COLLABORATIVE LEARNING AND AUTHORING IN THE FRAME OF E-PROJECTS

George Totkov, Daniel Denev, Rositsa Doneva, Mariana Sokolova

Abstract: It is presented a research on the application of a collaborative learning and authoring during all delivery phases of e-learning programmes or e-courses offered by educational institutions. The possibilities for modelling of an e-project as a specific management process based on planned, dynamically changing or accidentally arising sequences of learning activities, is discussed. New approaches for project-based and collaborative learning and authoring are presented. Special types of test questions are introduced which allow test generation and authoring based on learners' answers accumulated in the frame of given e-course. Experiments are carried out in an e-learning environment, named BEST.

Introduction

In the modern changing world there is an increasing need that students become better general problem solvers and better group workers [Kurilovas, 2006]. Therefore today an increasing interest for so-called "new pedagogies" exists, which means possibility to use rich, active and open pedagogical scenarios and learning strategies.

In the last years our research interests are related with new pedagogies, but also with their implementation in e-learning environments as PeU 1.0 [Totkov, Somova, 2002], PeU 2.0 [Totkov, 2003] and the newest e-learning platform BEST [Doneva, Denev, Totkov, 2006]. The main results obtained are:

- introducing the concept of e+learning (in BEST);
- modelling of open pedagogical scenarios by planning of the learning process (PeU 1.0, PeU 2.0, BEST);
- cooperative development of learning materials in e-learning environments (BEST);
- dynamical generation of e-courses and learning tests (PeU 1.0);
- implementation of adaptive learning strategies, managed by the model of the learning process PeU 2.0, BEST), etc.

One new direction of the research affects mostly the collaborative approach in all phases of introducing e-learning courses and programmes – from their planning, implementation and management, to supporting active and open pedagogical scenarios for collaborative learning and authoring.

Further we discuss the implementation of a collaborative approach to e-learning and the corresponding experiments in BEST.

Collaborative e+Learning Projects

Generally, under the term 'e+learning project' (*e-project*) we understand the work an educational institution has to perform during all phases of introducing distance education, e-learning courses and programmes, incl. planning, e-content development, administration, implementation, delivery, management, etc. The e+learning project is complex endeavour involving many different activities, events, subjects, rules, resources, constraints, etc.

The e-project consists of a great number of models of real management processes in different institutions, related to e-learning and united by common learning activities, users, events, resources and constraints. An e-project can be comprised of e-projects for different institutions. So, the e-project could be modelled as a specific management process based on planned, dynamically changing or accidentally arising sequences of learning (in this case) activities and events.

BEST (*B*ulgarian *E*ducational *Si*te) is a software environment used for creating, editing, sharing, storing, reusing and managing e-projects, developed in collaboration between different educational institutions.

BEST offers several structural formats which allow project managers and teachers to control the appearance of the sections (or topics) in their e-project/course. The *course topic format* resembles the structure of a book where one section corresponds to one topic of the course. The *weekly format* resembles the structure of a calendar where one section corresponds to one week of the course. The *social format* simply consists of a single discussion forum without content sections.

The *project format* is similar to the course topic and weekly formats, but allows teachers to define arbitrary durations for the sections (called 'project phases' in this context). The goal of the project format is to facilitate the management of a project for teachers as well as for students. A project phase is realised as a 'normal' course topic with additional characteristics (start / end date, etc.). Elements of the *e-project structure* (Fig. 1.) are phases, activities, checkpoints, etc. Phases are used for logical partitioning of the learning activities (assignments). Apart from project management tools, phases and

Figure 1. Selecting the 'Project' format

activities, project developers also have at their disposal tools for content creation of various educational activities and events.

For example, the project leader decides which learning activity or event (for example: creation of the e-course) will be the project phase and edits its parameters (start time, duration, etc.). Converting an activity back into a phase by keeping the description is also possible.
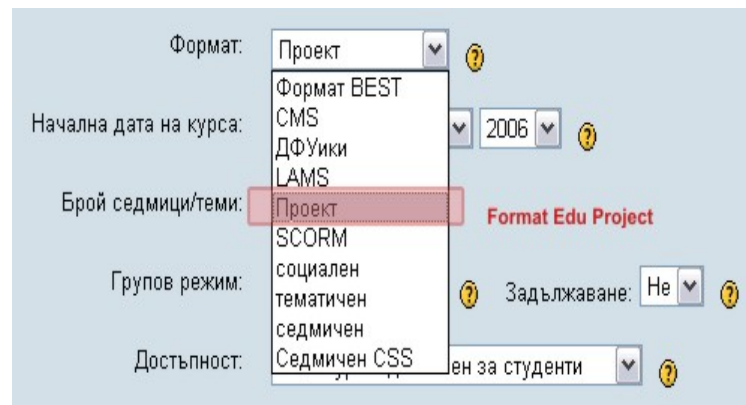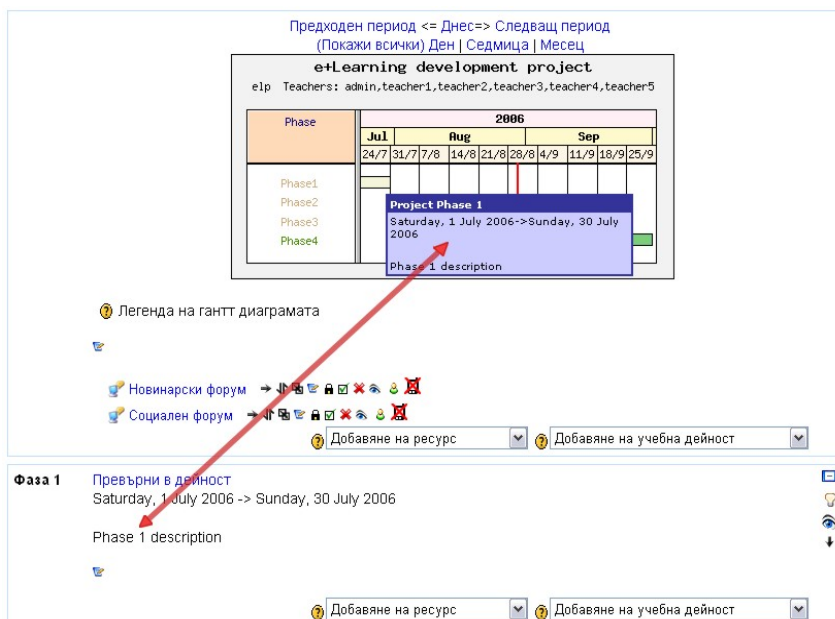

Figure 2. The phase in Gantt diagram

Once created, the phase can be moved, copied, locked or unlocked. In the last case, the input/output state is defined by logic constraints based on evaluations of test assignments, used learning times, learning events, etc.). The phase assignments are added as learning activities with specified time periods for implementation. The activities and the deliverables within the phase and the project are visualized using Gantt diagram (Fig. 2.). This enables a friendly overview on phase durations and deadlines.

It is also of interest for the teachers to know quickly whether all students have submitted their deliverables and whether all students got feedback. To this end, the milestones on the Gantt chart are represented by using a simple colour coding that reflects whether deliverables are *Finished* (green), I*n progress* (orange) or *Missing* (red).

Within each phase, assignments are treated as deliverables for this phase and represented in the Gantt chart as milestones. A project-based course can contain a mix of 'normal' BEST topics and phases.

BEST can be used even in the lack of e-format learning materials or Internet-based resources. In such cases BEST can be used for example as a system for reference and information of the respective educational institution, as a system boosting the organizing of the learning process, a communication system within the institutions, a virtual organizer of the subjects of learning and so on.

The so-called *meta-project* in BEST makes it possible to manage the implementation of an educational project or program, comprising other developed e-projects / e-courses. The meta-project is guiding for the rest of the projects and the development of the activities for all projects or courses included in it, is automatically reflected.

Learning, administrative and controlling activities can be included in different learning processes, integrated in an e-project. The results from certain activities (events) can determine the further development of the process; for instance – they can cause the dynamic appearance of a learning scenario (including the adaptation to a particular student), or automatically generate or 'lock' other virtual learning paths and activities, and so on.

Project-Based and Collaborative Learning

The 'traditional' students have trouble for: (a) initiating inquiry, formulate coherent research questions; (b) define a research project; (c) direct investigations; find resources, (d) manage time; keep deadlines, estimate time needed to do a task; (e) collaborate and give feedback; articulate work of others and give regular feedback; (f) follow-up the project; revise products [Schneider, Dillenbourg, Frété, Morand, Synteta, 2003].

The project-based learning/teaching can very well complement traditional instruction and are often the only realistic alternative in today's organization of the school and university system [Schneider, Paraskevi, 2005]. Activity-based, collaborative, and construction-based pedagogies in general require project-based and collaborative learning. Project based learning is a teaching and learning model (curriculum development and instructional approach) that emphasizes student-centred instruction by assigning projects. It allows students to work more autonomously to construct their own learning, and culminates in realistic, student-generated products. More specifically, project-based learning can be defined as [Synteta, 2002]:

- engaging learning experiences that involve students in complex, real-world projects through which they develop and apply skills and knowledge;
- learning that requires students to draw from many information sources and disciplines in order to solve problems;
- learning in which curricular outcomes can be identified up-front, but in which the outcomes of the student's learning process are neither predetermined nor fully predictable;
- experiences through which students learn to manage and allocate resources such as time and materials.

The powerful learning environments that aim at developing skills at general problem, deeper conceptual understanding and more applicable knowledge include the following characteristics [Van Merriënboer, Pass, 2003]:

- the use of complex, realistic and challenging problems that elicit in learners active and constructive processes of knowledge and skill acquisition;
- the inclusion of small group, collaborative work and ample opportunities for interaction, communication and co-operation;
- the encouragement of the learners to set their own goals and provision of guidance for the students in taking more responsibility for their own learning activities an processes.

The project based learning and collaboration between the subjects of e+learning are encouraged in BEST. The BEST system provides the following possibilities that can be used for modelling project-based and collaborative learning:

- *gathering and distribution of information* (teachers and learners share resources; the activities are designed to help them gather information and make it available to all);
- *creation of collaborative documents* (the students can write definitions, analyze cases, solve problems, write documents and create illustrated documents together around specific themes, etc,);
- *discussion and commentaries around productions* (learners identify together facts, principles and concepts and clarify complex ideas; they formulate hypothesis and plan solutions, make links between ideas, compare different points of view, argue, evaluate, etc.);
- *project management activities* (learners can design work plans, share tasks, form groups, realise collaborative tasks, etc.; teachers can distribute and regulate tasks, etc.).

A teacher can introduce such style of learning by inclusion some of so called 'learning activities' into his/her learning scenario. The learning activities palette makes BEST an impressive e-learning environment. This is the most dynamically developing part of the system which now consists of more than *30 learning activities* like: educational lesson, test (including mathematical editor), project, forum, chat, flash activity, forum plus, questionnaire, LAMS-model, learning IMS-object, SCORM-object, 3 Wiki-formats, inquiry, quick test, gallery, test dates, dialogue, journal, assignment, project task, exam, book, feedback, psychological test for identification, research, schedule, resource, dictionary, semantic map, certificate, meeting. Teachers could 'lock' the learning activity (using the abovementioned lock/unlock mechanism). In this way, different pedagogical scenarios, learning materials and events could be offered to students depending on their current progress (test grades, exam marks, degree of his/her communication activity, etc.). Thus, the teacher has to realise very complex adaptive learning strategies and scenarios based on lock/unlock mechanism.

The BEST environment provides, in practice, all used asynchronic and synchronic communication forms for collaborative work (as special kind of learning activities) – not only between teachers and learners, but also between the other users[2].

Collaborative Authoring of Test Questions

In spite of the enumerated advantages, as authors' and other researches' investigation shows, 'new pedagogies' including project-based and collaborative learning, do not guarantee automatic perfect results. True collaborative pedagogy strategies are generally the most difficult to implement, since there must be some degree of symmetry and actors must have a high capacity for negotiation. In other words, situations are difficult to achieve where peers are more or less at the different level, can not perform the same actions, have not a common goal and do not work together [Schneider, Dillenbourg, Frété, Morand, Synteta, 2003].

This is the motivation to do a step towards possible decision of this problem. Here we propose an idea on development of collaborative authoring tools where the content of the learning/teaching activities (reading materials, assignments, assessment questions, messages, etc.) produced by e-learning subjects could be accumulated and used for generation of new ones (self-development). And something more, even wrong or bad content could produced a good one (incl. other types of learning activities).

An experiment based on this idea is realised in BEST. The main idea is related with generation of new test questions) using the students' answers (accumulated in the frame of current e-course) to given 'special' test questions.

To create a classification of the question types which is suitable for computer realization, we can use different approaches. Most of the existing question classifications are according to the type of the answer of the question [Pashin, 1985]. It is also possible to create a classification using the Bloom's taxonomy of knowledge, if the teacher wants to test different knowledge levels [Bloom, 2007]. Other approaches are based on the cognitive goals of the education [Bijkov, 1995], the form of the answer [Ruter, 1978], the cardinality and type of the possible answers [Doneva, Somova, Totkov, 1998], etc.

In order to realise the abovementioned idea, we propose a classification of the test questions, using *2 (two) parameters* − the *type of the given answers* (text, images, files) and the *dimension* of these answers (one, two, three,etc.). The proposed classification (Table 1.) is based on the classification already implemented in the PeU 2.0 test system [Sokolova, Totkov, 2005], but *with very important difference*, reflecting two possibilities:

- a test question of the new test type could accumulate necessary data (during the real e-learning process) in order to generate new test questions (of some subcategory of the given test type), and vice versa,

- a test question of some subcategory type could produce a test question of 'main' test type, and as consequence of 1) – from all others subtypes. The question types possess the above properties we call *accumulative question types*.

For example, the well-known test type 'Open question with short free text answer' has the following common structure: <name, condition, schema of assessment, free text answer>. A lot of other question types have the same structure, but the last element ('answer') belongs to other data type (for example − set of false/true' short text answers, file, image, etc.). Any open test question could generate other test questions (i.e. types Multiple

---

[2] The number of user's roles In BEST is unlimited − there are realized 'dynamic' user's roles, organized as taxonomy of classes, depending on the set of privileges (BEST functions), allowed for current user.

Choice, Free Answer, Multiple Answers, True or False, etc.) if we already have on our disposal a set of student answers to this question. In order to automatically generate test questions, we could include new methods in the 'Open Question' class as follows − for collecting the corresponding answers during the current e-course, for producing a set of proper answers (along with frequencies, teacher grades, etc.), for generating test questions of any test subcategory, etc. This 'accumulative' open test question belongs to the class 'Accumulative open question' (Table 1.).

The generation of concrete test questions on the basis of 'Accumulative open question' type is an iterative process, consisting of *three steps*:

1) The question of type 'Accumulative open question' is formulated by the teacher and is included in some assessment test of the e-course;

2) The test is proposed to the students (in the frame of current e-course). Each student's answer is stored into a data base along with the 'Answer count' (how many students have those answer) and the 'Answer grade' (grading could be done automatically or by the teacher);

3) At any time of the current e-learning process, the teacher could edit the *set of possible answers* and their accompanying characteristics, delete the answers which are preposterous, sort the set according different criteria (depending on counts or grades) and use the set of answers for generation of new test question (from any subcategory).

Dimension	Data Type	Base accumulative question type / Subcategory (accumulated test type)
0	–	**I. Informative (no answer needed)** Embedded Answers (Close)
1	Text/ file/ image	**II. Accumulative open question (text answer)** Multiple Choice; Free Answer; Multiple Answer; True or False; True or False with Help; Multiple Answer with Multiple Choice; Question from File and Text Answer; Text Edit; Calculated; Description; Numerical **III. Accumulative open question (file answer)** File Answer; Question from File and File Answer **IV. Accumulative open question (image answer)** Multiple Choice of Images; Multiple Answer of Images; Area of Image; Areas of Image; Undue Image; Description of Group of Image; Description of a Disappearing Image (with/without Help)
2	Text / image	**V. Accumulative matching of elements (one and the same data type)** Matching of Texts; Matching of Images; Arrange According to the Meaning; Arrange According to the Meaning (after Multiple Answer) **VI. Accumulative matching of elements (different data types)** Matching of text and images; Image description; Arrange images
≥ 3	Text/ image	**VII. Accumulative matching of elements (one and the same data type)** Fill in Blanks; Fill in Blanks with Alternatives; Fill in Blanks with Images; Arrange the Table; Fill the Table; Rebus **VIII. Accumulative matching of elements (different data types)** Crossword Puzzle; Crossword Puzzle with Images

Table 1. The 'accumulative test question' classification

As the BEST learning environment was developed on the basis of the Moodle system, it had inherited a limited number of question types: Calculated, Description, Essay, Matching, Embedded Answers (Close), Multiple Choice, Short Answer, Numerical, Random Short-Answer Matching and True/False.

Following the abovementioned idea, the BEST environment is enriched with:

1) *Full implementation* of test type 'Accumulative open question'. On its basis we can generate (Fig. 3.) almost all Moodle's types (8 from 10) − Calculated, Description, Essay, Matching, Multiple Choice, Short Answer, Numerical and True/False (even some doesn't supported in Moodle, e.g. 'Text Edit');

2) *Some test question (sub)categories* from Table 1. - Arrange According to the Meaning, Fill in the Blanks, Fill in the Blanks with Alternatives, Text Edit, Arrange after Multiple Choice, Matching Text with Images,

Images Description, Multiple Choice of Images, Multiple Answer of Images and Arrange Images. Some of them are developed in relation with the test type 'Accumulative open question', while the others will serve as a basis for implementation of new accumulative test types.
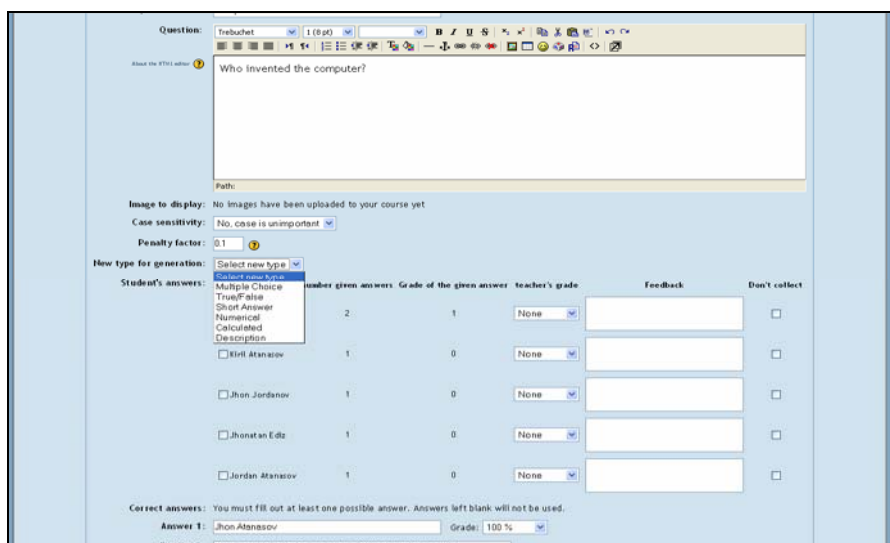

Figure 3. Generation of test question from a choosing subcategory

Bibliography

[Synteta, 2002] Synteta, P., Project-Based e-Learning: The model and the method, the practice and the portal. Accepted PhD proposal, University of Geneva, Geneva, Switzerland. URL: http://tecfa.unige.ch/perso/vivian/, 2002.

[Doneva, Somova, Totkov, 1998] Doneva R., Somova E., Totkov G., Test Paradigms, Proc. of the Twenty-third Int. Conf. Information and Communication Technologies and Programming, Sofia, Bulgaria, 9-13 Jun 1998, c. 155-161, 1998.

[Schneider, Dillenbourg, Frété, Morand, Synteta, 2003] Schneider D. Dillenbourg, P., Frété, C., Morand, S., Synteta, P, TECFA Seed Catalog, URL: http://tecfa.unige.ch/proj/seed/catalog/, Draft version.

[Van Merriënboer, Pass, 2003] Van Merriënboer, J. J. G., Pass F. , Powerful Learning and the Many Faces of Instructional Design: Toward a Framework for the Design of Powerful Learning Environments. Amsterdam: Pergamon, pp. 3–20, 2003.

[Schneider., Paraskev., 2005] Schneider D., Paraskevi S. , Conception and implementation of rich pedagogical scenarios through collaborative portal sites, in Senteni,A. Taurisson,A. Innovative Learning & Knowledge Communities / les communautés virtuelles: apprendre, innover et travailler ensemble", selected papers from ICOOL 2003 /Colloque de Guéret 2003, University of Mauritius (under the auspices of the UNESCO), pp. 243-268. ISBN-99903-73-19-1, 2005.

[Doneva, Denev, Totkov, 2006], Doneva R., Denev D., Totkov G., The BEST e-Learning Practices, ECI 2006.

[Kurilovas, 2006] Kurilovas E., The Conceptual Structure of European E-Learning Delivery Model, Information & Communication Technology in Natural Science Education – 2006, ISBN 9986-38-711-6, 2006.

[Pashin, 1985] Pasniih E. N., A. I. Metin, Automation system for teaching, Ecstern, Moscow,1985.

[Bijkov, 1995] Bijkov G., Methodology and methods for pedagogical approaches, Asconi-Izdat Sofia, 1995y., p.292.

[Ruter, 1978]. Th. Rutter. Formen der Testaufgabe, in Handbuch der Pedagogischen Diagnostik. Düsseldorf, Pedagogischer Verlag Schwann, 1978.

[Bloom, 2007] Applying Bloom's taxonomy, http://www.teachers.ash.org.au/researchskills/dalton.htm (visited February 2007).

[Sokolova, 2005] M. Sokolova, G. Totkov, About Test Classification in E-Learning Environment CompSysTech'05, Rousse.

[Totkov, 2003] G. Totkov, Virtual Learning Environments: Towards New Generations. Proceedings of the Intern. Conf. of Computer Systems and Technologies (e-learning), Sofia, Bulgaria, 19-20 June, 2003, P.2-1 – P.2-9.

Authors' Information

George Totkov – *Plovdiv University, 24 Tzar Assen St., 4000 Plovdiv, Bulgaria, totkov@uni-plovdiv.bg.*

Daniel Denev – *Intelekti Ltd., 1 Arch. G. Kozarov St., 5000 Veliko Turnovo, Bulgaria, daniel_i_denev@abv.bg.*

Rositsa Doneva – *Plovdiv University, 24 Tzar Assen St., 4000 Plovdiv, Bulgaria, rosi@pu.acad.bg.*

Mariana Sokolova – *Webfactory Ltd., 1 S. Vrachanski St., 1303 Sofia, Bulgaria, mariana_sokolova@yahoo.com.*