How Many Likes Can We Get for Logic?  
Exploring the Potential of Facebook for Enhancing Core Software Engineering Courses

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Abstract. The use of social network sites (SNSs) has been shown effective in several educational contexts for enhancing learning and increasing student engagement. This position paper explores the use of SNSs in the context of core software engineering courses, such as logic and formal methods, which are perceived as ‘boring and theoretical’ by many students, leading to lack of motivation and engagement, and as a result to deficiencies in mathematical background of future software practitioners. We report on our experience in using a Facebook group for blended learning in a Logic for Computer Science course at the University of Haifa, present students’ feedbacks and discuss some lessons learnt.

Keywords: software engineering education, logic, engagement, e-learning platforms, social network sites, Web 2.0

1 Introduction

Discrete mathematics and formal logic are considered as important core disciplines in standard software engineering curricula and provide the foundations for applying formal methods for specification, validation, testing and verification of software systems. Deficient mathematical skills of software practitioners, and as a result, inability to cope with formal notations, are hypothesized as hindering factors for wider adoption of formal methods in industry ([2, 6]). Mathematical courses are perceived by software engineering students as ‘difficult’, ‘boring’, and ‘too theoretical’ ([12]), leading to the vicious circle of lack of motivation and engagement, which in their turn reinforce fear of formal notations and mathematical methods. It is perhaps due to this reason that the problem of teaching logic and formal methods to future software practitioners is in the center of an ongoing fierce debate. Recent voices [11, 4, 12] call for rethinking the traditional syllabi of these courses, adapting it to the needs of modern practitioners. To the best of our knowledge, however, the use of technological platforms to support learning has not been considered in the context of logic and formal methods.

And yet Web 2.0 concepts and technologies are already transforming higher education [8], having provided a plethora of technological platforms for e-learning.

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In particular, social networking sites (SNSs), such as Facebook, Twitter, etc. seem to have great promise for supporting educational activities by allowing active participation, collaboration, interaction, information and resource sharing [1]. Of various SNSs, Facebook is certainly the most popular and is increasingly studied in the context of its educational value. Although there are no decisive conclusions, many works emphasize its pedagogical affordances, such as widening the context of learning, mixing information and learning resources, and hybridization of expertise; see [5] for a systematic literature review on the pedagogical use of Facebook.

This work-in-progress paper aims to explore how the use of SNSs can be adapted to the needs of a mathematical course, such as formal logic. In particular, what kind of content and type of interactions are appropriate for this type of courses, and what are the ways in which the learning of logical reasoning can be supported by SNSs. As an example, we report on our experience of using Facebook to enhance a Formal Logic course for Computer Science students at the University of Haifa, providing also a qualitative analysis of feedbacks collected from twenty five students. We summarize with some lessons learnt and propose some directions for future research.

2 The Facebook Group

The first author has been teaching logic and formal methods for software engineering students for several years. In her numerous interviews and informal discussions with students over the years about their motivation the points that were repeatedly brought up were a too theoretical content, lack of relevance to the real world and boring interaction with lecturer, where students mainly copy mathematical proofs from board [12]. In an attempt to address these problematic issues, we have decided to design a blended learning environment for a course of Logic for Computer Science at the University of Haifa. Facebook was chosen due to the above mentioned pedagogical affordances, as well as for minimizing setup time for the online group.

The course Logic for Computer Science was held in Fall 2015 at the University of Haifa. The course had twenty five registered students, all of which were required to sign up\(^3\) to the closed Facebook group created for the course. The Facebook page was declared to be as a supplementary source of information to the lectures, where student-student and student-lecturer interaction could take place outside of classroom, including student questions, bonus assignments and quizzes and enriching materials. The staff of the course included a lecturer, a teaching assistant and a webpage administrator, who was responsible for managing the Facebook site, posting new content and replying to questions and requests. All of them were active participants in the discussions of the group.

As usual in online platforms for course management, the students were encouraged to ask questions related to the material in the group, and it was also used\(^3\) Notably, all of the students had their personal Facebook accounts and used it for signing in (although they were suggested to create a new account for the course).
for exchanging administrative messages between the students and the staff. However, several special logic-related activities were carried out on a weekly basis in the group, which we describe next. The activities consisted of three types of challenges, for which the students could gain extra bonus points to the final grade. Each 2-3 weeks a scoreboard was posted, showing the leading winners in different categories.

The first activity was aimed at exercising logical reasoning in an ‘informal’ way. Namely, every week a logical puzzle was posted by the group administrator: the first three students who solved it gained bonus points. The puzzles had increasing difficulty, and were most of the times related to the studied material (truth tables, logical connectives, quantifiers, etc.). The second activity aimed to enrich the students’ knowledge with interesting topics outside of the scope of the syllabus. Every week the lecturer or the administrator brought up a question for discussion that was broadly related to logic. The students were also encouraged to post questions and links for discussion themselves, and several of them indeed did, getting extra bonus points for active participation. One example of a weekly discussion was on a recently discovered connection between logic and quantum physics. Some students’ comments in that discussion were: “Wow! That is so interesting, I wish I knew more about quantum physics”, and “This is the most significant link between important things in the universe and class material that I have ever seen!”. The third activity was intended to add a fun and creative dimension to the group. In this type of weekly challenges the use of various types of media was specifically encouraged. For instance, the students were asked to post an image (or a meme) which best captures the notion of logical inconsistency as studied in class. Another example was posting a link to a song featuring either the word ‘logic’, or related to logical reasoning in some way.

The interest the students showed in the group, the time they invested in solving the logical puzzles, and the variety of inputs they provided for the online discussions overcame our expectations. We felt that the group significantly contributed to the interaction between the students and course staff, sparked the students’ interest in logic, and increased their motivation to invest time in the course. As shown below, this was also reflected in the students’ feedbacks.

On the negative side, managing the Facebook group took more time than expected: in addition to the average weekly 2 hours spent by the group administrator managing puzzle-related activity and keeping track of the bonuses, the course staff spent at least one weekly hour to search for interesting content, answering questions and participating in the discussions. However, at least the time for the former can be reduced by reusing the once prepared resources.

3 Students’ Feedbacks

At the end of the semester the students were given the opportunity to express their thoughts about their experience through open-ended questions. Due to lack

\textsuperscript{4} A large variety of logical puzzles can be found. e.g., in [9, 3].

\textsuperscript{5} http://www.nature.com/news/paradox-at-the-heart-of-mathematics-makes-physics-problem-unanswerable-1.18983
of space, we only briefly summarize some notable categories that emerged. The puzzle challenge: Many students mentioned the puzzle challenge as the most fun and engaging activity in the group, which kept them motivated. Some of the answers supporting this finding are:

- I invested a lot of time in the puzzles. Each time the puzzle publishing time was approaching, I sat near the computer and refreshed the page until it appeared, and then I would go for it, enjoying every moment the wheels of my brain are turning.
- It was so nice to find out that studying the course material was helpful for solving problems which I thought were cool.
- I put considerable time into the puzzles for two reasons: first, it helped my learning, and second I like puzzles which require logical thinking.

The enriching discussions: the discussions helped some students deeper understand the connections between logic and other related topics. Some feedbacks supporting this finding are, e.g.:

- I actually read some papers and articles related to logic via the links that were posted in the group. Now if those links were posted on Moondly, I would probably not read them. But due to the fact that it was not mandatory, I really felt like reading them out of choice.
- Sometimes the links posted by the staff or other students made very interesting connections between what we studied and our daily life. Even images and memes that were funny - it made me see the material from a different perspective.

Increased motivation: active participation in the group activities increased motivation for most of the students, e.g.: (i) The group affected my course experience, I was motivated to read more about some topics that came up in the group. (ii) The challenges in the group made this course competitive and fun.

Improved interaction with lecturer: the group provided a new channel of communication with the lecturer, which many of the students appreciated, e.g., (i) I felt free to ask question any time of day, and this increased my curiosity. (ii) Facebook makes the connection with the lecturer deeper, more personal and free and it feels that the lecturer cares more.

It should be noted that some of the reactions were not so positive, and a few students felt the group was not helpful, e.g.: (i) I think the improvement may exist, but it is small and very dependent on the student, the students that understand the material and have no questions do not need the group. (ii) I do not use Facebook much and so the group had almost no effect on my experience.

4 Summary and Future Work

Deficient background of practitioners in formal logic has been pointed out as one of the main factors hindering a wider adoption of formal methods in industry. The discourse of how to adapt teaching of formal methods, and in particular of formal logic as their necessary background to the needs of software practitioners has been going on for over four decades [2]. Web 2.0 technologies, and in particular SNSs offer new educational opportunities for blended learning which could
be taken advantage of in this context. This paper discusses some concrete ways in which a popular SNS, such as Facebook, can be adapted to the context of a logic course, increasing engagement and motivation, enhancing learning and improving interaction between students and lecturers. We believe that the positive feedbacks we got from students are an indication of the great potential of using SNSs in logic and formal methods courses. To evaluate ideas discussed here, we plan to collect further empirical data for a quantitative analysis. Also, we plan to take the extra bonus points a step further, introducing more gamification and social features elements which have been found helpful for encouraging engagement (cf. [10]). It would be interesting to adapt or generalize the activities described here to the context of other courses in software engineering, especially those which are considered ‘theoretical’ and could be “boosted” by using technological platforms to increase student engagement.

References