# Designing Learning Environments Based on Collaborative Content Creation

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Abstract. One of the approaches how to support collaboration during formal or informal learning is application of concepts which have been successfully verified in different domains. Especially various web-based knowledge sharing applications have been applied as a model for designing learning environments so far (e.g. social networking sites or forums). However, these applications miss important features which are essential for education, such as learning process management or learners' reflection and awareness. In this paper, we specifically investigate how concepts of content creation systems can be adapted to support effective learning. We describe implementation of a web-based system called PopCorm which is dedicated to learning by synchronous collaborative task solving. Stated design decisions are supposed to help in further research how to adapt concepts of various systems for purpose of learning.

Keywords: CSCL, Collaboration, Knowledge sharing

## 1 Introduction

Knowledge management always played an important role in various types of communities and organizations. Well-managed knowledge represents a critical factor in competitive advantage and thus the organizations are highly motivated to pay appropriate attention to its continuous creation, sharing and refinement. Especially knowledge sharing is considered as a crucial process in which knowledge is exchanged among members of particular organization or community. The process of collaborative knowledge sharing has recently significantly changed with the rapid expansion of various Web 2.0 applications and services [2].

Knowledge sharing applications based on Web 2.0 principles include wikis, forums, social networking sites, content creation tools (e.g. Google Docs) or community question answering systems (e.g. Yahoo! Answers). As the popularity of these applications was increasing, they became the subject of interest in educational domain, too. Especially wikis and forums are extensively used to support learners' collaboration. However, these applications were not designed and developed for purpose of effective formal nor informal learning. Therefore, it is difficult or sometimes even impossible

to employ directly these systems to support learning [1]. There are many reasons for this discrepancy, such as instructors can lack the features for organization and management of learning process or for monitoring of current state of learners' collaboration. Moreover, learners can miss the appropriate awareness tools for their self-regulation and motivation. Some partial solutions have been proposed to address these problems so far (e.g. learning analytics). However, providing learners and instructors with full educational support requires more complex design solutions. Therefore, we investigate how to employ the concepts of popular web-based knowledge sharing applications to design effective learning environments, which are specifically aimed at collaborative learning. Our design is based on experiences gathered during developing and using a collaborative environment PopCorm for non-controlled learning as a supplement to the university course.

### 2 Related work

Learning systems should consist of tools dedicated to five categories of high-level functions [3]: (i) for dialogue and action; (ii) for workspace awareness; (iii) for supporting students' self-regulation or guidance; (iv) for teachers' assistance; and finally (v) for community level management. However, existing web-based systems for knowledge sharing provide none or only few of them. Therefore, specific studies are concerned how to connect principles of these systems with the appropriate functions for effective learning.

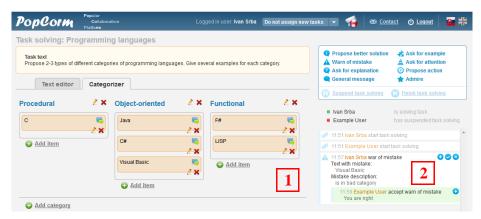
Authors in [1] investigated how to meet the needs of students and instructors while providing them with the possibilities of social networking sites. Learning environment *Classroom Salon* was proposed in which the collaboration takes place in small groups termed Salons. Each Salon can be open to the entire community or only to a particular subgroup. Students can use these Salons to post various documents, such as a piece of text, a program or a series of questions. Additionally, it is possible to annotate or vote on these documents. Another important feature is a dashboard which provides students with the statistics about created annotations.

Similarly, authors in [7] created a large-scale learning environment *OpenStudy* based on Web 2.0 technologies, such as online forums, real-time chat and social networking sites. Students are able to create a new topic of discussion, view existing topics or join the current discussion.

While solving some specific well-defined tasks, the main aim of collaboration is to create a valuable content rather than communicate or socialize (as a kind of collaboration which is supported by Classroom Salon or OpenStudy). In this case, it is essential to employ environments which support learning besides collaborative content creation. Therefore, we decided to design such environment and take into consideration concepts of popular content creation tools (e.g. Google Docs).

# 3 Learning Environment PopCorm – Design Trade-offs

We created the application named *PopCorm* (Popular Collaborative Platform) which is aimed to support formal as well as informal learning and simultaneously take advantage of popular concepts of content creation systems. PopCorm supports content in three different representations: free text, graphical diagrams and lists of items. Corresponding interaction tools were proposed to support each of these representations: a text editor, a graphical editor and a categorizer (see Figure 1). Another important element is a mean for learners' communication. Except collaborative content tools, we provide learners with a discussion which is a generic communication tool independent of a particular type of a task being solved. Learners can use this discussion anytime during task's solving to exchange messages related to the created content.



**Fig. 1.** Screenshot from the collaboration platform PopCorm; the categorizer tool (1) and semi-structured discussion (2) is displayed. The categorizer is a special tool developed for solving tasks the solution of which consists of one or more lists.

We describe PopCorm and our design decisions through trade-offs adopted from [3].

The Trade-off between Free and Structured Dialogue. Learners' communication in the discussion tool is partially structured by employing well-known approach of sentence openers. Groups, in which learners communicate via structured interface, show more intensive orientation on task solving in comparison with groups, in which members communicate via unstructured interface [4]. On the other hand, strictly structured communication interface can negatively influence collaboration [5]. Especially in the case that learners want to write a message which cannot be classified into any of predefined types of messages. Thus we decided to design a semi-structured interface which provides 18 different types of messages (e.g. propose a better solution or ask for an explanation) which include also general message type and comment which can be used to post any content. These special types of free messages solve the problem with the strictly structured communication interface.

The Trade-off between Parallel and Embedded Tools. We decided to embed the discussion directly to all interaction tools. Learners can take advantage of this integration and select particular text from editors and post a new message in the discussion

with the connection on the selected text. This solution enables fast and effective referencing on the created content. Additionally, the communication about the content is still compactly recorded in the discussion and it is not split in the numerous annotations strewn all over the content. On the other hand, the implementation of embedded tools can be difficult depending on the purpose and the design of particular tools.

The Trade-off Related to the Coordination of Action and Dialogue. The design and implementation of PopCorm allows users to collaborate simultaneously without any restriction. All performed actions are synchronized among all group members in real-time and with resolution of possible conflicts. It means that learners can collaborate really effectively at the same piece of text or drawing at the same time similarly as it is possible in content creation systems. This scenario is quite uncommon in standard learning systems which usually support only asynchronous collaboration.

The Trade-off between Self-Regulation and Teacher Support. Introduction of the structured interface plays the important role in our design because different message types allow us to automatically identify student's activities. Afterwards, we are able to analyze and evaluate learners' interaction. As soon as the group finishes the task solution, learners are presented with the statistics about their collaboration. The automatically calculated evaluation is important not only for learners but also for instructors who can monitor learners' performance and take actions if necessary.

# 4 Supported Collaboration Scenarios

Design of PopCorm was proposed in the way which supports different kinds of collaboration scenarios in formal or informal learning settings. In formal learning settings, students can collaborate on short-term tasks which supplement learning materials provided by the particular course. These tasks can be prepared by a teacher who plays the role of the instructor. A teacher can monitor students' collaboration by the provided statistics and even by observing the currently created content in real-time.

In informal learning, members of different communities (e.g. workplace teams, communities of practice) can collaborate on tasks which support their involvement in their organizations. Examples are solving of problems learners run into during their work, human resources trainings or even team building activities. In this case, the role of the instructor can be represented by a manager, a supervisor or a team leader.

**Evaluation.** We evaluated PopCorm in formal learning settings as a part of the education process within the course Principles of Software Engineering at Faculty of Informatics and Information Technology, Slovak University of Technology in Bratislava. PopCorm was used as a supplement to learning management system ALEF [8]. Totally 106 students participated in the long-term experiment. Learners were repeatedly assigned to 254 dynamic short-term study groups by a method based on Group Technology approach [8]. Each group solved one of 69 short tasks prepared by a teacher. Totally 3,763 messages in the semi-structured discussion were recorded.

During the experiment, learners perceived collaborative learning in PopCorm as an interesting and unconventional way of education. Students expressed positive feedback to their movement from individual learning to collaborative one. In addition,

they showed interest in the questions about how the proposed platform works. Last but not least, we received a lot of proposals how to enhance collaborative learning. The part of these improvements has been already implemented.

### 5 Conclusion and Future Work

Concepts of many popular Web 2.0 knowledge sharing applications have been applied in the educational domain so far, such as forums or social networking sites. While these concepts support mainly communication and socialization between learners, we focused specifically on adaptation of verified principles of content creation systems. Our web-based application PopCorm provides learners and instructors all features, which are necessary for effective and successful learning, while the main mean for learning is the content collaboratively created by learners. The evaluation of the proposed application design confirmed the success of this approach to creating innovative learning environments. In the future, we plan to investigate how concepts of recently very popular Community Question Answering systems (e.g. Yahoo! Answers or Stack Overflow) can be employed to support formal and informal learning.

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