SUPPORTING THE AUTONOMOUS LEARNING PROCESS WITH SIENA

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Abstract: This paper present a tool called SIENA that helps in the building knowledge in an autonomous learning process through: a) an open student model; and b) a student conceptual map to explorer and for instrospection. However, this new tool uses adaptive tests based on a Progressive Inquiry (PI) model. This tool has been used for teaching Computer Architecture in the School of Computer Science in the University of La Laguna, Canary Island.

1 INTRODUCTION

The european convergence process proposes an European Space of High Education which has involved to remove a teaching-learning centered in the teacher and a passive traditional learning and it proposes a new model which is centered in the learner and the second part of the binomial teaching-learning. Moreover, the concept of e-learning is moving to e-learning 2.0, where the keys and tools are the social nets, the collaboration and the autonomy, where the student can control his own learning (Kay, 2001).

New technologies have contributed to this new approach with blending learning and social tools. In order to obtain this kind of learning and the same time a significative learning where it is emphasized the social component of learning is essential to create new tools, new learning materials as well as specific applications in different subjects of knowledge.

On the other hand, the key in the educational process is that students can achieve the learning objectives effectively. That means to help the student acquire the required level of knowledge and skills in the subject domain. Thereby, it is necessary to adapt the teaching to each student particular needs. It is commonly agreed that, for adaptation, some kind of student representation is needed. One of the most common mechanisms to represent the state and evolution of student learning are Student Models.

The present works deals with the representation of the building knowledge in an autonomous learning process with through: a) an open student model; and b) a tool called SIENA, a student conceptual map explorer and instrospection.

2 OPENING STUDENT MODEL

Student Models can help teachers and students to pick up the learning characteristics of student and his evolution during the learning process.

The goal of any Student Model is to collect the information related to the student that influences in his/her learning such as the level of knowledge, the acquired skills, the learning objectives, the learning preferences, etc.

Usually, in the traditional Student Model the access to the data they contain is a problem. So, the community of Artificial Intelligence in Education has proposed the Open Student Model, where the student representation is designed for allowing inspection. This model allows the direct intervention of students in the process of diagnosis, and that permit to infer the knowledge that students has on the learning-teaching domain (Dimitrova, 2002).

This type of student model can be inspected by: a) the own student, b) his classmates and c) his

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teachers (Bull&Nghiem, 2002). The fact that a student can access to his own model, help him to better understand which learning strategy is following, because a new source of information is available. With this source he can think about his own learning Bull, S., McEvloy, A.T. & Reid, E., 2003).

Systems building under this perspective allow externalizing the student models, and in some cases, providing mechanism to teachers and students, can change the contents. The selection of an effective mechanism of communication reduces problems of understanding of the behaviour of student (Dimitrova *et al*., 2002).

Student model and conceptual graphs are a power tools to represent the knowledge. The knowledge represented in a visual way is easier to explore and understand. Cook y Kay (1994) was pioneer in to mix text and conceptual trees based on diagrams. Other approach of Dimitrova et al. (2002), is the inspection and discussion of a student model trough conceptual graphs (Rueda U; Larrañaga M; Arruarte A; Elorriaga Jon A., 2004).

Taken into account these previous works, we have developed a tool called SIENA, where the Student Model is represented and where the processes where each student can build his knowledge about a particular domain, in this case Computer Architecture.

3 WITH RESPECT TO SIENA

SIENA stands for Sistema Integrado de Enseñanza-Aprendizaje, and in English SCOMAX/SCOMIN: Student Conceptual Map Explorer/Student Conceptual Map Instrospection. It is a new tool to provide the learning which is based on conceptual maps, adaptive tests and a Progressive Inquiry (PI) model (Leinonen, T., Virtanen, O., Hakkarainen, K., Kligyte, G., 2002; Morales, R., Pain, H. and Conlon, T., 1999)

SIENA requires a conceptual map which is exported from Compendium called Pedagogical Concept Instructional Graph PCIG. It consists of a map with an organization among the nodes which are situated in the map in the order that the students requires for its comprehension. The student can visualize in the graph and the nodes his own state of knowledge in real time.

This tool has two main objectives:

1.- To allow to the teachers to know the skills of students about a subject.

2.- Self-evaluation of students in a autonomous virtual learning.

SIENA was building to solve the problem related to handling information flows in a knowledge-building environment, making students more aware of the nature of progressive inquiry process (Le Mans, France. Mühlenbrock, M., Tewissen, F., Hoppe, H.U., 1998).

The pedagogical model of progressive inquiry learning (PI model) was designed to facilitate engagement in an in-depth process of inquiry and expert-like working with knowledge.

The purpose of this tool was to develop and test a new pedagogical tool helping students to gain on more efficient meta-cognitive thinking by helping students to raise important ideas from the knowledge building, being more aware of the group common activities and stage in the progressive inquiry process.

The idea was to give students some real-time software tools helping them to make their own interpretations of the process they are involved in.

The tool presents the contents and carries out a test based on Bayesian networks among concepts and questions in all the nodes of a conceptual map of a subject. However, the questions in the adaptive test follow the scheme of the PI model, in this way:

a) Setting up the Context: questions about problems to central conceptual principles of the domain of knowledge in question or to authentic, rich real-world problem situations

b) Presenting Research Problems: questions or problems that guide the process, explanation-seeking why and how questions.

c) Creating Working Theories: conjectures, hypotheses, theories or interpretations for the problem being investigated, explication and externalization of these intuitive conceptions (through guiding students, for instance, to write about their ideas).

d) Critical Evaluation: to assess strengths and the weaknesses of different explanations and identify contradictory explanations, gaps of knowledge, and limitations of the power of intuitive explanation.

e) Searching Deepening Knowledge: search for new scientific information about the problem.

f) Developing Deepening Problems: weaknesses or limitations, questions and working theories often provide significant guidance for inquiry.

All aspects of inquiry, such as setting up research questions, searching for new scientific information, constructing of one's own working theories or assessing the explanations generated, are to be shared with other inquirers. These is the last phase of inquiry process, called "distributed expertise", and consist in explaining a problem to other inquirers.

4 FURTHER WORKS: COLLABORATIVE BUILDING OF KNOWLEDGE WITH SIENA

Advancement of inquiry can be substantially elicited by relying on socially distributed cognitive resources emerging through social interaction between the learners, and collaborative efforts to advance shared understanding (Hoppe, U.,1995). Through social interaction, contradictions, inconsistencies and limitations of a student's explanations become available because it forces him or her to perceive conceptualizations from different points of view.

For this reason, we are working on building a model of group represented from the information of the individual models, and with new information, such us, solidarity in the development of tasks and collaborations among students in the tasks carried out on SIENA, dialogues, etc. So, with this new model, will be possible visualize the interaction among students, with four basic elements that influence the formation of group: a) presence, in a particular activity, b) identity, of students c) interaction, among students y d) communication (Zapata-Rivera, J. and Greer, G., 2000; Rueda, U., Larrañaga, M., Arruarte, A., Elorriaga, J.A., 2003).

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