

# Designing Visualisation and Interaction for Social E-Learning: A Case Study in Topolor 2

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**Abstract.** This paper presents the design of the visualisation and interaction in Topolor 2, an online learning system that supports social e-learning using adaptation and personalisation techniques. The main goal of this study is to investigate if and how the visualisation and interaction design based on self-determination theory (SDT) can improve the learning experience and learning efficiency. The goal of this paper and demonstration is to showcase the new design of the visualisation and interaction features hands-on at the conference.

**Keywords:** self-determined theory, social e-learning, system design, evaluation.

## 1 Introduction

Social e-learning is a process in which learners achieve learning goals by sharing knowledge, skills and abilities in a community where they have common interests [5]. Sustainable social e-learning occurs along with learners' interaction with one another and their motivation in participation. The abundant resources shared within a learning community offer opportunities for learners to connect to various learning content and peers, whereas one of the biggest challenges is how to direct and motivate learners to access the most appropriate resources and benefit from them. Adaptation and personalisation have been suggested as potential solutions to tackle this challenge [3].

Topolor [4] is an online learning system that supports social e-learning using adaptation and personalisation techniques, based on the hypothesis that *extensive social features, personalised recommendations and Facebook-like appearance would make a system more familiar to the learners, and subsequently increase learning experience*. This paper demonstrates the design of the novel visualisation and interaction features in Topolor 2, which have been newly introduced, based on a solid theoretical foundation, the self-determination theory (SDT) [2]. These new features aim at fulfilling the learners' perceived psychological needs, so as to direct and motivate them to access learning resources in a social e-learning context. The ultimate goal is to investigate if and how the visualisation and interaction features designed based on self-determination theory (SDT) can improve the learning experience and learning efficiency. The goal of this paper and demonstration is to briefly introduce these new features, as well as give researchers a hands-on experience of them at the conference, and gather feedback from peers and e-learning specialists.

## 2 Self-Determination Theory

Self-determination theory (SDT) is an empirical motivation theory, which proffers that individuals become increasingly self-determined and self-motivated when they feel satisfaction of their psychological need of autonomy, competence and relatedness [2]. According to SDT, people strive for *autonomy* over their actions and decisions; they tend to obtain *competence* in their actions and surroundings; and since activities such as learning often occur in a social context, *relatedness* is proposed as the third essential psychological need. In all, SDT defines the following needs [2] to fulfil:

- *Autonomy*: a sense of internal assent of one's own behaviours;
- *Competence*: a sense of controlling the outcome and experience mastery;
- *Relatedness*: a sense of connection and interaction with others within a community.

It is expected that an e-learning system that fulfils all the above three psychological needs can sustainably increase the learners' intrinsic motivation, and thus improve the learning experience and learning efficiency [1]. Therefore, in this study, SDT guides the design of the visualisation and interaction in the second version of Topolor.

## 3 Visualisation and Interaction Design Based on SDT

**To Fulfil the *Autonomy* Need.** Topolor lets learners feel in charge of their own behaviours and feel in control of their learning progress. A learner can clearly see the 'layered' learning goal of the course, i.e., the long-term goal to complete the course, the medium-term goal to finish a topic and the short-term goal to read a resource, as well as the reason for recommendations. A learner knows what is happening in the community on the home page (Fig. 1 (a)), a course page (Fig. 1 (c)) and a topic page (Fig. 1 (f)) that show various lists of, e.g., resources and peers' activities, and she can adjust the lists using various filter-sorter widgets (Fig. 1 (a. 2) and (c. 2))).

**To Fulfil the *Competence* Need.** Topolor lets learners feel mastery of their skills and confidence in current context, where cognition and expectation are consistent with system responses, so as to be able to obtain further skills and confidence with relative ease. A learner can see her learning progress in various ways. For example, in the learning path pop-up view (pops up when clicking on the button 'Learning Path' on a course page, as shown in Fig. 1 (c), or on a topic page, as shown in Fig. 1 (f)), a learner can see which topics she hasn't learnt, which topics she is eligible to learn, and which topic is recommended for her to learn, as shown in Fig. 1 (e). A learner can also see her performance on a course (by clicking on the button 'My Performance' on a course page, as shown in Fig. 1 (c)), and on a topic (by clicking on the same button on a topic page, as shown in Fig. 1 (f)), in a pop-up view that shows her performance, such as the number of courses/topics she has learnt via a line-chart (shows when clicking on the tab-button 'course/text', as shown in Fig. 2 (h)). To strengthen the feeling of competence need satisfaction, Topolor provides some enjoyable and fun features, such as the one shown in Fig. 1 (g) that lets a learner compare ones own contributions to others ('PK.': 'Player Killer', naming convention taken from games).

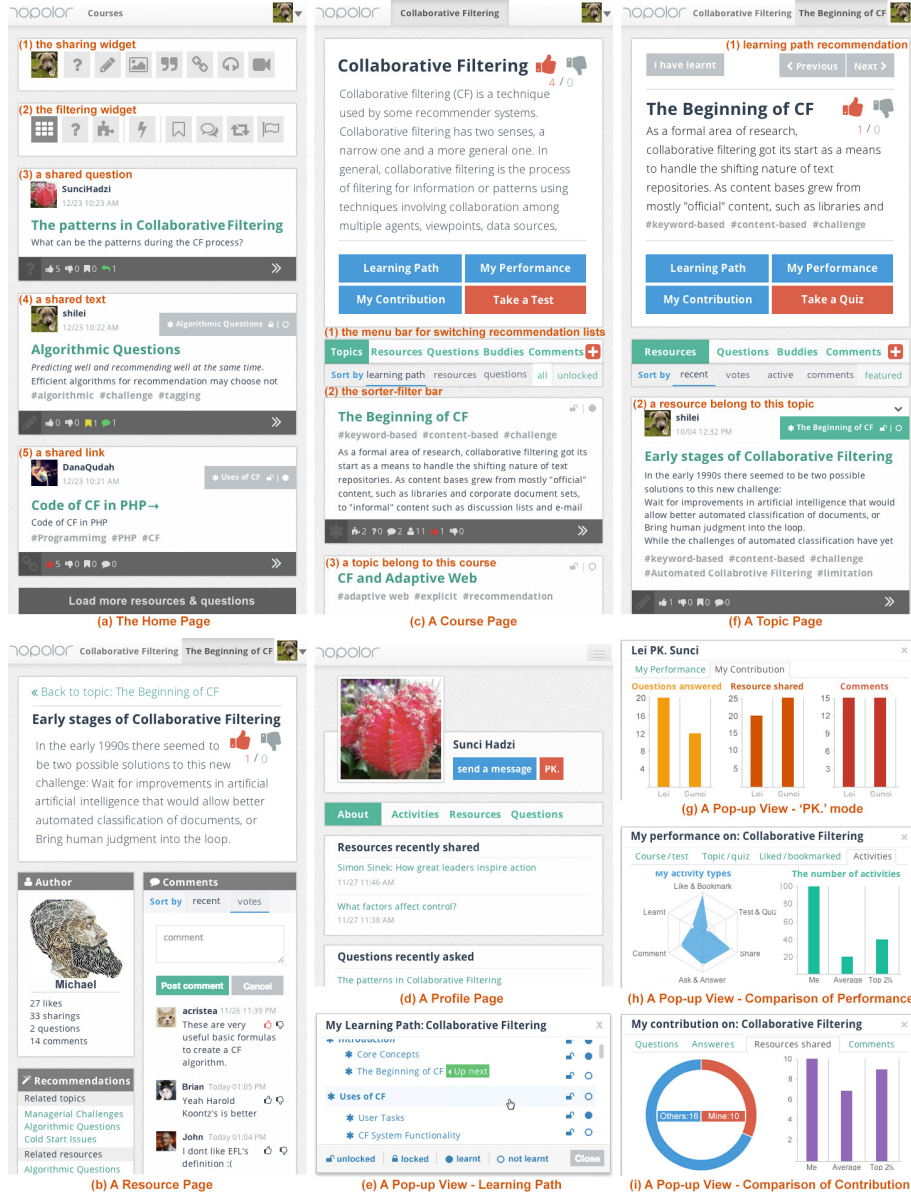


Fig. 1. The user interface of Topolor 2

**To Fulfil the *Relatedness* Need.** Topolor lets learners feel connected to peers in the social learning community by supporting social status visualisation and comparative social visualisation. A learner can view her or other 'social statuses' on a question or a resource page's author information panel (Fig. 1 (b), showing statistic numbers), and a peer's profile page (Fig. 1 (d), showing a learner's learning activities). A learner can

check her contribution to the learning community and compare her performance and contribution with others. The data in the user model are visualised and opened to the learners (Fig. 2 (g), (h), (i)), which potentially encourages them to contribute more to the community, as seeing each other's status may stimulate imitation and competition.

#### 4 Conclusion and Future Work

This paper has presented the new visualisation and interaction features in Topolor 2, an online social e-learning system using adaptation and personalisation techniques. These new features were designed rooted in self-determination theory (SDT), aiming at improving the learning experience and learning efficiency in social e-learning. We intend to demonstrate Topolor 2 to researchers and practitioners in the conference and both showcase these new features and gather feedback on further improvements.

The preliminary evaluations were conducted using questionnaires that consisted of seven 5-point Likert scale (from 1: *strongly disagree* to 5: *strongly agree*) questions asking the comparison between Topolor 2 and other regular e-learning systems, including *I believe Topolor a) helped me learn more topics; b) helped me learn more profoundly (deeply); c) increased my learning outcomes more; d) was easier to use; e) was more useful; f) was easier to learn how to use; and g) was easier to remember how to use.* 25 completed questionnaires were collected. The mean values for each of the answers were *a: 3.6, b: 4.0, c: 4.0, d: 4.0, e: 4.0, f: 4.1* and *g: 4.3* (all>3.0, the neutral value). The standard deviation values for each of the answers were *a: 0.71, b: 0.76, c: 0.68, d: 0.57, e: 0.64, f: 0.67* and *g: 0.74*, and the results' *Cronbach's alpha* value was 0.82 ( $\geq 0.8$ , indicating the results were reliable). The results indicated that the visualisation and interaction designed based on SDT had positive effect on the perceived learning experience and learning efficiency. The future work will start with investigating how each feature can improve the learning experience and learning efficiency, analysing the usage data tracked by Topolor's logging mechanism.

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