

# Empathic Mediators for Distance Learning Courses

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**Abstract**—Online distance learning introduces several challenges, such as the dependence of online tools, the asynchronous communication between teachers and students, and the lack of synchronous social engagement level that in-classroom teaching can leverage. The existence of an online tutor 24 hours/day would be an interesting asset to potentially stimulate the student's engagement with the learning unit and to work as an additional learning support tool. The Virtual Tutoring project aims at the development of solutions involving anthropomorphic 3D avatars that work as both virtual online tutors in the Moodle e-learning platform as well as coaches in a mobile application that interact empathically with the students by predicting their emotional state and selecting appropriate emotion regulation strategies. This paper presents the current status of the project, preliminary evaluations with students, and future developments.

**Keywords**—online distance learning, e-learning, virtual tutor, virtual coach, avatar, online tutor.

## I. INTRODUCTION

Virtual tutoring is a possibility to support students' learning in online platforms [1]. In this project, we want to better evaluate and understand the pedagogical impact and real potential of anthropomorphic user interfaces. This paper describes the two technological approaches based on anthropomorphic 3D models developed in the Virtual Tutoring project at Universidade Aberta (UAb). One approach involves virtual online tutors on the Moodle e-learning platform and the other is based on coaches who empathically interact with students, predict their emotional state, and select appropriate emotion control strategies. Best practices for distance learning generally point to the principles of student-centered learning: learning flexibility (spatial and temporal); and online interaction. The interaction is often asynchronous as it provides students with more flexibility to select appropriate occasions and settings, as opposed to synchronous approaches [2]. In addition, interaction is a key element in supporting student engagement and collaboration [2], becoming a central aspect of the research [3]. Consequently, virtual tutors should strive to provide aspects of these functions.

## II. VIRTUAL TUTOR: FIRST PROTOTYPE IN UAB'S MOODLE PLATFORM

The virtual tutor in the UAb Moodle platform is implemented as a WebGL application (developed using Unity and C #) and the developed solution was based on the pedagogical model used in UAb's courses (<http://hdl.handle/10400.2/2388>). João and Maria are the names of the 3D avatars provided by Didimo ([www.mydidimo.com](http://www.mydidimo.com)). At the beginning of the semester, the student chooses which avatar will play the role of tutor in a course. The tutor window is superimposed on the web page of a Moodle course in a fixed position in the lower right corner of the page, preserving students' usual interaction modes with the platform (for instance, scrolling up and down over the page). The tutor window displays the avatar with facial expressions, a balloon with his/her speech, a post-it that lists the novelties on the course since the last login of the student and a set of buttons (Figure 1). These buttons allow the student to easily find specific content on the page: the course plan, topics, forums, activities and evaluation exercises. The avatar's facial expressions and speech depend on the student's grades in the evaluation exercises and also on his assiduity on the course page. The teacher of the course sets some threshold values to adjust the avatar behavior in this course.



Figure 1 Tutor's window with the virtual tutor "João".

The first prototype of the virtual tutor was tested in a Biology module where all activities were planned day by day. The students solved and uploaded assignments; the teacher

corrected and gave a grade with individual comments. There was a forum for each topic covered in the course where students can expose doubts and receive explanation from the teacher. Test results reveal that the majority of the students consider: the virtual tutor interface is easy to use; functionalities are well integrated; avoids that new information goes unnoticed; feels that it is a tool that guides the student in the course and makes the access to the page less monotonous.

### III. VIRTUAL TUTOR: FIRST MOBILE PROTOTYPE

Although online learning environments offer more flexibility to the students, external factors may still lead to disinterest in them. To help mitigate this problem, we created Maria and João, two virtual coaches inhabiting an Android application that accompany the students, adapt to their needs, and empathically support them in their tasks.

The affective agent's conceptual architecture giving life to Maria and João is depicted in Figure 2. The virtual tutors' perception is based on subjective factors (i.e. perceived difficulty of a course) and objective factors (i.e. course grades). The value of these variables, when compared to what was expected based on the evolution of the same variables allows for the computation of an affective state associated with the situation of the student at this point in time (e.g. the student grades dropping more than expected) using an adapted version of the *emotivector* model (Figure 2). The user modeled affective states are then used to select an intervention strategy, which can be *task-oriented*, focusing on the completion of a specific task or be an *affect regulation strategy* that tries to improve the user's affective state [5]. These strategies are implemented through *dialogue trees*. Interaction takes place in real time using unlocked speech balloons to convey verbal information as well as providing non-verbal and back-channeling information through gaze, nods and animated speech balloons (see Figure 3)

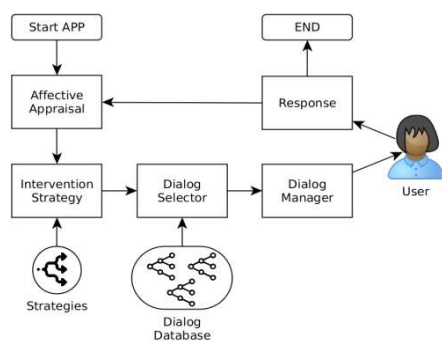


Figure 2- Conceptual architecture of the virtual tutors acting as coaches.

We conducted a preliminary evaluation using a prototype where the 3D avatars interacted with 13 students during a 10-day period to help them prepare for a final exam in an Environmental Sciences course. Students interacted with the virtual tutors on their Android devices, directly providing the tutors with both quantitative and qualitative data on how their study was progressing. Early results show that, on average,  $\frac{1}{3}$  of the students opened the app each day, with peaks near

assessments. On average, each student interacted with the application 5 out of the 10 days and the most active user interacted with the application during 8 days. These results are encouraging, as they suggest our approach was able to maintain students engaged with the virtual tutors.



Figure 3- Interaction example in the preliminary prototype.

### IV. CONCLUSIONS AND FUTURE WORK

The tests performed with the first prototype of the Virtual Tutor in Moodle's platform evidence the potential that this tool has on increasing student's engagement in a learning unit. This fact justifies by itself a fine-tuning stage and future enhancements. In particular, the Question & Answering functionality is under development.

The results of the preliminary tests with the Virtual Tutors acting as coaches in the mobile application suggest that the creation of a model capturing important elements of empathic behavior such as perspective taking and emotion expression, when complemented with online qualitative and quantitative information provided by the student, was able to maintain student engagement on a regular basis. We are preparing a longitudinal study to better understand the impact of interacting with empathic virtual tutors that are aware of the student's progress for the duration of a full course.

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