ECOMPETENCE SKILLS FOR ADAPTIVE LEARNING ENVIRONMENTS IN HIGHER EDUCATION

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Abstract

Adaptive Learning Environments (ALE) in Higher Education aim to provide academics with flexible learning tools that fulfil the needs of a heterogeneous learning community. ALE can be used to enhance traditional teaching as well as web-based instruction and can promote the implementation of alternative, open modes of learning and instruction. The utilisation of ALE in the educational process requires academics to adopt new didactical approaches, exploit innovative tools and subsequently possess the necessary competences at the technology and education level. The *Education and Language Technology Group*[1] at the Department of Informatics and Telecommunications, University of Athens, has developed a number of learning environments/tools with adaptive capabilities aiming to contribute and strengthen a variety of instructional and learning processes. In this paper we elaborate on eCompetence skills for using ALE in higher education and specifically for using the learning environments/tools we have developed, which focus on Adaptive Educational Hypermedia Systems, Reflective Tutorial Dialogue Systems, Assessment Tools and Synchronous Text-based Communication in Computer Supported Collaborative Learning.

1. Introduction

Research on learning has offered new insights into the instruction and learning process resulting in environments that are student-centred, encouraging students to take control over their own learning and collaborate with other students, connect school to real-life situations and focus on understanding and thinking. Moreover, research shows that there are major developmental differences in learning and that learning is enhanced when students' individual characteristics are taken into consideration. In this context, Adaptive Learning Environments (ALE), designed on the basis of modern learning theories, aim to provide academics with flexible learning tools that fulfil the learning needs of a heterogeneous learning community. ALE can be used in Higher Education to promote the implementation of alternative, open modes of learning and instruction, enhancing traditional teaching as well as web-based instruction. However, the utilisation of these environments requires academics to adapt their work culture, change their attitude towards the instruction process, adopt new didactical approaches and exploit innovative tools for enhancing teaching and learning. We have developed a number of learning environments/tools with adaptive capabilities, aiming to contribute and strengthen a variety of instructional and learning processes. More specifically, these environments/tools support adaptive content delivery, enhance learners' reflection, exploit alternative assessment tools such as concept maps, provide personalised feedback and facilitate learners' communication in collaborative activities. To integrate such tools in the educational process, academics need to appreciate their educational value and understand the underlying pedagogical theories and instructional design. In this paper we

[1] http://hermes.di.uoa.gr

The Challenge of eCompetence in Academic Staff Development, Mac Labhrainn, I., McDonald Legg, C., Schneckenberg, D., Wildt, J., Galway: CELT, 2006.

elaborate on eCompetence skills for using Adaptive Learning Environments in higher education, focusing on Adaptive Educational Hypermedia Systems, Reflective Tutorial Dialogue Systems, Assessment Tools and Synchronous Text-based Communication in Computer Supported Collaborative Learning.

2. eCompetence Skills for Adaptive Educational Hypermedia Systems

The World Wide Web offers the opportunity to develop innovative instructional delivery systems that connect learners with educational resources. The hypermedia form of the educational content in a Web-based educational system makes learning a task-driven process, where learners are motivated to control their access to information and explore alternative navigational paths through the content. Hypermedia implicitly stimulates the user to digress to other information, facilitating cognitive flexibility or stimulating versatility in mental perspective (Kommers, 1996). Adaptive Educational Hypermedia (AEH) systems (Brusilovsky, 1996; Brusilovsky and Peylo, 2003) aim at providing Educational Hypermedia systems with the ability to change dynamically according to the changing learner's state and needs, by introducing adaptation into the hypermedia form of the content. AEH systems, in particular, accommodate individual differences such as knowledge, needs and preferences in terms of providing individualised navigation support, delivering personalised content, adapting the presentation or the layout to the needs of the learner.

In the framework of designing, organising and setting up lessons to be delivered through an AEH system, the instructors need to possess skills for:

- *Designing lessons based on an instructional framework.* The instructor, in order to build lessons for a particular AEH system, needs to be familiar with the instructional framework underlying the development and delivery of content.

- *Designing e-content for an AEH system.* The instructor, in order to develop courseware to be used for personalised instruction, needs to modularise the content and design its hypermedia representation. The content modularisation allows the system to re-use its components under different contexts and learners' profiles. The instructor needs to determine the learning outcomes, analyse the content and modularise it into re-usable components, which reflect the main topics of the domain and are physically and conceptually connected and interrelated. The instructor also needs to take into account that the content will be used by a variety of learners. Developing multiple types of educational material (allowing those with different knowledge level or learning style to use material in preferred presentational modes) is a critical issue, enhancing the pedagogical perspective of an AEH system. Lastly, skills on using or developing content for the Web are helpful.

- *Develop assessment opportunities.* The instructor needs to develop multiple assessment opportunities aiming to (a) stimulate learners to self-assess their learning, and (b) support the system's adaptation by providing data for the learners' progress.

- *Interpreting students' interaction behaviour.* Data resulting from the monitoring of the students' progress and behaviour are usually available. The instructor should be able to access this data and assess students' behaviour in order to provide appropriate feedback.

In an attempt to elaborate on the design of AEH systems, the Education and Language Technology Group at the Department of Informatics and Telecommunications, University of Athens, developed INSPIRE (INtelligent System for Personalised Instruction in a Remote Environment).

INSPIRE (Papanikolaou et al., 2003) is a web-based AEH system that may deliver many different personalised courses. Based on the notion of learning goals that the learner selects, INSPIRE (see Figure 1) generates a sequence of lessons that correspond to specific learning outcomes, with the aim

of supporting learners in gradually achieving their goals. Moreover, INSPIRE proposes a navigation route through the lesson contents based on a learner's knowledge level and progress, and adapts the presentation of the educational material to the learner's learning style (Papanikolaou et al., 2002). All learners receive a variety of knowledge modules, such as self-assessment questions, theory presentations, experimentation activities, examples, exercises, projects. The order and mode of presentation of these modules in the educational material pages is adapted based on the learner's learning style –Honey and Mumford's categorisation (1992) has been adopted: *Activist*, *Pragmatist*, *Reflector*, *Theorist*. It should be emphasised that learners are allowed to follow the system's advice or not – select the educational material they prefer to study-, or even to deactivate adaptation.

The instructor needs to be competent both at the level of *designing courseware* and at the level of *using the platform* to monitor learners' progress. To support instructors in designing courseware for INSPIRE, we have developed an authoring tool which provides the necessary guidance through the different steps of this process.

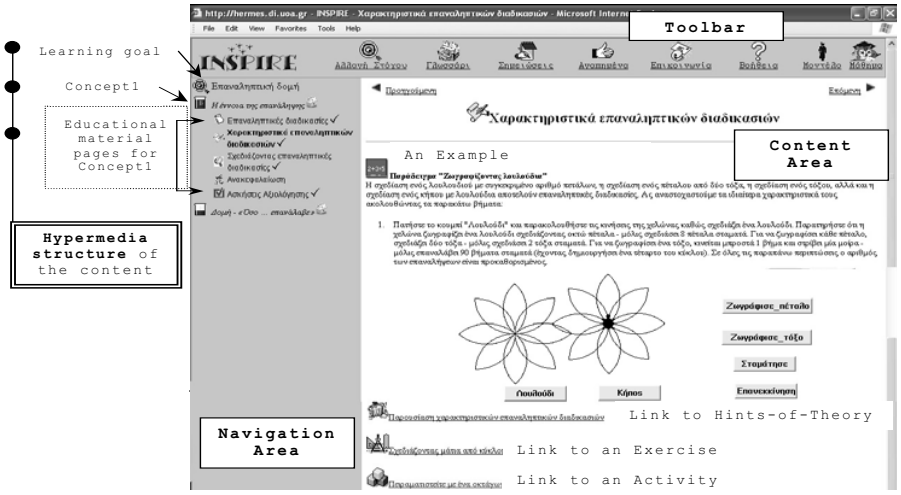

Figure 1: The main screen of INSPIRE

In particular, the aforementioned skills that the instructor needs to possess in order to use an AEH system, have to be adapted with respect to the functionality and the design specifications of INSPIRE.

- *Building lessons based on INSPIRE's instructional framework.* Courseware design in INSPIRE follows specific steps. Instructors should at first identify the main concepts to be taught and their interrelations (outcome, prerequisites). For each outcome concept, specific learning outcomes should be posed and multiple types of learning activities should be developed. These concepts should be further organised in layers from the more general to the more specific – each layer corresponds to the contents of one lesson.

- *Designing e-content for INSPIRE.* The instructor has to design the structure, the content defining learning goals, concepts and educational material pages. In particular: (a) Define a set of *learning goals* from the fundamental topics of the curriculum; (b) For each learning goal build a *conceptual structure* that includes all the necessary concepts comprising the goal and their relationships; (c) For each outcome concept develop *educational material pages* which include a variety of knowledge modules of different interactivity level and cognitive level.

- *Develop assessment opportunities.* Instructors need to design self-assessment opportunities that correspond to specific difficulty levels and abilities that the learner should demonstrate.

- *Interpreting students' interaction behaviour*. The instructor may access the learner model and get data resulting from the monitoring and the analysis of students' interaction and progress.

Currently, we use INSPIRE in order to deliver personalised content for the undergraduate course on "Computer Architecture" for the session on Computer Memory Hierarchy and we develop content for the course "Introduction to programming". The aim in both courses is for students to use INSPIRE as an additional learning resource. INSPIRE proved very popular amongst the students who reported that the usage of multiple types of educational material provided them with the opportunity to approach the main concepts of the subject matter through various perspectives, satisfying students with different ways of learning. Instructors that developed courseware for INSPIRE found the task quite complicated and time consuming. But, they found the process helpful in making them speculate on learners' individual differences and ways of dealing with a group of learners with different profiles. Moreover, the need to develop content for INSPIRE made them consider details of the subject matter and learners' misconceptions. However, they also expressed their doubt about the pedagogical effectiveness of providing learners with so much information, organised in a way that mainly reflects the experts' representation of the subject matter.

3. eCompetence Skills for Reflective Tutorial Dialogue Systems

Advanced computer learning environments require open learner models, which promote reflection in order to help learners overcome their learning difficulties. Open learner modelling engages the learner in the diagnosis process (Bull and Nghien, 2002). Interactive open learner modelling involves human learners in learning dialogues to improve learning through promoting and facilitating reflection. Reflective tutorial dialogue between the learner and the system about the learner's own beliefs, can make a learner model open. Learner text comprehension modelling examines issues that focus on assisting comprehension through the design of the text form and the design of dialogues. Towards this direction, the dialogue management, the dialogue strategies and the dialogue tactics, which mainly formulate the tutorial dialogue framework, aim at the promotion of reflection on learning (Schultz, 2003).

In the framework of designing, organising and setting up the appropriate educational settings for supporting learning through text comprehension, the instructors need to possess skills for:

- *Designing diagnostic learning activities.* The learning activity needs to be modelled according to the underlying model of the learner's text comprehension. The underlying educational model concerning the formulation of a text and the formulation of questions and alternative answers depends mainly on the theory of Baudet and Denhiere for text comprehension (1992). This theory considers text comprehension as the attribution of meanings to causal connections between occurrences in a text. Learners compose a representation of the text, which contains the cognitive categories: *event*, *state and action.* By constructing the appropriate questions and alternative answers in a text, the recognition of the cognitive categories can be inferred. Learners' text comprehension is based on the recognition of the cognitive categories.

- *Designing reflective dialogue learning activities.* The underlying model behind the dialogue management is the *Theory of Inquiry Teaching*, a theory for the use of discovery and inquiry approach in learning (Collins, 1987). Questions provide the focus and direction for the instruction through reflective tutorial dialogue. Learners formulate hypotheses based on observation of varied cases (examples), in order to force greater depth of processing of the new knowledge.

- *Specifying the appropriate dialogue tactics and strategies.* The instructor has to specify the dialogue tactics. For the construction of dialogue questions possible tactics that can be used are: a) selecting positive and negative examples, b) selecting counterexamples, c) forming hypotheses, d) testing hypotheses or f) tracing consequences to contradictions. Moreover, the instructor has to specify his dialogue strategies - methods for taking instructional decisions and constructing an initial plan for reflective dialogue.

- *Interpreting learner models.* The instructor may access data resulting from the diagnosis and evaluate learners' models in order to provide feedback to the learners and proceed to modifications regarding the dialogue strategies and tactics.

In an attempt to elaborate on the above issues, the Education and Language Technology group at the Department of Informatics and Telecommunications of University of Athens developed ReTuDiS a diagnosis and reflective tutorial dialogue learner modelling system for text comprehension (Grigoriadou et al, 2005). ReTuDiS consists of two parts: Diagnosis and Dialogue (Grigoriadou et al., 2005). In the diagnosis part, the system engages learners in a learning activity which includes reading comprehension of a text and answering question-pairs by using given alternative answers (Tsaganou et al., 2004). The text includes factors, which represent the three cognitive categories *action*, *state* and *event*. For every factor, at least one question-pair is submitted to the learner. The first question in the question-pair is related to the causal importance of the specific factor and a learner's answer concerning this question is called *position*. The second question is related to a learner's justification concerning the selected position and is called *justification*. The learning outcomes are summarised as follows: Learners must be able:

a. to recognise the three cognitive categories *state event* and *action*

b. to appraise a factor in the historical text which corresponds to the cognitive category *action* as the most important cause rather than to a *state* or *event*

c. to meet reflective dialogue and to construct coherent arguments, which means without contradictions, between a *position* and its *justification*.

Based on diagnostic results, the dialogue part 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 aforementioned skills that the instructor needs to possess in order to set up an educational setting, have to be adapted with respect to the functionality and the design specifications of ReTuDiS. In particular:

- *Designing diagnostic learning activities.* ReTuDiS is designed to be applicable to any text with a causal structure. Examples of texts in the domains of history and informatics have been used (Figure 2). The instructor must have the background to formulate the paragraphs-factors of the text, and associate them to cognitive categories, to formulate question-pairs concerning each factor in order to discover the learner's difficulties (contradictions or misconceptions).

- *Designing reflective dialogue learning activities.* In ReTuDiS (Grigoriadou et al, 2005) the instructor formulates dialogues by using possible learners' answers or based on his educational experience trying: (a) to encourage the learner to participate in dialogue, (b) to indicate the points where there are contradictions between learners' position and justification, (c) to motivate discussion, argumentation and justification with learners over their contradictions, towards eliminating their contradictions and constructing more coherent arguments, (d) to encourage the learner to try again, read the text and answer the questions participating in the re-construction of his own model. The instructor's role is to formulate dialogue phrases and associate them, structuring the possible dialogue plans.

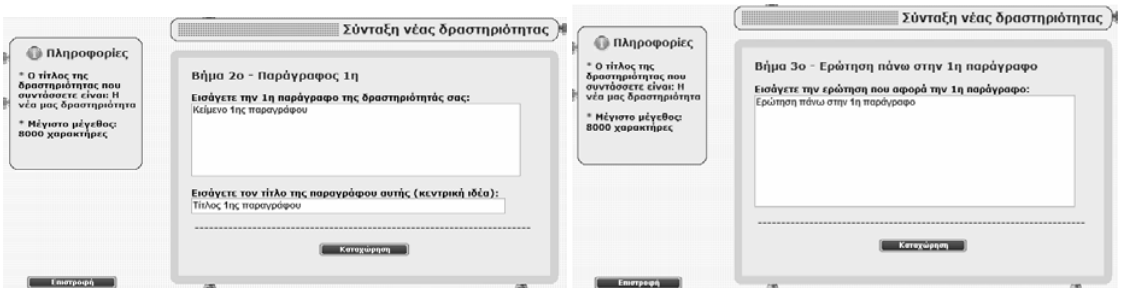

Figure 2: Screenshot of the Authoring tool of ReTuDiS: For the construction of a new activity the instructor: (a) is guided by the system (guidance frames on the left, (b) enters data (text frames on the right).

- *Specifying the appropriate dialogue tactics and strategies.* The instructor formulates positive and negative examples, counter-examples, hypotheses and tracing consequences to contradictions, The instructor selects a dialogue strategy. The main strategy adopted in ReTuDiS is starting dialogue from the learner's answers to questions with the minor contradictions. The construction of the initial dialogue plan (the dialogue to begin with based on the diagnostic results) is based on the dialogue strategy.

- *Interpreting learner models.* In ReTuDiS data resulting from the diagnosis part, before and after the application of the reflective dialogue, are evaluated (Grigoriadou et al, 2004). The instructor may access the learners' models in order to evaluate participation of learners in changing their models or changes in their learner models and provide feedback concerning the initial dialogue plan, strategies and tactics.

Formative evaluation was conducted as part of the development cycle of the system with the participation of instructors and learners. 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 instructors suggested the enrichment of the knowledge base with different texts and in different knowledge domains. Based on the results of the evaluation, we developed the ReTuDiS authoring tool which allows instructors to create interactive tutorial dialogue tutors for learner's text comprehension in a variety of domains.

4. eCompetence Skills for Educational Assessment Settings

Contemporary educational theory indicates that educational assessment can play a significant role in helping learners learn if it is interwoven with the teaching and learning process, instead of being postponed to the end of the instruction (Pellegrino et al., 2001). In recent years, a trend has arisen in recognition of this formative aspect to assessment with assessment methods assuming roles concerning the organisation and regulation of the teaching process, the reinforcement of learners' control over their learning and the facilitation of meaningful learning (Gouveia and Valadares, 2004). While traditional assessment has a retroactive role, focuses on grading and ranking aspects and emphasises the need to find out if the student knows, understands, or is able to do, the new role of assessment is much more prescriptive and proactive and emphasises the need to find out what the student knows, understands or is able to do.

In the framework of developing the appropriate educational assessment setting, the instructor needs to possess skills for:

- *Selecting the appropriate assessment tools/methods.* The instructor can influence the choice to learn meaningfully by the type of, and organisation of, information presented, how it is sequenced, the instructional strategies employed and the choice of the assessment tools/methods. The common multiple-choice or true–false questions as assessment tools

usually encourage rote learning and discourage meaningful learning. Also, traditional tests do not precisely reveal the conceptual dimensions of learners' thinking and understanding. Alternative assessment tools such as concept maps and innovative assessment methods such as self-, peer- and collaborative-assessment, have been introduced in recent years, aiming to enhance/promote meaningful learning and emphasising active participation of learners in the assessment process, reflective/critical thinking, self-monitoring, regulation, and social interaction. The instructor needs to be familiar with the aim and the application process of any new assessment method or tool before their effective exploitation.

- *Designing activities.* The instructor has to determine the learning outcomes, the context of the activity and the educational resources that are necessary to support the assessment process.

- *Specifying the evaluation framework*. Depending on the purpose of the assessment (i.e. Diagnostic, formative or summative) and the assessment tool used, the instructor has to specify the framework under which the activities are going to be evaluated. The evaluation framework may refer to the quantitative and/or the qualitative evaluation of the activity and subsequently to the quantitative/qualitative estimation of learner's knowledge.

- *Specifying the feedback framework and designing the feedback components*. In the context of aligning assessment with instruction, the provision of feedback should be considered as an inherent component of the assessment process. The instructor has to determine elements concerning the conditions under which feedback is provided, the forms and types of feedback that could be available and the feedback components themselves. An interesting dimension in the design of the feedback process is the possibility to provide to each learner the appropriate and right amount of help/support in the course of the elaboration of the activity. Empirical studies have shown that learners learn better if the amount of help/support provided is based on learners' individual differences.

Towards the direction of interweaving assessment with instruction and exploiting alternative assessment tools, the Education and Language Technology group at the Department of Informatics and Telecommunications of the University of Athens developed COMPASS, which is an adaptive web-based concept mapping learning environment (Gouli et al., 2004). COMPASS serves assessment and learning by employing a variety of concept mapping activities, applying a scheme for the qualitative and quantitative estimation of the learner's knowledge and providing different informative, tutoring and reflective feedback components, tailored to learners' individual characteristics and needs (Gouli et al., 2006). The aforementioned skills that the instructor needs to possess in order to set up an assessment educational setting have to be adapted with respect to the design specifications and the functionality of COMPASS. The instructor needs to be competent at the level of designing the desired assessment educational setting, which exploits concept maps as an assessment tool, as well as at the level of using the tool and basic Information and Communications Technology (ICT) applications (e.g. Internet, word processors). In particular:

- *Designing activities.* The activity needs to be modelled according to the conceptual structure of COMPASS domain knowledge, which is based on the notion of an assessment goal (fundamental topic of the subject matter). To this end, the instructor needs to define (a) the addressed learning outcomes, (b) the type of concept mapping tasks employed (e.g. the construction of a map, the evaluation of a given map), (c) the lists of concepts and/or relationships that may be available, depending on the degree of support provided, and (d) the concepts/propositions that may be represented on expert map and their weights (denoting their degree of importance for the accomplishment of the activity) (Gouli et al., 2004).

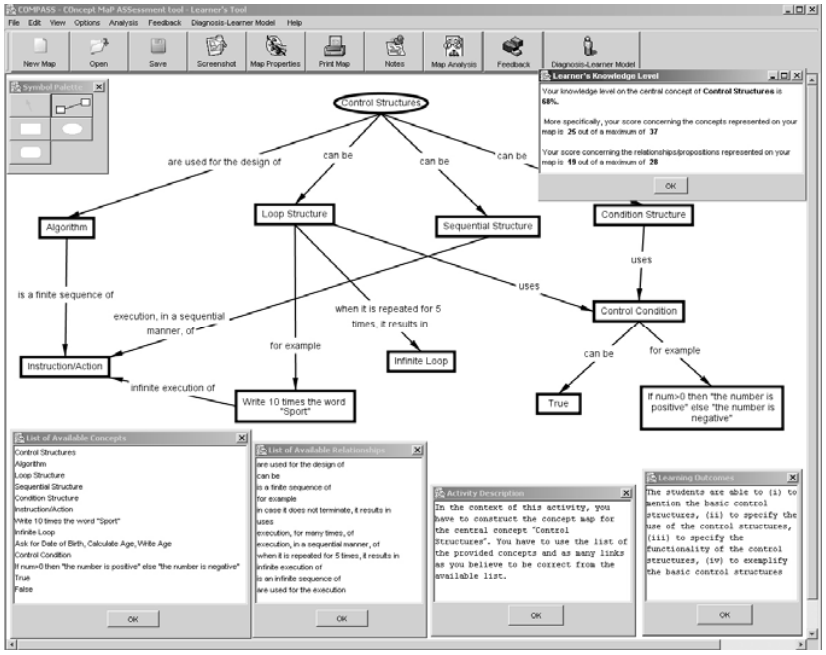

Figure 3: The main screen of COMPASS. A concept map of a learner in the context of an assessment activity is presented in the Working Area. The four windows at the bottom correspond to (i) provided list of concepts, (ii) provided list of relationships, (iii) description of the activity, and (iv) learning outcomes addressed by the activity, while the window at the upper right corner corresponds to the quantitative evaluation of the map.

- *Specifying the evaluation framework*. The assessment scheme embedded in COMPASS aims at the quantitative and the qualitative assessment of learners' concept maps, examines the accuracy and completeness of the presented propositions and takes into account the missing ones, with respect to the propositions presented on the expert map (Gouli et al., 2005). Depending on the learning outcomes that the activity addresses, the instructor needs to specify (a) the framework for the activity's evaluation, that is if the activity is going to be assessed by COMPASS (evaluation is based on the map analysis, where specific error categories are identified), or by the instructor or by peers, (b) the weights assigned to each error category as well as to each concept and proposition that appear on expert map, and (c) the correspondence between the different error categories with the qualitative characterisations supported (i.e. incomplete understanding/beliefs and false beliefs).

- *Specifying the feedback framework and designing the feedback components*. The instructor has to (a) specify the forms of feedback that can be available (i.e. text-based, visual and/or dialogue form), and (b) design the feedback components that can be available during the dialogue of the learner with COMPASS (e.g. tutoring feedback units for concepts and propositions, error-task related questions, explanations of response, correct response) (Gouli et al., 2006). The feedback components are structured in different layers in order to support the gradual provision of the right amount of feedback information. Also, the presentation of the appropriate feedback components on each layer is adapted to learners' knowledge level and preferences. Furthermore, learners have control over the provided adaptation by intervening in the feedback presentation process, in order to select the preferred layer of feedback and feedback component, in accordance with their own perceived needs and desires.

An empirical study that was conducted, aiming to investigate the strong and the weak aspects of the educational setting from the instructor's and learner's points of view, revealed that (a) the instructors found the facilities for designing the assessment activities and the feedback components as very useful, enabling them to define the appropriate elements in a more flexible way, and (b) most of the

students found that the proposed layout facilitates their interaction and the provided facilities help them to improve their maps and understand their false beliefs.

5. eCompetence skills for Synchronous Text-based Communication in Computer Supported Collaborative Learning

During recent years, new theories of learning have emerged and developed, pointing out the social dimension of the learning process. Effective collaboration presupposes active and well-functioning groups that have the required skills to communicate and the cognitive skills to learn (Soller, 2001). Students learning via Computer Supported Collaborative Learning (CSCL) technology usually use a synchronous text-based communication tool for their communication and need guidance and support. In many cases, the guidance takes the form of structured dialogue implemented through predefined message scripts (Soller, 2001).

In the framework of designing, organising and setting up the appropriate collaborative educational settings, the instructors need to possess skills for:

- *Designing collaborative learning activities*. The instructor has to determine the learning outcomes that are addressed in the context of the activity (e.g. whether the activity aims to make students able to apply a specific process, to evaluate the correctness of an answer), the context of the activity and the collaboration framework to be followed (e.g. the number of group members, the model of collaboration).

- *Forming students' groups*. The formation of groups may rely on students' characteristics such as knowledge level, learning style, attitude. The instructor has to take into account the students' characteristics in order to form effective groups.

- *Defining models of collaboration*. During the collaboration, the members may collaborate having the same duties or following specific roles, aiming to cultivate specific skills to the students. In this context, the instructor has to specify models of collaboration by determining the discriminative roles.

- *Specifying the appropriate predefined message scripts.* In the case of the structured dialogue, the instructor has to specify the sentence openers or communication acts that students will use to exchange messages.

We have developed ACT (Adaptive Communication Tool) (Gogoulou et al, 2005), which is an adaptive synchronous text-based tool. ACT supports both the free and the structured form of dialogue and two types of predefined message scripts (hereafter-called Scaffolding Sentence Templates (SST)) in the case of structured dialogue: sentence openers and communication acts. The tool presents the messages in chronological order and in a tree structure according to the reference message. The most discriminative characteristic of ACT is that it attempts to support adaptivity: provide the most meaningful set of SST with respect to the learning outcomes addressed by the collaborative learning activity and the model of collaboration followed (Figure 4), and adaptability: tailoring of the dialogue form, SST type and SST set to the students' needs and preferences. ACT evaluates and coaches the interaction by analysing the dialogue, by supporting alternative visual representations of the interaction analysis results and by guiding students.

The instructor needs to be competent at the level of designing the desired collaborative educational setting as well as at the level of using the ACT tool and basic Information and Communications Technology (ICT) applications. In particular:

- *Designing collaborative learning activities.* The learning activity is modelled on the basis of the educational framework followed, specifying the context of learning and how the learning

process is going to take place and the "action" framework provided, specifying the content of the activity as well as how learners will collaborate. To this end, the instructor determines (a) the level of the learning outcomes: Comprehension level (Remember + Understand), Application level (Apply), Checking-Criticising level (Evaluate) and Creation level (Analyse + Create) (Gogoulou et al., 2005)), (b) the sub-activities of the activity, (c) the model of collaboration followed; that is, the number of group members, the role of each member and the moderator of the group who is responsible for the coordination of the group process and (d) the type of dialogue.

- *Forming students' groups.* The instructor accesses the student's model which keeps information about student's characteristics in order to determine the groups for each collaborative activity. The group may consist of up to four members.

- *Defining models of collaboration*. The instructor has to specify models of collaboration by determining the discriminative roles (e.g. in the "Driver-Observer" model, the Driver is responsible for making proposals and clarifications while the Observer is responsible for asking questions and clarifications) and the moderator of the group.

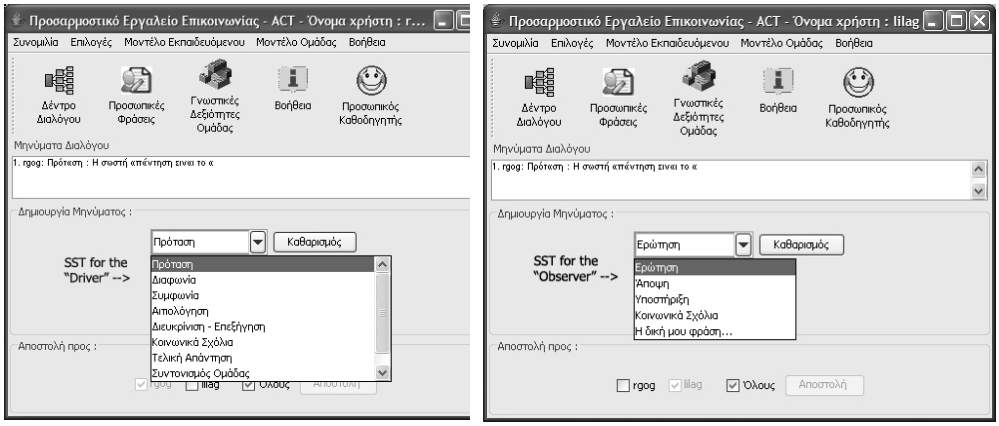

Figure 4: Adaptation of the communication acts to the roles implied by the collaboration model

- *Specifying the appropriate SST.* In case of the structured dialogue the students use specific SST to exchange messages. The ACT tool supports predetermined SST, but the instructor may specify additional SST if the available ones do not cover the communication requirements (e.g. in case of determining a new collaboration model, new SST may be required for each new role). The SST follow a specific form, thus the instructor has to specify the required attributes such as the outcome level that the SST is aligned with, the discourse category of the SST denoting the intention of the student's message (e.g. Proposal, Question), the roles that the SST serves in case the model of collaboration implies specific roles.

- *Interpreting students' collaboration.* Data resulted from the monitoring and the analysis of the students' collaborations is available. The instructor may access this data and evaluate students' collaborations in order to provide feedback to the students and proceed to modifications regarding groups' formation, the SST provided, etc.

During the formative evaluation of the ACT tool, two pilot studies were conducted at the Department of Informatics and Telecommunications at the University of Athens: the first one in the context of a postgraduate course and the second one in the context of an undergraduate course. From the students' point of view, the provided SST, as well as their usage and accessibility, seem to be satisfactory, resulting in coherent dialogues, while the adaptation mechanism proved to be appropriate regarding

the selected set of the SST. From the instructors' point of view, the tool may facilitate and support students' collaborations. Additionally, the usability and the ease of use are considered satisfactory.

6. Conclusions

The integration of *Adaptive Learning Environments* in the educational process requires instructors to become aware, and appreciate the educational value, of such tools, to understand the underlying pedagogical theories and instructional design and to possess eCompetence skills for using ALE. The pilot use and preliminary evaluation of such environments, developed at the Department of Informatics and Telecommunications at the University of Athens, revealed the added value in the learning and teaching process and the instructors' positive attitude in adopting such tools in the instruction. However, it seems that both students and instructors need a period to become acquainted with the facilities provided and to develop the appropriate eCompetence skills. Especially, the instructors who consider useful the provision of authoring and help facilities in order to facilitate the design and management of the desired educational setting integrating ALE.

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