Didactic Model for Realization of E-Learning Course

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***Abstract*— This paper presents a didactic model developed within the research project "E-learning Recommender System". The model uses collaborative learning environment with purpose to improve the quality of education by introducing innovative computer technologies in the processes of teaching and learning. Learning environment was created in accordance with new pedagogical approaches of e-learning 2.0 and it combines LMS, Web 2.0 tools and educational recommender system ELARS (E-Learning Activities Recommender System) for personalization of activities in e-courses. Presented didactic model can be applied to different types of e-courses.**

***Keywords*— didactic model, recommender system, e-course, collaborative learning, e-tivity**

I. INTRODUCTION

When started, e-learning was mostly used to enhance traditional teaching methods. Teacher present topics, distribute learning materials, and communicate with students about those learning materials. Later e-learning evolve with aim to extend students' learning activities to open content on the internet [5], [6]. The learning process that includes social software in e-learning is called E-learning 2.0, due to Web 2.0 tools that are used to enhance the process of learning itself. Web 2.0 tools enable a shift from a distributive to a more collaborative mode in e-learning. In particular, the ease of use and simplicity of Web 2.0 technologies allow creating learning environments, which can realize activity-rich pedagogical models and facilitate students' development of competences [6].

In E-learing 2.0 learning is perceived as an interlinked social process, in which students use Web 2.0 tools to develop learning outcomes. They do not only use the already distributed learning materials, but also collaborate and produce their own learning resources [1].

Student-centred didactical models presents the work in progress as part of the research project "E-learning Recommender System" with main goal to develop didactical models for realization of e-learning courses in Moodle based learning management system MudRi, supported by Web 2.0 tools and ELARS (E-learning Activities Recommender System) [15]. These courses, besides the usual activities supported by LMS, include personal collaborative e-learning activities (e-tivities) [11].

The second part of this paper describes the activities in e-learning 2.0 process – e-tivities. The third part presents novel didactical model through design of e-course "Extracurricular informatics and technical activities". The fourth part gives evaluation results of e-course while the last part brings conclusions and future work plans.

II. ACTIVITIES IN E-LEARNING

Considering the pedagogical aspects of e-learning, it is necessary to include elements that comply with different theories of learning: behaviourism, cognitivism and constructivism. E-learning 2.0 promotes constructivism according to which students should be active participants who do not remember teaching materials literally, but create their own versions of the course content by exchanging views and opinions with their colleagues [5], [9], [14].

The teacher is still an important participant of that process, although his main task is no longer transmitting the knowledge but guiding students in the process of acquiring knowledge [5], [9].

The process of designing the e-learning 2.0 environments is established in socio-cultural learning, which is in a constant cognitive development with the power of dynamic social interaction. Cognitive learning focuses on learning processes and development trough creating, editing and remixing learning content socially and collaboratively [3].

E-learning activities (e-tivities) are very important in e-learning 2.0 environment. Such activities can be individual or group based activities with a collaborative task [10], [9]. An e-tivity is the interaction of a student with other students using specific tools [1]. It is achieved through completion of a task and oriented towards specific learning outcomes that should be achieved [2]. E-tivity consists of several components: the context within the e-tivity occurs (the subject, the learning outcomes, and the environment within which the e-tivity takes place), the learning and teaching approaches and the undertaken tasks. The task is determined with its type, the resources (e.g. teaching and learning materials, tools), the interaction and roles of the participants involved (e.g. individual or group assignment) [9].

Teacher, as an important participant of the e-learning process, designs a task with required learning materials, tools that should be used for e-tivity and mode of interaction

between participants. Besides defining a task, teacher should also support students during the e-tivity in order to encourage them for participation and collaboration with their peers.

Didactical models developed during the research project are in accordance with the e-learning 2.0 approach and based on collaborative e-tivities. Web 2.0 tools enable realization of different e-tivities and therefore, represent one of the building parts of developed didactical models. In addition, the personalization of e-tivities is achieved using the educational recommender system ELARS which extends the environment for e-learning.

III. Implementation of e-tivities with Web 2.0 tools and recommender system

A. Course Context

The e-learning course "'Extracurricular informatics and technical activities" was designed for senior students in the integrated graduate program in Primary education at the Faculty of Teacher Education, University of Rijeka. The course is taught in the ninth semester of last year of studies, with 45 hours per semester and 4 ECTS credits (European Credit Transfer and Accumulation System) [7]. Each learning outcome is expressed in terms of credits, with a student workload, so one ECTS credit generally corresponds to 25-30 hours of students' work.

B. Learning Objectives and Content

Students who attend this course are future primary education teachers. The overall course objective was that students acquire fundamental theoretical knowledge about using computer technology in classroom teaching, especially how to use and generate different interactive learning materials for education.

The students were trained to implement information and communications technologies (ICT) in traditional (f2f) education for extracurricular activities with children, as well as to use e-learning.

On completion of this course, students should be able to identify various approaches of ICT used for teaching and learning, define e-learning and evaluate different types of e-learning, analyse different types of interactive educational materials in order to choose the most appropriate one for teaching and learning.

Students should achieve above given learning outcomes through the following course topics: ICT in education, e-learning and e-tivities moderating, blended learning and online learning, Web 2.0.

From the beginning, this course was prepared with required learning materials, teaching strategies, assessment and grading methods, and integrating new technologies that can support the learning process. The course is taught since the academic year 2010/2011, using LMS "MudRi" (Moodle version implemented at University of Rijeka). The LMS is used to organize the course's content, deliver resources and facilitate communication between students and teacher using the forums [8], [9]. Assignments realized exclusively with the help of the LMS required the new tools, which were founded on the Web, so learning environment was extended with Web 2.0 tools. At first, tools for preparing and sharing photos, presentations and tools for designing web pages were introduced.

This year course moved to an e-course carried out as blended learning model with the e-learning activities (e-tivities). The "program-flow" [12] or sequential blended learning model was chosen, that assume predefined linear steps executed by the student. This model was appropriate for higher education where courses are organized as sequence of topics that suit learning outcomes, as well as for the transition from f2f to the blended learning model [12]. In this didactic model some live events were replaced with e-learning activities, which students can complete by themselves using Web 2.0 tools [13].

New e-course also brought in a collaborative and problem-based learning as individual or group-based assignments for students. The aim was to increase students' motivation for participation. In order to combine problem-based learning with other approaches (preparing and sharing different multimedia content, social networking, reflective learning, etc.), the whole set of tools was selected. The e-learning environment included following Web 2.0 tools: Flickr (for sharing photos), Pixlr (for photo editing), Bubblr (for creating comics), MindMeister (for mind mapping and brainstorming), Blogger (for blogging), Diigo (for bookmarking), Google+ (for social networking), Google Drive (for and sharing documents), SlideShare (for sharing presentations), Wikispaces (for creating wikis) and YouTube (for creating and sharing videos).

Since the students were introduced with the online learning for the first time, course was organized in a way that the two assignments were carried out in the classroom and two online. Trying to ensure more engaged learning experiences in online learning, students were allowed to use the tool that suits their preferences. To accomplish their choice, several tools for realization of certain e-tivity were offered for the two last assignments.

C. Course Learning Design

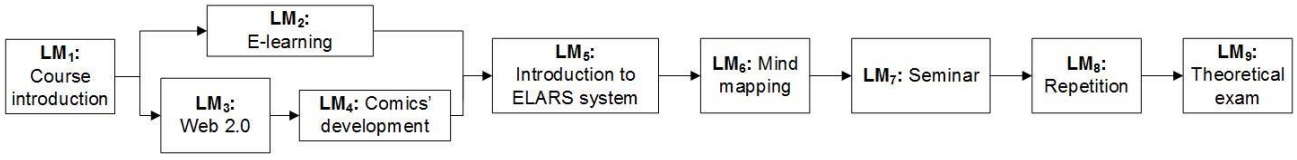

Fig. 1 Course learning modules

Additionally, for the collaborative e-tivities students were allowed to form groups by themselves. In order to support them during that process, further improvements of the learning model were made by providing personalization using ELARS recommender system [15].

According to the above, the development of the novel didactic model went from combining f2f learning with Web 2.0 tools, with personalized e-tivities.

Learning design for the course "'Extracurricular informatics and technical activities" consists of sequence of activities. Activities are grouped in learning modules (Fig. 1).

The course starts with an introduction module (LM_1) and two theoretical modules LM_2 and LM_3, which include lectures in the f2f environment and support activities where students are solving their first assignment - Comics' development (LM_4). To fulfil this assignment student should work with three different Web 2.0 tools (Pixlr, Flickr and Bubblr) in classroom and publish it. Task is completed when students submit the link to their work in LMS.

In LM_5 module students are introduced to ELARS system and have to submit questionnaire results regarding their preferences of VARK learning styles [4] and Web 2.0 tools.

Four modules related to the main course topics within which students participate in e-tivities follow this module.

Module "Mind mapping tools" (LM_6) includes f2f activity during which students choose collaborators using ELARS and participate in the "Mind mapping" e-tivity, handled in the controlled environment (classroom).

Fig. 2 shows activities planned for the next learning module "Seminar" (LM_7). After reading directions for assignment, students choose collaborators using ELARS system. Formed groups have a task to identify the possible application of a chosen Web 2.0 tool in the classroom and to create their own example of collaborative e-tivities that uses the chosen tool as class activity or as a supplement to teaching. Students within the group can choose between nine offered Web 2.0 tools. Formed groups then choose recapitulation e-tivity with the help of the ELARS system and create a seminar in the written form using recommended tool - Google Drive or Wikispaces.

The last task of this assignment is to make a presentation of their seminar in SlideShare, publish and to present it in front of other students.

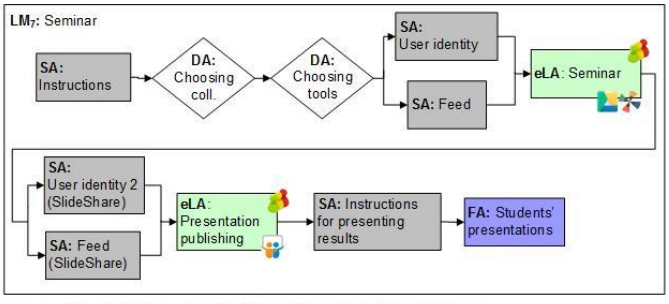

Fig. 2 Workflow in module LM_7

Module "Repetition" (LM_8) includes choosing recommended e-tivity by ELARS system and then collaborators to create a summary of subject matter in the written form using Blogger or in the form of a video using YouTube (Fig. 3).

During each e-tivity, students use the ELARS system to get feedback regarding their engagement [2].

E-tivities in course are designed to provide students interaction with other students in order to achieve learning outcomes of each module. E-tivities are used for formative and summative assessment and require continuous students' engagement [9]. The tasks and the tools used for each e-tivity are shown in Table I.

The personalization in the context of e-tivities that is achieved using recommendations is also based on course learning design [13], [10]. In the process of defining course learning design in the ELARS system, teacher is authorized to set the recommendation criteria in such way to fulfil the needs of following e-tivity. Recommendations are based on selected student's characteristics (learning styles or tool preferences or activity level for completed e-tivity) [13].

The similar approach is used to determine collaborators recommendations. In LM_6 module "Mind Mapping", collaborators were offered based on learning styles and preferences for the MindMeister tool.

In LM_7 and LM_8 module offered Web 2.0 tools in tools recommendation, are ranked according to known or predicted preferences.

For each e-tivity, teacher can specify expected actions and required individual or group activity level. ELARS system includes recommendation tips that are filtered according to the set of expert rules and the expected actions defined by teacher.

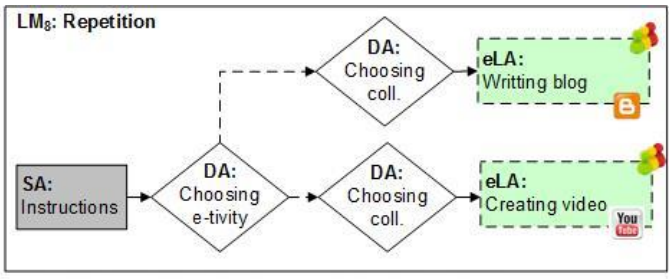

Fig. 3 Module "Repetition" (LM_8)

D. Grading

Students collect credits during the semester from several elements. Table I shows the amount of course activities, ECTS credits for each activity, assessment methods, and grading credits. The final grade of e-course is calculated as a sum of all gathered credits for each course activity. Continuous participation in all activities can reach grades according to the standard evaluating scale for graduate program in University of Rijeka: A - 90-100% - excellent (5), B - 80-69.9% - very good (4), C - 70-59.9% - good (3), D - 60-49.9% - sufficient (2). Score less than 50 points denotes that student fail the course and have to retake it in the next academic year.

TABLE I
COURSE ACTIVITIES, TASKS AND CORRESPONDING CREDITS

Module	Activity	ECTS	Specific Task	Tools	Assessment	Credits (max)
LM_1-LM_7	Participating in e-course	1	The presence in class, reading lessons, announcements, recommendations on regular basis	MudRi and ELARS	0-5 points for presence; 0-10 points based on the activity logs	15
LM_4	Comics' development	0,5	Create a comic with edited pictures and publish it (individually)	Flickr, Pixlr, Bubblr	0-10 points according to the specified criteria	10
LM_6	Mind mapping	0,5	Create mind map with key concepts of the assigned topic (groups with 2 members)	MindMeister	0-10 points according to the specified criteria	10
LM_7	Seminar: Web 2.0 tools in education	1	Write a seminar with description of assigned Web 2.0 tool and identify its potential use in education; create and publish presentation (groups with 3 members)	Google Drive /Wikispaces/ SlideShare	0-25 points, according to the specified criteria	25
LM_8	Repetition	0,5	Summarize subject matter using optional e-tivity twice during the course (groups with 4 of 5 members)	Blogger/ /YouTube	0-10 points, depending of the quality/quantity of contribution	10
LM_9	Theoretical exam	0,5	Solve online test	MudRi	0-30 points, depending of correctness	30
	Total:	**4**				**100**

IV. EVALUATION

In order to examine students' attitudes towards applied didactic model, an anonymous online questionnaire in MudRi system was conducted. The main objectives were to determine the extent to which students are satisfied with the planned e-tivities and the tools used to support them. From a total of 35 students, 22 of them (62.8%) filled the questionnaire. Since the number of students who participated in this research was relatively small, the results are not statistically significant. However, obtained feedback provides insight into possible problems that students have encountered during e-course and will be used to improve the presented model.

The Likert scale of attitudes was used with the optional choices: 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree. Average results for the most important statements from the questionnaire with standard deviations, as well as number of answers given for each choice in statements are shown in Table II.

The results show that the students were satisfied with the use of Web 2.0 tools, but less with ELARS recommender system and e-course in general. Although the results about these two components were weaker, it should be taken into account that the standard deviations in these statements are quite large. Thus, additional analysis e.g. the statement of the effectiveness of a didactic model (S2) it can be determined that significant number of students (13) agree that applied didactic model was effective while only five did not. Similar results are shown in statements S5 and S6, about ELARS system. In S5 average result is 3,23, but 50% of students do consider ELARS recommender system useful for e-tivities, 23% are indifferent and 27% does not consider ELARS system useful. In S6, 10 students were satisfied with the received recommendations and five were not.

Besides rating the statements, students gave answers to some open-ended questions in form of positive or negative comments about e-course. Between positive comments, it should be stressed out that students recognized the freedom to choose collaborators, tools and e-tivities within the e-course using the ELARS system. They also pointed out usefulness of Web 2.0 tools and the variety of tasks as positive aspects. Students had some prior experience with Web 2.0 tools such as blogs, Glogster, YouTube, Facebook, but they lack an awareness of how those tools can be used for learning. Therefore, familiarizing with other tools was very useful for them.

On the other hand, since students included in this research are future Primary education teachers who encountered online learning for the first time, they stated that they would prefer more f2f lecturing and "live contact" with the teacher and colleagues. Some students stated that such learning model requires too much engagement time and the excessive participation. They were not satisfied with strict deadlines for assignment. One student complained regarding Seminar 1 since the task assumed that he becomes familiar with chosen tool by himself. Comments like this might indicate that students are not enough independent and would prefer higher level of guidance. However, one of the aims of introduced didactic model was also that the students acquire competences for lifelong learning.

Lack of independence and potential lack of skills for working with information and communication technologies also affected students' attitudes towards ELARS system. Their comments showed that students had minor difficulties with the system, especially when input data for activity level monitoring was requested by the system. Some of the students consider monitoring of their activity level by the system unnecessary (especially if the tasks are regularly solved) while others well recognized the potential of this functionality. They pointed out that it can be useful for distributing task among the members of the group, as well as in their future work with children, in order to get insight how much anyone made during collaborative activities.

Several students stated that they would better recognise recommender system in a larger group, where students do not know each other so well.

TABLE II
ANONYMOUS QUESTIONNAIRE RESULTS

No.	Questionnaire statements	1	2	3	4	5	Avg	StDev
S1	You are satisfied with realized e-tivities and communication within the e-course.	2	4	5	8	3	3,27	1,17
S2	You consider applied learning model effective.	5	2	2	12	1	3,09	1,31
S3	You find positive the freedom to choose collaborators and tools for e-tivities within the course.	0	2	1	14	5	4,00	0,80
S4	You consider Web 2.0 tools useful for realization of e-tivities.	1	0	2	16	3	4,14	0,79
S5	You consider ELARS recommender system useful for e-tivities.	5	1	5	6	5	3,23	1,44
S6	You are satisfied with recommendations received in ELARS system.	4	1	7	9	1	3,09	1,16

The students' average grade was very high: B - very good. In average, students collected 85 points. This shows that despite some minor difficulties with used tools, they were motivated and managed to achieve learning outcomes.

V. CONCLUSIONS AND FUTURE WORK

Didactic model described in this paper was reinforced with LMS, Web 2.0 tools and E-Learning Activities Recommender System - ELARS. Such e-learning environment is based on e-learning 2.0 approach, pointing out design with collaborative e-tivities.

The survey results were satisfactory and pointed out that didactic model should be more adapted to students with potential lack of skills for working with ICT. Reason for satisfaction can be also distinguish in the fact that students' academic achievements were very good. It is also important to point out that the dropout rate of e-course was none and that students' final results still showed the motivation for this approach of learning.

The future work will be focused on encouraging independence of students, introducing additional guidelines that will ensure that students with lack of skills in ICT can use the ELARS system without difficulties. It is also necessary to highlight the importance of strict deadlines for sequential blended learning model and continuous monitoring of students work, not to be considered as personal control. Other efforts will be taken in increasing teacher-student communication and encouraging students (via additional e-mails) to fulfil the learning outcomes.

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