

# COACH BOT

## *Modular e-Course with Virtual Coach Tool Support*

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Abstract: The COACH BOT project aims at designing and testing an innovative e-learning methodology for adult education that combines Conversational Agent Technology (chatbot) with an ad hoc designed modular learning path. The pilot e-course addresses a target group of home health care professionals (e.g. home caretakers, nurses, etc). The project's innovation consists of the development of a collaborative e-learning environment featuring a "chatbot" or "Virtual Coach" who interacts with users through a human-like interface. The "Virtual Coach" acts as a teacher, coach and tutor, who supports learners "individually" during the modular e-course by providing in-depth information, assessment, case studies, technical and methodological support. The e-course curriculum is based on a personalised approach allowing learners, with help from the COACH BOT, to customize their own training path and benefit from a suitable training path that is relevant to their profession and based on their own specific needs, knowledge and skill requirements.

## 1 INTRODUCTION

The "COACH BOT" project is financed by the European Commission within the framework of the Lifelong Learning Programme. The two year project started in November 2008 and will end in October 2010. The project aims at designing a new model of adult distance education, addressing home health care service professionals, based on an e-learning methodology that combines the Conversational Agent Technology (chat-bot) with an ad hoc designed modular learning path.

The multi-actor partnership consists of seven organizations, six from the European Commission and one from Switzerland, from six different countries, namely:

1. Consorzio FOR.COM. Formazione per la Comunicazione (Italy)
2. Aarhus Social and Health Care College (Denmark)
3. Gruppo Pragma S.r.l. (Italy)
4. Romanian Society for Lifelong Learning (Romania)
5. Secondary school of nursing Ljubljana (Slovenia)
6. Norton Radstock College (United Kingdom)

7. Seed Association (Switzerland)

This article will explore the project's main objectives, potential results and e-learning methodology that will provide significant training benefits to home health care professionals.

## 2 THE PROJECT OBJECTIVES

Today, most professionals do not have extra time to study or enroll in training courses, therefore on-line vocational training courses are an ideal solution. It is essential for an e-learning course to be able to tailor to learners' personal and professional training needs offering valuable content to enhance their work experience. Online training also needs to provide learners with assistance, feedback and encouragement in order to customise their learning experience according to their needs and alleviate any feelings of detachment during the course. An online teacher/tutor can provide a sense of "online presence" which is a critical element to enhance distance learning that can also have a direct effect on establishing interpersonal relationships and trust during online communication (Craig S.D. et al., 2000).

In response to these aspects, the COACH BOT project will design and test an online training course for home health care professionals using the chat-bot methodology (a virtual tutor) that will allow trainees to personalize their own training paths and access different learning contents according to their own needs, knowledge and skills.

The health care sector is a complicated system that demands extensive resources and consists of a set of integrated services and inter-collaborative health teams that require a broad skills base. Despite growing training demands in the field, current training systems are too slow and inefficient to cope with new changes. The "COACH BOT" chatbot and e-course addresses these issues by providing health care professionals with the opportunity to renew and improve their skills through a flexible distance learning approach.

### 3 THE E-LEARNING PLATFORM

The E-Learning platform is based on the open source LMS Claroline that allows teachers to create and administer course websites through a WEB browser. This LMS is worldwide used and the vast community guarantees to solve any problems the platform administrators or users might have.

The project's technological team selected the LMS Claroline, among other possibilities e.g. Moodle, for its very clean and comprehensible source code, allowing developers to easily implement new modules to create highly personalized learning paths and embed the virtual agent into the LMS.

### 4 PEDAGOGICAL AGENTS

The COACH BOT project methodology is based on Pedagogical Agents that are autonomous software systems, realized with Artificial Intelligence methods that can operate in the training environment as tutors who adaptively assist users in performing training tasks (Craig S.D. et al., 2000). They can intervene in case of suboptimal performance, demonstrate skills, provide explanations, answer questions, and play the role of team members in multi-person tasks. Agents can be represented either as abstract pointers, disembodied hands, or as virtual humans with articulated bodies. Experiments have shown that ECAs can increase the motivation of a student interacting with the system. Jonhson

(Jonhson et al., 2000) showed that a display of involvement by an ECA motivates a student in doing his or her learning task. Pedagogical Agents are therefore virtual facilitators gifted with great reactive and interpretative skills promoting learning that is based on a knowledge transfer and the student is followed "step by step" by his/her own agent/trainer. This new learning methodology is highly experiential which allows real time testing and interaction.

Intelligent Agents make the content delivery highly interactive and personalized, articulating along individual paths following the learners' natural inclinations and respecting the different times of knowledge acquisition from individual to individual (Monova-Zheleva M. et al., 2008). Virtual teachers may use methods of Artificial Intelligence for evaluating the student's performance and reactions, and mainly for adapting teaching according to specific needs and particular environments. They can show the student how to perform a rather complex task; taking advantage of non-verbal behaviours, in order to capture the student's attention during the crucial moments of learning. Thanks to anthropomorphic features, virtual teachers make the interaction between student and learning system more involved and effective, allowing the acquisition of new contents to be improved and considerably implementing the learning level of the student, who learns with an active experiential participation. The methodology of Intelligent Agents as virtual professors/facilitators interacting with the student activates a strong emotional response on one side, and a real know how capability on the other. In the first case, it is important to underline the fact that training has a major impact if the person involved in the process is stimulated, not only by the cognitive-rational component, but also through the emotional component.

### 5 THE CONVERSATIONAL AGENT TECHNOLOGY

Today, many AI researchers have created domain-oriented chatbots, able to understand a specific knowledge domain with realistic, multi-purpose initiatives and human-like behaviour. The main challenging function of the agent is natural language analysis where the COACH BOT must "understand" what the user wants to know by analyzing the input phrase. In order to create the "brain" and personality

of the virtual agent, the project team decided to use AIML (Artificial Intelligence Markup Language), which is a dialect of the popular XML. AIML files consist of simple stimulus-response modules called categories. Each <category> contains a <pattern>, or "stimulus," and a <template>, or "response." AIML software stores the stimulus-response categories in a tree managed by an object called the Graphmaster. When a bot client inputs text as a stimulus, the Graphmaster searches the categories for a matching <pattern>, along with any associated context, and then outputs the associated <template> as a response. These categories can be structured to produce more complex humanlike responses with the use of a very few markup tags. AIML bots make extensive use of the multi-purpose recursive <srail> tag, as well as two AIML context tags, <that> and <topic>. Conditional branching in AIML is implemented with the <condition> tag (Wallace R., 2003). Bot personalities are created and shaped through a cyclical process of supervised learning called Targeting. Targeting is a cycle incorporating client, bot, and botmaster, wherein client inputs that find no complete match to the categories are logged by the bot and delivered as Targets to the botmaster, who then creates suitable responses, starting with the most common queries. The Targeting cycle produces a progressively more refined bot personality. The art of AIML writing is most apparent in creating default categories, which provide noncommittal replies to a wide range of inputs.

To provide academic and technical assistance and emotional support to users, the COACH BOT is present in the e-learning interface and possess human features. The learning process occurs inside the Learning Management System (LMS) that offers the didactic framework in which the user can follow the course and interact with other LMS didactic functionalities. Since the upper banner is almost always constant in all e-learning applications, it is the best place to put the interface. In this position the COACH BOT is always "near" the user and can always interact.

## 6 THE WORKFLOW OF THE COURSE

The virtual agent's main semantic structure is described by the following graph:

All these sections are embedded in the same virtual assistant, so the user does not see this segmentation in the dialogue software. Each area is

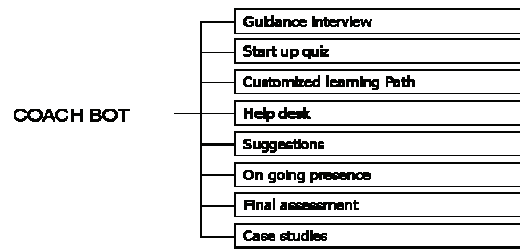


Figure 1: Virtual agent's conceptual map.

then structured into sub areas that relate to the COACH BOT's different tasks and the course contents it will cover.

### 6.1 Guidance Interview

The guidance interview can be considered the first contact between the conversational agent and the student. The student first becomes familiar with the virtual agent who starts a friendly conversation with him/her in order to create a sort of empathetic relationship. The ultimate goal of this interaction is for the agent to define a professional profile and consequently a learning path that best fits the student. The conversational agent also asks more general questions concerning the student's expectations and professional ambitions. Here the agent behaves more like a mentor who tries to understand the user's emotional aspects. The user's information is stored for further statistics and to enrich and personalize future conversations between the student and the agent.

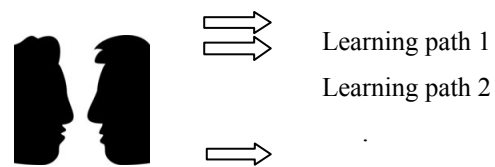


Figure 2: Student profiling.

### 6.2 Start up Quizzes

Following the guidance interview that defines the student's professional profile and consequently learning path, the student is allowed to access the *exercise area* on the E-learning platform. The system presents the user with as many quizzes as the number of modules foreseen for his / her learning path. These exercises are considered start up quizzes that test the initial knowledge of the student on topics presented in the course. There are a total of three learning objects (i.e. audio/video lessons) for

each module and for each learning object the system asks the student three questions. The student therefore must answer 9 questions per module. If the student answers all 3 questions concerning a particular topic correctly the corresponding learning object is optional, otherwise it is mandatory for the student to continue with the subsequent learning objects.

Based on the results of the start up quiz, a customized learning path is then created considering the previous knowledge of the student. The learning path adapts a constructivist approach which indicates when course contents are **mandatory** for study concerning topics that scored low and are not well known by the user and contents that are **optional** for topics that the user shows sufficient knowledge. The virtual agent will present the quizzes, explain their meaning and comment on the user's results. From a student's viewpoint, the virtual agent behaves like a teacher who tests his/her knowledge and assigns relevant learning objects to be studied.

### 6.3 Customized Learning Path

The student can find their customized list of course modules in the learning path section of the LMS. Unlike the standard version of the LMS, this area highlights the list of relevant modules that correspond to the user's start up quiz results. Within each module, learning objects are highlighted in two different colours indicating if they are compulsory or optional. The standard tracking system has been enhanced in order to allow the virtual agent to memorize, according to each user, what learning objects are compulsory and the number of times and the duration he or she studies a particular learning object. This kind of information is useful for the virtual agent to track the student's progress and when delays occur, the agent can invite him or her to study compulsory learning objects. In this situation, the virtual agent behaves like a tutor.

### 6.4 Help Desk

The goal of the Help Desk area is to provide users with extensive help concerning LMS functionalities and tools. By using only natural language, the COACH BOT can explain the meaning of the different functions in a way that is easy for the student to understand when asking for help. This user-friendliness allows learners to focus more on studying course contents and permits users who are not computer or LMS experts to use the system

effectively. Each tool featured in the LMS is explained in detail to cover both the generic and specific (interface related) questions that a user can do. The forum area, for example, can be "exploded" to cover these questions. The virtual agent has to understand and answer questions related to the "generic" forum usage (e.g. "Who can participate?", etc.). In addition to all the questions that can arise from the specific LMS user interface such as "What is a reply?" and so on. The virtual agent behaves in this case as a technical tutor. It is important to underline that the Coach Bot is not a normal FAQ but rather an agent who uses a natural language interface. This means that the user can write and ask certain question in different ways. Conceptually it is possible to "explode" this semantic area by the following graph:

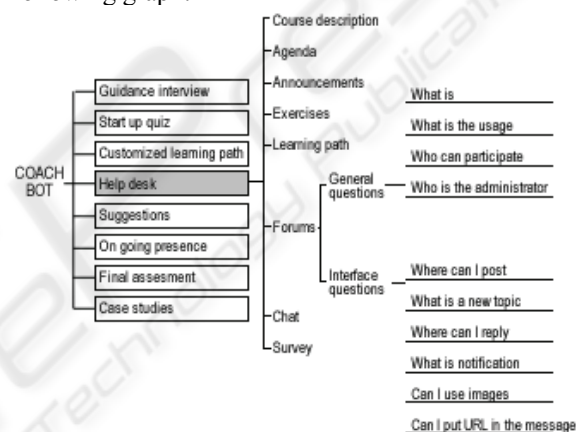


Figure 3: Virtual agent's conceptual map: help desk.

All the lines under the "Forums" are "exploded" such as the "What is" line and all the areas of the Coach Bot are "exploded" like the "Help Desk - Forums - "What is" one. This natural language capture technique applies to the Coach Bot's entire structure and not only to the Help Desk semantic area.

### 6.5 Suggestions

The virtual agent is able to help the user concerning specific course topics, which is referred to as the Suggestions area and is illustrated in the figure below.

The lines Content 1, Content 2, etc. are related to keywords specific to the course that the LMS offers. The virtual agent's aim in this area is to act as a teacher and not, like in other areas, as a tutor. Each content keyword is related to a set of questions that in turn are related to particular aspects of the



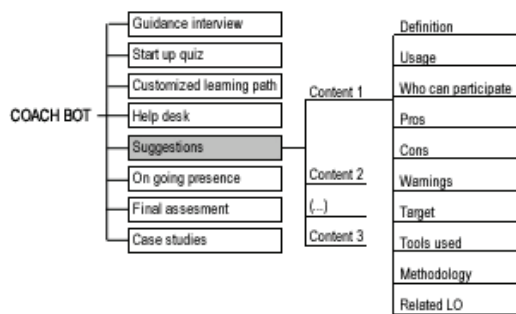


Figure 4: Virtual agent's conceptual map: suggestions.

content. If, for example, Content 1 is "Catheter", the user can ask for the definition, what is its usage, pros and cons, warnings, etc. Similar to the Help Desk area, many different syntaxes that a user can supply are collected. For example the answer related to the definition can be activated by the sentences illustrated in the figure. This virtual agent's area can be seen as an interactive glossary or a "quick answer teacher" but does not have to substitute the main learning sources that are, and remain, the learning objects. When the user wants more information, the virtual agent will refer him/her to the learning object that discusses the requested content.

## 6.6 Ongoing Presence

In order to keep learners motivated, the COACH BOT interacts with each learner throughout the course in different ways by providing ongoing verbal feedback during the learning process. Learners can receive positive feedback when they are proceeding well or notified when they are studying too slowly or when they do not study specific fundamental lessons.

- The project's didactic goal for the course is to ensure that each student completes at least 80 % of the compulsory learning material. This in turn depends on the performance results of the student's start up quizzes. Two thresholds have been fixed in order to trigger virtual assistant interventions: 40 % of the learning material completed by the student at mid course and 60 % of the learning material completed at three quarters of the course.

## 6.7 Final Assessment

The aim of the final assessment is to determine what the student has learned from the e-course with the help of the virtual agent. Ideally students should obtain better results than the startup quiz, thanks to the e-course curriculum. Each learning path will feature the same number of final quizzes as start up

quizzes and consequently modules. A singular final quiz will be presented in the exercise section on the E-learning platform, only if the student has answered all the different startup quiz questions correctly at the beginning of the course and if he/she has studied the corresponding module 'enough' according to the tracking results.

Technically, the concept of studying 'enough' signifies that a student has accessed all compulsory learning objects within a module within the expected time predefined by the didactic development team. When a student answers some of the startup quiz questions incorrectly, he/she should ideally study the respective module and repeat the same process for the next modules. The virtual agent suggests this same study tip concept throughout the course. In case the student answers all the questions in the different startup quizzes correctly, he/she will have no questions to answer in the final quizzes.

## 6.8 Case Study

Case studies aim at enhancing the student's knowledge by showing a practical case study and then testing the student's ability to implement the acquired skills. The COACH BOT will present three case studies at the end of the course through the Machinima technique. Machinima is the use of real-time three-dimensional (3-D) graphics rendering engines to generate computer animation. In particular, Linden lab's Second Life will be used to create these highly engaging 3-D animations.

## 7 THE EXPERIMENTATION

The experimentation methodology consists of two test groups that will follow the same e-course:

- the **experimental group**: trainees who take the e-course with the support of the virtual COACH BOT;
- the **control group**: trainees who take the e-course without the support of the virtual COACH BOT.

These two different groups will offer meaningful data for analyzing the effectiveness of the virtual coaching facility. The two different questionnaires will be given to both the control and experimentation groups:

- "Expectations questionnaire" delivered at the beginning of the e-course.
- "Customer satisfaction questionnaire" delivered at the end of the e-course.

The questionnaire results will be compared in order to assess different self-perceptions, the level of satisfaction of the e-course contents, structure and virtual support and to compare the achieved results with users' initial expectations. Moreover, a follow up session will be held two months after the end of the e-course to assess the pilot application usability and transferability through the arrangement of three focus groups, namely:

- 1° experimental group users
- 2° control group users
- 3° mixed focus group

This method will provide qualitative data from different points of view incorporating all three types of group sessions.

## 8 CONCLUSIONS

The real innovation of the COACH BOT project is the embedding of a pedagogical agent in an open source and SCORM compliant learning management system. The virtual agent becomes a mentor, a coach, a teacher, a didactic or technical tutor depending on the student's type of learning activity. This project provides the premises to provide the distance learning community with a multiple purpose pedagogical agent that is easy to integrate in any open source LMS like Moodle, ILIAS, Dokeos, Atutor, etc. This is true also because the pedagogical agent has been implemented as an independent module even if the student is perceiving it as if it was completely embedded in the E-Learning platform.

Considering these aspects, the COACH BOT project is therefore in line with the priorities of the European Lifelong Learning Programme who financed the project based on its implementation of a new methodology in the E-learning field.

From a technological viewpoint, different improvements can be made to the project as a follow up in the future, such as:

- The guidance interview that creates a profile (cluster) of the students can be further developed by means of adaptive neural networks that are very appropriate for classification purposes.
- The start-up quizzes that test student's prior knowledge can be processed by means of Fuzzy logic inference engines to guarantee more flexibility in understanding student's didactic needs.
- Classes could be conducted in virtual worlds by a pedagogical intelligent agent that would

always be present and available for students independently of when the real teacher was available or online.

- Additional conversational agent technologies e.g. Autotutor with The DAN (Dialog Advanced Network) and the LSA (Latent Semantic Analysis) systems can be experimented.

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