Promoting Active Learning Through Problem-based Discussion Forums

Gabriela Lovászová, Viera Palmárová
Department of Computer Science, Faculty of Natural Sciences,
Constantine the Philosopher University in Nitra, Slovakia
glovaszova@ukf.sk, vpalmarova@ukf.sk

Abstract

In this paper, the pedagogical potential of online discussion forum is discussed through the lens of constructivist and constructionist learning theories. The asynchronous online discussion forum is suggested as an effective tool for realizing collaborative learning activities that can enrich student’s learning experience in many ways. The key attributes of online discussions and the factors influencing the discussion forum’s design are identified. The focus is on study of students’ behaviour during discussion and on recognition of some behavioural patterns of forum’s participants. We mention also some implementation issues of discussion forums in LMS Moodle. An example of constructivist learning activity realized through an online problem-based discussion forum is presented in a case study. The case study shows how a well-designed online discussion forum can encourage students’ activity, motivation, and other social-constructivist attributes of their learning. Discussion forum in course on functional programming is described in detail and our findings grounded in observations and data analysis are summarized.

Keywords


Introduction

Global objective of all the research projects concerned with teaching and learning is to enhance the efficiency and quality of these processes. The blended model of teaching/learning has become popular, and at universities in particular, because it merges best practices applied in traditional face-to-face learning scenarios with new chances provided by digital technology and the online environment (Hadjerrouit, 2008). In our courses, we prefer the blended teaching/learning strategy too. When designing learning activities for lectures, seminars or lab sessions, we adhere to principles of constructivist and constructionist learning theories (Ackermann, 2010). Such learning activities are student-centred, problem-based, and collaborative. To learn in a constructivist manner, students should acquire knowledge actively, while solving problems, performing experiments or creating concrete artefacts. They should construct new concepts and reveal new connections individually, but with proper guidance of their teacher and/or in collaboration with fellow learners. The social and cultural aspects of learning are often underrated, especially by people who themselves lack the positive experience of collaborative learning. In learning communities (even when working in pairs or small groups), students can share their motivation, creative ideas, knowledge and skills and so they are able to benefit from the collective intelligence. The productive collaboration with more
experienced learners can accelerate students’ progress and fosters their communication, social and learning competences.

Nowadays, the idea of active learning that is shared with others can be accomplished also within the online environment (Rollet et al., 2007). Learning management systems, e. g. LMS Moodle, where developed and are used in order to make the social constructivism and constructionism manageable even in large-scaled groups or in distance courses that completely omit the personal contact of participants (Dougiamas, Taylor, 2003).

We use e-learning courses implemented in LMS Moodle also in full-time study programmes to supplement the classroom instruction (Palmárová, 2011). These e-learning courses

- provide students with information and study materials,
- are designed to promote active learning,
- facilitate students’ self-paced learning,
- and are meant to strengthen the students’ feel of being a friendly learning community member.

In this paper, we suggest the online discussion forum as an effective tool for realizing collaborative learning activities in courses on computer programming. At first, we analyse the constructivist potential of discussions forums. We identify key attributes of online discussions and consider behavioural patterns of their participants. Some implementation issues of the Moodle’s Forum activity module are mentioned as well. The next chapter is dedicated to a case study. We describe the suggested learning activity in detail and summarize our findings grounded in observations and data analysis.

**Constructivist potential of discussion forums**

In learning activities based on personal contact of participants (e. g. joint problem solving, team projects, team competitions), the act of discussion occurs naturally. Students need to talk to their partners (classmates, teachers) in order to achieve the common goal. They can be even directly asked to present their answers, solutions or to express opinions. The face-to-face communication is interactive and so it is likely to result in some meaningful conclusion.

The asynchronous online discussion can enrich the learning experience in another way. Besides the community building aspect, the online environment:

- gives students more time to think about the topic,
- motivates students to interact with others (to learn from others),
- enable students to use their own, less formal language,
- make it easier for introvert or slower students to present themselves as active and valuable members of the group.

In pure e-learning scenarios, the online discussions should be seen as essential components of learning. The online forum usually provides the only way for mediating a classroom-like learning activity in distance courses.

**Taxonomy of online forums**

It is quite challenging to design an effective online discussion. There are more variants of asynchronous discussion forums and factors to consider (figure 1). In (Schellens, Valkcek, 2005), the
researchers investigated question, whether working in asynchronous discussion forums fosters knowledge construction. Garrison (2007) explores issues that have emerged from the research on social, cognitive and teaching presence in an online community of inquiry.

In (Abawajy, Kim, 2011), the authors present a useful taxonomy that helps to understand features of various online discussions as well as the related strengths and shortcomings. They classify online discussion forums as follows:

- auxiliary forums,
- hybrid forums,
- embedded forums.

The auxiliary forum represents optional, open, self-directed, unstructured discussion in which the learner-to-learner interaction prevails. The teacher responds to students’ posts from time to time, in order to keep the discussion threads lively and relevant or to support students with learning difficulties. In programming courses, our students are active in online forums dedicated to homework assignments. These forums are appreciated especially by novice programmers, who seek for help from their more advanced colleagues.

In the hybrid model, online discussion is an integral part of the face-to-face classroom scenario. The online forum is used to enhance or to mediate the collaborative learning activity. The participation is compulsory and assessed. Topics and deadlines are set by the lecturer. In programming courses, we use such online forums quite frequently, for short warm ups (at the beginning of lab sessions), for team competitions/projects that last a longer period (from few days to few weeks) and for peer assessment of solutions.

The embedded forums are used in distance courses. In this case, the asynchronous online discussion replaces the face-to-face interaction so the active interventions of teachers are required and frequent. Students are obliged to contribute and their contributions are assessed. In distance programming courses, the embedded forums provide the platform for pursuing the same collaborative learning activities that we have listed above in relation to the hybrid model. But the amount of posts that need to be read, replied to and evaluated is much higher and the quality of the feedback is more important.
Behavioural patterns

Discussion itself requires a pattern of call and response, with turn-taking and listening being as important as contributing thoughts to the dialogue. Students who are silent during the lesson may perform better on assessments than their extrovert, more communicative classmates. In asynchronous online discussions, the act of reading is the equivalent of listening. In (Dennen, 2008), the behavioural pattern of lurking is introduced. A lurker learner is the one, who observes situation without contributing actively in any other noticeable way. Dennen (2008) presents her research study focused on non-posting/lurking participation behaviour of students involved in online discussion forums. Students who preferred posting messages rather than reading, often with motivation to meet the course requirements as quickly as possible, were unlikely to feel like the discussion was a meaningful learning activity. The lurking students tended to indicate that the discussion activity was worthwhile. They were more interested in reading messages in order to find a model and point of entry into the conversation or review the contributions posted earlier.

We also believe that lurking has the potential of being beneficial learning activity that should be taken into account when preparing online discussions.

Implementation issues

The online discussions launched for educational reasons are typical for e-learning courses. It is convenient and recommended to use a learning management system. In case of not having this possibility, the LMS could be surrogated by any social network that supports the concept of separated user groups.

We have been using the LMS Moodle’s Forum activity in our e-learning courses for many years. This activity module implements five types of forums to choose from, each of them can be customized by additional settings (Moodle.org, 2012). Table 1 maps the general intent of the proposed learning activity to the appropriate forum type. We can define permission for students to assess contributions and use various rating scales and evaluation rules. Multiple discussions can run simultaneously in separated groups of arbitrary number of participants; subscription to forum can be made mandatory; number of a user’s contributions can be limited; deadlines can be set; different display options can be applied etc.

A transcript of the discussion is automatically archived and accessible online, so the researchers can use it for further analysis immediately. The posts can be exported when needed. Thanks to the Moodle logging system that records the active as well as the passive actions performed in online forums, we have another source of interesting input data to learn from.

<table>
<thead>
<tr>
<th>General intent</th>
<th>Specific requirements</th>
<th>Suitable forum</th>
</tr>
</thead>
<tbody>
<tr>
<td>To build a friendly learning community</td>
<td>Everybody sets topics, posts contributions and replies to others</td>
<td>Standard forum for general use</td>
</tr>
<tr>
<td>To promote active learning</td>
<td>Everybody has the same chance to express her/his ideas without being influenced or constrained by previous “speakers”</td>
<td>Question and answer forum</td>
</tr>
<tr>
<td></td>
<td>Every member of a group should contribute to common goal set by the teacher</td>
<td>Single simple discussion</td>
</tr>
<tr>
<td>To manage the peer assessment activity</td>
<td>Everybody can present her/his original solution/project and waits for classmates’ ratings and comments</td>
<td>Each person posts one discussion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard forum displayed in a blog-like format</td>
</tr>
</tbody>
</table>
Online discussion focused on functional programming: a case study

This case study shows how a well-designed online discussion forum can encourage students’ activity, motivation, and other social-constructivist attributes of their learning. We worked within the context of a computer programming course. In such courses, problem-solving and hands-on assignments are typical learning activities. In online forums, students are asked to post their solutions written in a formal programming language. The source code is usually explained by inline comments or in a short additional paragraph. To increase the readability of sample source codes, students are instructed to pay attention also to formatting issues.

Objectives

The main goal of our study is to design a learning activity that would be:

- mediated by online discussion forum,
- suitable for computer programming course,
- engaging (increasing students’ motivation and learning activity),
- and collaborative (encouraging social interactions in the learning process).

Scenario

Our research was set up during the winter semester of the academic year 2011-2012 with two groups of 13 and 20 students, who attended the course on functional programming. The course is a part of the applied informatics study programme. Students were tasked with solving 8 programming problems by applying standard higher order functions in Haskell programming language. Assignments of all problems were published through the online forum. Students were asked to suggest their own solutions as well as to study the solutions of others. Students’ solutions were evaluated and graded by the teacher as follows:

- 3 points for the first correct solution (in each of two groups),
- 2 points for further correct solutions,
- 1 point for partially correct solutions,
- 0 point for incorrect solutions,
- no grade for contributions without any solution.

The learning activity was implemented as the Moodle’s Question and Answer discussion forum. In this kind of forums, you must first post your answer in order to see other responses. This feature allows equal opportunity for answering the question among all students. The answers are independent, thus they may recur in discussion.

The learning activity was carried out in two phases. In the 1st phase, participation was compulsory. Students were working during the seminar for 1.5 hour. The discussion was synchronous. The teacher evaluated or commented students’ contributions immediately after their submitting. After the classroom activity, students could continue discussions at home; the teacher continuously evaluated their solutions. The 2nd voluntary phase of the learning activity lasted for 1 month.
Data analysis and observations

Figure 2 shows the time progress of the activity expressed in number of total logs per day. The most logs (915) were recorded during the classroom part of the learning activity (2 seminars on November 15th). Remaining 694 logs were distributed throughout the one month time period of the 2nd phase. As the participation in the 2nd phase was voluntary and the assessment of the participation in the forum did not influence the final assessment, we evaluate students’ participation in the activity as a result of the high intrinsic motivation to learn.

![Number of logs](image)

Figure 2: Time progress of the activity – the number of logs

More detailed analysis of logs resulted in identifying 4 specific types of students’ behaviour during the activity. Table 2 contains the characteristics and percentage of these behavioural patterns: poster, lurking poster, lurker, and passive participant.

<table>
<thead>
<tr>
<th></th>
<th>Behavioural patterns observed during the learning activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>poster 67 % posters’ participation in discussion is active, their postings always contain solutions</td>
</tr>
<tr>
<td>B</td>
<td>lurking poster 12 % lurking posters contribute solutions to the discussion as well as join discussion without any solution</td>
</tr>
<tr>
<td>C</td>
<td>lurker 12 % lurkers monitor discussion without any visible creative contribution</td>
</tr>
<tr>
<td>D</td>
<td>passive participant 9 % passive participants do not join any discussion at all</td>
</tr>
</tbody>
</table>

Table 2: Behavioural patterns observed during the learning activity

Our further observations refer to the behaviour and the performance of students in four groups. Diagrams in figures 3, 4, and 5 demonstrate minimum, maximum, and average values of the quantities monitored in each group.
Diagrams of figure 3 compare students’ activity in two phases of discussion. Posters (A) had the highest number of logs in the 1st phase; the rest three student groups generated similar number of logs. In the B group, 2 students did not participate in the classroom activity that’s why the minimum value is 0. The order of individual logs in the 2nd phase differs from the previous case. The number of posters’ logs (A) decreased. Posters reached good assessment during the classroom activity, for that reason, we suppose, they were less motivated to continue the discussion at home. The activity of lurking students (B, C) increased in the 2nd phase significantly. They were less successful in solving assigned problems than students from the A group and so they tried to solve the problems at home. Students from D group got passive in the 2nd phase of the activity.

Further, we were interested in type of students’ activity. We filtered the active logs: postings with solution, lurkings (postings without any solution), and discussion views after initial posting.

The first two diagrams in figure 4 show that the highest engagement in discussion appeared in B group. The total number of joined discussions (posted plus lurked) is 7.25, in average, so students belonging to this behavioural pattern joined nearly all 8 discussions. Students tagged as the D group stayed out of discussion. Their total number of logs from figure 3 represents readings of the assignments without any active contribution.

We were also interested in students’ activity after their initial postings. The number of individual logs involving discussions that were joined is shown in the third diagram in figure 4. These logs
represent student’s interest in others’ solutions. Passive monitoring of the discussion predominated in this type of logs. Active discussion about others’ postings was rare.

Students’ score achieved during the activity is shown in figure 5. Total points in the first diagram depend on the number of solved problems (figure 4). Total score includes also bonus points (for first correct solutions), which all have been granted to posters (A group). The relative successfulness in solving of the assigned problems excluding bonus points is shown in the next diagram. The maximal dispersion of the values in A and B group indicates the high heterogeneity of groups as regards students’ performance. However, considering the average relative score and granted bonus points, we evaluate posters’ performance as the best. Participants from the C and D groups got zero score.

Findings

By implementation through the online discussion forum, we have reached high level of students’ activity. 91% of students (groups A, B, and C) took part in the forum actively without extrinsic motivation like grades. 79% of students (groups A and B) have solved at least one of the 8 initial programming problems (3.11 problems of average).

We have observed several types of social interactions in the online environment. Although students worked on individual basis, the online discussion forum provided stimulating social context for their activity. Students competed who would solve the problem first and get the bonus point; they competed who would achieve the highest score; they compared their solutions with others; they learned from others’ discussion in the role of lurker. Although the term “lurker” often carries negative connotations, we consider the lurking behaviour as contribution to student’s learning experience.

Conclusion

The presented study was aimed at designing a constructivist learning activity based on competitive collaboration through online discussion forum that would be suitable for courses on computer programming. We examined the suggested learning activity by analysing students’ visible as well as their „invisible” participation in the online discussion. It is likely, that students who behaved as lurking posters or lurkers benefited from reading the posts of others significantly. When using an online forum for discussions, all the ideas and solutions of the community are saved into a common digital repository. This fact enables and could motivate students to return to those
assignments they have struggled with during the traditional face-to-face lessons. The competitive character of the learning activity is likely to be satisfying for ambitious students who are quick and do not have difficulties with the curriculum. We found the problem-based online discussions to be an effective tool for promoting active learning as well as for applying the individual approach. However, the success of the online discussion depends mainly on the well-structured content set by the teacher and her/his level of commitment to the community of students.

References


