Collaborative Learning and Knowledge Transfer in Consciousness Society

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Starting from the expression "workplace learning" which states that the use of personal computers at work or at school reflects learning activities and work activities which are interchangeable at individual level, this paper presents collaborative models dedicated to processes of teaching, learning, assessment and research in education. One of the most important activities is represented by computer supported collaborative learning (CSCL) which, from its occurrence, presented a special interest for researchers in informatics. CSCL is based on human-computer interaction (HCI) and on computer supported cooperative work (CSCW). CSCL promotes in turn the development of computer supported collaborative research (CSCR). Information and communications technologies represent not only a media support but, most of all, a mean for accessing resources worldwide. The development of the information technology and of the information society brought benefits both to the traditional form of education, and to the distance education represented by the assisted instruction. The evolution of the information society led to the emergence of the society based on knowledge which represents an intermediary step between information society and consciousness society, who wants to be a moral society. This article highlights the transfer of data, information and knowledge (explicit and implicit) during assisted instruction processes along with the possibility to create collaborative content in consciousness society.
Keywords: *CSCW, CSCL, CSCR Assisted Instruction, Consciousness Society*

1 Introduction

Information technology and communications developments led to profound transformations that determined the transition to a society based on information, communication and knowledge. Such an information society requires intensive use of information in all the fields of human existence and activity, with significant economic and social impact [1].

Information Society and the development of information technology bring benefits to the educational system, traditional study and to courses in campus, but, the most important, they facilitate the distance education and online courses.

Unlike traditional education that involves the presence on campus at the same time of both the teacher and the students, distance education eliminates the constraints of time and space.

To encourage interaction between instructor and student, as a result of physical remoteness of the actors involved in the system, a series of more attractive means of communication is used: electronic mail, video, audio, computer networks and virtual spaces for discussions between instructors and students or between students. A step was made from learning through knowledge verification to active construction of knowledge in order to develop reflections and to stimulate the intellectual activity of the students.

Informational society and information technology support the development of education by providing premises for improving the teaching-learning-assessment process, both for the traditional form of classes conducted in classrooms and for distance and on-line courses.

The optimal deployment of the educational process involves a combination between traditional and modern methods. The implementation of a complementary solution to help traditional courses would lead to a better preparation of the students. This complementary solution is represented by an assisted instruction system provided by a collaborative platform. Generally, the

students use different approaches regarding what they study, as a result of their diversified previous preparation. In order to support them, assisted instruction platforms and, implicitly, collaborative platform were developed. Collaborative work, learning and research activities emerged as a result of the development of personal computers and of the interaction between humans and computers.

2 Computer supported activities

The development of information and communication technologies and their use in almost any area led to the development of human-computer interaction (HCI). Practically, the human-computer interaction is a concept that incorporates informatics, represented by the design and the implementation of interfaces of applications used for human-computer communication, sociology, used to see how people and informatics systems adapt to each other, psychology, used to identify cognitive processes of humans and users' behavior, linguistics, focused on the development of human and machine languages and of the relationship between them. [6]

The development of informational society and of computer networks supported the emergence of cooperative work. Through its massive development, the Internet made communication and cooperative work possible, without the restrictions of geographical area that participants are situated in.

Chronologically, *Computer Supported Cooperative Work* - CSCW represents the first field with collaborative dimension, which was developed based on Human-Computer Interaction (HCI). CSCW reflects the major change of computer's role in society, from a simple personal tool, to a tool allows people to communicate one with each other [7].

The basis of CSCW is represented by *Groupware* [6] which is a collaborative software platform designed to provide support to people involved in the same activity. In addition to deploying collaborative activities, collaborative learning with computer support was developed. *Computer Supported Collaborative Learning* (CSCL) emerged as a result of the growing impact of cooperative work done by people involved in the same activities.

Computer supported cooperative work is defined as a social activity which involves participants communicating with each other in order to achieve a goal or to solve a problem. The learning process itself emerged as a result of communication between participants, exchange of ideas, and share of achieved knowledge in areas of common interest.

The learning activity conducted through computers has a significant impact on participants as a result of their cultural diversity. Once the geographical limits were removed, participants to computer supported collaborative learning program may belong to different countries, cultures and to a more diversified preparation.

Computer assisted collaborative learning is considered to be a separate branch of learning area, which emerged also from the desire to promote learning at group level, as a reaction to computer software that forced users to learn as isolated individuals. The huge potential of the Internet to connect people in innovating ways provided a stimulus for the research in CSCL area [8].

Unlike CSCW which supports cooperative work in order to increase productivity, CSCL is oriented towards education. The most important characteristic of CSCL is represented by its collaborative nature. Due to this collaborative learning process which uses computers, the students interact one with each other and communicate, exchanging information. This way, they acquire new knowledge, more efficiently and with a better understanding. Each student must interact with the other participants at the course. Often, the communication process is difficult and slow due to the lack of self-confidence or of low confidence in the other participants.

If CSCW focuses on communication techniques, CSCL focuses on the content of

communication process, mainly because of the priority area it is used in, which is the education. Research regarding the discovery of new communication techniques led to the emergence of *Computer Supported Collaborative Research* which supports the research activity. Peter Sege [9] considers that, in order to adapt to social changes, every person must update yearly 7% of the knowledge he achieved so far. This way, the emergence of CSCR after CSCW and CSCL is a natural one, as a transition from particular to general, from work activities to research activities..

A graphical representation of the evolution of CSCW, CSCL and CSCR from HCL, adapted from [10], is shown in Figure 1.

Fig. 1. Collaborative fields based on Human-Computer Interaction

Based on human-computer interaction, HCI, people started to interact with each other through computers which simplified communication inside groups. This way, CSCW occurred. As the group activity may have an educational character, the computer supported collaborative learning emerged. After the collaborative learning stage, the desire to explore, learn more and to discover new communication techniques led to the emergency of computer supported research activity represented by, CSCR.

From the evolution of collaborative areas based on human-computer interaction, unique characteristics of personal computers may be identified: interactivity, computing precise operations, possibility to provide multiple and dynamic representations of phenomena. At the same time, computers facilitate the transmission of data, information and knowledge, and provide the means for a collaborative interaction at the group level.

Collaborative platforms for computer assisted instruction, used in educational systems and more, inherit the collaborative character from CSCL. Beside the group activities which involve a student-student interaction, this kind of platform focuses also on the student-instructor interaction. There may be different types of interaction, customized for each user of the assisted instruction system.

The main approaches in assisted instruction are the educational approach and the technological approach [11]. These reflect the transition from using methods in the teaching-learning process to using concepts, similar to the transition from providing solutions to providing support. This theory is presented through the adapted *assisted instruction matrix*, Figure 2. Starting from this matrix which outlines the three technological approaches (*classical, interactive* and *collaborative*), the importance of a *customized* approach in the instruction activity may be highlighted.

Taking into account only the instruction made through a collaborative platform, irrespective of the traditional form of instruction that takes place in a classroom, the assisted instruction matrix may be represented using three approaches: *interactive, customized* and *collaborative*.

First, these approaches may be viewed independently: each one of them, individually developed, results in performance in own activity area, irrespective of the students that do not fall under that approach.

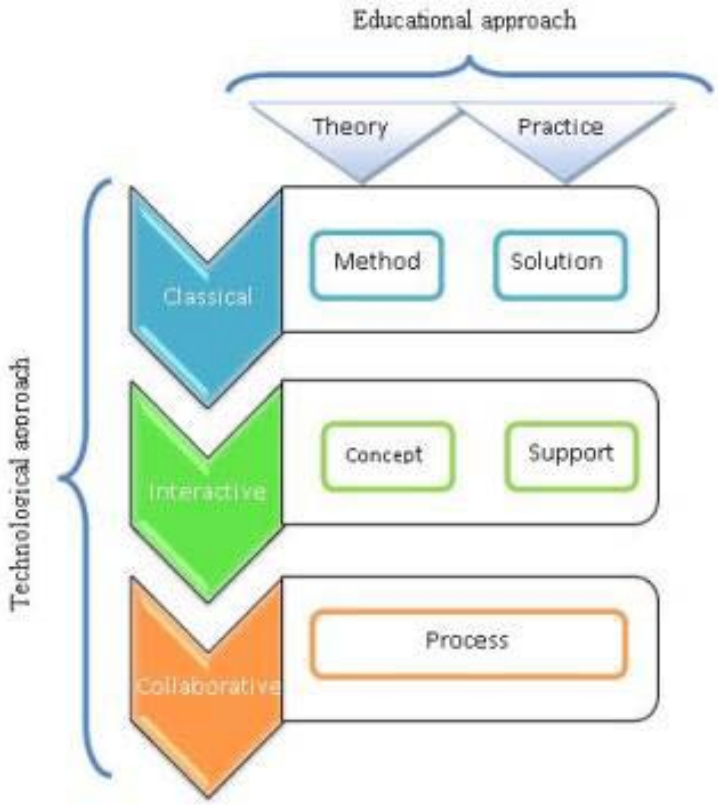

Fig. 2. Assisted instruction matrix

Making an interconnection of the approaches stated above: interactive, customized and collaborative; results in the development of more efficient assisted instruction processes [5]. This way, the needs of a much larger number of students may be met, compared to the solution of using an individual approach.

3 Transfer of data, information and knowledge

An assisted instruction system is characterized by the quality of the interaction with the user. Generally, assisted instruction systems are targeted either on the student or on the instructor. When targeted on the student, a greater importance is given to the activities of the students: home works, projects, group activities, thematic discussions taking place along the instruction process. If targeted on the instructor then the content of the didactic materials is the most important. An optimal instruction system combines the two approaches and takes into account the communication between those involved in the instruction process.

As a result of instructor-student and student-student communication forms, each side gets in contact with new data, information and knowledge in the studied field or in adjacent areas.

Data is defined as primary observations about phenomena and processes in real world. Data represents, in fact, objective measures for attributes of entities in the surrounding environment. The *information* represents data with a novelty character that is to be included in some useful context. Any piece of information may be considered to be data. Still, not all the data may be considered to be information but only the data that has a novelty character for the receiver [12].

Unlike information that may be assimilated in a very short time like seconds or minutes, knowledge represents packets of information assimilated in days or weeks by reading documentation, learning, using experience and intuition or by deploying group or individual activities. Some pieces of knowledge are often used unintentionally, without realizing where we have them from, when we acquired them or which

connections they resulted from. The connections that a person can make in real time, based on certain data, information and knowledge, make the difference between humans and computers.

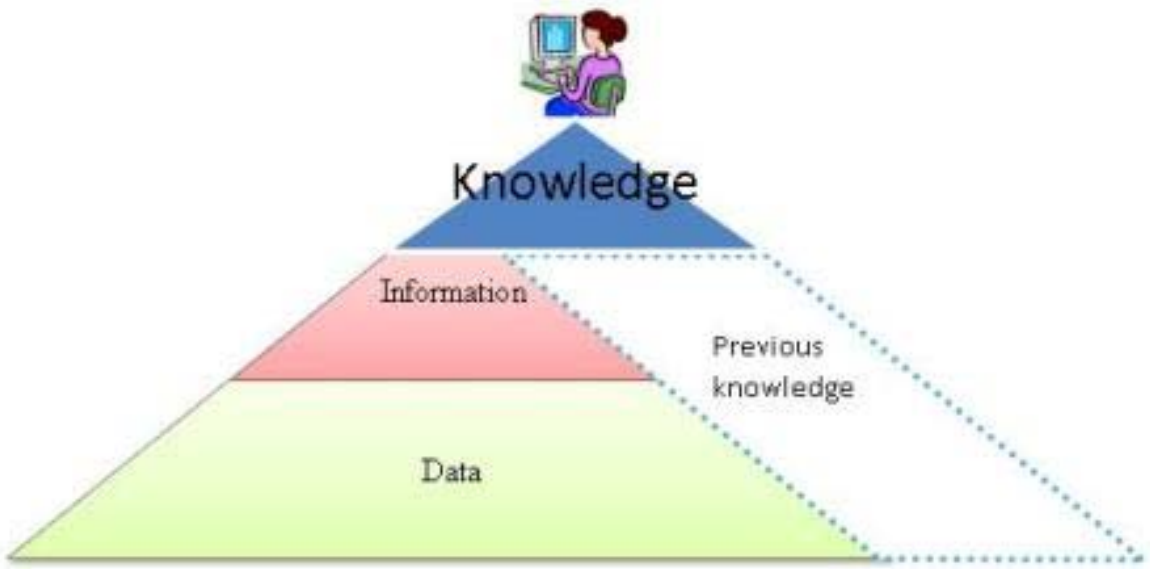

Fig. 3. Transition from data to information and knowledge

The knowledge acquired by a student after completing a discipline within the assisted instruction system, result from the data and the information he received and processed during the course and which he combined with his previous knowledge. A representation of this transition is depicted in Figure 3.

The development of knowledge represents the acquisition of new knowledge in order to innovate, adapt or accomplish the defined goals. [13]

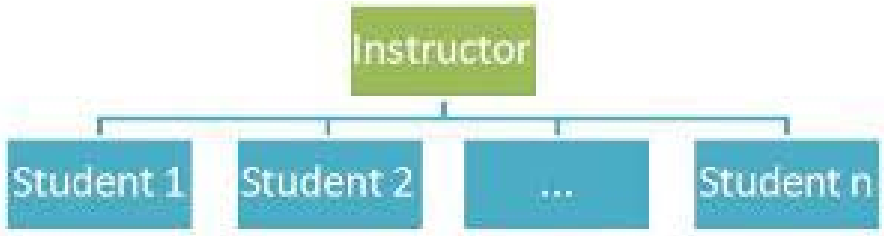

Fig. 4. Hierarchical knowledge transfer

Knowledge transfer from the instructor to the student may be accomplished by teaching, Figure 4, which involves a one-to-one communication in only one direction, from the instructor towards his students. All the students benefit from the same pieces of information no matter the geographical area they are located in, either at the same time or at different times by watching the course recorded in a video format.

This method is applied mainly when the students have their first contact with the discipline and with the type of information presented during the course. These kinds of courses have a more general character and their goal is to present the general theoretical notions and concepts underlying the discipline.

Once they already have been in contact with the theoretical notions, the students may look

for additional information regarding the studied domain in bibliographical resources.

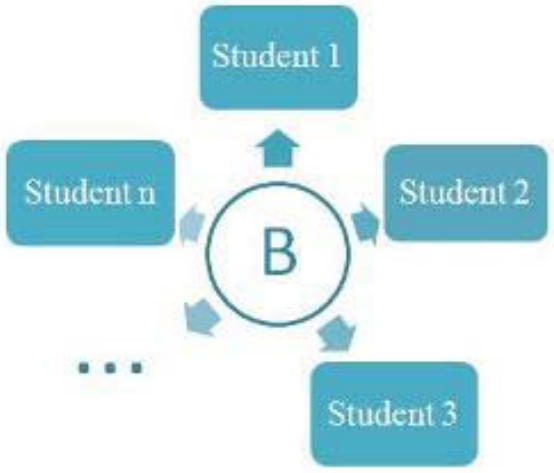

Fig. 5. Centered knowledge transfer

The knowledge transfer from electronic or printed bibliographical resources **B** provided by the instruction system, Figure 5 helps the students better understand the notions taught at the course. This way, the emergence of a knowledge base specific to each student is encouraged. This knowledge base consists of the knowledge acquired at the course and the knowledge acquired during individual study.

The collaborative dimension of the assisted instruction system is given by the anarchical knowledge transfer that takes place between the students [14]. After they assimilated the notions from the course according to hierarchical knowledge transfer and the knowledge acquired through individual study, the students may communicate with each other through the assisted instruction platform, deploying this way a collaborative activity, Figure 6.

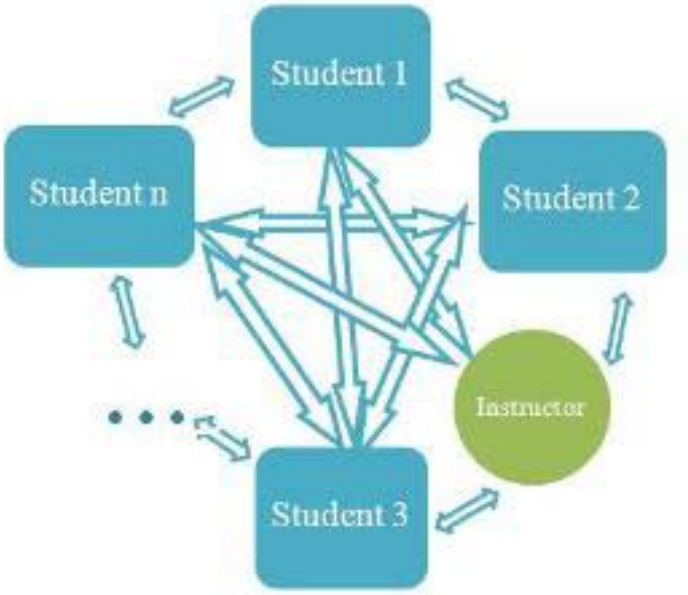

Fig. 6. Anarchical transfer of knowledge

Collaborative activity determines an increase of the knowledge base as a result of communication between students. Any question a student has may be answered by collaborating with one or more colleagues. This way, the scope of knowledge belonging to each student grows significantly. The instructor can interfere with this collaborative activity also. His presence may clarify all the questions of the students regarding the assimilation of the discipline he teaches. This way, the instructor may asses his activity, may conduct the study of his students and may decide if it is necessary to restructure his course or his teaching and collaborating methods.

Students learn one from each other and clarify notions that they didn't understand very well at the instructor's course or during individual study, through group activity, using different forms of real time communications like chat, audio and video, provided by the assisted instruction collaborative platform. This method, known as vicarious learning, allows learning by observing the others. In other words, those students from the group of study that do not actively participate at the debates learn by observing the others. They may watch the questions, the answers and the problems debated by their colleagues and the instructor and this might clarify a part of or all the questions they have about the studied domain. This method is largely used in the traditional activity of teaching-learning inside the classrooms.

The knowledge belonging to each student is particularized by the differences between each student's abilities. Some students assimilate most of knowledge after the course of the instructor, other students understand better the taught notions when they study individually or deploy collaborative activities of studying.

The conducted instruction process must consider the structure of students' program. Although they use a collaborative platform for instruction, their program should not tend to either of the two extremes: too loaded, which will encourage the abandonment as the students cannot face the requests; too loose will result in the fall of interest towards the study [3].

Based on the collaboration between the student and the instructor and between students and on the common knowledge in a discipline, materials, documents and home works may be created through collaborative activity on the assisted instruction platform. Collaborative authoring represents the activity of creating a document done by more authors. This kind of collaborations involves both discussions and arguments over the structure of the document and analyses and debates over its content. Instructors' materials and course supports for a discipline taught to the students may be created also through a collaborative activity. The geographical boundaries are eliminated in this case too. Creating collaborative documents would be very efficient for the parties involved if made simultaneously by all the participants.

Also, students may develop their projects, do their home works and papers on different subjects related to the course. The instructor may interfere with their collaborative activity with the role of controlling, verifying and conducting. Still, the collaborative authoring requires efficient communication means between the members of the group. [15] [20]

The measuring the dimension of the knowledge base inside a group of students may be done through the content of collaborative documents created. The result of the activity which is the document itself, may be analyzed through the transmitted information, novelty degree, presentation methods, transmitted message and through the knowledge and preparation level of those who conceived and created it.

Starting from Nonaka's principles on organizations, the assisted instruction process requires a program which stimulates the creativity of the students. If students are allowed to put in practice their ideas and knowledge and to benefit the support from the instructors, if they can communicate with the other students and can create collaborative documents then innovating

solutions might be discovered in the studied field. On the contrary, beside the risk of increased abandonment, the instruction program is limited to training only mediocre students.

According to Nonaka, knowledge can be divided into *tacit knowledge* and *explicit knowledge*. For assisted instruction applications, explicit knowledge is represented by the knowledge that the student has and is aware of, as a result of what he previously studied. This knowledge is mainly placed at a social level and is expressed in a formal language [16]. In contrast, tacit knowledge is placed at individual level and is hard to be formalized. Because of the subjective character it has, based mainly on experience and intuition, tacit knowledge is harder to be transmitted or communicated. This knowledge is particular to each student and particularizes him. Often, the student is not aware to have this knowledge.

Inside the assisted instruction systems, the students which had access to the same information are differentiated by the tacit knowledge they possess. When they communicate one with each other through the assisted instruction platform, the knowledge socialization process takes place through the discussions that address different subjects proposed in the studied discipline.

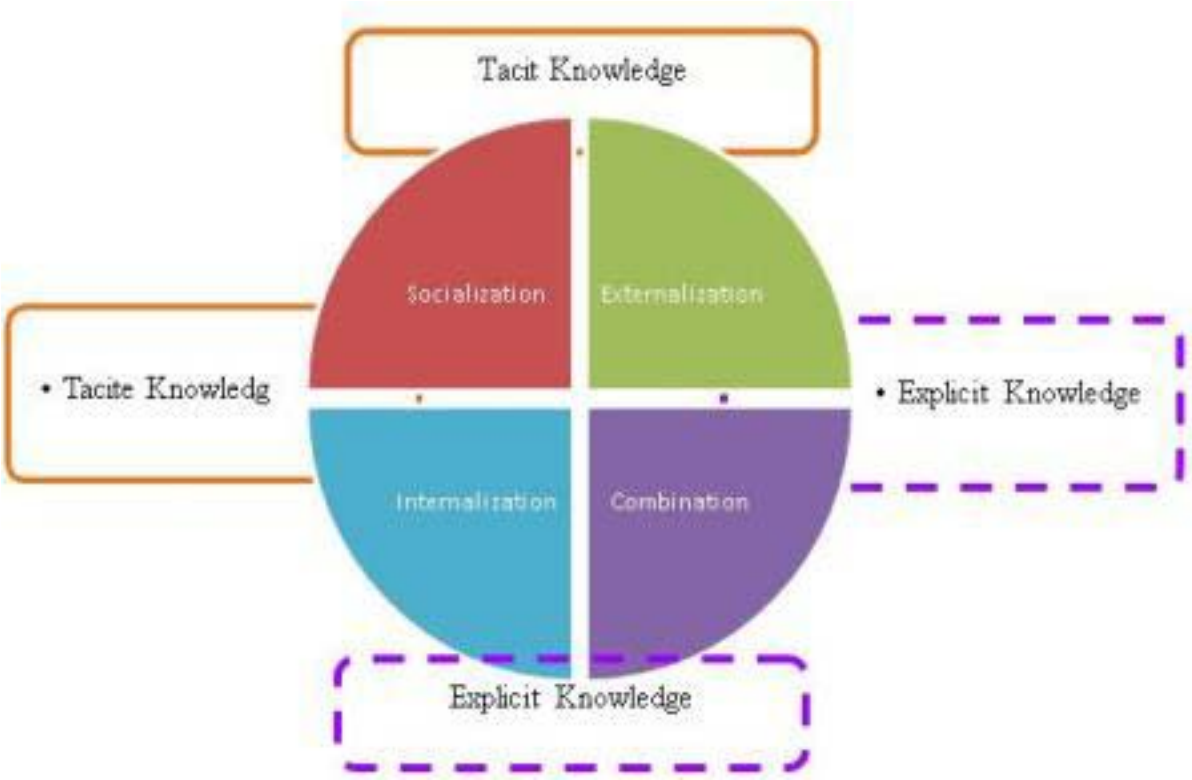

Fig. 7. Knowledge transfer matrix

This way, tacit knowledge is transferred from one student to the other through *socialization*. As result of communication between students, individual study and of courses taught by the instructor, tacit knowledge becomes explicit knowledge through an *externalization* process, Figure 7.

The reverse process of externalization is called *internalization* and involves passing explicit knowledge to tacit knowledge [17]. The main advantage of this transfer is given by the fact that this knowledge becomes operational and useful to its possessor which will use them in appropriate activities, specific to the field of activity. This knowledge becomes part of the personal skills of the owner and may be used in deployed activities without the owner being

aware where he has tit hem from or how he acquired it.
Based on the explicit, conceptual knowledge of the students, other explicit knowledge may be acquired and new terms and concepts may be clarified. The *combination* of explicit knowledge determines the enrichment of student's knowledge base. The combination process increases the knowledge transfer between different groups of students which participate at the instruction process. Due to communication facilities provided by assisted instruction platforms, explicit knowledge is transferred into documents, e-mails and databases. Also, collaborative documents might be created to contain explicit knowledge.

4 Collaborative activities in consciousness society

At international and national level we can notice that computer assisted instruction systems are widely used both by educational institutions and by different other companies that look towards training and specializing the personnel in a particular field.
Unlike a traditional e-learning system, inside an assisted instruction system the students receive more attention from the tutor.
The assisted instruction activity involves a communication process between the student and the instructor, process which is determined by the reaction of the former to the message sent by the latter. This reaction is often represented by the interest in the course and by participating actively at online discussions.
Various studies stated that there are some users of assisted instruction systems which are not motivated enough by the training program and which treat the system superficially [3]. The causes may be both personal, when the student didn't consider seriously the courses, or pedagogical, when the teaching/learning method was not appropriate for the learning style of the student.
Personal causes may be remedied by giving the student time to significantly improve his learning curve. In order to solve the other type of causes, the assisted instruction system should be customized for each student or group of students by using various methods for representing the information transmitted during the instruction.
Starting from the student, we can consider the assisted instruction process to be a recursive process [4] [5].
In order to achieve a high satisfaction degree, represented by an evolutionary path of the student in superior learning provided by the instruction system, the student must take all the determination phases in a certain order, order which can be represented through a pyramid (Fig. 8).
The base of the pyramid is represented by the *knowledge* about everything regarding the instruction notion, from its simple existence to principles and objectives. Based on his personal *skills* required to use such a system and on applying them, the future student may *decide* regarding the *satisfaction* degree brought by the instruction system he used in order to study a certain discipline or a certain domain. Depending on the degree of *satisfaction*, the student becomes *aware (C)* if the method was efficient and consequently if the decision was adequate.
Getting results that denote some involution causes the apparition of the recursive process: there is a *reorientation* of the way the instruction is done, going back to the basic stage, of *knowledge*, in order to retake all the steps required to choose an assisted instruction system
If after a limited number of tries the results are the same, considering that both the student and the instructor considered very seriously the courses, then the student is not compatible with the assisted instruction system. Beside *knowledge*, *understanding* and *skills*, stages that represent the base elements of the pyramid of student determination, *becoming aware* of the information gained after graduating an assisted instruction course represents the key element of the pyramid.
Assisted instruction may be realized inside a collaborative platform, leading to the appearance of a collaborative activity

between the participants at the training (Figure 8). Thus, during the determination phases, the student is continuously collaborating with the other students.
In a collaborative platform, the assisted instruction provides, as the main feature, the collaboration between the participants. Another important feature provided by this type of instruction is the possibility of individual awareness, of filtering through his own consciousness the information gained through the use of the system.

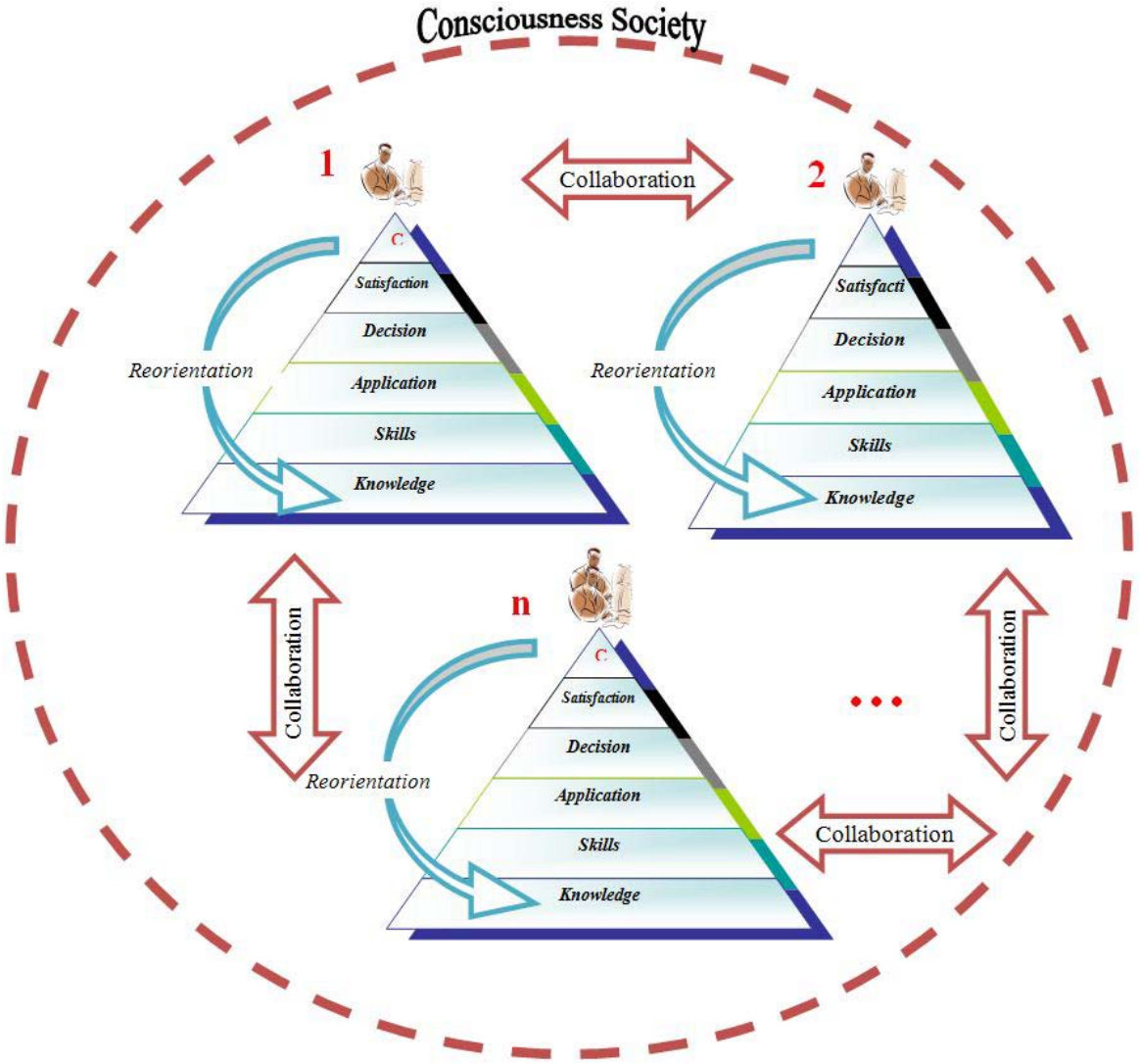

Fig. 8. Consciousness society from the perspective of assisted instruction

The consciousness is defined as a feeling, an intuition that the human being has about himself. It represents a form of objective psychological reflection of the reality, through notions, representations, judgments, reasoning and affective processes. Consciousness practically represents the ability of the student to understand, to realize, to acknowledge a situation or a fact, as the result of the activity of his brain. The same time, the consciousness is the one that determines the appearance of the sense of responsibility towards a situation or a person. The student, due to his awareness, will know at the end of the course taken in an assisted instruction system if he reached the knowledge level that he inadvertently targeted at the beginning of the course.
If we consider the collaboration between the students, we can speak about the emergence of a group of people who communicate among themselves, a group which acknowledges the activity performed, in order to collaborate for solving a problem or

for sending some information. We can speak therefore about a consciousness society inside a collaborative platform, from the perspective of assisted instruction.

5 Conclusions

The information society has led to the development of the concept of computer-assisted instruction concept existed since the '70s. This concept means that a teaching method, using new information and communication technologies, modeling and analysis builds cyber principles of instruction. Aided and aims at determining and applying their knowledge to solve problems [2]. This type of training has undergone a significant evolution from its appearance until now, when envisage new directions of development represented by personalized assisted instruction at user groups or individual level.

In order to obtain a higher training level of the students using this type of education, both individual instruction program and programs based on educational platforms are used. The trend of the assisted instruction is moving towards collaborative educational platforms that seem to satisfy all the requests of the students using instruction systems.

The design of the teaching-learning process is based on the analysis and specification of the use cases, roles, resources, activities and pedagogical methods. The design of this process represents the key element in designing and implementing e-learning systems. This idea is supported by most of the international standards (IEEE, SCORM, IMS, etc.).

Using computers in education became a necessity, related to the accelerated development of information technology. For the new generation of students already familiar with the multitude of multimedia information, the concept of using computer-assisted instruction is a necessary requirement.

Assisted instruction collaborative platforms involve more than publishing educational materials over the internet in order to be more accessible for the students. Assisted instruction involves also a sustained activity of both instructor and his students. The role of the assisted instruction is to help students understand things that are unclear, that were not clarified during a classical course that took place in a classroom. Also, the assisted instruction has a complementary role, providing the instructor with the necessary means to conduct the learning process of his students and to identify quicker and easier the parts more difficult to be understood by them.

Deploying collaborative activities inside an assisted instruction platform facilitates extending the scope of knowledge for each student separately. Students that attend the course may group according to their interest in certain fields. This way, a knowledge base is created at the level of each group which is a result of collaborative activities. This knowledge base is different from one group to another and represents, actually, the element that uniquely identifies and particularizes the entire group.

According to [19], *informational society* is naturally followed by *knowledge society*. Knowledge society ensures high dissemination of knowledge to all people through new means like internet and through new learning methods.

Knowledge society represents an intermediary step towards the emergence of *Consciousness society.* The latter is regarded as a moral society [20], a new information era.

If the students of an instruction system want to acquire the information from courses, to specialize in a certain field by attending such courses, then the awareness step (C) inside the determination pyramid is crucial.

The consciousness is the one that makes the difference between a machine and a human being. If the student is *aware* of not fulfilling the objectives of the course due to different reasons, he should either re-attend the course or he should go towards another course. The awareness of each student on his activity and the results he has, together with the collaborative aspect of assisted instruction systems, determine the development of

consciousness society in assisted instruction domain.

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