the basis of famous methods for CALS (Computer Aided Learning Software) to learn languages: learners are receivers that decode and reconstruct, trainers are mediators who provide and facilitate. The advantage is that the purpose of learning, the steps of the process and the evaluation process are clear to everyone. The disadvantage is obviously that if the "correct" stimulus is not given, the student can not answer, nor therefore learn.

For e-Learning, this behaviorist and positivist vision of the transmission channel then produces a systematic enhancement of the "Access", which can be seen in two directions:

- the enhancement of access by the network is embodied in a kind of "**just in time**" e-learning model, where the positive keywords have become hypertext, navigation, accessibility, transparency... One can speak of a « right-click » syndrome (just sufficient knowledge, in any place and at any time). But if a book is a kind of author dictatorship, hypertext and the dictatorship of the navigation are soon faced with a problem of credibility of the source: Who wrote this web page, a philosopher, a scientist or a student ? With whom am I talking through this "pedagogical call-center", with a tutor, a teacher, an author or an expert? There is a big difference between "navigate in knowledge" and "access to knowledge";

- this enhancement of the access and the network is also reflected in a march towards the **standardization and the certification** of educational resources (DC, *Dublin Core* used by libraries since 1995, or LOM, *Learning Object Model* adopted by ISO): with the concept of learning object (described by 9 elements and 71 fields (*Typical Learning Time, Level of interactivity* ..)) LOM assumes that knowledge is predefined and transferred, without depending on the interaction. In addition to cataloging the objects, standards are also needed for students/LMS communications and LMS/servers communications. Here SCORM (*Sharable Content Object Reference Model*) is the reference: not only

does it manage lessons (*Activity*) composed of basic *units* (the reusable *SCO*) themselves composed of simple resources (*Assit*), but it also specifies the form of communications that can be exchanged (sessions, identification, messages, quiz, answer tracing ...). These behaviorist teaching models, originally designed for the validation of pilots and engineers in aeronautics, are now involved in the creation of a real LMS market.

III. THE RELATIONAL AND CONSTRUCTIVIST PERSPECTIVE : EDUCATION IS AN EXCHANGE

In the relational and constructivist perspective, learning is primarily an «**Exchange**», fundamentally based on the feedback concept : the message is structured in the interaction. From an epistemological point of view, the assumption is made here that the meaning is defined in the exchange and that experience is the source of knowledge.

In communication sciences, this approach is fundamentally based on the concept of **feed-back**. For Wiener [24] and cybernetics (literally the science of "rudder") the circular process of information on the current action achieves the objective. The Palo Alto Group shows the centrality of this concept of feedback (positive or negative) in behavior between individuals: the message is structured in the interaction, it includes all types of messages exchanged (verbal/non-verbal, ritual/spontaneous ...) and the role of meta-communication is to talk about the meaning of these signs.

In organizational sciences, the construction of meaning in the exchange is a cornerstone of **systemic** approaches (Le Moigne [12]: "*Understanding (instead of explaining) the behavior of a system ... Developing intelligible representations of dissonance/consonance phenomena*"). While proponents of the « variance theory » see organizational phenomena as linear relationships between dependent and independent variables, the proponents of the *process theory* prefer to speak of events rather than variables, which means to delve into the complexity and temporality of the process.

In educational sciences, Piaget [18] is the most illustrious representative of the pedagogy of action: individuals in situations develop new knowledge structured through **Assimilation and/or Accommodation**. The advantage is to foster an ability to interpret multiple realities with possible transfers to new situations, the disadvantage is the possible conflict between divergent thinking and a situation of compliance. The typology proposed by Moore [15] separates the *learner-content* interaction (active process of cognition), the *learner-learner* interaction (in addition to individuals, the community also learn) and *learner-instructor* interaction (didactic contracts or slightly didactic contracts, according Brousseau [2]).

For e-Learning this connectionist and constructivist vision of exchange and feedback then produces a systematic enhancement of the "**Interaction**" in two direction:

- the enhancement of the interaction is embodied in a kind of "**self-service**" e-learning model where the positive

keywords have become autonomy, individualized courses, tutorials, customization, training project... The learner becomes a consumer of training services that have been customized, the master of his choices, responsible and autonomous through the co-production of his training project. But autonomy is here an attribute of a supposed modern and motivated user, it is no longer a goal of education. It is here a prerequisite assumed, which then becomes a factor that strengthens inequality for those whose background does not exactly give such autonomy: isn't the "digital divide" primarily a social divide?

- the enhancement of the interaction is also reflected in the march to the modeling of educational **activities**, following criticism of a simple transmission of contents : *"Activities are central, but resources are not... The content is more difficult to reuse than the scenarios ... "* (Koper [10]). Educational Modeling Languages characterize this approach, although new divisions of labor have not yet been clarified between developers and educators. For example IMS-Learning Design describes *unit-of-learning*, a real scenario "structured and reusable" giving all the details : the file *Method* describes the order of intervention of the components (which are *activities*, *roles*, *environments* running in parallel in each *act*, as well as *properties* or *outcomes* of *activity-structure*). *Method* contains also the *objectives* and *prerequisites*, and starts one or several *plays* decomposed into *acts* and *role-parts* (as in the theater) with *conditions* and *notifications*.

IV. THE COLLECTIVE AND SOCIO-CONSTRUCTIVIST PERSPECTIVE : EDUCATION IS A NEGOTIATION OF MEANING

In the socio-constructivist perspective, learning is primarily a collective "**negotiation of meaning**" and the social interaction is the source of knowledge : cognition is socially mediated (culturally produced and performed in a zone of proximal development) and activities are socially relatable (we only know what we can tell).

In communication sciences, this approach is primarily **integrative**. It rests on three basic elements: the context determines the positions (relations student/teacher, client/vendor, patient/doctor ... or protector/protected, victim/savior ...), interactional dynamics is based on symbolic and operational issues (look good, get information ...) and finally the co-construction of meaning is an inference process consisting in co-selecting, among the possible implications of an explicit statement, those relevant to the context.

In organizational sciences, one speaks of a theory of "**conceivable collective action**". The action involves a process of subjectivation by mutual collective conditioning, where the subject restricts, bounds, landmark what he will consider to form and transform a "management object". Habermas [8] speaks about "communicative action", where players seek agreement on an action situation, to coordinate their actions by consensus if certain guarantees of validity are met: understanding, sincerity, trust and legitimacy. The community itself learns, with the idea of socially distributed

cognition: knowledge, tacit and explicit, is important if it helps the innovation process of the community (spiral of knowledge, communities of practice ...).

In educational sciences, the emphasis is here on "**mediator artifacts**" : practices, real objects or symbols that are developed collaboratively during a long-term process. It would be less important to link schools to the Internet, than to link schools with each other through the Internet. Vygotsky [22] is the most illustrious representative of the socio-constructivist view, with the concepts of "socially mediated cognition" in a zone of proximal development and "social activities relatable". There are many advantages (tasks in authentic contexts, reflective practice by metacognition, multiple representations of reality ...) but also disadvantages (more facilitators than prescriptive models, and especially great difficulty in defining outputs to achieve).

For e-Learning, the socio-constructivist vision produces a systematic utilization of **Collaboration** in two directions:

- The value of collaboration can be grasped in a kind of « **industrial reuse** » **e-learning model**, where the positive keywords have become: collective labor, fixed costs, modularization, editorial board, certification, quality... The teacher still thinks like a craftsman, but education entered the computerizing process of the entire society. Industrialization and liberalization thus become major elements of an education policy: partnerships with industries of communication, national or even international fundraising and competition;

- The value of collaboration is also reflected in the move towards open **collaborative environments**: small flexible community portals (where the teacher can provide the orchestration scenarios), peer-to-peer to co-publish papers, cooperative learning object warehouse (with annotation process and peer review), an e-Campus that provides a single point of access to a set of resources and services ... The interfaces for collaborative tools are now open and standardized: XML (to structure the documents regardless of the form), SOAP (Simple Object Access Protocol to define the structure of messages exchanged), WSDL (Web Services Description Language to provide a standardized description of the features of an application), AJAX (asynchronous JavaScript and XML to create interactive web applications on the client-side)... These standards already allow the integration of heterogeneous environments in an e-Campus and may be considered as an educational portal like a kind of "glue" which assembles innovative and interoperable components with standard interfaces.

V. CONCLUSION

These considerations lead us to say that educational models and thus e-Learning models are bound by their epistemological presuppositions, and they reflect one of three visions of communication:

- in the behaviorist model of transmission, one highlights access and a "just in time » learning model. E-Learning provides here most of the specific material and suitable exercises: it is an approach **by content**, typical of new

opportunities for catalog and platforms offered by LOM or SCORM standardization.

- in the connectionist model of exchange, one highlights interaction and a « self-service" learning model. E-Learning provides here a particular environment, real facts, cases and expertise: it is an approach **by scenario**, according to the new possibilities offered by screenwriting with Educational Modeling Languages.

- finally, in the socio-constructivist model of negotiation of meaning, one highlights collaboration and an « industrial reuse » learning model. E-Learning provides here collaborative portals: it is an approach **by tools**, characteristic of the new possibilities of integration in using the open protocols and the open languages of the social Web.

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