

## **Collaborative Learning Activities Supported by Intelligent Agents**

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The changes introduced by the Bologna Process in the educational paradigm, moving from a lecturer centered paradigm to a learner centered paradigm, involves a more supported learning process based on learning outcomes and the adoption of new pedagogical methodologies.

To improve the learning process and facilitate the student support, we propose the adoption of intelligent agents in learning environments, with the mission to follow closely the student in their learning activities, coaching, advertising for difficulties, adapting the context to the learner profile, and making a connection between the student and the lecturer.

The adoption of artificial intelligence in education has the goal to improve the learning process adapting the contents and the learning environment to the student profile. The student profile is based on her learning style, learning needs, goals and choices.

The first system that adopts artificial intelligence techniques was the Intelligent Tutoring Systems (ITS). Kearsley defined an intelligent tutoring system as an application of artificial intelligence techniques to teach students. According to Sleeman and Brown, an intelligent tutoring system must have its own problem-solving expertise, its own diagnostic of student modeling capabilities, and its own explanatory capabilities.

The ITS systems are specially developed to computer based training (CBT), witch are very learner centric. The main disadvantage appointed to these systems is the limitation of the student creativity, because the student needs some autonomy in the construction of their knowledge. In the other side if the system is very passive the motivation of the student can decrease quickly.

We propose a new architecture to support learning activities using intelligent agents, based on the IMS Learning Design standards. The IMS Learning Design is a framework to develop learning activities with pedagogical flexibility, personalization, reusability and interoperability.

This multi-agent architecture, based on web services, uses the case-based reasoning methodology to perform adaptation of the learning activities, recommend learning sequences, collect opinions about a subject, suggest Web resources, alert the student for events, and give support in the agenda management.

The use of intelligent agents has several advantages in the support and personalization of e-learning. The ITS systems doesn't support collaboration and cooperation like groupware and cooperative work technologies. This architecture integrates the features of intelligent tutoring systems, with the functionality of groupware and collaborative work tools, making possible the collaboration in learning activities and the reusability of learning contents and contexts.

In our tests with a group of students, it was reported that the knowledge produced by the agent it was very important to accomplish the learning activities. Students have the opportunity to consult Web resources that other colleagues consider interesting and the possibility to make collaborative annotations of contents. When a student has one question, the agent infers the knowledge of the system and presents one or more solutions based on learning experiences of other students.