LEARNER MODELLING COMPUTER NETWORK TEXT COMPREHENSION IN RETUDIS

Grigoriadou Maria
University of Athens, Dept. of Informatics & Telecommunications
Ilisia Panepisthmiopolis GR-15784, Athens, Greece
gregor@di.uoa.gr

Tsaganou Grammatiki
University of Athens, Dept. of Informatics & Telecommunications
Ilisia Panepisthmiopolis GR-15784, Athens, Greece
gram@di.uoa.gr

ABSTRACT

The Reflective Tutorial Dialogue System (ReTuDiS) is an open learner modelling system for text comprehension. The system makes diagnosis of the learners' cognitive profile and engages them in a reflective dialogue. In this paper we present the application of ReTuDiS for computer network text comprehension. Learners participate in a reflective dialogue concerning computer network topology. The dialogue promotes learners' reflection and helps them become aware of their reasoning, a fact which leads them towards scientific thought.

KEYWORDS

Learner modelling, technical text comprehension and reflective dialogue.

1. INTRODUCTION

Recently, there has been growing concern about scientific text comprehension [2]. Efficient teaching and learning requires that tutors should be familiar with the difficulties which learners are likely to face. For example, the learners' difficulties regarding concepts relevant to computer network organization and operation suggest research into alternative learning and teaching approaches. In this paper we present issues, which focus on assisting comprehension through reflective dialogue supported by a learner modelling system.

Tutorial dialogue has many positive characteristics for promoting learning. It provides learners with a learning environment that is appropriate for the accomplishment of learning goals. It provides tutors the opportunity to tailor instruction to individual learners' needs. Reflective tutorial dialogue between a learner and the system about the learner's own beliefs can make a learner model open [16], [21]. Interactive open learner modeling involves human learners in learning dialogues to improve learning through promoting and facilitating reflection. Advanced computer learning environments require open learner models, which promote reflection, in order to help learners overcome their learning difficulties [3], [4]. Open learner models encourage learners to reflect on the domain being studied, on their own strategies for learning and on their own understanding. Towards this direction, the dialogue management, the dialogue strategies and the dialogue tactics, which mainly formulate the dialogue framework, aim at the promotion of reflection in learning [9], [24], [32]. Through dialogue learners defend their views to the system by collaborating, discussing and arguing the assessment, which the system has made of their knowledge and beliefs. The recently growing interest in opening the learner model to the learner encourages the development of tutorial dialogue systems which give learners greater responsibility and control over their learning process [16].

There are systems in the literature supporting learner models, which are related to text comprehension. SimStudents, an integrated learner model, for story and equation problem solving uses an ACT-R based cognitive model [18]. Other systems are the Empirical Assessment of Comprehension [19] and the Engines for Education [21]. The model of comprehension and recall [8] is based upon Trabasso & Van den Broek's model [26], which considers understanding of text as a process of finding (by the reader) the causal path that links text from the beginning to its end. Recently, various approaches have been proposed [7], [31] which involve learners in negotiating dialogues, as well as learner models which encourage learners in inspection and modification of the model. Moreover, developments promoting collaborative learner modelling such as SQL-Tutor [3], dialogue planning [9], learner reflection through discussion such as StyLe-OLM [7], mixed -initiative dialogue [20], dialogue management [9], [32] and tutorial dialogue [24] have been explored. ATLAS-ANDES is a tutorial dialogue system, which uses a combination of knowledge construction dialogues and allows the generation of tutorial dialogues [32]. ScoT is a scalable, reusable and conversational tutorial dialogue system [24]. ReTuDiS (Reflective Tutorial Dialogue System) is an open learner modelling system for text comprehension [12], [28].

In this paper we present the adaptation of ReTuDiS for computer network topology text comprehension. In the second section, we focus on theories and research concerning scientific text comprehension. In the third section, we describe ReTuDiS applied for computer network topology text comprehension. A detailed description of the diagnosis and dialogue part is presented. Finally, we conclude and give our future perspectives.

2. TECHNICAL TEXT COMPREHENSION

Many studies on text comprehension have focused their interest on the sentence structure presented by the text [2], [25], [29], [17]. Van Dijk & Kintsch [29] hold that sentence structure of a text could be organized on the basis of hierarchy in order to allow the importance of sentences in the text to be revealed. Sentences on the upper hierarchy levels are structurally characterized as important information, whereas those at the lower levels are characterized as conveying usual and less significant information. The cognitive psychological approach in text comprehension suggests that the internal variables of the reader hold a primary role in text comprehension, such as his personal goals, interests and pre-existing knowledge. However, cognitive science does not ignore the influence of the text form, in which factors such as text cohesion and logical coherence of facts presented have been proved to be significant elements that facilitate its comprehension. In a DeCorte, Verschaffel and DeWin research [6], it has been shown that small changes on problem formulation had a great impact in problem comprehension and problem solving by learners.

In approaching the technical text comprehension, many researchers have been examining issues that are focusing on assisting comprehension through the design of the text form. These efforts assume that readers build mental representations of information contained in the text. Mental representations capture elements of the surface text, of the referential meaning of the text, and of the interpretation of the referential meaning, thus constructing a micro-world of characters, objects, spatial settings, actions, events, feelings etc [10],[11].

Deniere & Baudet [1] express the opinion that in order to examine the representation constructed by learners during the comprehension process of a text, primary role should be attributed to the understanding of the conceptual categories *state*, *event* and *action*. The term *state* is static and describes a situation in which no change occurs in the course of time. The term *event* refers to an effect, which causes changes but is not provoked by human intervention. The event can be coincidental or provoked by human intervention, e.g. by a machine. An *action* is an effect that causes changes but is originating by a man. This consideration deals with text comprehension as the attribution of meanings to causal connections between occurrences in the text. Learners compose a representation of the text, which contains the cognitive categories: *event*, *state* and *action*. Learners' arguments are based on these three cognitive categories. For the interpretation of learners' cognitive processes their discourse is analysed, in order to trace the recognition (or not) of the three cognitive categories.

Furthermore Deniere & Baudet say that text analysis in relation to the conceptual categories of state, event and action does not suffice. The organization and structure of cognitive representation should be examined on micro and macro-levels.

The person who reads a text gradually constructs the microstructure of the text representation, i.e. the states, event and compound actions of the world described in the text as well as the time and causal relationships that interlock those structures. Deniere & Baudet hold that a person, in order to be able to explain the operation of a technical system on a micro-level scale has to construct a representation of the "natural flow of things", where every new event should be causally explained by the conditions of events which have already occurred. The creation of a text that allows a precise description of a technical system and facilitates readers in constructing its microstructure representation must involve:

- The description of the units that constitute the system based on the causal relationship which unites them.
- The description of event sequence taking place in these units in respect of the cause affecting them as well as of the changes they bring to the state of the system.

On macro-level, the development of the macrostructure by readers is achieved through the reconstruction of the microstructure and the establishment of a hierarchical structure with goals and sub-goals. The creation of a text which facilitates readers in constructing its macrostructure representation for a technical system must involve the teleological hierarchical structure of goals and sub-goals of the various operations as well as their implications.

3. RETUDIS FOR COMPUTER NETWORK TEXT COMPREHENSION

ReTuDiS is a diagnosis and tutorial dialogue learner modelling system for text comprehension, which infers learners' cognitive profile in order to construct and revise the learner model with the learners' participation [12], [27]. ReTuDiS consists of two parts: the Diagnosis part and the Dialogue part [13], [28].

3.1 The Diagnosis Part of ReTuDiS

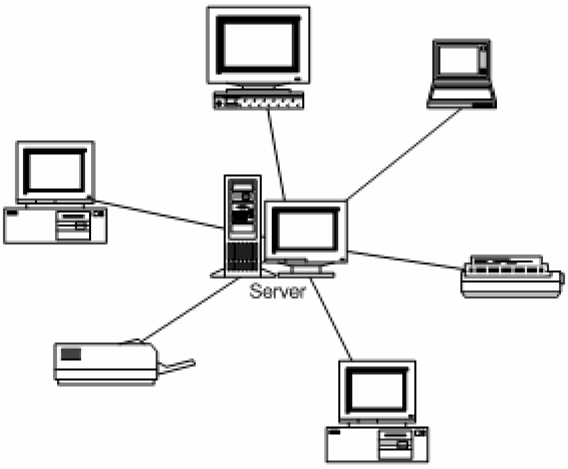
The diagnosis part of ReTuDiS is based on Baudet & Denhière's theory about text comprehension [1]. The technical text describes a local network - a system of units (server, workstations and peripherals) connected according to a topology. Messages are sent and received between the local network devices causing events. There are causal and temporal relationships between events [14]. At the end of a sequence of events the system changes its state returning from one state to another.

The Diagnosis part of ReTuDiS engages learners in an activity which includes reading comprehension of the local network text and answering question-pairs by using given alternative answers. Learners' answers are used for diagnosing learners' text comprehension. The text includes factors, which represent the two cognitive categories *state* and *event*. For every factor a question-pair, is submitted to the learners. The first question in the question-pair is related to the causal importance of this factor for the proper function of a local network and the learners' answer concerning this question is called *position*. The second question is related to the learners' justification concerning the selected position and is called *justification*. Learners have to study all the text to comprehend it, to compare each factor with the others and then select answers from the given alternative answers, in order to express their position on certain issues and support it by a justification. The alternative answers concerning position and justification are classified as *valid*, *towards-valid* or *non-valid*.

Local Network Topologies

A local area network (LAN) is a computer network covering a local area, like a home, office or small group of buildings such as a college. A LAN consists of many devices (file server, workstations and peripherals) which make common use of a transmission medium with high-data speeds. Each device is called a node of the network.

The topology of a network dictates its physical structure and refers to the configuration of cables, computers, and other peripherals. How different nodes in a network are connected to each other and how they communicate, the methods in other words that workstations use to access and transmit data on the cable, are determined by the network topology. The physical topologies used in networks are: linear bus, star, star-wired ring and tree.



A star topology is designed with each node connected directly to a central network server, the hub or concentrator, which manages and controls all functions of the network. Nodes communicate across the network by passing data through the server. All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only. Each node submits a connection request to the server to communicate with another node. The server mediates between the nodes testing and managing the requests for communication, sending and receiving messages. The failure of a transmission line linking any peripheral node to the central node will result in the isolation of that peripheral node from all others.

The main advantage of a star network is that one malfunctioning node does not affect the rest of the network, and it is easy to add and remove nodes and detect faults. The main disadvantage of star networks is that they require more cabling than other topologies. In addition, the entire network becomes unusable, if the central computer fails.

Question-pair 1

1a) Which device plays the most important role in a star topology local network and which the less important.

1. Server- workstation- printer (towards-valid)
2. Workstation- server- printer (non-valid)
3. Server- printer- workstation (valid)
4. Printer- Server- workstation (non-valid)

1b) Justify your answer

1. Because the network malfunctions without a server and printing jobs stop for all workstations without a printer (valid)
2. Because the network malfunctions without a server and a user is off line without a workstation (towards -valid)
3. Because the network malfunctions without a workstation and the printer can not receive and print data without a server (non-valid)

Figure 1. Local network text - Star topology and question-pair 1

Figure 1 depicts a fragment of a technical text concerning computer network topologies. It also depicts question-pair 1 and alternative answers with (non-visible by the learner) characterizations.

For every question-pair the combination of the learner's *position* and the corresponding *justification* constitutes the learner's *argument*. An *argument* is defined as *complete*, when both position and justification are valid. Otherwise the argument is *non-complete*. The expert defines the different degrees of *argument completeness*. The argument completeness, which is associated with the recognition (or not) of an instance of a cognitive category, is used as a vehicle for revealing the degree of recognition (or not) of the corresponding cognitive category.

All possible combinations of position-justification pairs give the corresponding argument completeness. Possible values of argument completeness are: c*omplete, almost complete, intermediate, nearly incomplete* and *incomplete.* Learners' cognitive profiles of computer network text comprehension are formulated taking into account the number of their arguments with high degree of argument completeness. The cognitive profile expresses the degree of recognition of the cognitive categories. Possible values of cognitive profiles are: *very low*, *low*, *nearly low*, *below intermediate*, *above intermediate*, *nearly high*, *high* and *very high.* The Diagnosis system infers the argument completeness of all the learners' arguments.

3.2 The Dialogue part of ReTuDiS

The dialogue generator is based on the learners' cognitive profile, inferred by the diagnosis part, the learners' answers to question-pairs and the selected by the human tutor dialogue strategy offered by the system [28]. The dialogue generator activates the appropriate for the learner sequence of dialogue-parts, and using the dialogue plan, dynamically constructs the individualized learning dialogue. Dialogues are appropriate to learners' learning difficulties, as they appear according to their learner model. The system has a library of dialogue-parts at its disposal, each of which is designed to remedy a particular learning difficulty. In order to generate the appropriate dialogue in response to the learners' feedback, the system first analyzes the learners' essays, in order to assess which are the contradictions within their arguments.

3.2.1 Dialogue Strategies

ReTuDiS is designed to allow for reflective tutoring. In order to construct an initial overall tutoring plan, the system uses information from an annotated record of the learner's performance in the comprehension activity concerning the computer network topology text. The strategy used for taking instructional decisions and constructing the initial tutorial plan is strategy 2 of ReTuDiS [28].
Strategy: The system sorts learners' argument characterizations in a list according to decreasing degree of argument completeness. The tutorial dialogue begins with a discussion about the factor for which the learner seems to face the least number of learning difficulties. The system generates the sequence of dialogue-parts for this factor. Then the system prepares the next dialogue-part, based on the results of the previous dialogue-part.

3.2.2 Dialogue-part Library

The *specific* dialogue-parts of different types are shown in Table 1. Each specific dialogue-part is seen as a reusable component, which is dependent on the specific text. Specific dialogue-parts which learners use in the dialogue are the alternative answers.

Table 1: Dialogue-part library- Specific parts

types of dialogue-parts	**dialogue-parts**
factors	- importance of devices in star topology
learner argumentations expressing:	
scientific thought	- the network malfunctions without a server and printing jobs stop for all workstations without a printer
experience	- the workstations are not able to send data between each other
quantity	- the network malfunctions without a server and a user is off line without a workstation
cyclic thought	- the network malfunctions without a workstation and the printer can not receive and print data without a server
system argumentations expressing:	
counterexamples	In case a user shuts down his/her workstation, can the others print?
generation of hypothesis	Form the hypothesis that the server malfunctions. Do we have a working local network? Can any workstation print?

3.2.3 Dialogue plan

The dialogue is generated in 4 stages. Learners are involved in interactive dialogue with the system concerning their contradictions within his arguments through a series of reflective activities where the system:

- *encourages participation in dialogue*: The system makes learners aware of the general framework of the assessment results, that is whether learners are correct or not and encourages them to take their first decision to participate in the discussion.
- *indicates contradictions:* The system uses qualitative criteria to indicate the points where there are contradictions between learners' position and their justification.
- *schedules dialogue tactics*: Learners' decisions can guide the system to use the appropriate individualized dialogue tactics (by giving an example, a counterexample or generating a hypothesis)
- *motivates discussion and justification:* The system discusses and justifies itself while arguing with learners about their contradictions.
- *encourages participation in diagnosis*: The system encourages learners to try again to read the text and answer the questions. So, learners are involved in the diagnosis process and the revision of the learner model.

3.2.4 Dialogue Tactics

The following dialogue (Table 2) illustrates the system-learner interaction concerning *question-pair 1*. The learner's position is *valid* and his/her justification is *towards-valid* (answers: 1a)-1 and 1b)-1 of Figure 1). The learner's argument is *nearly incomplete* corresponding to the category *state*. ReTuDiS uses dialogue tactics to support tutorial interactions. For example, in turn 3, the tactics: *selection of counterexamples* and *generation of hypothesis* are used. The learner considers as order of importance the: "Server- workstation-printer". The tutor's counterexample can be "*In case a user shuts down his workstation, can the others print?*" In order to make the learner reason, the tutor generates the hypothesis that "*The server malfunctions. Do we have a working local network? Can any workstation print*?"

Table 2: Dialogue example in 4 turns concerning an argument

1 System: Your answers concerning the IMPORTANCE OF DEVICES IN STAR TOPOLOGY, indicate that you consider A SERVER VERY IMPORTANT FOR NETWORK OPERATION AND A PRINTER LESS IMPORTANT. Your argument is characterized NEARLY INCOMPLETE. Do you want the system to EXPLAIN or to CONTINUE?
Learner: EXPLAIN
2 System: Your answers concerning the IMPORTANCE OF DEVICES IN STAR TOPOLOGY consist of your position and your justification. Your position is that THE ORDER Of IMPORTANCE in a local network is SERVER- WORKSTATION- PRINTER. This is a TOWARDS-VALID position. Your justification for that position is that THE NETWORK MALFUNCTIONS WITHOUT A SERVER AND PRINTING JOBS STOP FOR ALL WORKSTATIONS WITHOUT A PRINTER. This is a VALID justification.
Your position on the IMPORTANCE OF DEVICES IN STAR TOPOLOGY is CONTRADICTORY TO your justification. That is why your argument is characterized NEARLY INCOMPLETE. What do you intent to do now? INSIST or NOT INSIST.
Learner: I INSIST on my position.
3 System: Let's consider that A USER SHUTS DOWN HIS WORKSTATION, CAN THE OTHERS PRINT?
Learner: I believe that THEY CAN'T.
System: So, what is your logical conclusion?
Learner: The order: SERVER- WORKSTATION- PRINTER is not right
4 System: Would **y**ou like to try to answer again?

4. FORMATIVE EVALUATION

Formative evaluation was conducted as part of the development cycle of the system and with the participation of human experts. Evaluation aimed at further revisions, modifications and improvements and focused on indicating problems with dialogue coherence, suitability of dialogue tactics and strategies appropriate for planning effective diagnostic dialogues. The experts were given explanations about the aims of ReTuDiS and asked to explore a variety of potential situations envisaging the behaviour of a learner who would discuss his domain knowledge with the system.

ReTuDiS recorded the learners' answers and inferred their cognitive profiles, taking into their argument completeness for all stated arguments, before and after the application of the reflective dialogue. It is worth noticing that most of the learners with high degree of argument completeness indicated change in their learner models.

In general, dialogue planning appeared suitable for organising dialogue that meets the requirements of dialogue-based interactive and reflective learning. The dialogue tactics in ReTuDiS were considered adequate in respect to maintaining the local focus of the dialogue.

5. CONCLUSIONS AND FUTURE PLANS

In this work we presented knowledge representation of ReTuDiS for computer network text comprehension. Based on diagnostic results, the dialogue generator component engages learners in learning dialogues according to the appropriate dialogue strategy and tactics. The dialogue indicates contradictions within the learners' answers and discusses with them, in order to help them eliminate their contradictions. The dialogue promotes learners' reflection, helps them become aware of their reasoning and construct more coherent arguments while leading them towards scientific thought. The application perspectives of this dialogue-based interactive and reflective learning environment aim at individualized learning, by activating the appropriate dialogue for a learner interactive dialogue with the system. There are apparent educational benefits of the system in that it can change learners' reasoning. In our future plans we foresee further research into the application and evaluation of diagnostic and learning interaction in classroom conditions.

REFERENCES

[1] Baudet S., Denhière G. (1992). *Lecture Comprehension de Texte et Science Cognitive*, Presses Universitaires de France, Paris.

[2] Brown, A.L., & Day, J.D., (1983). Macrorules for summarizing texts: The development of expertise. *Journal of Verbal Learning and Verbal Behavior*, 22, 1–14.

[3] Bull S., (1997). *Collaborative Student Modelling in foreign language learning.* PhD Thesis, University of Edinburgh.

[4] Bull S., Nghien Th. (2002). Helping Learners to Understand Themselves with a Learner Model Open to Students, Peers and Instructors. In Brna P., Dimitrova V. (eds) *Proceedings of Workshop on Individual and Group modelling Methods that Help Learners Understand Themselves, International Conference on ITS,* San Sebastian, Spain

[5] Collins Al., (1987). A Sample Dialogue Based on a Theory of Inquiry Teaching. *In Reigeluth Ch., Instructional Theories in Action*, Lawrence Erlbaum Associates Inc., Hillsdale.

[6] DeCorte, E. Verschaffel, L. & DeWin, L. (1982). Influence of rewording verbal problems on children's problem representations and solutions. *Journal of Educational Psychology*, 77, 460-470.

[7] Dimitrova V. (2002). Interactive Cognitive Modeling Agents- Potentials and Challenges, *Proceedings of 6th International Conference ITS 2002 Workshop*, Spain, 52-62.

[8] Fletcher Ch., van den Broek P., Arthur E. (1996). A Model of Narrative Comprehension and Recall, *In Models of Understanding Text,* (eds) Britton B., Graesser C. Lawrence Erlbaum Associates Inc. Publishers, Mahwah, New Jersey.

[9] Freedman R., (2000). Plan-Based Dialogue Management in a Physics Tutor, *Proceedings of the 6th Applied Natural Language Processing Conference, (ANLP00)*, Seattle.

[10] Goldman, S. R., & Bisanz, G. (2002). Toward a functional analysis of scientific genres: Implications for understanding and learning processes. *In J. Otero, J. A. León, & A. C. Graesser (Eds.), The psychology of science text comprehension, Mahwah*, NJ: Erlbaum, 19-50.

[11] Graesser, A. & Tipping, P. (1999). Chapter 24: Understanding Texts. *In A Companion to Cognitive Science, Bechtel, W. & Graham, G. (eds)* Blackwell, Malden MA.

[12] Grigoriadou M., Tsaganou G., Cavoura Th., (2003). Dialogue-Based Reflective System for Historical Text Comprehension, *Proceedings of the 11th International Conference on Artificial Intelligence in Education Workshop: Learner Modelling for Reflection*, Sydney, Australia, 238-247.

[13] Grigoriadou M., Tsaganou G., Cavoura Th., (2004). Dialogue- Based Personalized Reflective Learning, *Proceedings of the IEEE International Conference on Advanced Learning Technologies (ICALT2004*), Joensuu, Finland, 266-270.

[14] Grigoriadou M., Kanidis V. (2003). Cognitive Aspects in Teaching the Computer Cache Memory with Learning Activities based on a Coherent Technical Text and a Simulation Program. *Proceedings of the 6th Hellenic European Conference on Computer Mathematics & its Applications- Minisymposium: Informatics in Cognitive Sciences*, Athens, 429-235.

[15] Johnson-Laird P.N. (1983). *Mental Models: towards a cognitive science of language, inferences and consciousness*, Cambridge University Press, Cambridge.

[16] Kay J. (2001). Learner control, *User Modeling and User-Adapted Interaction*, 11, 111-127.

[17] Kintsch W. (1998). *Compréhension: a paradigm for cognition*, Cambridge University Press, UK.

[18] MacLaren B., Koedinger K. (2002). When and Why Does Mastery Learning Work: Instructional Experiments with ACT-R “SimStudents”, *Proceedings of 6th International Conference, ITS 2002*, Spain, 355-366.

[19] Mathan S., Koedinger R., (2002). An Empirical Assessment of Comprehension Fostering Features in an Intelligent System. *Proceedings of 6th International Conference, ITS 2002*, Spain, 330-343.

[20] McSherry D. (2002). Mixed-Initiative Dialogue in CBR, *Proceedings of the 6th European ECCBR Workshop on Mixed-Initiative Case Based Reasoning*. Aberdeen, Scotland, 1-8.

[21] Paiva A., Self H. (1995). TAUGUS- A User and Learner Modeling Workbench, *User Modeling and User-Adapted Interaction*, 4, 197-226.

[22] Schank R. C., & Abelson R.P. (1977). *Scripts, plans, goals and understanding*, Lawrence Erlbaum Associates Inc. Publishers, Hillsdale.

[23] Schank, R. & Cleary, C., (1994). *Engines for Education*, from http://www.ils.northwestern.edu/e-for-e/index.html

[24] Schultz K., Bratt E. O., Clark B., Peters S., Ponbarry H., Treeratpituk P. (2003). A Scalable, Reusable, Conversational Tutor: SCoT. *Proceedings of the 11th International Conference on Artificial Intelligence in Education Workshop: Tutorial Dialogue Systems*, Sydney, Australia, 367-377.

[25] Stevens, R.J. (1988). Effects of strategy training on the identification of the main idea of ex-positorypassages. *Journal of Educational Psychology*, 80, 21–26.

[26] Trabasso T. & Van den Broek P. (1985). Causal Thinking and the Representation of Narrative Events, *Journal of Memory and Language*, 24, 612-630.

[27] Tsaganou G., Grigoriadou M., Cavoura Th., Koutra D., (2003). Evaluating an Intelligent Diagnosis System of Historical Text Comprehension, *Expert Systems with Applications*, 25(4), 493-502.

[28] Tsaganou G., Grigoriadou M., Cavoura Th. (2004). W-ReTuDiS: a Reflective Tutorial Dialogue System. *Proceedings of the 4rd Panellenic Conference with International Participation “Information and Communication Technologies in Education” (ETPE2004)*, Athens, 738-746.

[29] Van Dijk, T.A., & Kintsch, W. (1983). Strategies of discourse comprehension. New York: Academic Press.

[30] Williams, J.P. (1986). Research and instructional development on main idea skills. *In J.F. Baumann (Ed.) Teaching Main Idea Comprehension*, Newark, de: International Reading Association, 73–9.

[31] Zapata-Riviera D., Greer J. (2002). Exploring Various Guidance Mechanisms to Support Interaction with Inspectable Learner Models, *Proceedings of 6th International Conference ITS*, Spain, 442-452.

[32] Zinn C., Moore J., Core M., (2002). A 3-Tier Planning Architecture for Managing Tutorial Dialogue, *Proceedings of 6th International Conference*, Spain, 574-584.