# SOCIAL E-LEARNING IN TOPOLOR: A CASE STUDY

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**ABSTRACT**

Social e-learning is a process through which learners achieve their learning goals via social interactions with each other by sharing knowledge, skills, abilities and educational materials. Adaptive e-learning enables adaptation and personalization of the learning process, based on learner needs, knowledge, preferences and other characteristics. In this paper, we present a case study that analyzes the social interaction features of a social personalized adaptive e-learning system developed at the University of Warwick, called Topolor. We discuss the results of a quantitative case study that evaluates the perceived *usefulness* and *usability*. The results demonstrate a generally high level of learner satisfaction with their learning experience. We extend the discussion of the results to explore future research directions and suggest further improvements for the studied social personalized adaptive e-learning system.

**KEYWORDS**

Social E-Learning, Adaptive E-Learning, Adaptive Educational Hypermedia System, Evaluation, Social Interaction.

## 1. INTRODUCTION

The Internet and the World Wide Web have made it possible to provide new types of learning environments where learners can interact with their peers and engage in effective and attractive learning experiences (Welsh, 2003). Social media is comprised of Internet-based applications that stand on the ideological and technological foundations of Web 2.0. These applications allow creation and exchange of user generated contents like never before (Kaplan, 2010). The increasing use of social media and Web 2.0 tools as well as various social features such as sharing, tagging, rating, commenting in e-learning systems can offer new opportunities for communication, collaboration, and active participation in a learning process (McLoughlin, 2011). Discussions and group work are often integrated into collaborative and participative learning practice, providing a range of educational benefits, which are thoroughly discussed in the literature (e.g. (Hrastinski, 2009), (Rovai, 2004) and (Woo, 2007)).

Adaptive (Educational) Hypermedia (A(E)H) (Brusilovsky, 2004) is another research direction that offers improvements to the area of e-learning. AEH systems (e.g. (Cristea, 2007), (Ghali, 2009) and (Foss, 2009)) provide personalized learning experiences to individual learners, according to a range of characteristics, such as learning goals, background knowledge and preferences (Rosmalen, 2009). The use of adaptation, along with the social affordances of Web 2.0 tools, carries a great potential for improving e-learning systems and learning experiences. However, the review of the previous work indicates that current e-learning systems have only marginally explored the integration of social interaction features and adaptation techniques. This research intends to address this gap by evaluating a system that was developed to foster effective social and adaptive e-learning experiences.

The aim of this research is to improve learning experience and learning outcomes via a social adaptive learning paradigm, based on the hypothesis that *extensive social features, personalized recommendations and Facebook-like appearance of a system, anticipated to make the environment more familiar to learners, subsequently increases the usefulness and usability of the system*. To isolate research variables, this paper focuses exclusively on studying the *usefulness* and *usability* of the social features in adaptive social e-learning. It is based on our recent quantitative case study that explores the use of Topolor (Shi, *et al*., 2013a; Shi, *et al*., 2013b) – a social personalized adaptive e-learning system. The rest of paper will review the research background, depict the social interaction tools in Topolor, and present the conducted experiment and its results. And finally, the conclusions and the outline of future work will be described.

## 2. RESEARCH BACKGROUND

Learning is inherently a social experience. Social aspects of learning have been emphasized in a range of theoretical frameworks developed to explain how people learn (e.g. (Vygotsky, 1978) and (Wenger, 2009)). Yet, developing effective and efficient online social learning environment remains an open problem. While online interaction via social networking services has become widely accepted and heavily embedded in day-to-day life, providing solutions that foster creation of effective e-learning spaces are not straightforward.

Online interaction tools have also been integrated and used in AEH (Brusilovsky, 2004). This enabled adaptation of educational hypertext to the personalized needs of learners (Brusilovsky, 2000) in e-learning systems. Since early 2000s, many AH frameworks have been proposed, such as AHAM (Wu, 2002), the Munich model (Koch, 2006), XAHM (Cannataro, 2002), LAOS (Cristea, 2003) and GAF (Knutov, 2008). Few were later extended to accommodate some social features, e.g., Social LAOS (SLAOS) (Ghali, 2009b) added a collaboration mechanism into the framework, and led to the development of the MOT 2.0 system (Ghali, 2009c). It introduced social features such as a chat tool, tagging, rating and commenting on learning content. However, while these systems cater for personal needs within specific learning contexts, they are often limited in their strategies for adapting to social needs or in their social features. Some recent work (Šimko, 2010) has already proposed the need for creating adaptive and highly interactive integrated learning environments. However, their work suggests only a limited number of mechanisms for enabling social interaction. Hence, there is a gap for extending and evaluating social interaction tools in adaptive e-learning settings. Additionally, their framework does not take into account the role of learner familiarity with other social interaction tools from e-learning environments and social networking websites, such as Facebook.

In fact, the features that many of the learners are familiar with from social networking websites remain missing from the current e-learning systems. For instance, sharing a learning status, engaging in a simple question/answer exchange and sharing notes remain cumbersome or impossible in many of the available systems. Subsequently, the potential of adaptation, recommendation and personalization that is based on the use of the above social features remains largely unexplored.

In this paper we address the above gap by introducing and evaluating a range of social features previously missing from the available adaptive e-learning systems.

## 3. THE TOPOLOR SYSTEM

To evaluate our hypothesis (SECTION 1), based on our experiment of requirement analysis (Shi, *et al*., 2012), we have developed the Topolor system built on the Yii Framework[1] and Bootstrap[2]. Topolor is made available open source and is hosted on Github[3] for easy sharing and version control. It is deployed[4] and used as a social learning environment to support some postgraduate level modules in the University of Warwick. The registration for using the Topolor system has been recently opened to public. Thus, a larger cohort of users is expected in the near future, providing opportunities for collecting feedback, usage data and suggestions for further improvements.

The Topolor system mainly consists of three sub-systems (Figure 1). Each of these contains a set of interaction features that are generally referred to here as the social interaction toolset (Shi, *et al*., 2013c). The subsystems of Topolor are the following:

- *Topolor-Home* provides a chronological list of the learning statuses posted by individual learners. It also provides access to a set of interaction tools that encourage informal communication and collaboration such as commenting on, sharing and favoring of learning statuses (Figure 1a).
- *Module Center* offers a warehouse of online courses, as well as provides adaptive learning content recommendation, learning expert recommendation, and interaction tools that encourage personalized social e-learning such as sending messages to recommended learning experts (Figure 1b and Figure 1d).

1 http://yiiframework.com
2 http://twitter.github.com/bootstrap
3 https://github.com/aslanshek/topolor
4 http://www.topolor.com

- *Q&A Center* maintains some lists of questions/answers related to the learning contents, and provides adaptive question recommendation, learning topic recommendation, expert peer adaptation and social interaction tools for discussions and practices (Figure 1c).

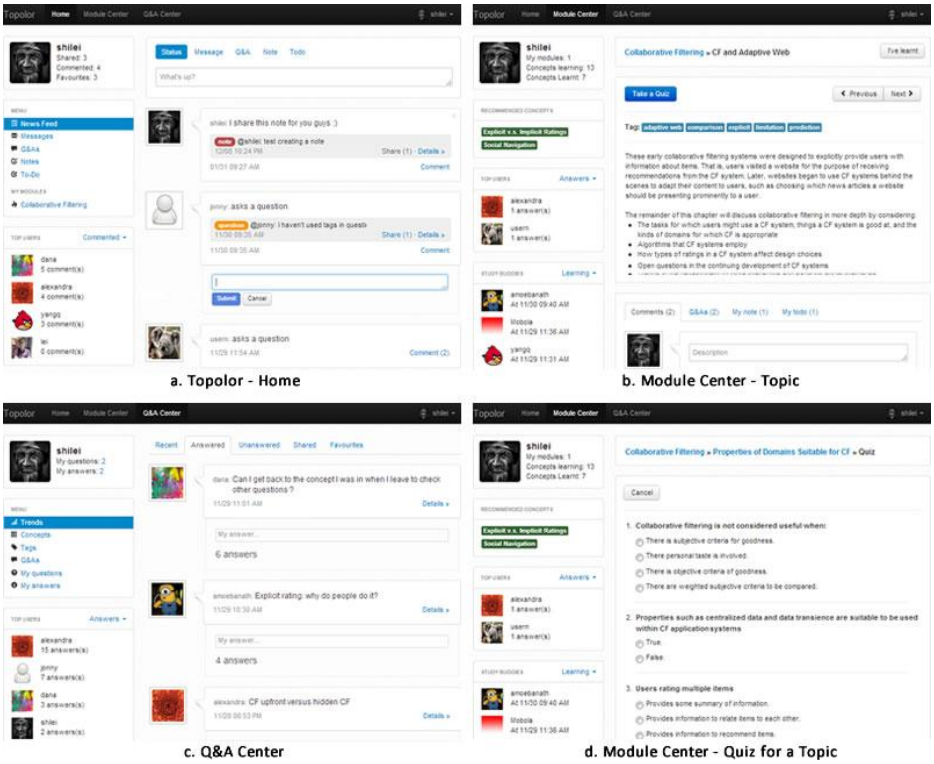


Figure 1. User Interface of Topolor

The social interaction toolset is one of the most important components in the Topolor system. To provide easy access to interaction, this toolset can be accessed from many places in the system. For instance, Figure 2 shows the interaction with this toolset from the *Topolor-Home* index page (Figure 1a).

This paper focuses on three social interaction tools. The *status tool* (Figure 2a) is used to share learning statuses. Learners can favorite and comment on each other's posted learning statuses; the *messaging tool* (Figure 2b) is used to send private messages to others; and the *Q&A tool* (Figure 2c) is used to ask and answer questions. Learners can also use Q&A tool for discussions.

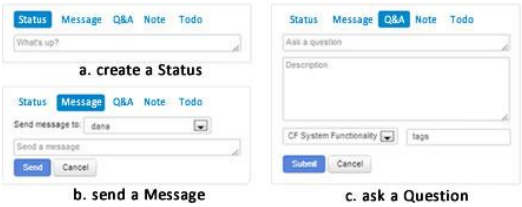


Figure 2. Social interaction toolset: (a) learning status creation tool; (b) messaging tool; (c) Q&A tool

## 4. CASE STUDY DESIGN

Topolor has been evaluated from various perspectives (Shi, *et al*., 2013d). In this section, we present the design of the conducted case study. The case study was comprised of three consecutive stages: 1) the

experiment of using the Topolor system, 2) the questionnaire about the usefulness and ease of use, and 3) the analysis of the questionnaire results and some qualitative feedback from the users.

## 4.1 Experiment Design

The experiment was conducted with the help of 21 students from the Department of Computer Science at the University of Warwick, who were registered for a 4th year MSc level module 'Dynamic Web-Based Systems', and a lecturer who was leading this module. The experiment lasted for 2 hours, during which the students were asked to learn a lesson on 'Collaborative Filtering' from the system as well as ensuring to perform specific tasks to familiarize themselves with the features related to the provided social interaction toolset. The full list of the 18 tasks completed by the students is listed in Table 1.

Table 1. Tasks Performed by The Student

| Status | Message | Q&A: Question | Q&A: Answer |
|---|---|---|---|
| Create (1) | Send (7) | Create (9) | Create (12) |
| Edit (2) | Reply (8) | Edit (10) | Edit (13) |
| Remove (3) | | Remove (11) | Remove (14) |
| Comment on (4) | | Share (15) | |
| Favorite (5) | | Favorite (16) | |
| Share (6) | | Add Tag (17) | |
| | | Edit Tag (18) | |

## 4.2 Questionnaire Design

*Usefulness* and *ease of use* are fundamental determinants of user acceptance for a tool usage (Adams, 1992). After running the experiment, each student was asked to fill in a questionnaire to measure *usefulness* and *ease of use* of the social interaction toolset. Likert Scale (McIver, 1981) questions were used to get the feedback on all available features, as tested by tasks in Table 1. The students had to select one of the five responses for *usefulness* and *ease of use*, respectively, as shown below. A score was assigned to each response, on a scale of 1-5 as numbered below. After collecting the questionnaires, the responses of the students were analyzed.

- *usefulness*: 1) very useless, 2) useless, 3) neither useless nor useful, 4) useful, and 5) very useful.
- *ease of use*: 1) very hard, 2) hard, 3) neither hard nor easy, 4) easy; and 5) very easy.

# 5. ANALYSIS AND RESULTS

Out of the 21 students who participated in the experiment, 10 students responded to the optional questionnaire. The results extracted from the questionnaire are presented below. Figure 3a shows the mean of the responses, and Figure 3b shows the standard deviation. The number of total questions in the questionnaire was 36, of which 18 questions were for testing *usefulness* and 18 for *ease of use*.

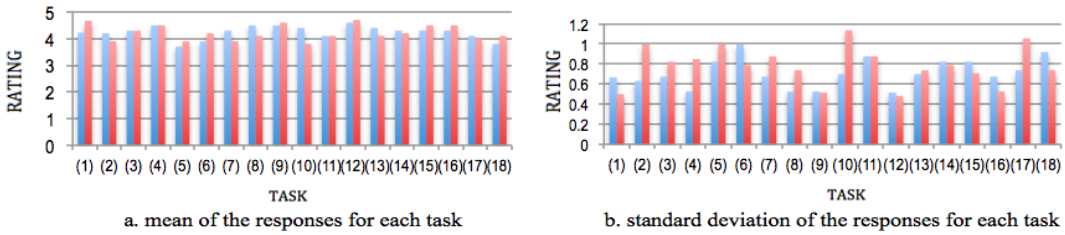


Figure 3. The a. mean and b. standard deviation of the responses for each task (Y-axis presents rating scores; X-axis presents the task order; blue columns present the usefulness; red columns present the ease of use)

## 5.1 Usefulness

The blue columns in Figure 3a and Figure 3b present the *usefulness* results. The *means* of the summative results rank between 3.7 and 4.6. The *standard deviations* of the overall results are between 0.516 and 0.994. All the reported values of a *mean* are much larger than 3 (the neutral response), suggesting students' attitudes to be generally positive.

## 5.2 Ease of Use

The red columns in Figure 3a and Figure 3b present the *ease of use* results. The *means* of the overall results rank between 3.8 and 4.7. The *standard deviations* of the overall results are between 0.483 and 1.135. As all the *means* are greater than 3, it enables us to infer that most of the students found the social interaction toolset to be relatively *easy to use*.

## 5.3 Reliability

We adopted *Cronbach's alpha* to measure the reliability of the test. According to Carmines, a *Cronbach's Alpha* of 0.8 is considered as highly reliable (Carmines, 1979). The values of *Cronbach's Alpha* for each of the questions are shown in Table 2. Both *usefulness* and *ease of use* are considerably larger than 0.8, suggesting a high level of reliability of the results.

Table 2. Cronbach's Alpha (Reliability Statistics)

| | Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | Number of Items |
|---|---|---|---|
| **Usefulness** | .934 | .944 | 18 |
| **Ease of Use** | .948 | .957 | 18 |

# 6. DISCUSSION

In addition to the questionnaire data collected from the students, we also received some qualitative feedback from both students and the lecturer of the module. The general feedback was consistent with the results of the questionnaire. However, the responses included some specific suggestions for further improving some of the social interaction features, which ranked lower from the point of *usability* and *ease of use*. Due to the space limitation, this paper focuses mainly on the quantitative results from the questionnaire. However, some of the qualitative feedback is discussed below as appropriate.

Overall, the results from the questionnaire demonstrate that the social interaction toolset is perceived to be useful and easy to use. 83% of all the features have been rated by the students as useful, and 78% of the features as easy to use (i.e., average mean $\geq 4$). Consistently with the questionnaire, qualitative feedback included a description of the system as "similar to known social networking sites (e.g. Facebook); fast and responsive". Another respondent said: "One of the best aspects of Topolor is the ability to interact with others during the process of learning". We now proceed to a detailed discussion of the individual social interaction tools, namely *status*, *messaging* and *Q&A*.

## 6.1 Status

The questionnaire results demonstrate that the feature (4), *commenting on a status*, was rated as the third most useful feature (mean = 4.5), and its *ease of use* was ranked as the fourth highest (mean = 4.5) among all the social interaction features. This result is further supported by the qualitative feedbacks. For example, one of the respondents explicitly mentioned that commenting on each other's *statuses* was one of his favorite features for interacting with other students.

On the other hand, (5) *favoring a status* had the lowest rating (mean = 3.7) on *usefulness*. The possible reason for this could be that the students might not have known what the use of favoring a status was. We

assume that it would be necessary to develop a mechanism for providing basic information on less familiar features such as favoring. Additionally, wider use of favoring with other features such as questions/answers might also affect the future patterns of use. Furthermore, the possible reason for the second lowest rating on (5) *favoring a status* for its *ease of use* (mean = 3.9), can be that labels for favoring/unfavoring statuses became visible only when the status message was being hovered over. The suggested improvement would be to keep the labels and the number of times the statuses are favored always visible.

## 6.2 Messaging

The rating for (7), *sending a message*, was, whilst high, the second lowest (mean = 3.9) with regards to its *ease of use*. The possible reason for this is the current notification mechanism for new messages. More specifically, if a student was on the messaging page, on receiving a new message a notification button, like 'You have 2 new messages', would show up. Clicking on that button would refresh the webpage with an AJAX response and show the received messages on the top of the message list. However, if the students were on other webpages, they wouldn't know whether they received any new messages. Therefore, the students might have had no idea when and how to start messaging. Additionally, whilst most of the webpages in the Topolor system provide at least one tool for sending messages to other students, such as 1) a new message box (Figure 2b) and 2) an avatar list of the recommended learning peers (Figure 4a) that could be clicked on, and then a messaging box (Figure 4b) would pop-up. There are still other webpages that did not provide such tools, potentially affecting the results on the *ease of use* of sending messages.

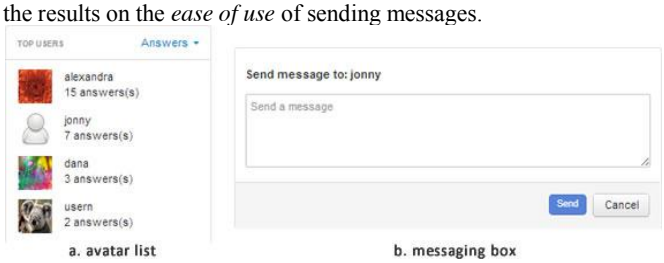


Figure 4. a. Avatar list of recommended learning peers to send messages to; b. the resulting pop-up messaging box

## 6.3 Asking and Answering Questions

The questionnaire results indicated that (12) *answering a question* was rated as the most useful feature (mean = 4.6) as well as the easiest feature to use (mean = 4.7), among all the social interaction features. A similar result was found from the qualitative feedback, where the way of asking and answering questions was explicitly mentioned as favorable. Furthermore, (9) *asking a question* was rated very high on the *usefulness* (mean = 4.5) and *ease of use* (mean = 4.5) too. Therefore, we can report with confidence that the students were very satisfied with features of asking and answering questions.

However, the *usefulness* of (18) *editing the tags of a question* was rated as the second lowest (mean=3.8), and the *usefulness* of (17) *adding tags to a question* was rated as the fourth lowest (mean=4.1). It seems that *tagging on questions* was not considered as useful as other features of the Topolor system. We can conjecture that when a student asked a question in a given learning content area, the relation between the question and the learning content would have been automatically established, so that tagging the question would not have brought additional benefits. Posting questions beyond the learning content area would be necessary to further comment on this feature.

The *ease of use* of the feature for asking/answering questions, (10) *editing a question* was rated the lowest (mean = 3.8). To provide an attractive user experience, we used AJAX calls to implement the feature. For example, when a student clicked on the title or the description of a question, it would activate the HTML editing box; and when the editing box lost focus, it would be replaced by the updated HTML text. No explicit buttons were provided to trigger editing actions. This might have not attracted student attention to the existence of this functionality. Even though the style of the mouse cursor changes when hovering the title or the description of a question, this hint might not have been a clear enough indication to the students about the provided editing functionality. Moreover, *editing a question* may require engagement with the system over a longer period of time, so the evaluation of this feature is to be finalized after using the system in the long term.

# 7. CONCLUSION

In this paper, we have 1) presented the social interaction toolset of the Topolor system, 2) reported a case study with a quantitative analysis on its *usefulness* and *ease of use*, and 3) discussed the results and identified potential improvements of the toolset. The developed Topolor system, as shown in Table 1, was designed to include a wider range of social interaction features than previous AEH systems. The results of the case study show that the social interaction toolset is found to be *useful* and *easy to use*. The overall attitude of the students towards the social interaction toolset in particular was very positive. The oral feedback was that they would have wanted to have more lessons in it. Decisive in this, we believe, was the fact that a lot of the social features had a look and feel familiar to them, similar to the popular Facebook environment, familiarity that is essential to consider in designing such systems.

Although all of the questions received positive responses from the students, we are still keen to improve the social interaction toolset further. We reviewed the relatively lower rated features and discussed the possible reasons that might have led to lower ratings. To improve this toolset, we intend to conduct further research based on the presented results and the discussion, particularly in the following directions:

- *Redesign the favoring tool*. First, we intend to find a better way of favoring and un-favoring learning statuses, questions, and learning topics. Second, we intend to explore the use of data on favored items for adaptation and personalization.
- *Provide a status-filtering tool*. We intend to extend the existing mechanism of learning status sharing by introducing a support for filtering and evaluating its benefits for collaboration. This feature has the potential to improve the process of locating relevant statuses and communicating with learning peers.
- *Provide an auto-tagging tool*. While tagging enables to connect various concepts within the system, students are usually reluctant to tag. Hence, we intend to enable Topolor to automatically generate tags for questions and explore inter-relations.
- *Improve AJAX notification messaging*: We intend to identify a more appropriate mechanism for delivering system notifications.
- *Enhance the messaging tool*. We intend to enhance the messaging tool by supporting instant messaging and appropriate notification.

The development of the next version of the Topolor system has been initiated. Future experiments will focus on evaluation of the new and improved features. The future deployment of the enhanced system will especially enable further inquiry into the role of social interaction in adaptive e-learning environments and the benefits for enriching *learning experiences* and improving *learning outcomes*.

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