Information technology and knowledge-based interactions in collaborative learning

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Abstract: - The intensity and rhythm of the changes in the field of TIC constantly generate new challenges and opportunities in almost all fields of the nowadays society. The opinions as concern TIC applications in educational settings are quite divergent, from voices who deny any positive influence upon educational activities, to those who sustain TIC as a revolutionary premise and an outstanding innovative tool which make possible significant reshape of the educational processes. The paper summarizes the most important aspects of development from TIC to TICE and e-learning activities which is an introduction frame for a Romanian project which aims to design and implement multi-agents architectures for e-learning.

Key-Words: - ICT, ICTE, knowledge-based interactions, e-Learning, collaborative learning

1 Information and communication technology (ICT))

In today’s world, Information and Communication Technologies (ICT) are present not only in theory, but also in the daily practice that structures organizational contexts, systems of social or interpersonal relations, thus putting their mark on both the public, and the private sector. Not infrequently, curiosity and interest in ICT among researchers in a variety of fields lead to amplified valorization, and even an overestimation of their potential.

The acronym ICT covers a heterogeneous reality – from mobile phone to CMC, as well as Internet or Intranet, to mention just a few of their concrete forms of application.

In order to set their still vaguely defined contour, let us point out that in a functional conception, ICT are a collection of technical objects built by applying the principles of information and telecommunication, which however implies meaningful procedures and relations, and informational added value. According to an operational conception, ICT means technology used for introduction, storage and communication of information [14]. In a wider approach, ICT represents a multitude of “technical devices including apparatus to process information, in the mathematical sense of the term, resulting in the social effect of message circulation and, through this, making it possible to exchange and interpret information, as well as to produce know-how and knowledge in society” [10].

However, we believe, as do other authors, that in order to circumscribe the concept of ICT as correctly as possible, its definition has to make explicit reference to each of the three component concepts, namely technology, information and communication [2].

After such a definition, ICT is the totality of technologies relying on informatics, microelectronics, telecommunication (especially networks), multimedia and audiovisual, which when combined and interconnected, allow the search for, storage, treatment and transmission of information in the form of various types of data (text, sound, pictures, videos, etc.), as well as the interaction among people, and between people and machines.

Including multiple and multidimensional instruments, ICT indicates possibilities both in the plane of connectivity, and in that of accessibility or the power to compute. However, several authors stand for the opinion that ICT does not fully outline its meaning and functions except in a mediated communication process and in harmonization with a complex social network. Therefore, “ICT includes individual instruments that allow connection, and their use is structured through a permanent tension between autonomy and control”, a tension that is part “not only of the learning process”, but “it also is in the focus of permanent users of these technologies” [8]. It is also stated that the technical devices must be granted the deserved amplitude to “make them mediators and not mere instruments …”, that “they can be described as a stable mixture between the human and the natural, the social and the material; that it must be insisted on the manner in which they make up together the techniques and the social and natural environment” [1].
At the same time, there is increasing debate about their double mediation, a technical one because the instrument used structures the practice, and a social one, because the objectives, the forms of exploitation and the sense attributed to practice are found in the social corpus [11]. The technical sphere and the social sphere interact and influence each other continuously; as a result one can accept that ICT’s uncontested progress generates fewer leaps and bounds, and innovations than the complex social processes which take a long time for running [12]. Hence, the option to preponderantly use the phrase ICT’s social anchorage instead of social insertion, the former better illustrating the media coverage and the strategies subjacent to the cross-penetration of the technical and the social spheres.

Yet other authors underscore that social groups have access to multiple means for accommodating to a technical innovation, and propose an anthropological approach of technology which targets the combination between the “technical framework” and the “functional framework”. This would lead to the emergence of a new social and technical framework, which - without eluding the importance of the imaginary – includes the representations of the technical devices and their use both at the producers’ end, and at the users’ end. As a result, the dynamics of change can only be defined in terms of duration: “an innovation becomes stable at the end of a long process, when there is a relationship between the operating framework and the exploitation framework” [7].

2 Information technology in educational settings

In the information society, ICT’s influence can be noticed on several levels, covering a wide range of practices and in almost all fields of knowledge, from the natural sciences to the humanities, education being a specially targeted area. Although education has always taken them into account with the aim of enriching its practices and the educational objectives, the relationship between education and ICT has not always resulted in ICT’s integration and total adoption. Although ICT has proven its value as a means of transmitting and storing knowledge, in the beginning it was granted an exclusively instrumental importance, and was only perceived as objects used in the automation of processes and the improvement through replacement or suppression of the previous technologies.

In the current context, ICT has a numeric nature, which is consolidated with the development of information networks, and Web is a tangible product of this context. It is a technical and also a media object at the same time, which allows the performance of communication, being simultaneously the place of convergence of resources in the form of text, sound, image or interactive resources. As a consequence, Web is a space which allows perpetually changing meaning; in other words, given its numeric nature, it can be easily modified and adapted to communication practices even by non-professional users.

However, the fact that Web is the subject of modifications and adjustments is not the same as automaticity from the standpoint of technical determinism, but rather it is a space in which meaning can be constructed in a variety of ways. From this perspective, Web is a technical object whose components converge to build a code of significance, which is represented on the one hand by the application and projection of information representation, and on the other hand by the information code which makes this visual representation possible. In the Web space the media function as representations of content – they are transparent to the extent that they focus on what they say rather than on their functions and as interaction – they are opaque to the extent that they focus on maneuvering and interaction rather than content.

Obviously, the considerations for ICT also hold true for information and communication technologies in education (ICTE). Nowadays, ICTE are “informatics applications which participate in the functioning of training in the transmission and collection of knowledge.” They include informatics services and applications which make use of the Internet technology for educational purposes, as well as integrated equipment (called platforms, educational environment) available on various servers through which one ensures, for instance, access to applications such as videoconferences, chat, electronic messaging services, as well as production, editing and storage of teaching material [3].

Teaching, which is the major function of these training environments, and which is embodied in the teacher-learner relation, is part of the cultural, social and organizational dynamics. In ICTE mediated cooperation, the cooperative dimension, and even the collaborative one, is a key aspect of reconfiguring activities around the networking numeric techniques. At present, ICT provides the instruments for this collective activity so that it is based on exchanges among and coordination of individuals at a distance or in face-to-face sessions.
A series of studies have pointed out the difficulty of co-constructing collective “intelligence” even when a wide array of devices is used. While synchronization of actions and of their duration, supported by coordination, is done well enough, not the same is the case with collaborative activities, which pursue the negotiated, progressive and collective production of knowledge. Although the device may prove to be an additional obstacle in the institution’s attempt to promote change and constructive dialog. Therefore, relative knowledge of the preceding technical process, of the information and communication strategies to orient and guide the framework of ICT use is definitely a must, though not sufficient. In this case, human mediation done by the tutor/ trainer allows the technical devices to intervene as mediators in socialization processes, to articulate the technical and using framework, and thus not only to accompany change, but also to foster new means of knowledge transfer.

The possible uses of ICT in educational contexts include recurrent elements especially in the transmission of knowledge. For instance, one finds that the reticular model is amplified, becoming more open and complex, which thus disrupts the traditional logic of emitter-receiver especially in the teacher-learner relation. This breach of the linear model which provides for innovation opportunities in cognitive dynamics fits in with the nature of the required instruments. However, its application in practice implies a series of previous knowledge of the individuals, as well as their potential to mobilize knowledge and skills.

The process of knowledge networking leads not only to new relations among the production, transmission and learning of educational content, but also to the emergence of new types of interaction and exchanges among the stakeholders involved in the learning process. This in turn shapes – in a diachronic perspective and in a socially and culturally identified environment – the changes and mutations in which ICT are invited to participate.

Although for the sake of analysis we could take into account numerous experiments and innovative educational situations relying on ICTE, further we will discuss the topic of the distance learning in various educational contexts, our objective being to point out the interactions in the threefold relation among teacher – learner – technical mediation

3 e-Learning

Since the beginning of the 1990s, educational institutions have seen in the emergence of a network-based society the shaping of new ways of instruction and learning. Dissolving spatial and social distance as well as facilitating interactions is possible in a context that is heavily marked by technological innovation, a process seen as an ensemble of social relations constructed around or through technology.

In distance learning the direct, face-to-face, relation between the teacher and the learner fades or disappears, and its place is taken over by mediation defined by information and communication technologies. The emergence of distance learning, in particular, on the Internet is accompanied by an extraordinary polysemic complexity. A boom of terms, such as e-Learning, e-training, e-education, tele-education, or tele-training, which are terms sometimes used as magic formulae and, at the same time, as publicity gigs.

In the opinion of the Commission of European Communities, e-Learning (a spelling proposed by the Commission) or e-Learning (the spelling more commonly used in specialist literature) means “use of new multimedia technologies and of the Internet to improve the quality of learning, facilitating access to resources and services, as well as distance exchanges and collaboration” [5].

Therefore, according to the above definition, e-Learning has the main objective to improve the quality of learning and not to replace the traditional ways of learning. The means to achieve this objective are multiple, complementary and independent, such as accessing resources (syllabus, practice, courses, video, CD-ROM, etc.), services (distance tutoring, means of communication, solving exercises, support etc.) and the opportunities to share and collaborate at a distance (through forums, chat, e-mail, phone, etc.).

The application and development of e-Learning – ushered in especially by Web-based and Internet-based technologies – require the construction of so-called e-Learning platforms. Although in e-Learning the human collaborative and interactive dimensions are essential, most of the current e-Learning platforms have a series of shortcomings in this respect, which at a very general level are manifest in the poor use of interactive pedagogy approaches (simulations, practice); the absence of semantic surveillance instruments of the learners’ activities; the limited possibilities of synchronic communication; cognitive overload of the teacher and relative isolation of the learner, and lack of group self-awareness [9].
The shortcomings and limits mentioned above may be overcome through adding new functions to the existing e-Learning platforms, namely a multi-agent system built on these platforms. The option is justified by the conviction that despite all their shortcomings, the existing platforms have interesting and very elaborate functions. Therefore, adding a certain number of agents with the purpose to assist the users in their activities and to favor social interactions, which lead to the increased autonomy of various users, especially of the learners, seems more efficient and realistic.

4 Project presentation

To discuss some of the issues that e-learning platforms are confronted with in their use as resources of learning based on social interaction, we present below a proposal developed within the research project funded by the Romanian Government, entitled “Socio-cultural models implemented through multi-agent architectures for e-Learning”.

The major objective of the project is to analyze the efficient operational procedures for e-Learning, which are useful in the accomplishment of quality instruction, the promotion of understanding innovation and the impact of ICT, as well as the development and rational use of the instruments to manage social interactions in e-Learning, special attention being paid to the tutor in managing online interactions in terms of operational ways pursued by the tutor, and the effects on the outcomes of training. This project is about improving understanding, developing and testing distance learning-training mediated by ICT to facilitate the collaborative and rational construction of knowledge.

The specific objectives of the project are: a) To identify and analyze a wide range of significant distance training experiences. These experiences will provide a wider perspective upon the conditions which, in different contexts, make the operational procedures adopted by the tutor more efficient in connection with the information technology artifacts used. b) To identify the nature and the structure of informatics artifacts that support the efficient operational procedures. Testing the prototype artifacts for distance learning allows the tutors/teachers to improve their efficiency in the process of collaborative knowledge building in virtual communities. c) To identify and disseminate good practices and psychological and educational guidance that must be kept in mind in the development and use of ICT in training.

The outcomes of the project target people in the field of training program development, those who use ICT and services based on online education and e-Learning – training institutions, universities, as well as the development of platforms and instruments to interact on the Web.

The multi-agent system proposed in this project adds two new categories of functions to an e-Learning platform: a) functions pertaining to assistance for users (provision of information about interactions among them, evaluation of the workload for a set period, reorganization of groups, reshaping the calendar of group activities) and b) functions for retrieving the date of interactions (automatic examination of the dates of interaction to alert users when progress in the distance instruction is not satisfactory or when the group risks being terminated).

More precisely, the new system will make available four groups of functions: 1 Supervision of group activities and of the learners. Based on the date of interactions built as a rule (whether cumulated or not over a period of time), as well as the number of members connected in a group, the percentage of time spent on-line in the group, the number of messages read/sent to forums, etc., the system will provide an assessment of the state of the activity and / or group cohesion. 2. Assessment of the stage of accomplishment of an activity. The system will provide information about the activity at any time. Thus, one could tell if at a point in time the activity has been started or is in progress. If it has started, the system will provide information about its level of accomplishment in each of the basic groups (groups of learners). This information is useful because it will provide an objective basis to change the calendar of one or other activity. 3. Management of the forum by the tutor. The forum is one of the most important instruments in distributed collaborative learning, which is why the multi-agent system will implement a function that will indicate to the tutor the proximity of beginning and ending interventions as compared to the opening and the closing of the forum, relying on the idea that the tutor has to be the first in the forum to welcome and guide the learners and the last to conclude the forum. 4. Management of effective connection time. This function will allow knowledge of the percentage of time spent on-line to complete an activity as compared to the time set for carrying out the said activity. In this way, the tutor can estimate each learners’ level of engagement.

4.1 Context, objectives and target groups

The project relies on the statement that social
interactions influence cognitive activities, or in other words that the interactions among the stakeholders of learning are an essential catalyst in the process of knowledge building and a key factor in developing cohesion among the members of the learners’ groups [16]. In e-Learning, the collaborative dimension, and group cohesion are the defining elements that motivate and engage, which determine production, discussions, negotiations, rewording of concepts learnt during training. Based on data about group interactions, on the one hand one can estimate the state of the group, and the evolution of the distance learning session, and on the other hand more precise predictions can be made about the sustainability of the group and the users’ future behavior, the interactions within the group bearing evidence to the existence of the group, as well as its evolution and dynamics [6]. In essence, the thesis we set relies on the socio-constructivist principles stated by Vygotsky [15], who considers that knowledge is an outcome of socially shared actions upon material and symbolic objects.

As stated above, the distance learning devices are too often inadequate for transmission of knowledge in the context of new online media. Indeed, some of them are centered upon the object of learning, and make use of a vertical manner of transmission of knowledge acquired and/or constructed previously. Moreover, the forms of interaction revealed in formative contexts stay too centered on the teacher and frequently reproduce focused cognitive processes, characteristic of convergent thinking. Experimental studies in the social psychology of education and in informatics show that other forms of interaction and tutoring, the many-to-many rather than the one-to-one communication networks, favor acquisition of new fundaments for reasoning, especially through sharing ideas, and confronting or relating different viewpoints on the content addressed.

Considering the sharing taking place among learners in a Web-based group, it is possible to analyze how sharing of information is done among individuals and whether the construction of knowledge is a collaborative process that engages all participants or not.

4.2 Innovativeness, tendencies and perspectives

The innovative aspect of the project is granted by the variety of disciplines represented by the members of the research team, including researchers in psychology, education, informatics, and system theory, information and communication sciences.

From the psycho-pedagogical standpoint, the transfer of knowledge gained in the last years in social psychology about the dynamics of social interactions and the reasoning processes in real context to the context of distance learning is a new approach. There are still forms of interaction and communication that are less present in training, and especially in e-Learning: interactions and forms of peer tutoring, communication networks that favor the emergence of advanced cognitive strategies, etc. From the sociological perspective, the analysis of virtual networks is very important. From the standpoint of informatics, the project is innovative because it underscores the divergence between the learning infrastructures and the new practices on the one hand, and it integrates the theoretical findings about multi-agent intelligent systems in e-Learning technologies. Finally, for information and communications sciences, the twofold, qualitative and quantitative, approach to the same phenomenon is more productive. Optimizing the information transmission equipment based on numeric technologies, applying the information artifacts to human mediation between the teacher and the learners, and among the learners are all added value bearer aspects. Moreover, the project allows for measuring deviation from the initial strategies of the emitter (the person in charge of educational projects) and the objectively measurable effects on the receivers (the learners that use the system).

The major outcomes will target better understanding of innovation and the impact of ICT on education and learning processes, the development and dissemination of rational use of distance learning instruments, the definition of operational procedures based on instruments (informatics artifacts, e-Tutor) in order to facilitate and activate forms of interaction that exist in the traditional models of training, and which are no longer suitable for the current distance teaching-learning environments.

The project contributes to the clarification of the fundamental issue inherent to e-Learning platforms and their uses, the limits and values promoted by them, because it addresses operational approaches to managing virtual communities. It allows for the improvement and standardization of the on-line training (e-Learning) supply, on the one hand, through sharing the lines of conduct based on experimental results and the good practices identified in various contexts (pre-service training, advanced training, in-service training), and on the other hand through raising awareness in the major actors in training (decision-makers, trainers, professors, etc). Moreover, the results will make up
a shared patrimony of basic knowledge for future projects targeting ICT and e-Learning in which the partners will be engaged actively in the future.

5 Conclusion

Distance learning, and e-Learning in particular, relies on a new logic of knowledge sharing, a logic in which it is imperative that the user make meaning of the technical object because the use of a new instrument takes place within the relation between the user and the technical device. It is also true, however, that in this relation the human mediation – teacher-learner and learner-learner – plays an important role, because it pursues to support the devices that are being used and favors building of knowledge. The intervention of the user herself in her own training is another significant element to be considered. Studies into the sociology of informatics and communication sciences users pointed out in the early days of these technologies the need to place the user in the center of the technical learning process [4]. Involvement of the learner is paramount because she builds a veritable training project and thus becomes a sort of mediator in her own school career.

References: