Proposal of a New Approach for Supplementary tutoring Online

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Abstract— **This paper presents an approach for online tutoring adapted to the needs of each learner through a system to overcome the encountered difficulties.**
Theorically, we will be based on:
- **The pedagogy of error considering the error as a better tool for teaching.**
- **The differential pedagogy that enables all learners to develop optimally.**

Technologically, we will use the concepts and methods of the multiagents approach for the design of our environment. In the system to develop, the Supplementary tutoring could become an essential asset in a strategy of change towards a true differentiation. It will build customized learning situations for each type of learner.

Index Terms— **differential pedagogy, intelligent tutoring system, learner profile, multiagents system, ontologies, pedagogy of error.**

I. INTRODUCTION

At the exit of the school, the remedial courses are in continuum with the public school. It even constitutes a learning way which replaces it, and which is perceived like essential by the majority of learners and their parents because of the adverse conditions of public school which the most significant are: the excess of students in classes, and also the limited situation of the teacher in the curriculum as well as the number of hours allotted there.

Supplementary tutoring includes two different activities: the most widespread is that of the private Supplementary tutoring in school subjects, the other one is the support online [1].

A. Private Supplementary Tutoring

As Glasman (2004) defined it, the private supplementary tutoring are courses given on a purely paying basis outside school hours in academic subjects that students learn in school [2].

They are given by people receiving benefits who can be teachers or students, doing individually, or a part of a commercial structure which remunerates them or puts them in relation with customers.

These courses are given in individual form, or small groups of students at providers' or students' homes or at the premises of a specialized company.

In the reality lived at the Moroccan public schools, these courses are given, in most of the time, in the form of group made up of almost all students of the class who come to the sessions of tutoring each with his objective: some to overcome their difficulties and others just to have a high mark. And therefore, the teacher is under the same adverse conditions as in the classical courses: the problem of the overcrowded classes persists, and it's difficult for the teacher to choose the right learning strategy as well as to provide support adapted to the needs of the learner. Consequently, learners with learning difficulties do not overcome them.

B. Support Online (Online Accompaniment)

On the Internet, all learners registering on a support site online perform the same exercises whatever are the encountered difficulties, their level, and their learning style.

In a situation of a misunderstanding or an error, the learner has to repeat the same exercise without knowing the origin of his error, or to check the solution or move on.

We suggest in our research to present an online support system that will help the learner to overcome difficulties, to know the origin of his error, and after adapt to him the adequate learning situation.

The benefit from support online adapted to the learner's needs is: [3] [4]

- To be followed throughout his schooling.
- To optimize his chances of success.
- To have a real transmission of the knowledge with various methodological tools and different learning strategies.
- To profit of a personalized school accompaniment which makes it possible to cope with the intensity of the curriculum, to remain in the rhythm and to even take the advance.
- To offer a school accompaniment which rests on a flexible and evolutionary pedagogy: flexible because the tutoring agents are listening of the requests of their learners, and evolutionary because the interest is to make learners more autonomous and more resistant to the stress

II. PEDAGOGY OF ERRORS

In education, as in life, the error is mainly perceived negatively, it is disappointing and expensive. The failure can be seen as the result of errors so the error is taken as an index of failure. Classical education did everything to banish the error in all components of the activity of students and teachers. This is also to avoid the mistakes that we develop knowledge and technology, and that teaches them. [5] Yet in all modern theories of knowledge construction, psychological or epistemological theories, from Poincare to Skinner, to Piaget and to Bachelard , and in various forms, the role of the error in the adaptation, and therefore in learning, has been reported as fundamental. The game of trial and error leads to an empirical adaptation to the conditions and ensures the acquisition. [6]

It is difficult to speak of evaluation without naming error, which by its omnipresence in the academic discourse justifies the first. In our research we will take into account that:

- The error status is inseparable from the educational- learning process
- The error analysis is complex.
- The error is essential to learners' progress.

To achieve our goal we will propose to conceive an environment that enables us to:

- Analyze students' errors.
- Prevent , predict , exploit them,
- Identify known obstacles related to knowledge present in a teaching content and learning situations to overcome those obstacles.

III. DIFFERENTIAL PEDAGOGY

The differential pedagogy is a process that involves implementing a diverse set of resources and learning strategies to enable heterogeneous learners to achieve, by different routes, their objectives.

There are four forms of differentiation [7] :

- To differentiate the content: What the student learns.
- To differentiate the structures (environment in which the trainings and the evaluations are done)
- To differentiate the process: This is to vary the means and learning situations taking into account the various ways in which students process information to support the intended learning.
- To differentiate the productions: Is to allow students to use different vehicles to show what they have learned or understood.

In our proposal approach we will be based on the differentiation by process to adapt learning situations to learners' needs, considering that Differentiating instruction involves responding constructively to what learners know. It also means providing multiple learning pathways so that learners can have access to the most appropriate learning opportunities commensurate with their capacity to learn. It involves matching learners' approach to learning with the most appropriate pedagogy.

In other words, Differentiation is recognised as a means for meeting the individual needs of all learners and particularly for those who have exceptional learning profiles. For those exceptional learners who have learning difficulties, this differentiation is seen as the responsibility of our proposed system.

IV. MULTIAGENTS SYSTEMS

An agent can be a physical or virtual entity that can act, perceive its environment (in a partial way) and communicate with others, is autonomous and has skills to achieve its goals and tendencies. It is in a multi-agent system that contains an environment, objects and agents (the agents being the only ones to act), relations between all the entities, a set of operations that can be performed by the entities and the changes of the universe in time and due to these actions. The main application of multi-agent systems can be listed as follows [8]:

- **Problem Solving**: As an alternative to centralised problem solving, either because problems are themselves distributed, or because the distribution of problem solving between different agents reveals itself to be more efficient way to organise the problem solving - it can be flexible and allow failures in the system - or because, in some cases, it is the only way to solve the problem.

- **Multi-Agent Simulation**: Simulation is widely used to enhance knowledge in biology or in social science and MAS gives us the possibility to make artificial universes that are small laboratories for the testing of theories about local behaviours.

- **Construction of Synthetic Worlds**: These artificial universes can be used to describe specific interaction mechanisms and analyse their impact at a global level in the system. The entities that are represented are usually called animats, since they are mainly inspired by animal behaviours (hunting, searching or gathering habits). The aim of this research is to have societies of agents that are very flexible and can adapt even in cases of individual failure. (For example, when robots are sent on an expedition and they are required to be very independent from the instructions they could receive.)

- **Collective Robotics**: Defining the robots as multi-agent systems where each subsystem has a specific goal and deals with that goal only. Once all the small tasks are accomplished the big task is too. multi-agent systems approaches can also be used in the co-ordination of different mobile robots in a common space.

- **Kenetic Program Design:** multi-agent systems can also be seen as a very efficient modular way to program.

The multi-agents approach is a required approach for complex systems, their fully decentralized approach makes them particularly adapted for the type of our proposal system.
And that allows us to work on the overall operation of a system by focusing on the entities that compose it and their interactions.

V. ARCHITECTURE OF INTELLIGENT TUTORING SYSTEMS

An intelligent tutoring system is a system that provides direct customized instruction or feedback to learners without the intervention of human beings [9] .The usually accepted architecture of the intelligent tutoring system is composed of four different subsystems or modules: learner module, domain module, planner and tutor. These four modules collaborate to supply a learning adapted to the specific needs for a learner. The figure1 presents the typical structure of an intelligent Tutoring System [10].
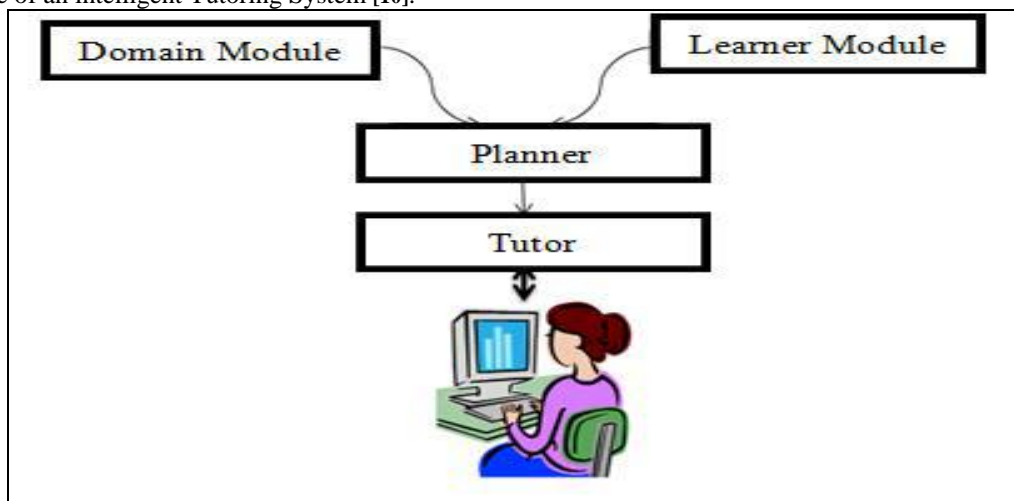

Fig. 1. Architecture of Intelligent Tutoring System

A. Domain module

The domain module contains the relative information with the materials taught. This information must be easy in order to be usable by the others modules of the intelligent tutoring system.

B. Learner module

As its name indicates, the learner module has to supply information about the learner.
He therefore informs about the level of the subject' knowledge. According to the complexity of the module, it informs also on a number of features of this learner.
The system's knowledge of the learner can be represented by various manners such as overlay model, semantic networks, learner profile, or models of fuzzy logic.
The most frequently representations used are [11] : overly Model, buggy Model and stereotypical model.

- The Overlay Model: This method appeared with the first educational systems which consider the learner module as a subset of the domain module that lacks information. In this case the purpose of learning is to get a perfect overlay model of the learner on the domain module

- The Buggy Model: This second method is an extension of the previous one. Introduced by [12], it consists of adding to data from the method overlay a list of errors made by the learner.

- The goal is then to consider these bugs and try to understand their origins
- The stereotypical model: In a stereotypical model properties and learner's knowledge are represented with combinations of values assigned to stereotypes such as beginner, intermediate, expert.
- A learner inherits all the properties defined by a stereotype.

C. The Planner Module

The planner use the data obtained of the learner module to make choices among the available learning elements proposed by the domain module.
There still, the representation and the organization of knowledge in the domain module are dominating for the implementation of the planner module.

D. The Tutor Module

The tutor plays the part of interface between the system and the learner, this module has two objectives:
- Detection: it must make it possible to obtain information of the learner and to transmit it to the learner module to allow the update of this last.
- Action: it must apply by means of its graphic interface the decision taken in planner module is inspired for that by a strategy of learning.

VI. PROPOSED APPROACH

The objective of this research is to propose an intelligent system of an online support adapted to the learners 'needs according to the mistakes made by the learner after having carried out a series of exercises suggested by the system. After having carried out a diagnostic evaluation, the agents allow the location and ranking of the errors. According to the collected errors, the type of the pedagogical obstacle is determined, and after a specific training sequence will be started. To achieve our goal we propose:
- A representation of the links between errors and pedagogical obstacles which cause them.
- A design of multiagents which ensures the follow-up, the collection of the errors and the proposal of the adequate learning sequence.
- Experimentation in a specific field.

VII. OPERATION OF OUR PROPOSED SYSTEM

We propose to present an online support system that will help the learner to overcome difficulties, to know the origin of his error by adapting to him the adequate learning situation.
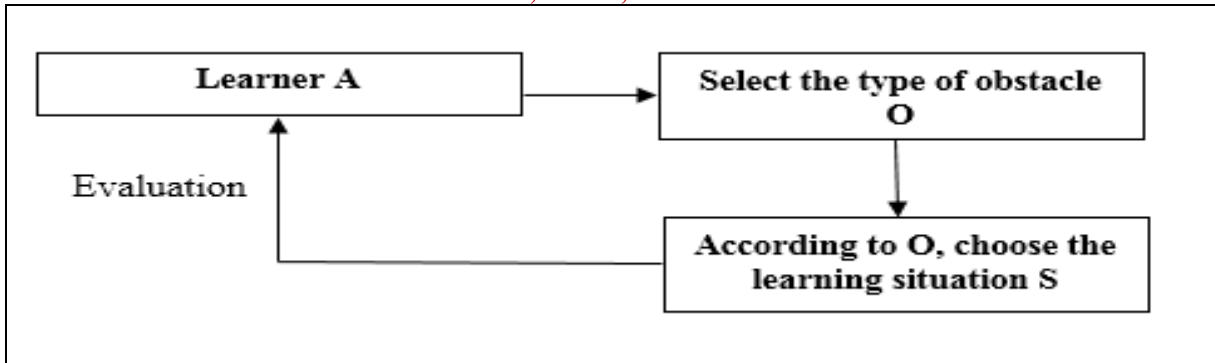
Fig. 2. Operation of our Proposed System

VIII. EXTRACT OF PROPOSED SYSTEM

In this part we present the different agents to be integrated in our proposal system.

For each learner connected to our system:

An agent (error collecting) follows his activity, collects the errors he made, and will provide a list containing the errors to another agent in interaction with him (learner Agent), that will select the learner profile according to this list.

Then, according to this learner profile the sequence agent offer the adequate learning sequence that will responds to the needs of our learner.

The figure3 presents an extract from the proposed system and the agents to be integrated, which ensures the follow-up, the collection of the errors and the proposal of the adequate learning sequence.
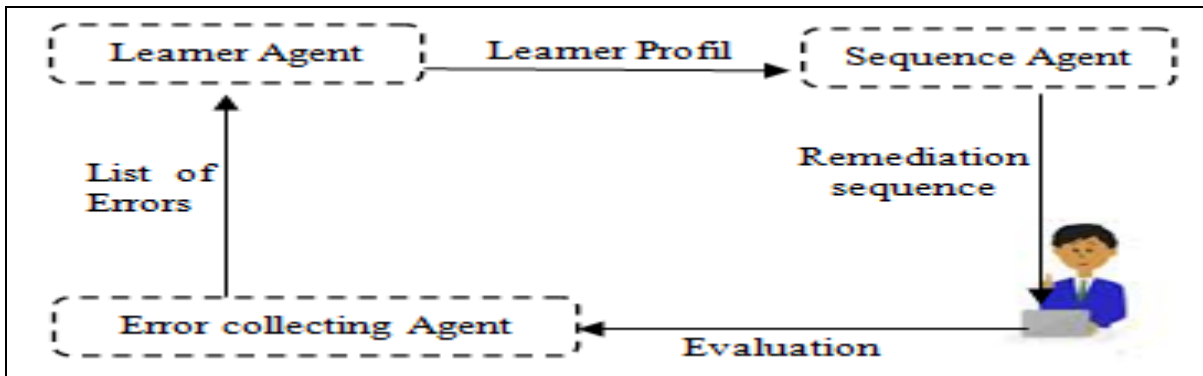

Fig. 3. Extract from proposal System

IX. CONCLUSION

In this paper, we presented a proposition of an intelligent tutoring system for a Support Online which adapted to the learners 'needs according to the mistakes they made. We are limited to the general architecture based on the four component modules on the intelligent tutoring system by alluding to the agents to be integrated. Those agents will ensure the follow-up, the collection of the errors and the proposal of the adequate learning sequence. The next step is to develop the idea by integrating a diagnostic module, which should assign dynamics profiles to different learners and we will propose the conception and of our system.

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