To Build Light Gamification upon Social Interactions: Requirement Analysis for the Next Version of Topolor

Lei Shi, Dana Al Qudah, Alaa Qaffas and Alexandra I. Cristea

Department of Computer Science, University of Warwick
CV47AL Coventry, United Kingdom
{lei.shi, d.al-qudah, aqaffas, acristea}@dcs.warwick.ac.uk

Abstract. The introduction of social dimension enables traditional adaptive educational hypermedia systems to provide more versatile personalized services. Topolor has been developed to investigate the impacts of social interaction and feasible engagement strategies in such a system. We have evaluated Topolor's social features from the perspectives of *usefulness* and *ease of use*. We intend to develop the next version of Topolor, starting with enhancing relatively lower rated social features. This paper presents our plan of building light gamification upon the evaluated social interaction features with relatively lower rating.

1 Background

Adaptive educational hypermedia systems can provide rich learning experience with educational hypertext and hypermedia adapted to learners' personal needs [1]. By introducing a social dimension, it becomes possible to offer more personalized services, e.g., social interaction tool and learning peer recommendations [2]. Topolor is a social personalized adaptive e-learning system that builds social features upon an adaptive educational hypermedia system [3, 4]. It is under iterative development, and its first version has been used as an online learning system for the MSc level students in the Department of Computer Science at the University of Warwick [5]. We have evaluated its first version from various perspectives and the results showed high satisfaction from the students [6, 7, 8, 9]. At this stage, we aim to focus on the relatively lower rated features, and improve them to make Topolor more engaging.

Gamification is defined as *the use of game design elements in non-game contexts* [10]. It describes an effective way of engaging users and motivating their behaviors using game mechanisms and/or elements. The use of gamification in enhancing engagement in an e-learning environment has gained traction in recent years, and its benefits have been stated by a number of researches [11, 12, 13]. Hence, we expect gamification can also help with the improvement of those identified features as well as enhance engagement in Topolor. This paper presents our plan of introducing gamification into Topolor, focusing on building light gamification mechanisms upon those identified social interaction features with relatively lower rating.

2 Evaluation Summary of Social Interaction Features in Topolor

As a social personalized adaptive e-learning system, Topolor[1] provides not only adaptation services, such as learning topic adaptation and learning path adaptation, but also social interaction features to support social e-learning and collaborative e-learning [14]. For example, learners can post and share their own learning status, as well as favorite, share and common on their peers' learning status. They can send messages to each other; they can also ask questions and answer others' questions.

We have identified 110 types of actions that students could perform in Topolor, 18 of which were annotated as social interaction actions, as shown in Table 1. We have evaluated each action's *usefulness* and *ease of use*, using a Likert Scale questionnaire. For each action, a student had to assign a score (1: very useless - 5: very useful) to its *usefulness*, and a score (1: very hard - 5: very easy) to its *ease of use*.

Table 1. Social Interaction Actions Annotated in Topolor

Learning Status	Create, Edit, Remove, Comment on, Favorite, Share
Message	Send, Reply
Q&A – Ask	Create, Edit, Remove, Share, Favorite, Add Tag, Edit Tag
Q&A – Answer	Create, Edit, Remove

The experiment was conducted in the Department of Computer Science at the University of Warwick, with the help of 21 MSc students. The optional questionnaires were collected after a time-controlled (2 hours) online learning session. Finally, we collected 10 questionnaires to analyze. The results shown that all the evaluated actions were positively rated (score ≥ 3, the natural score), as the minimum score for usefulness was 3.70 (mean = 4.30, standard deviation = 0.25) and the minimum score for ease of use was 3.80 (mean = 4.15, standard deviation = 0.29). We have examined the evaluation results' reliability. The *Cronbach's Alpha* value for *usefulness* was 0.934, and that for *ease of use* was 0.948. Both are larger than 0.8, suggesting a high level of reliability of the results [15]. We focus here only relatively lower, (whilst still above average) rated actions, as shown in Table 2, with minimum values in bold.

Table 2. Ranking list of the Usefulness and Ease of Use of the Evaluated Actions

Action	Mean value of *usefulness*	Mean value of *ease of use*
Favorite a learning status	**3.7**	**3.9**
Share a learning status	**3.9**	4.2
Edit a learning status	4.2	**3.9**
Edit a question	4.4	**3.9**
Edit a tag on a question	**3.8**	4.1

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1 http://www.topolor.com

3 Building Light Gamification Mechanisms

Gamification is implemented for creating more interest, attention and interaction to make a system more engaging [16]. Light gamification mechanisms in this paper literally mean that we intend to introduce gamification as a solution to symbiotically make Topolor easier to use and more engaging, rather than replace its social learning community. In this section, we will specifically address the initial reasons for starting this work, propose three light gamification mechanisms, and depict the scenarios how these mechanisms work in the system.

From the evaluation results we can see that the students felt positively about 'editing', but they liked 'editing' slightly less than the other social interaction actions. 'Editing' features we considered minor features in Topolor, because in a modern social system, what's more important is the timeliness of posts, and it does not make sense to dramatically update a post which has already had comments. For instance, Facebook[2] and Twitter[3] do not allow users to edit their posts, but users can delete their posts. However, these 'editing' features somehow influence the overall satisfaction of the students. Therefore it is necessary to provide mechanisms, which can guide users to use the provided features, especially those that are more complicate while still useful. Inspired by this, we intend to introduce a so-called *tip mechanism*, in order to help the students to get used faster to various features, as well as a *badge mechanism* that encourages them to explore more features.

The evaluation results also reveal some issues about favorite-ing and sharing a learning status, which were designed for the engagement of informal communication and collaboration. While the *tip mechanism* and the *badge mechanism* might make such features easier and more pleasant to use, there may be side effects such as the 'noise' produced. For instance, students may abuse such features only to earn more badges, rather than for learning purposes only. Therefore, to reduce the 'noise', we intend to introduce another mechanism, a *peer-review mechanism*.

Details about the 3 proposed gamification mechanisms are as following:

Tip Mechanism. The first time that a student views a part of a user interface where there is/are a potential feature(s) to use, Topolor will pop up a canvas to remind the student to use the feature(s), and then, if the student clicks 'details', the pop-up will expand to show more information about how to use the feature(s), step by step. These tips will be packaged as missions [17] that a student may be willing to achieve, and when a student completes a mission, s/he will be awarded for the engagement. Additionally, these *tips* can also show the explanation of why the student is offered a specific learning topic, path or peer recommendation, which are expected to improve Topolor's usability. In such a way, the *tips mechanism* acts as a navigator guiding students to use various features in Topolor, and make it more engaging.

Badge Mechanism. Badges are among the most visible elements of gamification. The process of earning badges engages participation, and the exhibiting of badges earned can cultivate an environment of collaborative and competitive e-learning [18, 19]. There will be three ways to earn badges in Topolor: one is to earn by completing a

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task of (a) learning topic(s); another is to earn by trying Topolor's features (in association with the *Tip Mechanism* mentioned above); the third one is to earn by helping peers, namely, awarding for the social interaction, e.g., answer a question asked by her/his learning peers. To make the badge mechanism work effectively, we will also design 1) user profile pages to support the visualization of badges that a learner has earned, 2) badge info pages to show what badges can be earned and how to earn them, and 3) user level mechanism to offer privileges according to the badges earned, which might be further extended to a *role-play mechanism*, e.g., along with earning more badges, a learner can 'grow-up' from a 'pupil' with limited privileges to a 'senior scientist' with full privileges.

Peer-review Mechanism. This mechanism will actually be implemented for two objectives. One is to prevent learners from abusing features in Topolor, as mentioned above; the other is to improve the quality of posts. For instance, when posting a learning status or when asking or answering a question, peers can cast a vote on the post's quality as well as click 'Like' button to praise its contribution. The results from the *peer-review* will be finally transferred to the credit to earn badges, which can enhance a learner's reputation, so that s/he has greater weights in determining peer posts' quality. It can also inform the display options of posts (e.g., high quality first).

4   Conclusions and Future Works

In this paper, we have revisited the evaluation results of social interaction features in Topolor, focusing especially on the lower rated features. We have also proposed three light gamification mechanisms to improve those identified features. These mechanisms are also expected to influence the entire system, so that the next version of Topolor can support more engaging social personalized adaptive e-learning.

The follow-up work has started already with the implementation of these three proposed light gamification mechanisms. Then we will conduct experimental studies on the evaluation of the new version of Topolor, analysis on learning behaviors, and comparison between the two versions of Topolor, in order to investigate the impact brought by the newly introduced light gamification mechanisms. Care will be employed to differentiate between the effects of these different mechanisms. To compare the two versions of Topolor, we will consider various criteria and evaluate them from more perspectives. For instance, besides the evaluation of usefulness and ease of use, mentioned in this paper, learning success, task performance, improvements in communication, etc. will be considered as well.

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