eLearn Center NEW GOALS call in intelligent tutor systems at Universitat Oberta de Catalunya (UOC)

PREAMBLE

Intelligent tutor systems (ITS) have recently become very popular, thanks, mainly to the possibilities offered by technology and the spread of blended and on-line learning, where these kind of tutors are especially important. These systems include many different applications (AutoTutor, Assessment and Learning in Knowledge Spaces, eXtended Tutor-Expert System, and Web Interface for Statistics Education, among others). Individually-paced electronic tutoring is potentially an effective way of meeting the students' varied learning needs within the limited time available for content teaching. [1].

ITS can be defined as computer programs that model learners' psychological states to provide individualized instruction. They have been developed for diverse subject areas (e.g., algebra, medicine, law, reading) to help learners acquire domain-specific, cognitive and metacognitive knowledge.[2]

Many different techniques have been applied in several ITS:

- Automatically creating learning paths[3], [4]
- Introducing motivational and metacognitive feedback based on the learner's past state [5]
- Automated coaching and collaborative techniques.[6]
- Visual cueing
- Accommodating learners' individual differences during learning activities.

Many different technologies have been used to implement these techniques: Bayesian networks[7], fuzzy logic [8], natural language recognition [2], the Bloom's taxonomy to provision personalized guidance[9], etcetera.

ITS appear to have a more pronounced effect on college-level learners than on K-12 students. However, there is no evidence yet suggesting that any ITS is significantly better than other teaching methods or that work better for one subject domain than another [83]. And it is not clear if ITS have effects on students. Some papers [10]–[15] find positive results; and some others find no significant differences between control and research groups. [2], [16], [17]

Although there is no general agreement regarding the positive effects of ITS, there are some items that are found as positive in all previous studies:

- What is improved is student cognition, engagement and affect. Although this is achieved through specific components and interventions that are inherently affective, cognitive, and metacognitive in nature [18]. It is important, therefore, to include motivational and metacognitive feedback. [5]–[7]
- The use of ITS can facilitate the achievement of the same learning goals in less time compared to other teaching methods[16], [19].
- Personalization plays a key role [20]: ITS have different effects in different kind of students (extraverted vs. introverted[21], high-performing vs. low-performing[22], K-12 vs. high school. [14], [14]
- Effects are greater after some years of application. [23]
- It is key an alignment of test and instructional objectives[24]. Educational contents have to be designed by people who have both, technical skills and the teaching experience required for creating the contents. [25]
- None of the papers reviewed reports any negative effect of ITS.

ITS are often combined with gamification techniques. Gamification is the use of game design elements and game mechanics in nongame contexts.[26] This idea has been used successfully in many web based businesses to increase user engagement. Some researchers suggest that it could also be used in web-based education as a tool to increase student motivation and engagement. Based on the concepts of the increasingly popular gamification, game-based learning and serious games movements, it gives teachers and students the opportunity to experience first-hand how game mechanics can be used to make learning fun and addictive.[27]–[29]

Once again, studies do not show concluding remarks: some studies found no significant differences[30], [31], while others found better results in the gaming group. [32] Even in engagement or motivation, differences due to gamification are not significant.[33] On the contrary, studies find that it increases motivation in students and instructors,[34] and some find some positive time-scale effects.[35] It has been found, also, that there are some effects by showing students how they are performing.[36]

Finally, it is important to note that ITS approximations are usually subject focused: algebra, [11], [16], [17], [20], [23], [37] statistics,[10], [14] construction of models of dynamic systems,[38][39] second language learning,[15], [40], [41] reading [42], SQL [5], [19], electricity and electronics[43], mathematics[18], [25], [44]–[46], AI search algorithms[47], computer sciences[36], computer network design [3], mechanics

engineering [22], research methodology[33], multimedia [48], programming, [8], [9], [30], [32], [34] chemistry, [49] physics,[39], [50] or policy argumentation,[51] are some of the examples.

As can be seen, research on ITS is mostly carried out on technical subjects. It is also found on discursive subjects but to a lesser extent except for foreign language teaching. ITS have been used in many different subjects, but no approximation, as far as we know, has tried to propose a global system able to include different subjects of different knowledge in a global tutor with different applications.

RULES OF THE CALL

This document specifies the terms of the eLearn Center NEW GOALS (NG) call.

PURPOSE OF THE CALL

The goal of the project is to propose and execute the research to design, develop and test an intelligent tutor system at the Universitat Oberta de Catalunya (UOC).
This tutor system should meet the following goals:

- Work in at least three different subjects of different kinds and in different faculties.
- Generate and work with open, interchangeable data, allowing collaboration between tutors of the participant subjects.
- Incorporate elements for giving useful feedback to users.

NATURE AND TERMS OF THE GRANT

The researcher selected in this call:

- Will have a full-time UOC contract.
- Will have independence in carrying out the research proposed in the project attached with the application.
- Must report on the project's progress to the eLC's and/or the UOC's management.
- Will receive a salary on a par with the UOC's academic staff, according to UOC's category and the merits provided.
- Will receive a research fund to cover expenses related with carrying out the project.
- Will work at the university's facilities.
- Will be supported by a full-time team of 3 senior researchers. 3 of the 4 members of the team (Principal + 3 researchers) will be UOC researchers.

The chosen PI is expected to contribute to positioning the UOC as a leader in the project's research field, through the scientific value of the work performed and its dissemination through publications in impact journals and attendance at key events in the field.

The research team will be composed of UOC research staff. They will be selected by the PI from pre-selected candidates in an internal, competitive selection process.

ELIGIBLE CANDIDATES

Anyone who meets the requirements set forth in the following section can take part in this call.

AVAILABLE BUDGET

The project's PI will have 27,000 euros a year to cover expenses related with the project (this quantity will be prorated for the actual months that the project is in progress in each of the calendar years of the project period).

In addition, the project's PI will have 6,000 euros a year as accommodation expenses if this person is living outside of Catalonia when this call is decided.

REQUIREMENTS AND OBLIGATIONS

The requirements for taking part in the call are:

- Hold a doctoral degree.
- Distinguished research career
- Experience in managing research (PI in competitive projects)
- Knowledge of the key principles of strategic planning, allocating resources, leadership techniques, and coordinating people and resources
- Ability to lead in the field of research and knowledge transfer

- Knowledge of the scientific sector and related business sectors
- Communication skills (spokesperson, conflict management, outreach, etc.)
- Ability to motivate
- Commitment to the institution
- Ability to inspire trust
- Ability to take decisions (entrepreneurship, allocation of resources, negotiating skills, etc.)
- B2-level English or higher
- Submit your application by the date and in the way stipulated in the Application Submission and Deadline section.

Within the framework of a translational research process, the selected candidate will be required to actively lead the NG research project The starting point will be a systematic review (or equivalent) of the field proposed, obtaining evidence for assessment of the results obtained in a real-life test environment, which is then fed back to the research.

CALENDAR

The project is expected to be developed in 3 years (6 semesters).

Experiments have to be taken during the UOC semesters and, therefore, must to respect UOC calendar.

DEADLINE AND SUBMISSION OF APPLICATIONS

The **deadline** for submitting applications is **30 July 2018 at 23:59 hours**. Applications must be sent to the mailbox preaward_osrt@uoc.edu, writing the code "**UOC_NG-ITS_ nom_sol·licitant**" in the subject field. The application will be considered formally accepted when the applicant has received a confirmation email from the mailbox preaward_osrt@uoc.edu.

The following documentation must be included with the **application**:

- CV in a single PDF file (max. 15 pages)
- Copy of the doctoral degree certificate or the academic transcript, expressly stating the date of obtainment.
- Project report with the description of the research, specifying:

    o Project abstract.
    o Objective.
    o Definition of the research within the lines set out by the project.
    o Work methodology.
    o Expected results (max. 10 pages).

- Work plan and project timeline (max. 2 pages, not including the Gantt chart).
- Provisional budget.
- Letter of motivation and intentions, in which the candidate explains their interest in performing the research at the UOC and describes the project submitted, highlighting the most salient points of the candidate's CV (publications, previous projects, etc.) that support it. Max. 2 pages.

SELECTION BODY AND CRITERIA

The Research and Innovation Committee and the Office of the Vice President for Teaching and Learning will be the bodies responsible for evaluating the applications, on the basis of the following criteria:

- **Excellence 40%**
    o Quality and credibility of the research project.
    o The researcher's ability to lead the research line based on scientific experience and professional background.
    o International recognition of the researcher's profile and research activity.

- **Implementation 30%**
    o Scope and clarity of the expected research results.
    o Consistency and sufficiency of the project's work plan.

- **Impact 30%**
  - o Alignment of the proposal with the research area proposed and institutional fit.
  - o Applicability and scientific interest of the project proposed.

In addition, if the selection committee considers it appropriate, the candidates will have to pass an interview.

DECISION

The applications received for this call will be assessed by the Research and Innovation Committee and the Office of the Vice President for Teaching, which will give their decision after 10 September 2018.

The UOC Knowledge Transfer and Research Support Office (OSRT) will notify the outcome of the call to all the applicants using the email address provided at the time of submitting the application for the project.

It is estimated that actual **recruitment** of the selected **candidate** to start to lead the research project at the institution will take place in October 2018.

EXECUTION OF THE GRANT AWARDED

In the first year, an annual budget charged to the FUOC's structural funds will be granted. In the second year, a new budget with the same features will be granted.

The UOC Knowledge Transfer and Research Support Office (OSRT) will notify the grant's financial code to the awardee within 7 working days after notifying approval of the grant, so that they can begin executing the expenses included in the grant.

The grant can only be used for the expenses itemized in the budget submitted. Any modification of the budget items must be approved by the eLearn Center's Management.

All of the expenses charged to this call must be made in accordance with the UOC Knowledge Transfer and Research Support Office's (OSRT) procurement procedure for projects, and the FUOC's travel policy.

PROPOSAL FOLLOW-UP

Once the project has been completed, the Principal Investigator must draw up a report with the results obtained by the project, using the template provided for this purpose, and send it in PDF format to the mailbox postaward_osrt@uoc.edu.

During performance of the project, the eLearn Center will monitor completion of the milestones established in the planning and may ask for changes to adapt it to the academic calendar or any other developments.

The Principal Investigator will draft an interim report at the end of the project's first year, describing the progress and deviations from the schedule and outlining the results obtained.

RESULTS AND JUSTIFICATION OF THE PROJECT

At the end of the year, the researcher responsible for the application will submit the following documentation **within a maximum of one month**:

- A **report**, which includes:
    - A description of the activity performed.
    - The scientific output generated by the project.
    - Results actually obtained compared with those expected at the time of making the initial application, with deviations.
    - The future lines to be followed.
    - The project's final recommendations.
    - Recommendations for the management of future projects.

- **Updating the information in the GIR**, with the data concerning the activity performed, if applicable and, insofar as any intellectual property restrictions allow, depositing it in the O2.

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