eLearn Center NEW GOALS call to join the research team for the "Intelligent Tutor System" project

PREAMBLE

Intelligent tutor systems (ITS) have recently become very popular thanks, mainly, to the possibilities offered by technology and the spread of blended and online learning, where tutors of this kind 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 (eg algebra, medicine, law and 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 methods have been used to implement these techniques: Bayesian networks [7], fuzzy logic [8], natural language recognition [2], Bloom's taxonomy to provide personalized guidance [9], etc.

ITS appear to have a more pronounced effect on college-level learners than on K-12 students. However, there is currently no evidence to suggest that any ITS is significantly better than other teaching methods or that they work better for one subject domain than for another [83]. Furthermore, it is not clear whether ITS have any effects on students. Some papers [10]–[15] report positive results, while 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 positive findings that are reported in all previous studies:

- Improvement is observed in students' 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 on different kinds 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].
- An alignment of test and instructional objectives is fundamental [24]. Educational content must be designed by people who have both technical skills and the teaching experience required for creating the content [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 non-game 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, previous studies do not allow any general conclusions to be drawn: some studies found no significant differences [30], [31], while others found better results in groups using gamification [32]. Even in engagement or motivation, differences due to gamification are not significant [33]. By contrast, certain studies find that gamification increases motivation in students and instructors [34], and others find some positive time-scale effects [35]. It has also been found that it, to some extent, has the effect of 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], engineering mechanics [22], research methodology [33], multimedia [48], programming

[8], [9], [30], [32], [34], chemistry [49], physics [39], [50], and policy argumentation [51], are some examples.

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

RULES OF THE CALL

This document describes the rules of the eLearn Center's internal New Goals call to pre-select the members of the research team who will take part in the project selected in the call "NEW GOALS to develop and test an Intelligent Tutor System (ITS)".

PURPOSE OF THE CALL

The purpose of this call is to pre-select 5 candidates to join the research team for the project funded with the call "NEW GOALS to develop and test an Intelligent Tutor System (ITS)". The goal of the ITS project is to propose, 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 call seeks to help complement and expand the participating researchers' scientific careers by performing research under the leadership of researchers of recognized international standing and repute in their respective research areas. Thus, the call may become an opportunity to position oneself as a leading researcher in the project's field of study.

There are two possible pathways for participation:

- **Full-time**: these are professors who are released from their teaching load to devote themselves solely to research. From among the applications received, the UOC's Research and Innovation Committee will pre-select five candidates on the basis of their experience and their main contributions to

the project. After a round of interviews, the Principal Investigator (PI) of the New Goals (NG) research project chosen will make the final selection of the three researchers who will work full-time on the project during a specified period, which may or may not be equal to the project's duration.

The faculty members joining the research team must contribute to advancing knowledge in the research area, taking part in disseminating the results in impact academic journals and key events in their subject area.

- **Part-time**: these are professors who wish to join the project and devote their research time to it.

The researcher chosen in the call for PI of the NG projects will choose 3 candidates, from among the 5 pre-selected, to work full-time in the research team.

The selected faculty members will join the research team to work on the project proposed by the PI for a maximum of 3 years. During the time they are working on the project, they will continue to receive their salary from the UOC. The university will provide the necessary resources to find substitutes for their teaching work. The research activity will be carried out from the researcher's usual workplace.

ELIGIBLE CANDIDATES

Any member of the Universitat Oberta de Catalunya's teaching and research staff can enter for this call.

REQUIREMENTS AND OBLIGATIONS

The requirements for taking part in the call are:

- Be a full-time member of the UOC faculty.
- Hold a doctoral degree.
- Have a level of English equal to or greater than B2 or equivalent.
- Have the ORCID identifier.

- Have scientific output up to date in the GIR and, insofar as any intellectual property restrictions allow, deposited in the O2. Any queries related with bibliographical citations and copyright and self-archiving policies can be referred to "The Library Replies", which can be accessed from the Library's home page.

DEADLINE AND SUBMISSION OF APPLICATIONS

The **deadline** for submitting applications is **11 March 2018 at 23:59 hours**. Applications must be sent to the mailbox preaward_osrt@uoc.edu, writing the code "**UOC_NG-Equip_ nom_sol·licitant**" in the subject field. The application will not be considered formally accepted until the applicant has received a confirmation email from the mailbox preaward_osrt@uoc.edu.

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

- Summary of the candidate's most salient scientific experience during the last 5 years, highlighting particularly those aspects related with this call's research area (2 pages).
- Letter of introduction and motivation, highlighting the main reasons why the candidate wishes to take part in the proposed research activity.
- Authorization by the Dean or the head of the research group to work on the new research arising from the call.

SELECTION BODY AND CRITERIA

The Research and Innovation Committee will be the body responsible for evaluating the applications, on the basis of the following criteria:

- Alignment of the candidate's main contributions with the research proposed.
- The candidate's experience in research projects, especially international projects.
- The candidate's CV (This will be consulted directly in the GIR).

DECISION

The applications received for this call will be assessed by the Research and Innovation Committee, which will give its decision after 10 April 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.

Once the call has been decided, the pre-selected candidates will have to pass the interview with the project's Principal Investigator, who will give the final decision on the candidate's admission.
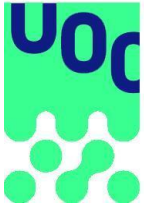
EXECUTION OF THE GRANT AWARDED

In the first year, an annual budget charged to the FUOC's structural funds will be granted. This means that the funds awarded must be executed between 1 January and 31 December 2018. Any sum remaining unspent after these dates will be lost. In the second year, a new budget with the same features and execution periods will be granted for 2019.

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.

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