

# Outlining an Intelligent Tutoring System for a University Cooperation Information System

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**Abstract**—International opening of universities and research institutions is essential in the development of their research and innovation activities. Abdelmalek Essaadi University (AEU) attaches crucial importance to partnership and international cooperation, and actively participates in national and international cooperation and exchange programs. In order to manage the monitoring and evaluation of its cooperation activities as it evolves, the University has set up a system of information on the governance of university cooperation for proper management and managing better partnerships. When setting up a new information system, end-user training in this new management tool is a very important part of this process. For this reason, the University has adopted the idea of developing an intelligent tutoring system. This system will be based on the Moodle platform and will be fully automated and adaptable to the needs of each learner. This article presents the basic design of the intelligent tutoring system incorporated in the management information system of university cooperation SIMACoop of our university and shows the feasibility of the intelligent tutoring system around an information system.

**Keywords**—information system; learning process; intelligent tutoring system; SIMACoop; Moodle

## I. INTRODUCTION

Computer science has played an important role in spreading and sharing knowledge. Information and communication technologies (ICTs) have greatly promoted the dissemination and sharing of knowledge and expertise [2, 3], and improved our ways of informing and communicating. This technological emergence has revealed a new way of learning known as e-learning. It is based on access to online, interactive and sometimes personalized training that develops skills, while making the learning process independent of time and place [4]. Since the beginning of e-learning, artificial intelligence techniques have been tested to increase the learning experience, and have led to the emergence of a new field known as intelligent tutoring systems (ITSs) which refers to the concepts and methods of artificial intelligence and cognitive psychology. An ITS consists of making an artificial tutor available to learner [5], and aims to provide immediate and personalized instructions and feedback [6]. The main agents targeted by

most of these systems are students. AEU has many information systems designed and implemented to improve the management practices within the university. Among these systems, a new information system is recently set up for the management of the university cooperation [1]. It is important to mobilize human and financial resources on the technical aspects of a new information system, however, the university must also integrate the goal of effective and efficient use of this new application. For this reason, the need to develop an intelligent learning system dedicated to its teachers and administrative staff emerged. This learning system is to facilitate the use of the new information system, and at the same time reduce administrative costs and save time. The current paper describes the latest part of previous work published in [7-8].

## II. AEU: A BRIEF INSIGHT

Abdelmalek Essaadi University (AEU) occupies an important place in the educational scene in Morocco, it has exceptional potential, and is open to global exchanges [9]. It offers a wide range of accredited training in many disciplines and at all levels. The training is essentially organized according to the LMD (License - Master - Doctorate) teaching architecture of higher education and is organized in four areas: Science and Technology, Humanities and Social Sciences, Law, Economics and Management, and Medical and Pharmaceutical Sciences. It brings together, in addition to the presidency, eight faculties and five schools, more than 197 branches, and includes more than 954 research professors, 539 administrative and technical staff and more than 86000 students [10]. In addition, despite its young age, AEU has developed an interesting and promising research potential. Research at the AEU is now structured within 5 doctoral studies centers, 21 laboratories, 12 groups and 42 research teams accredited by the University Council (UC).

International activity has been defined in the University's development strategy as a priority axis. Currently, AEU has more than one hundred collaboration agreements with universities in Europe, America, Asia and the Arab world. In this context, a significant mobility of research, administrative

staff, students and teachers has been triggered in both directions, in the context of both research projects and cooperation programs. A large number of students, especially sub-Saharan students, undertake, under cooperation agreements, their higher education in different institutions. All this predisposes the University to play an important role internationally [11]. Like all universities, in the context of modernization, AEU has many information systems. The utility of these information systems is that all University members (teachers-researchers, administrative staff, students) and its partners have the information they need analogous to their user status.

### III. GOVERNANCE INFORMATION SYSTEM OF UNIVERSITY COOPERATION

Strengthening trust and exchange among all its partners is one of the goals of AEU, which gave cooperation an exceptional potential. It is based in particular on national and international partnerships aimed at supporting the development and quality of higher education and research system, in particular the scientific and engineering courses sought by the socio-economic community. Currently, AEU has more than one hundred collaboration agreements with other universities. Each year the university responds to several calls for international cooperation projects, actively participates in exchange programs, which allow it to develop its training offer, increase student mobility abroad, increase the number of scholarship recipients and to intensify the framework agreements. University cooperation requires effective management in order to monitor and coordinate the various activities of this cooperation and to ensure the continuity of constructive and productive relations. It is for this reason that an information system in the university has become a compulsory condition for a good steering of the cooperation and the management of better partnerships, and to establish a solid policy for the development of the institutional relation. In order to achieve this goal the university has set up the SIMACoop information system for the management of university cooperation [1, 7-8, 12]. This system has been deployed for the following reasons:

- Difficulties in identifying cooperative activities carried out by teachers individually, institutions independently and the presidency.
- Difficulties to follow cooperation agreements in time and their results.
- Difficulties in making a personalized follow-up of foreign students.

SIMACoop is a monitoring system that supports governments and universities cooperation plans. It facilitates the partnership management process signed between the university and its various partners, tracks the implementation of the partnership and the extent to which each party is meeting its obligations and commitments and respecting agreements and memoranda of understanding to partner missions and their strategic objectives. Its scope is to improve communication, collaboration and integration between universities and their partners. SIMACoop is a coherent information system centered

in a global platform that generally integrates three main aspects of university cooperation governance connected to a university database [1]:

- The management of university cooperation projects, including partners, activities, budget and expenses.
- The management of agreements and conventions (including signatories of agreements, actions and budget).
- Personalized monitoring of foreign students.

This system is dedicated mainly to project managers, administrators of institutions and universities, and contains tabs that manage:

- Information on cooperation projects, partners contributing to the project, activities, budget and project expenses.
- Information on agreements and conventions signed by the university.
- Information about foreign students, who benefit from cooperation agreements.

It is enriched with a warning system, which informs the project managers and the administrative personnel of the dates of the activities, the imminent ones, those which present a delay of realization, the convention dates, and non-renewable agreements. After the deployment of SIMACoop, AEU organized training tours within the university's institutions and meetings to train teachers and administrative staff in the use of SIMACoop and how to take advantage of its features. But despite the university's efforts to have its staff adapt to the system, some of them had difficulties and problems accessing the system services, and their training was not sufficient, even if the system integrates an intuitive and user-friendly interface. For this reason, the university has thought to develop an intelligent tutoring system for the personnel training on the operation of the system.

### IV. INTELLIGENT TUTORING SYSTEM

#### A. Generalities

In classroom, the course is the same for everyone, there is no individualization. Teachers guide learners and need to perceive their needs in order to improve teaching. However, in group tutoring environments, the one-to-one time spent by teachers on each learner decreases considerably. For this reason, some learners prefer the use of a tutoring learning system with which they can learn at their own pace [12]. Recently, the use of information and communication technologies in education has increased considerably. ICTs are considered a synonym for modernization, especially in the field of university teaching-learning since they provide advanced and up-to-date technological tools and applications. The ICT adoption strengthens the teaching process, facilitates and improves the effectiveness of learning, research and scholarly communication, promotes knowledge building and ensures that the learner becomes cognitively active and takes cognitive action in developing his skills. The rapid advancement of information technology has provided new learning methods, environments and innovative ways not only for the

dissemination of knowledge but also for the exploration of learning strategies that foster the building of skills [14]. ICTs have the power to complement, enrich and positively transform learning and teaching process, fill learning gaps, improve quality and relevance of learning, enhance inclusion and improve learning, administration and governance while they facilitate administrative transactions [3, 15-16]. With the emergence of ICTs, a new training approach, or more precisely a new way of learning, has emerged called e-learning. E-learning enhances the quality of training as an advanced learning process in which learners acquire new skills or knowledge through information and communication technologies [17-18]. It is intended to help the acquisition of personalized knowledge adapted to the speed and pace of progression of the individual learner. The range of existing e-learning applications includes [4]:

- Price management systems, a field mostly covered by industrial products.
- Intelligent tutorial systems, adaptive hypermedia, a highly oriented research area.
- Collaborative tools used for learning, videoconferencing, etc.
- Digital exams, online quizzes, etc.

Among these teaching processes, there is a tutoring system that helps learners in their progression adapted to their current level of knowledge, called a system of intelligent tutorials, which uses techniques derived from artificial intelligence based on the theory of learning and cognition to assist the learner in solving a problem, analyzing responses and cognitive diagnoses. The intelligent tutoring system (ITS) is a very useful tool to support and enhance learning process, it is designed to simulate the behavior and advice of a human tutor in order to emulate an artificial tutor [5, 19]. This tutor should be able to solve the same problems as those posed to the learner. He could thus follow the reasoning of the learner and understand his mistakes. This artificial tutor provides immediate and personalized instructions and comments. The goal of the ITS is to enable a learner to learn by his own. In general, it alternates between the phases in which the learner conducts the exercise and the tutor validates the actions, and the phases in which the tutor performs the tasks and explains them to the learner [20]. ITS interacts directly with students and performs many pedagogical functions usually reserved for teachers or tutors while providing access to high quality education for each learner. Any ITS usually includes a "domain model" that knows what to teach, "a pedagogical model" that knows how to teach, "a learner model" that can personalize learning with respect to it, and "a model of the interface", i.e. the visible means allowing the interrelation between the learner and the system [12, 21-22] (Figure 1). In any ITS, the assessment of learner acquisition of knowledge is a primary task, this assessment is necessary to adapt learning materials and activities to learners' abilities [13, 23]. Knowledge assessment is a systematic process of collecting, analyzing and interpreting data. To evaluate the acquisition of knowledge, different techniques can be used by the system, such as tests or exercises, questions, etc.

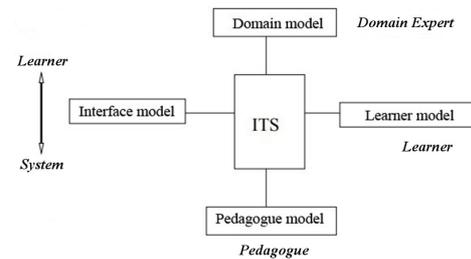


Fig. 1. Classic conceptual architecture of an ITS

### B. ITS Development

Our main goal is to design an ITS that meets the needs of the university's faculty and administrative staff and provides an advanced learning environment, adapted to their current level of knowledge. Its purpose is to provide instant, personalized instructions and comments without the intervention of a human tutor. The formation process of our system consists of five different tasks [24]:

- Objective choosing.
- Realization of the learner characteristics.
- Realization and use of ideas on learning and motivational learning.
- Choosing and using the means to learn (methods and techniques).
- Evaluate the learning achievements of the learner.

Within the university there are three types of users who can access the SIMACoop information system: project managers, research professors, and administrative staff. Their missions are differentiated in the information system, and the use of the latter does not represent the same difficulties for them. Each user has a defined role in the SIMACoop information system, associated with a usage profile in the system representing all the functionalities that the user can access. This profile determination plays an important role in the design of our ITS in order to specify the training to which the user/learner will have to participate. The ITS will have a resource base that includes all training elements according to the profile of the enrolled users. Each of these users is subjected to a set of controls during the registration in order to know their preliminary achievements and present them the attributes of their profile. This tutoring system will guide them in training according to their individual achievements and objectives, and will present the skills that the learner will have acquired after a training action. The system will be divided into different modules based on the classical modules of an ITS indicated above. These modules are at the same time independent and linked in input and output allowing their separate evolution. The system will be able to model learners' profiles using an "enrollment and evaluation" module that will evaluate the learner's knowledge and will update his profile. To learn about the level of the learner, the system will offer the learner some tests to pass. These tests will in fact be added by the expert (expert model), and attached to the resources to allow the

follow-up of the learning and the update of the profile (Figure 2).

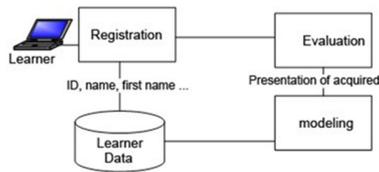


Fig. 2. Steps followed for profile modeling

### C. Implementation Tool

At present, there is a vast choice of e-learning development solutions that allow easy communication of information and interoperability of applications. The choice of a platform to develop our solution is motivated by problems of maximum adaptability to our needs and criteria. Moodle meets our needs perfectly, enjoys a good reputation and many successful implementations in the education field. The determining factors in its favor are: its ease of use, it is free and, especially, its possibility of developing and integrating new tools through its open source license. Moodle is an abbreviation for “Modular Object-Oriented Dynamic Learning Environment”. It is an online learning platform, an LMS (learning management system), freely licensed to create communities, and educate around content and educational activities. In a content management system, Moodle adds a few pedagogical and communicative functions creating an online learning environment: this application makes it possible to create, via network, interactions between pedagogues, learners and teaching resources [25-27]. Moodle has a very broad community of users, it is scalable, robust, stable and interoperable, and there are no problems with the content portability. It is characterized by [28]:

- User-friendly interface for all user types.
- Several languages can be used simultaneously in the various courses of the same platform.
- Filters make it easy to use media files within Moodle pages.
- Detailed usage reports for each learner help supervising learning efforts.
- Moodle facilitates the dynamic management of a course with a calendar. Each course is a portal composed of blocks that the tutor can display as he wishes, avoiding information overload.
- It has many features shared with other online training platforms: forums, resource manager, tests and nine turnkey modules. It also includes a module for creating tests. The questions created with this module can be shared and reused in different test contexts.
- It is very flexible, it was designed from the beginning in a modular way that makes it possible to meet the needs of an isolated trainer as an academic institution.

All these features of Moodle favor developing a fully automated and adaptable teaching system for the use of

SIMACoop information system, which will give this system the main features of an ITS. It will communicate through the Moodle platform with three main user types who have the right to access the system to perform various actions:

- An administrator who manages the use of the system and its database.
- A learner who follows the training through the system.
- A teacher who accesses the system for consultation and adds educational resources to the database.

### V. CONCLUSION

The information systems in the university have become indispensable, helping the university staff (administrative staff, teachers and students) in their activities and in the accomplishment of their missions. In the implementation of an information system, a multidimensional vision must be apprehended. In this article, we have emphasized the place of the learning dimension within the university, and more specifically the feasibility of a system of intelligent tutoring around the information system. This learning is instrumented by the use of ICT and artificial intelligence concepts, and taking it into account from the design phase of the information system would better integrate the learning object. The introduction of new learning technologies such as ITSs for university staff around their daily management tools is a real challenge today.

### ACKNOWLEDGMENT

This research was supported by the Information System Engineering Research Group.

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