Supporting Effective Interaction in e-learning:
Towards a Constructivist Approach

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Abstract— In this contribution, we argue in favor of the importance of the role that interaction plays in supporting effective e-learning processes. Interaction among peers, in fact, either with real or virtual companions, is the fundamental component of the process of building and sharing new knowledge. In particular, we intend to argue in favor of a constructivist approach to e-learning. We support our view by reporting on our experience in the design of a platform for language learning through dramatization. Finally, we present the direction we intend to follow in our future research, towards the definition of an approach for enhancing effective interaction during collaborative learning and knowledge sharing in online learning environments.

Index Terms— constructivist approach, autonomous and collaborative learning, e-learning, communities of practice, modeling interaction, web forums, hypertext, language learning.

I. INTRODUCTION

Technology is part of our everyday life at various levels: the advent of the web as a communication media has enabled universities and companies to overcome the limitations due to geographical distances through the development of community of practices, forum, collaborative learning environments and so on.

In this paper we argue in favor of a constructivist approach to e-learning: the way in which people interact in a virtual learning community, may considerably affect the effectiveness of the process of building and sharing new knowledge. We support our view by reporting on our previous research experience in designing an effective platform for foreign language learning [10,11].

The idea that the knowledge may be actively built by the learner himself through the autonomous construction of paths of experiences is the key concept underlying constructivism [1-5]. An intelligent e-learning platform should be equipped so as to recognize and correct wrong and ineffective behaviors of its users. Embedding some forms of intelligent analysis of the interaction in online learning environments may help in facilitating the cooperative development of the learning process. This is true for both autonomous and collaborative learning environments, in which the interaction is either simulated or real, with virtual and human partners.

The paper is structured as follows: in Section II we provide the description of the conceptual framework we refer to; then, in Section III we argue in favor of a constructivist approach in both autonomous and collaborative e-learning, with particular focus on the cognitive model of learning; finally, we provide conclusions and directions for future work.


Building an effective platform for e-learning involves dealing with several issues not usually encountered in traditional learning. One of the main limitations is the lack of ‘social presence’ [6] due to distance and remote communication. One of the most relevant consequences of this is the loss of the constructive feedback provided by human tutors in face-to-face teaching. This is particularly true for the teaching of topics that constantly require a feedback, such as foreign language learning [10,11]. In our view, the solutions to these drawbacks may be the starting point for the development of new successful paradigm of teaching in e-learning environments, both in a collaborative or autonomous learning context.

With respect to the autonomous learning paradigm, two different approaches are usually implemented: the behavioral model and the cognitive model. In the behavioral model, the learners are seen as passive entities of the learning process and passively absorb the notions. On the contrary, in the cognitive model the student is the active actor of the learning process, which is conducted through the direct experience of the real world situations.

Hence, is the role played by the interaction among the participants to an online collaborative learning environments a very important issue that we believe is particularly relevant to address in the design of effective e-learning platform. Several studies in different domains have highlighted how the knowledge sharing among peers in forum or community of practices is a fundamental approach to the creation and diffusion of new knowledge [12,13,14]. This is the underlying idea on which online collaborative learning environments ground their success.
Communities of practice, in particular, are gaining more and more importance in recent years since they are a fertile ground for activities, such as group learning processes, which favor, in their turn, the building and sharing of new knowledge in the scope of a shared repertoire [15,16].

In the communities of practice, in particular, the learning process is modeled as a social phenomenon: the way the knowledge is managed enables also the formalization of the tacit knowledge, which is usually difficult to transfer from one person to another [13]. These environments may be seen as ‘learning communities’ [17] in which the communication and the cooperation among the participants as well as the sharing of experiences and the mutual help are the key factor of the success of the learning process and enhance the acquisition and consolidation of professional skills in the members [18]. The learning process is based on the interaction between the members and this ‘experience-based’ approach to learning may be successfully employed in developing new paradigms of autonomous learning as well. It is the case, for example, of the design of a hypertext as a transposition of the constructivist approach [19].

In the following section we argue in favor of the implementation of the constructivist approach in e-learning. To Bruner [1,2] the act of discovery new knowledge is the results of a matching between our own expectations and the actual regularities that we can observe and perceive in the real world. Therefore, the process of building knowledge is much more related to the action dimension rather than to the process of passively acquiring information. In particular, we report about our experience on designing a multimedia platform for enhancing the student autonomous creation of effective knowledge building paths in foreign language learning. Moreover, we propose an approach to support problem solving and effective interaction in collaborative learning environments, which is the topic of our ongoing research.

III. IN FAVOUR OF A CONSTRUCTIVIST APPROACH IN E-LEARNING

The main goal of this contribution is to argue in favor of a constructivist approach to e-learning. To support our view we describe, in the following, our previous experience in the design of a platform for language learning through dramatization. Moreover, we present the direction we intend to follow in our ongoing research, with the final goal of enhancing effective interaction during collaborative learning and knowledge sharing in online learning environments such as a web forum or a community of practices.

A. Learning by dramatization: a hypermedia environment to support language learning

The idea that the knowledge may be actively built by the learner himself through the autonomous construction of paths of experiences is the key concept underlying constructivism [1-5,20]. This is particularly true for the learning of a foreign language. Language, in fact, is the device that we use to formalize in our minds the knowledge we acquire about the world and our social environment [20,21].

As far as language learning is concerned, the main possibility of experiencing real world use of the new language is given by the interaction with others. The approach we have implemented in developing a courseware for language learning [10,11] reflects the one adopted by the ‘learning by doing’ perspective [3], and fits in the more general scope of constructivist language learning (see [22] for a review).

In our platform, language learning is designed as an autonomous process. The use of technology though may be easily exploited to encourage students to adopt an ‘adventurous’ approach to information seeking and for making connections. In this sense, e-learning technologies implement the multiple constructivist conditions for learning, which in return upheavals in the online teaching and learning of foreign languages. Our course has been developed adopting the hypertext of the learning paradigm, which we believe is a powerful transposition of the constructivist approach in learning. That allows, in fact, the student learning of a foreign language by actively experiencing its use.

In the behavioral model language is considered as an autonomous entity whose rules, that people use to communicate, are established according to social factors independent from the learners, and are passively acquired by them. On the contrary, the cognitive model aims at extending the learner’s cognitive abilities and personal skills acquired in the mother tongue, through the direct experience of the real world.

According to the cognitive model, we have designed an approach called ‘learning by dramatization’ in which the learners may experience the direct use of language thanks to the autonomous exploitation of the multimodal resources of the hypertext, by simulating realistic interactions with virtual agents. From a pedagogical point of view, our hypertext implements a constructivist approach: the learners may navigate autonomously through the learning units, choose their own path in the network of concept presented and autonomously create their own network of concepts according to their own mental associations.

Learning by dramatization. According to the constructivist theories, we designed the courseware in order to enhance the student’s active role in learning. In
the ‘learning by dramatization approach’ the student is told to behave like an actor in a set of situations, which are virtually simulated in the hypertext. He has to dialogue with virtual characters in real-life situations to accomplish tasks like making/answering questions, formulating statements, expressing opinions, describing situations and so on. Students are requested to play all the roles involved in the scenario, by spontaneously building their own sentences on the basis of the original dialogue path of each scenario. Any new correct student’s utterance is recorded and enriches the existing database. The student must complete these interaction tasks with the virtual characters in order to go on in the exploration of the multimodal contents and, hence, to proceed in the learning process.

The students who experimented the course were positively impressed because they could simulate familiar situations, and this requires continuous active involvement and gives an immediate feedback. Moreover they found very interesting the possibility of playing an active role in enriching the knowledge base on the domain by formulating new correct sentences for the different situations described in each scenario.

B. Analysis of the interaction on a web forum

In the previous section we have shown how simulated interaction with virtual characters may be used as a device for building new knowledge in autonomous learning processes using hypertexts. Interaction, of course, is the key component of collaborative learning environment as well and allows developing a social space in which collaborative problem solving may be conducted [8,9].

Nowadays, the role of the web technologies is becoming increasingly important because they allow interaction between members who are physically distant. Tools as email, forum, videoconference, and so on offer the possibility to overcome the limitations due to physical and temporal barriers among people, favoring the interaction processes that are the key factor for the success of the communities of practice [13, 26].

One of the most powerful instruments in this scenario is the web forum. It is mainly used as a discussion environment but it represents a powerful platform for collaborative knowledge sharing, learning and problem solving. Moreover, interaction on a web forum naturally contributes to the creation of an informal ‘repository’ through which the cognitive memory of the members of the community can be made ‘persistent’.

In spite of its great potential in this sense, though, the use of a web forum has not been originally conceived as an e-learning environment. As a consequence, it does not necessary ensure effectiveness of the exchanges among its members with respect to the goal of achieving actual knowledge sharing and/or building. In fact, members of a forum do not necessary hold the required social and communication skills to successfully conduct the interaction, which may often result in task-free and informal conversations [6].

Therefore, embedding some form of intelligence in such environments assumes a great importance. It may help, for example, the moderator of the forum in ‘teaching’ to the members how to properly behave in order to effectively complete problem solving or knowledge building tasks. The idea is to evaluate, in real time, the effectiveness of the individual discussions going on, in order to prevent or correct wrong behaviors of members. By enriching the communication devices of a community of practice (e.g. a chat or a forum) with some form of embedded intelligence, the system would be able to monitor and guide the people involved in the interaction towards a more effective and fruitful behavior in case of divergence from the ideal pattern of an effective e-learning interaction.

Which approach? Several theoretical models have been proposed to enhance effective interaction in online collaborative environment [27, 29]. These research projects aimed at developing and applying effective conversational models to which the members of a collaborative learning environment may refer during the interaction.

The majority of these models have the final goal of creating an intelligent system to support the interaction, by exploiting conversational models. These models are conceived to enhance reflection on own knowledge, elaboration and explanations of information, ideas and opinions, motivation and articulation of the reasoning through argumentation and negotiation processes, which are the activities that typically characterize the effective collaborative learning among peers [30-34].

The final goal of our ongoing research is to investigate whether and how a wrong and non-effective attitude of participant to e-learning problem solving tasks can be recognized and corrected [9]. To address this issue we plan to define a method that will be implemented in a module that we plan to integrate in our web forum [23,24]. In particular, we aim at combining language analysis and dialog pattern classification techniques using Hidden Markov Models (HMM) [35,36]. Rather than adopting an intrusive approach, we plan to develop a module that constantly monitors [37,38] the conversations of the members of a web forum, to understand the dialogue dynamics going on among the participants. The module has to be equipped in order to understand the shallow dialogue dynamics of the discussion, that is who is telling what to whom. This monitoring activity should be conducted continuously, so that the system could have, at every time of the interaction, the exact and updated image of what is going on in the forum. In this way, the system will be able to detect and correct situations in
which the participants to a discussion deviate from the
typical patterns of effective knowledge sharing.

The main source of inspiration for our research is the
"Collaborative Learning Model" and, in particular, the
"Collaborative Learning Conversation Skill Taxonomy"
developed by Soller [34] on the basis of the
"Collaborative Skills Network" by McManus e Aiken
[26]. The Collaborative Learning Conversation Skill
Taxonomy is based on the identification of three main
Skills that define the behavior of people taking part to a
collaborative learning activity. The individual
contributions to the interaction are characterized by their
main communicative goal (e.g. requesting, arguing,
answering, and so on) and the interaction in the
collaborative environment is guided through the use of a
structured interface. Research in fact demonstrates that
structured interfaces enhance effective interaction in e-
learning and problem solving scenarios [29,39].

Towards supporting effective interaction in web forum.
In the next future we plan to collect and annotate the
interaction logs through the use of our web forum in
order to create a dataset of interactions coded as sequences
of dialogue act, to isolate typical pattern that can be
classified according to Soller’s taxonomy.

The next step will be to apply conversational analysis
techniques to the coded interaction in order to verify
whether these phenomena can be isolated and detected
automatically, starting from spontaneous and unstructured
conversations. Once the divergence from an effective
interaction pattern is detected, the system may decide to
guide the participants towards a correct behavior and to
support the interaction appropriately.

The envisaged methodology involves using
conversational analysis techniques for dialogue pattern
analysis. In our previous research, we have already tested
the potential of the HMM formalism in exploiting
dialogue pattern differences in user attitude recognition
[7,28]. We plan to employ the same approach in the
conversational analysis engine that will be embedded in
the behavior of a software agent. The work with which
this approach has more in common is the analysis of
collaborative distance learning dialogues by Soller [8] that
studies how dynamically recognize when and why
students have trouble in learning.

IV. CONCLUSIONS
In this paper we have argued in favor of a constructivist
approach to e-learning. In particular, such approach may
be successfully employed in both autonomous and
collaborative learning environments.

As far as autonomous learning is concerned, we have
reported about our experience on developing a multimedia
platform for foreign language learning. Our approach
overcomes the traditional limitations affecting language
teaching in e-learning by making appeal to the cognitive
model of learning. In particular, it enhances the student’s
autonomous creation of effective knowledge building
paths. The courseware has been evaluated with students in
our University. They judged the system efficacious and
interesting and evaluated the tool as useful and attractive
[10,11].

Then we have illustrated the directions we intend to
follow in our future research about modeling the attitude
of participants to a collaborative learning dialogue in order
to understand whether it is diverging from the typical
pattern of an effective interaction.

The final goal of this contribution has been to show
how interaction plays a fundamental role in learning,
according to the constructivist approach. Though, e-
learning presents several drawbacks in this sense, that are
mainly due to the lack of social presence due to the
distance among peers in collaborative learning
environments or the distance or absence of the teacher in,
respectively, remote and autonomous learning scenarios.
Technology offers in part the solution to this problem by
overcoming the limitations due to geographical distances.
On the other hand, the construction of structured learning
material may be designed according to paradigms that
transpose the constructivist approach in the e-learning
domain (e.g. using hypertexts). The possible solutions to
these problems may be seen as a way of practically
implementing the constructivist approach: rather than
being a mere surrogate of traditional learning in praesentia, e-learning may develop a great potential by
allowing students to autonomously manipulate multimedia
and virtual object for the autonomous building of their
own path of knowledge discovery through experience. For
example, using a hypertext allowed us to exhaustively
investigate an effective learning paradigm in which the
student is the main actor of the learning process by
exploring the software material of a foreign language
course. Analogously, exploiting conversational analysis
techniques in a web forum may be seen as a way to guide
members to adopt an effective behavior with respect to the
task of achieving actual knowledge sharing and building.

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