Knowledge, Education, Learning and Teaching:
Meanings and Relationships[1]

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Article Outline

This is an epistemological article of international scope embedded in historical and cross-national perspectives which draws on the author's ideas and analysis of varied scholarly production from Europe, Africa and the United States. The article's main aim is to contribute shedding light on some key curriculum-related educational terms and concepts whose meaning is not always obvious and which are sometimes hardly understood in their relationships to one another. The article successively analyses knowledge, education as a process and education as a result/product as well as education as a science. It also discusses learning, teaching, teaching-and-learning as a process and teaching-and-learning as a science – the science of Didactics – before ending by suggesting a conclusive recommendation for the optimization of the didactical process.

Introduction

There would be no rationale for educating in general and teaching in particular if people could not learn. And, basically, people learn throughout their lives. This is to say that people learn even if there is no educator or teacher. In this case, the subject matter of education in general and of learning in particular is simple and easily accessible. In many other cases though, the subject matter of education in general and of learning in particular is complicated and hardly accessible. Then, the educator in general and the teacher in particular are needed to help people learn or, in other words, to help people develop, acquire or construct/create knowledge.

1. Knowledge

You cannot be wise without some basis of knowledge […].
(Alfred North Whitehead)[2]**.**

Throughout this article, the word knowledge is considered as being any subject matter that may be dealt with by the processes of education in general and of teaching-and-learning in particular. So,

in this sense, knowledge encompasses the following:

- facts, dates and events, theories and concepts, rules, formulas and algorithms [cognition];

- states of mind, feelings and attitudes [affectivity];

- skills, competencies and behaviors [psycho-motivity].

In actual fact, all the three categories above-listed as components of knowledge fit in one or the other of the main two types of knowledge as established by different scholars (Darley et al.: 1984; Mark & Greer: 1995; Mayer: 1987; McGraw & Harbison-Briggs: 1989; Tardif: 1997), i.e. declarative knowledge and procedural knowledge. Simply put, these two types of knowledge respectively relate to the following:

- Declarative knowledge comprises any subject matter of education in general and of teaching-and-learning in particular that can be readily described such as facts, dates and events on the one hand, and theories and concepts, rules, formulas and algorithms, feelings, attitudes and states of mind on the other hand. Particularly, Darley et al. (1984) qualify this knowledge as propositional and subdivide it into episodic knowledge on the one hand and semantic knowledge on the other hand, while Mayer (1987) splits it into the same semantic knowledge on the one hand and factual knowledge on the other hand.

- As regarding procedural knowledge, it refers to any subject matter of education in general and of teaching-and-learning in particular that involves the putting into practice of the declarative knowledge or the 'how' of doing things, of feeling and of behaving (Darley et al.: 1984; McGraw & Harbison-Briggs: 1989). This category of knowledge of course includes skills and competencies as well as behavior.

Finally, talking of these two types of knowledge, Tardif (1997, p.52) says that declarative/propositional knowledge is about answering the 'what' question whereas procedural knowledge is about answering the 'how' question. In addition, this author (Idem, p.53) introduces a third type of knowledge which, through the processes of generalization and discrimination[3], allows the application and the transfer of those two above-mentioned types of knowledge in other situations/contexts and moments that are generically called 'conditions'. Hence, this third type of knowledge is called conditional knowledge and is about answering the 'why', 'where' and 'when' questions.

2.Education

Ask me my three main priorities for Government, and I tell you: education, education and education. *(Tony Blair)*[4].

Since Durkheim in the fifties and Rousseau in the sixties up to recent authors like Boutilier (1992), Egan (1992), Putnam & Putnam (1993) and Lagemann & Graham (1994) to cite only a few, so many attempts to define the word 'education' have been made to the extent that one may arguably affirm that there are as many definitions of education as there are schools of thought. Nevertheless, education is generally considered as a global term that refers altogether to the process, the result/product and the science of delivering or availing knowledge to people for acquisition or of setting up conditions that are conducive

to developing, acquiring and constructing/creating knowledge. Two important features of education are that it is proper to human beings and it is realized throughout life. Some animals in fact, such as dogs, bears, elephants and dolphins, may be trained through shaping which is a low-level teaching technique or procedure that corresponds to the psychologists' application of secondary reinforcement in operant conditioning as will be further detailed, but they cannot be educated. As concerning education's second feature of being realized throughout life, it is this that is at the origin of the concept of 'adult/continuing education'.

Education as a Process

Considered as a process, education is composed of two sub-processes that both hinge on a third one. These first two sub-processes are respectively the process of upbringing and that of instructing [as usually used in the USA] or teaching-and-learning [as usually used in the UK and most of European countries] while the third on which they both hinge is that of instilling discipline into children who are brought up and instructed/taught. The point that these three sub-processes of education have in common is constituted by the following two senses of which one is broad while the other is restricted. In its broad sense, education deals with the delivering or availing of knowledge for acquisition or with the setting up of conditions that are conducive to developing, acquiring and constructing/creating knowledge in any life circumstance in which human beings are involved, either in their families, at school or in society at large. In its restricted sense though, education deals with knowledge delivering, availing and acquisition or the laying out of optimal conditions for knowledge development, acquisition and construction/creation only in institutional settings such as schools, colleges and universities.

Furthermore, education is subdivided into the three following sectors: non-formal education, informal education and formal education.

Structured but not regular, non-formal education refers to education that is organized and carried out in occurrences such as seminars and workshops, conferences, colloquia, and the like.

Both non-structured and non-regular, informal education refers to education that is realized haphazardly in life. It neither respects any structure nor follows any program of activities or timetable. It may occur, for instance, on occasions such as those of personal reading, inter-individual chats, or any other diverse events.

At the opposite of informal education, formal education is both structured and regular. Being carried out in institutional settings, it actually corresponds to education in the restricted sense as earlier announced. This type of education is realized within an organized structure and according to a determined program of activities or schedule. An essential example of such an education is that offered and taken up within teaching-and-learning institutions such as schools, colleges and universities. These teaching-and-learning institutions range within four levels of education, i.e. preschool, primary, secondary and tertiary or higher education. For this very reason, formal education is also called school/academic education and is also simply referred to in this article as teaching-and-learning. This point will be further referred to when teaching-and-learning is being analyzed.

Education as a Result/Product

Education is also sometimes considered as being a result/product of the above-evoked process as in the expression 'a solid education' [E.g.: Such person has got a 'solid education']. In this case, it bears the meaning of 'knowledge' as has been discussed in detail under section **1.** above.

Education as a Science

The science that studies the process of education of children and young people either in family, at school or in any other social situation in general is called pedagogics or pedagogy. It includes two more specific sciences that both hinge on a third one. These two sciences are respectively the science of pediatric nursing, nursery nursing or infant care and that of teaching-and-learning [also called didactics as will be further analyzed in detail] while the third on which they both hinge is moral or disciplinary education. Thus understood, this science of pedagogics or pedagogy contrasts with the other science called andragogics or andragogy that deals with adult education. In its broader sense however, the term pedagogics/pedagogy refers to the systematic study of the process of education – thus including adult education – that, at the same time, resorts to art, philosophical reflection as well as scientific theory and practice/experience in order to deepen its consciousness and to improve its practice/exercise. On this point, it is to be noted that the main science whose theory and practice constitute the basis for pedagogics/pedagogy is psychology which allows the understanding, the prediction and the management of the learner's behavior. It might be in order to separate pedagogics/pedagogy from its traditional 'artistic' connotation and rather stress its scientific connection with psychology that psychopedagogics/psychopedagogy was born. Some authors in fact, such as Stones (1983), equate psychopedagogics/psychopedagogy to educational psychology or psychology of education. For instance, Stones' book referred to above is a reviewed edition of the previous one titled *Psychopedagogy: Psychological Theory and the Practice of Teaching* by the same Stones, Emeritus Professor of Education in the University of Liverpool and Fellow of the British Psychological Society, which was first published in London by Methuen & Co. Ltd in 1979.

In its broader sense, this science of pedagogics/pedagogy is also often designated by the term education, thus giving this term a second meaning of science in addition to that of process that was firstly referred to in this section.

3. Learning

What one knows is, in youth, of little moment; they know enough who know how to learn. *(Henry Brooks Adams)[5]*.

Learning consists of acquiring or developing, constructing/creating knowledge of any kind [either propositional/declarative or procedural] that is converted to oneself's own use in various life situations, contexts or conditions through the processes of application and/or transfer. In other words, learning aims at the acquisition or the production and the stabilization of knowledge as including facts, mental dispositions and competencies that are planned by educators through learning objectives. This is to say that, after a certain period of time, such knowledge has to be integrated into the individual personality structure, thereby causing appropriate

and lasting changes in behavior, so that the person continually adapts to his/her different life situations, contexts or conditions by adequately resolving various problems that he/she encounters, thus satisfying his/her needs, motivations and curiosities or professional demands.

For the sake of methodology, the structure of personality has been divided into three domains of human behavior, which, in actual fact, is the expression of knowledge. These domains of human behavior are the cognitive domain [domain of intelligible information], the psychomotor domain [domain of movement or skill-related information] and the affective domain [domain of information related to values and attitudes]. Therefore, learning definitely deals with all these three domains of human behavior.

According to Bloom [Editor] (1956), cognitive learning is realized at any of the following six hierarchically increasing levels: knowing, comprehending, application, analysis, synthesis and evaluation. On this taxonomy, some authors, such as Guilford (1967) and Guilford & Hoepfner (1971), consider that the level of divergent production [creativity, invention] should be added, while some others, such as Minder (1977), believe that this level is already contained, though implicitly, in that of synthesis. As for the psychomotor domain, one of its investigators named Dave[6] in 1967 came up with the following five gradual levels of learning: rough and spontaneous imitation of movement, mechanical execution of movement according to given instructions, precision of movement, speed and coordination, as well as acquisition of automatism or naturalization. Concerning the affective domain, the study carried out by Krathwohl et al. (1964) came up with levels of learning that may be increasingly scaled into five steps as follows: reception, reaction, selection/choice, commitment, and genuine own option-wise life.

Since this issue of knowledge and learning was investigated, several relevant theories have emerged. From empiricism (Locke: 1632-1704) that stresses the importance of the environment stimulating to action as the only source of knowledge, as well as from nativism/maturationism (Chomsky in 1966) that emphasizes the importance of maturation of the individual's aptitudes that are considered to be inborn as being the unique responsible agent for knowledge, were developed more modern interactionist theories that integrate the former two theories thus giving importance to both individual aptitudes and environment. Of these theories, the most important that may be noted are behaviorism or the stimulus-organism-response [SOR] theory, also known as the theory of conditioning (Thorndike in 1898 and 1913; Skinner from the 1930s on), cognitivism or the theory of acquisition, processing and storage of information (Tolman: 1886-1959), and constructivism (Piaget, Durkheim, Vygotsky and Bruner) of which the theory of social learning (Vygotsky) or the theory of imitation of behavioral model also called vicariant learning (Bandura since the 1960s up to the 1980s) is actually an aspect.

4. Teaching

Those who can do, do; those who cannot, teach; those who cannot teach, teach how to teach. *(Wolfgang Butzkamm)[7]*.

One paramount consideration of teaching is that only what students cannot learn by themselves, or what they can learn by themselves but within such a long time that cannot be available due to the need for

these matters to be quickly known by people should be taught. Therefore, teaching should be considered as facilitation of learning or, in other terms, as a process that helps learning take place. Actually as Bruner (1997, p.48) puts it, "we humans show, tell or teach someone something only because we first recognize that they don't know, or that what they believe is false." Thus, pedagogic, instructional or didactic efforts are attempts to correct this deficiency of ignorance and false beliefs ascribed to learners by demonstration, explanation or discussion (Idem). For this reason, teaching is an intent-driven, planned and structured activity, be it institutionalized or not, regular or irregular. In actual fact, teaching occurs either in formal education or in non-formal education, but never in informal education. This is the reason why teaching is a special profession that requires its practitioner to know well how to go about it from the starting situation in order for the learners to achieve learning or, in other words, to develop, acquire or construct/create knowledge and express it through a relevant outcome or behavior.

According to De Corte et al. (1996), this starting situation is the whole of personal, social, school and conditional data in relationship with the starting behavior of the learners, the starting behavior of the teacher, as well as the whole situation of the classroom and the school, that influence the process of learning and teaching. In other words, the starting situation is the set of various assets that the teacher has to consider, to take into account or to capitalize on in his/her teaching. The teacher usually informally estimates these assets, though some of them – such as the prior knowledge of learners – may also be established through formal assessment. Indeed, assessment of prior knowledge is of paramount importance in teaching since, as Popper (1979, p.71) puts it, "the growth of all knowledge consists in the modification of previous knowledge – either its alteration or its large-scale rejection. Knowledge never begins from nothing, but always from some background knowledge […]."

The starting situation for teaching – and consequently for learning – is more detailed under section 5.1.2. further.

5. Teaching-and-Learning

The Process of Teaching-and-Learning

Teaching-and-Learning versus Informal Education

Teaching-and-learning corresponds to formal education, and contrasts with informal education as earlier stated under section **2.1.** Following is a table – **Table I** – which compares informal education and teaching-and-learning from the viewpoints of their level of organization, their level of intent expression, their implementing agents, their duration, their contribution to life preparation as well as their beneficiaries and the social sanctions or accreditations they provide the latter with.

The Starting Situation

It is obvious that teaching and learning are part and parcel of the same process, the teaching-and-learning process. In this process composed of the teaching-and-learning procedures and strategies, teaching provides assistance to learning when necessary, in the perspective of the starting situation towards the achievement of the expected outcome or behavior. This 'starting situation' is broader than the 'entering behavior' that American educationists De Cecco

and Lembo quoted by the Belgian De Corte et al. (1996, p.84) limit to the 'starting behavior of the students', and its numerous variables that determine the teaching-and-learning process (De Corte et al.: 1996, pp.85-89) otherwise identified as 'conditions which impinge on the teaching' by Brown & McIntyre (1993, pp.69-82) may be summarized and categorized as detailed in the following table – **Table II** –.

Teaching-and-Learning Procedures/Approaches

Findings so far reached by educational pieces of research carried out within the modern trend of interactionism[8] about teaching-and-learning procedures end up to the two main approaches of conditioning and constructivism.

Conditioning

Conditioning is a teaching-and-learning procedure that does not involve the learner's consciousness and willingness. For this reason it is applicable to both human beings and animals.

Constructivism

Opposite to conditioning, constructivism is a teaching-and-learning procedure that does involve the learner's consciousness and willingness. For this reason it is applicable only to superior animals, i.e. animals whose brain cortex is more developed such as apes and human beings.

Constructivism is of three types, i.e. imitation, insight and trial-and-error.

The constructive theory of learning in general is based on an implicit assumption that all students have the aptitude to construct meaning from their observations, associations and actions (Gipps: 1999). More particularly, the learning procedures of insight and trial-and-error are based on the assumption which considers the student as a thinker who learns and achieves understanding or sense making – metacognition – through 'intersubjective interchange' (Bruner: 1997, pp.56-60). On this point, Perrenoud (1991, p.83) observes that "the merit of a teaching [-and-learning] approach depends on […] whether the pupil [and the learner in general] is regularly put in working or interactive situations that are actually structured in such a way that he [or she] is obliged to adjust his [or her] actions, identify his [or her] mistakes and take account of his [or her] partners' viewpoint – i.e. to learn by trial and error, cognitive conflict, intellectual cooperation or any other adjustment mechanism."

Some considerations about the procedures/approaches of teaching-and-learning

In order to conclude these procedures/approaches of teaching-and-learning, one may say along with Bruner (Op. cit.) and Black & Wiliam (1998) that there is no single royal road nor optimum model for good classroom practice applicable into all contexts and circumstances but that, as Cullen et al. (2002: p.43) put it, "in thinking about the choice of instructional strategies and methods […] appropriateness is now the key principle". Moreover, it should also be borne in mind that at the end of the day, "any choice of pedagogical practice implies a conception of the learner and may, in time, be adopted by him or her as the appropriate way of thinking about the learning process. For a choice of pedagogy inevitably communicates a

conception of the learning process and the learner. Pedagogy is never innocent. It is a medium that carries its own message" (Bruner: Op. cit., p.63).

Teaching-and-Learning Methods and Strategies/Tactics

Teaching-and-learning methods or teaching-and-learning strategies/tactics are teaching-and-learning procedures/approaches that have respectively been either effective-tested and labeled [in this case they are called methods] or not [in this case they are called strategies/tactics] (Raynal & Rieunier: 1997).

Teaching-and-learning methods and strategies/tactics are mainly either merely teacher- and content-centered [in this case they are related to the expository or 'top-down' procedure/approach] or merely student- and learning-centered [in this case they are related to the self-heuristic procedure/approach of 'independent discovery'], with an intermediary category in-between that corresponds to the mitigated dialogical/Socratic/heuristic procedure/approach of 'oriented/guided discovery' (De Corte et al.: 1996; Kember: 2001; Minder: 1977; Raynal & Rieunier: 1997; Reece & Walker: 1997).

Insofar as teaching is considered as strongly influencing learning, the teacher- and content-centered approach to teaching entails 'strategic' [such as cheating or studying just for examination purposes] and 'surface' [such as rote memorization] approaches to learning, while the student- and learning-centered approach to teaching entails 'deep' approaches to learning [such as studying for understanding] (Marton & Säljö: 1984 [9]. See also Ramsden: 1992; Entwistle: 1984; Biggs: 1999; Cannon & Newble: 2000).

Teaching-and-Learning Techniques

In order to practice any of the above-stated teaching-and-learning procedures/approaches [see section 5.1.3. above], there is a vast array of techniques that the teacher or the learner may combine with different teaching-and-learning resources/aids [see section 5.1.6. below] so as to develop appropriate teaching-and-learning methods and strategies/tactics [see section 5.1.4. above] according to specific situations. Following are examples of such techniques: explanation; demonstration or display; observation; lecture; association; questioning and answering or dialogue; oral or written expression; repetition; review or rehearsal; reflection; experiment; analysis and synthesis; induction and deduction; brainstorming; discussion or debate; individual or team work; individual non-supervised work or assignment; supervised work; seminar or workshop; group work; case study; simulation, role playing or dramatization; field trip; positive or negative reinforcement; and eclecticism.

Teaching-and-Learning Resources/Aids

Basically, the main teaching-and-learning resources/aids are the learners and the teacher themselves. In contrast to those, additional resources/aids that assist them for a better teaching-and-learning process are called auxiliary teaching-and-learning resources/aids and may be distributed into the following three major categories:

- Concrete resources/aids or *realia* [i.e. real people, genuine things, situations or problems][10];

- Semi-concrete or audio-visual resources/aids [e.g. moving or fixed pictures, photographs, images, drawings, and/or

recorded sounds];

- Abstract resources/aids such as verbal descriptions.

The Science of Teaching-and-Learning

The science that deals with the education of the individual, either child, youth or adult, but in the sole situation of teaching-and-learning in the purpose of teacher specialization and professionalization is called didactics, named after the same model as physics, pedagogics, economics and other 'ics'-ended sciences or disciplines of study.

About this science, Seel (1997) writes: "Didactics should be understood as the science of and operating theories for teaching. Teaching is dependent on situational and institutional conditions. In this connection, teaching refers to the various types of instruction as the specific form of teaching which appears in school institution". Therefore, this author carries on writing that "the concept of didactics" should be understood "as a theory of planned teaching in schools [instructing]". Bringing in the element of learning, Gundem defines didactics as "a science and theory of teaching and learning in all circumstances and in all forms" (Hamilton: 1999)[11]. In its manifesto, the Department of Didactics of the Faculty of Education in the *Université de Montréal*, Canada, states: "Didactics is concerned with the teaching and learning of academic subjects. It is a field of knowledge, practice and research" (Université de Montréal, Faculté des Sciences de l'Education: No Year, web page).

The understanding of didactics as the science that studies the process of teaching-and-learning is also shared with Ramsden (1992, p.7) when he writes that 'didactic' knowledge comprises knowledge of how a subject is best learned or taught. Furthermore, the same author points out that teaching – and therefore learning – should be considered "in its broadest sense to include the aims of the curriculum, the methods of transmitting [and receiving/acquiring, of course] the knowledge those aims embody, the assessment of students, and the evaluation of the effectiveness of the instruction with which they are provided" (Idem, p.9). In his turn, Vergnaud (1992, p.19) explains the science of didactics in the following terms: "Didactics studies the processes of delivering and acquiring knowledge in order to improve them. Hence, it studies the conditions that are or are not conducive to learning, by particularly caring for specific problems that are raised by the content of the knowledge and the know-how whose acquisition is targeted."[12] Put in simple words, this idea means that the didactical[13] science deals with the procedures/approaches, methods or strategies/tactics, techniques and resources/aids that are to be used in the teaching-and-learning of a given curriculum. Therefore, it is arguable that when these devices of didactics – didactical or teaching-and-learning devices – are conveniently applied, i.e. in accordance to didactical principles [see components of variable number 4 of **Table II** under section 5.1.2. above] and to specific contexts/situations, people realize a good level of formal education – i.e. students achieve a good level of school-acquired or school-learned knowledge on the one hand and teachers attain a good level of teaching on the other hand.

Finally, it is to be noted that Pepin from the Open University, UK, published a paper in 1999 (Pepin: 1999, p.49) intended among other things to serve as a possible conceptual base for researchers to develop "a common understanding of what is generally called 'the

science of teaching' or 'didactics'." Concerning this 'common understanding' of didactics among researchers, it is actually possible, especially as the divide between British and other Europeans on this issue is not too deep since they all similarly refer to the same basic concept of 'teaching-and-learning'. On the other hand, even if Americans prefer to use the term 'instruction' (Rowntree: 1981, p.133), they however use the term 'didactics' as well without any allusion to teacher-centeredness and student's rote learning especially when they refer to the theoretical aspect of professional training, mostly in the field of medicine. For more details on this point, one may search the World Wide Web for the word 'didactics' by using the Google search engine.

This science of teaching-and-learning is taught and learned within separate departments of didactics of the faculties of education in many universities not only in Europe but also in other continents all over the world. For Non-European universities that have departments of didactics, one may cite the following examples:

- on the American continent: the Canadian *Université de Montréal* (see website:

http://www.scedu.umontreal.ca/FSE/English/did.htm as retrieved on 11/11/2001; see also http://www.umontreal.ca/ang/facdep_ang.html);

- on the African continent: the South African Stellenbosch University (see website:

http://www.sun.ac.za/education/didactics/ as retrieved on 18/11/2001), the University of the North (see website: http://www.unorth.ac.za/FacultySchools/sch-education/index.html as retrieved on 17/06/2002) and the University of South Africa [UNISA] (see website: http://www.unisa.ac.za/study/info/underg /quals/edu/e_bsec.html#did as retrieved on 17/06/2002).

Didactics actually corresponds to the science otherwise called 'curriculum studies' or, simply, 'education': thus, it includes a core component that is general – 'general didactics' – and subject components that are specific – 'specific didactics' – according to various class subjects (Buchberger & Buchberger: 1999; Imsen: 1999; Kansanen & Meri: 1999; Seel: 1999). 'General didactics' corresponds to what is otherwise called 'general curriculum studies' or 'general education' whereas 'subject didactics' [e.g.: didactics of science, didactics of mathematics, etc.][14] corresponds to 'subject curriculum studies' or 'subject education' [e.g.: science education, mathematics education, etc.]. This double categorization – general and specific didactics – is reflected for instance throughout the twenty three records of book titles found in the University of London Institute of Education Library Catalogue under the item 'didactics' as retrieved on 18/11/2001 from its Web version called WebCat (Websites: http://144.82.31.12/uhtbin/cgisirsi/TCMce4iKM6/142460 009/88 and http://144.82.31.12/uhtbin/cgisirsi/az1pot4lI2/142460009/9) and throughout the eighteen records of book titles found under the same item in GeoWeb (Website: http://library.ox.ac.uk), which is the World Wide Web interface to OLIS, Oxford University libraries' online catalogue, as retrieved on 18/11/2001 as well. On this point see also for example the Learning, Teaching and Assessment RTG of the Manchester University School of Education from the World Wide Web http://www.education.man.ac.uk/ as retrieved on 19/11/2001,

or the Department of Curriculum Studies and Teacher Education of the Stanford University School of Education on the World Wide Web http://www.stanford.edu/dept/SUSE/navigation/programs navfrm.html as retrieved on 19/11/2001.

However, in a last analysis on the same point, I cannot overlook the fact that from my experience as a teacher educator whose main area of interest is Curriculum and Teaching, I personally have noticed that the use of the expressions 'curriculum studies' or 'education' to mean the 'science of teaching-and-learning' mostly brings about confusion between the concepts of 'curriculum-as-a-science-to-study' and 'curriculum-as-a-program-of-study' on the one hand, and between those of 'education-as-a-process' and 'education-as-a-science' on the other hand.

As used in this article therefore, the qualifier 'didactic' does not contain any pejorative meaning and is by no means linked to authoritarian instruction (Rowntree: 1981) or only associated with the approach to teaching that is teacher-centered inducing reproductive learning (Kember, 2001), thus leaving aside the other approach to teaching that is student-centered while both approaches in actual fact coexist and converge towards the same content/subject-element that constitutes the third summit of the didactical triangle (Kansanen & Meri: 1999) or of the educational growth triangle (Waugh: 1974). For an outline of these triangles, see **Diagram IIa** and **Diagram IIb**.

About the student-teacher relationship in particular, Waugh (Op. cit., p.131) suggests that "each should accept responsibility for knowing and understanding other in their relationship to the subject and each must recognize that the other has something to teach him [/her]. Where each, for whatever reason, regards the flow between them as being mainly or exclusively one-way there will be little growth […]."

In any case, as Bruner (1997, p.63) puts it, "real schooling […] is never confined to one model of the learner or one model of teaching. Most day-to-day education in schools is designed to cultivate skills and abilities, to impart knowledge of facts and theories, and to cultivate understanding of the beliefs and intentions of those nearby and far away". Moreover, the role of the teacher is "to give and share aid, to comfort and scaffold. Learning in its full complexity involves the creation and negotiation of meaning in a larger culture, and the teacher is the vicar of the culture at large. You cannot teacher-proof a curriculum any more than you can parent-proof a family" (Idem, p.84). Therefore, it should be acknowledged that, "even when the students are adults, the pedagogical relation between the teacher and the student is, still, however, asymmetrical. In the pedagogical relation the teacher has something that the students do not yet have" (Kansanen & Meri: Op. cit., p.112). This reality that ascription of a certain ignorance or certain false beliefs to learners constitutes a *sine qua non* for pedagogic, instructional or didactic efforts – that in fact are attempts to correct such an assumed deficiency either by demonstration, explanation or discussion – is otherwise confirmed by Bruner (Op. cit., p.84) when he contends that "we humans show, tell, or teach someone something only because we first recognize that they don't know, or that what they believe is false".

In a last analysis, the qualifier 'didactic' is herein used rather in the same sense as it is used by authors like Hudson (1999) from the Sheffield Hallam University, UK, and Pepin (1999) from the Open University, UK. In actual fact, it is definitely arguable that the

qualifier 'didactic' does not have any pejorative meaning (Hamilton: 1999). In any case, it would not be fair to connect it with 'didacticism' that is essentially negative. Actually when added to some words, the suffix 'ism' gives them a pejorative or negative sense because it entails an 'abuse' or 'excessive and inconvenient repetitive use' of something. For instance, this is the case for words such as 'activity' and 'activism', 'nationality' and 'nationalism', 'philosophy' and 'philosophism' or 'instruction' and "instructionism" (Cullen et al.: 2002, p.7) as well as 'didactics' and 'didacticism'. In fact, the words 'activity', 'nationality', 'philosophy' and 'instruction' have positive meanings, but 'activism', 'nationalism', 'philosophism' and 'instructionism' are essentially pejorative or negative. Similarly, 'didacticism' is pejorative or negative whereas the word 'didactics' has a positive meaning. Likewise, wouldn't the qualifier deriving from 'didacticism' rather be 'didacticist' whereas 'didactic' would derive from 'didactics'?

Conclusion

On the one hand, the reality brought out through the above-developed analysis is that teaching and learning are two complementary parts – sub-processes – of one unique process, the process of teaching-and-learning or the didactical process, and are studied either generally in the broader science of education called pedagogy/pedagogics or specifically in the science called didactics. Furthermore, learning is so paramount that teaching, which is inseparable from assessment, should only be carried out in case there is a need for helping learning to take place.

On the other hand, most of the principles that determine the teaching-and-learning process emphasize the involvement of the learner in his/her learning towards the achievement of his/her autonomy.

Lastly, I argue that teaching-and-learning procedures/approaches of insight and of trial-and-error make people not only develop, acquire and construct/create knowledge, but also allow more resistance to forgetting than the procedure/approach of conditioning. Therefore, in order to optimize the process of teaching-and-learning, I suggest that any people involved in teaching should endeavor to promote, if not practice, those procedures/approaches whereby students 'learn to learn', i.e. insight and trial-and-error (Darley et al.: 1984), and develop didactical strategies/tactics relevant to those procedures/approaches, i.e. combine appropriate teaching-and-learning techniques with suitable resources/aids, in accordance to didactical principles and to specific contexts/situations.

Footnotes

[1]Except for some minor changes, the content of this article is excerpted from my unpublished PhD thesis' Conceptual and Theoretical Framework (See Rwanamiza: 2004, pp.44-72).

[2]This Whitehead's quotation is drawn from Ramsden (1992, p.1).

[3]Instead of 'discrimination', Patton quoting Stake talks of 'particularisation' conceived as being "a full and thorough knowledge of the particular, recognizing it also in new and foreign contexts"

(Patton: 1990, p.488) for "that knowledge is a form of generalization too [...] arrived at by recognizing the similarities of objects and issues in and out of context [...]" (Idem, ibid.).

[4]Blair, T.: Speech at the Labour Party Conference, 1 October 1996 in *Times*, 2 Oct. 1996 [online] in Guardian 5 October 1996 p. 8/1. Retrieved on 19/12/2001 from http://www.askoxford.com/quotations/917.

[5]Adams, H. B. (1907). *The Education of Henry Adams*. Retrieved on 19/12/2001 from http://www.askoxford.com/quotations/912).

[6]Other investigators of the psychomotor domain include Guilford, Simpson, Kibler and Harrow (Minder: 1977).

[7]Refer to RWTH Aachen, Institute of Didactics. This reflection of Professor Wolfgang Butzkamm is a continuation of the famous quotation "He who can, does. He who cannot, teaches" from Shaw, G. B. (1903). *Man and Superman* as retrieved on 19/12/2001 from http://www.askoxford.com/quotations/3514. Professor Wolfgang Butzkamm is at the present time the great name of the didactics of living languages and psycholinguistics in Germany. About him, a bibliographical note is provided in French at http://www.rwth-aachen.de/lfed/Ww/notbiograph.html as retrieved on 19/12/2001.

[8]Interactionism as a theory of learning has already been previously evoked under section **3.** above.

[9]Indeed, as pointed out by Norton (No Year, web page), "Marton & Säljö were the first researchers to make a distinction between deep and surface approaches to studying" in their 'seminal paper' whose bibliographical reference is: Marton, F. & Säljö, R. (1976). On Qualitative Differences in Learning I. Outcome and Process. *British Journal of Educational Psychology*. 46, 4-11. However, concerning the classic qualification of rote memorisation as a surface approach to learning, caution should be taken especially as regarding students from some cultural backgrounds as has been found by Woodrow & Sham (2001) with British-Chinese pupils in what they termed 'the Chinese Learner Paradox'. About this point, these authors observe that "the commitment to memorising is [also] misleading since for British-European students it is associated with surface learning whilst the evidence points to the capacity of the Chinese students to develop deep learning structures by this method - the Chinese Learner Paradox" (Idem, p.377).

[10]It is in application of this first category of auxiliary teaching-and-learning resources/aids that was born the didactical approach of 'problem-based learning' [PBL] which is in honour mostly in Medical Education where problems encountered are 'often poorly defined' (Eshach & Bitterman: 2003, p.492) or even 'generally ill-structured and open-ended' (Beasley & Ford: 2003, p.1) while "in technical disciplines [...], problems that can be used as a basis for problem-based learning are more difficult to formulate as they tend to have distinct solutions with less basis for discussion" (Idem, ibid.). Indeed, in Medicine, "the problems that patients present can be confusing and contradictory, characterized by imperfect, inconsistent, or even inaccurate information" (Eshach & Bitterman: 2003, p.492). So, PBL was created "as an alternative instructional method to prepare medical students for real-world problems by letting them solve

medical problems based on real-life cases, rather than having them learn mainly through lectures which taught the sciences out of context" (Abdullah: 1998, web page).
PBL was implemented for the first time in the 1960s at McMaster University [Canada] and Maastricht University [Netherlands] (Camp: 1996) and, since then, "has been incorporated as a curriculum component in a number of medical schools around the world" (Pross: 2002, p.1), especially "in the 1970s and 1980s in Canada, Australia and the United States, and in the late 1980s in the UK" (Coventry University in conjunction with LTSN Generic Centre: 2003, web page) where "as yet there has been relatively little provision of resources to support its implementation, development and research" (Idem, ibid.).

[11]In his paper, Hamilton (1999) observes that the European discourse of didactics is similar to the Anglo-American discourse of pedagogics and contends that only their language divides them. However, I would like to complete this observation in the sense that the concept of didactics is also understood as the science of teaching-and-learning elsewhere outside the European continent as further exemplified in this article.
Another thing that is curious in Hamilton's paper is the fact that Anglo-Americans usually known as pragmatic people would use the term pedagogics instead of that of didactics for the simple 'superstitious' reason that the latter "conjures up the unwelcome European ghosts of an unattractive educational past" (Idem, ibid.) while yet it should be understood that instead of attributing it to the sole Europeans for some defects noticed along their great and valuable endeavour, this educational past should rather be universally assumed with its ups and downs since education has benefited from worldwide experiences and thus cannot be claimed as anybody's prerogative.
Finally, on this issue, Kansanen (1999, p.21) notes that the Anglo-American Curriculum Theory and the *Deutsche Didaktik* – and the European Theory of Didactics in general – have got separated "in response to political and ideological circumstances" especially that there was an "absence of almost any discussion of *Didaktik* in British and American literature". On this very last point, see also Simon (2002).

[12]The translation of this passage from French to English is mine. Otherwise, the original excerpt in French reads as follows: "*La didactique étudie les processus de transmission et d'appropriation des connaissances en vue de les améliorer. Elle étudie ainsi les conditions dans lesquelles des sujets apprennent ou n'apprennent pas, en portant une attention particulière aux problèmes spécifiques que soulève le contenu des savoirs et savoir-faire dont l'acquisition est visée.*"

[13]The adjective 'didactical' that derives from 'didactic' (see the Oxford English Dictionary Online as retrieved on 11/11/2001 from the World Wide Web http://dictionary.oed.com/cgi/entry/00063610) is used throughout this article with its original meaning of 'of teaching' [and of learning of course, since teaching would be meaningless if it was not first and foremost assumed that there are learners to whom it is going to be addressed].

[14]See for example University of South Africa [UNISA]: No Year, p.57.

[15]This note serves to point out my use of the adjective 'didactical'

instead of 'didactic' as used by the authors to qualify the triangle of teaching-and-learning. See note **13** above to compare the meaning of both adjectives. Actually, it is arguable that, anything else remaining otherwise unchanged, there is a parallelism between the semantics and the grammatical use of the word clusters composed of 'didactics, didactical, didactic and teaching-and-learning' on the one hand and of 'economics, economical, economic and economy' on the other hand.

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