
Facilitating Students' Collaboration and Learning in a Question and Answer System

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Abstract

Green Dolphin (GD) is a question and answer system for students learning programming, with a social web interface. It crowd-sources the task of answering technical questions to the peers of students who ask questions. GD has several original features that make it different from existing systems. It automatically identifies students who are knowledgeable based on their activity, and tags them as experts to whom other students can ask questions. GD provides students with automatic feedback of the quality of code they submit. Thus, students get fast and high quality answers from their peers and the system, freeing up time for teachers. After a student posts a question in GD, it delays making visible answers from instructors and teaching assistants so that other students are encouraged to participate, and have time to answer the question. We believe that this can significantly increase student participation, collaboration and sense of ownership. Students gain new knowledge from the flow of questions and answers in the system. They develop communication skills by asking and answering questions as well as programming and debugging skills.

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General Terms

Design

Introduction

Question and answer boards are becoming increasingly popular on the web. Stack Overflow is a successful and fast professional question and answer site. Users receive first answers to their questions in about 11 minutes, so there are a lot of questions asked in the board every day [7]. Many users participate often to collect reputation points. The point system is a game to entice users to visit and participate in the website regularly. Stack Overflow assists professional programmers in getting fast and helpful answers, and it had more than 7 million visits by August 2010 [7].

Such systems are quite useful in education as well. Piazza is the most popular educational question and answer board [2]. Many professors use Piazza to support students in courses. Students ask questions and receive a single answer, from a lecturer or from another student. Piazza demonstrates the benefits of a question and answer site as an educational supplement, but it has limited features. For example, only one student answer is displayed per question. A student answer is posted in a wiki style, so other students must edit the earlier answer rather than post their own

answers. Another such system is the Classroom Salon [2].

However, we believe that the full potential of question and answer boards to elicit student participation and enhance collaborative learning is yet to be realized. A number of design features can be conceived for such systems, which are not present in the existing systems. Green Dolphin (GD) is a new educational question and answer board that addresses this problem by introducing several new features.

Flow of Knowledge

A question and answer website increases the flow of knowledge for students. Students can gain knowledge from reading, asking, and answering questions [5]. Students learn from questions and conversations as professionals do in Stack Overflow. Students gain various perspectives from discussions related to questions and learn from others' mistakes [4].

Students can learn communication skills from question and answer websites. Students have to elaborate on their problems and provide information to other users. Moreover, they practice communication by writing answers or soliciting more information from others. Students have opportunities to develop problem-solving skills when they answer questions. They have to understand and analyze problems posed by others and then find solutions. Students can practice debugging and programming skills to solve a problem [1]. Therefore, a question and answer board gives students chances to solve more problems and gain more experience.

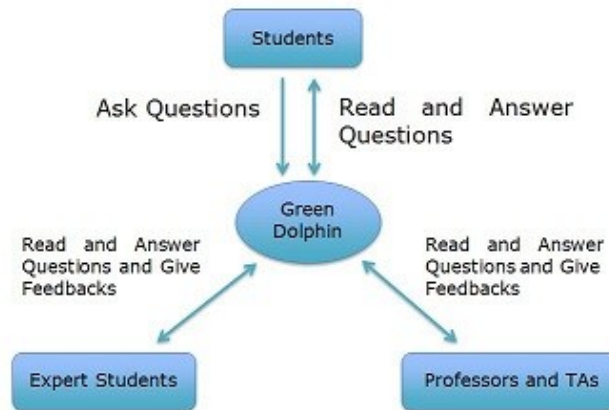


Figure 1. Knowledge flow among novice and expert students and their teachers in Green Dolphin. Students gain knowledge from reading and answering questions.

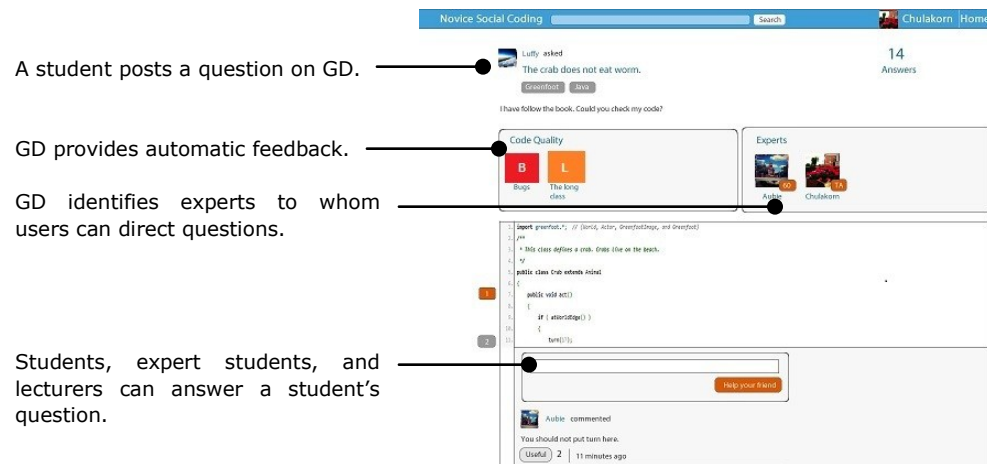


Figure 2. A screen shot of Green Dolphin

Green Dolphin

Green Dolphin (GD) is a casual and social question and answer board designed to support collaborative learning of programming. Figure 1 illustrates the flow of knowledge among its actors. It is designed to encourage student collaboration. GD has an automated system to identify students who are experts [3, 10]. Students can ask other students, or students identified by the system as experts, for help, so they gain high quality answers. GD can detect “code smell” [8] and suggest to students how to refactor their code to improve poor coding practices. Therefore, teachers save time by not needing to critique qualities of students’ code. GD is designed to fulfill students’ needs for collaborative learning by allowing them to interact with and ask questions of the professional community consisting of their classmates, teachers and Teaching Assistants (TA).

Similar to Stack Overflow, GD utilizes an economy of points to incentivize student participation. A point system can successfully increase collaboration in question and answer sites [7, 9]. Moreover, this method can potentially decrease the number of low quality questions [6]. GD awards points to students when they do collaborative activities, such as asking and answering questions. Students have to spend points to direct questions to specific expert students, teachers or TAs, or to buy snacks, because food is also an incentive [10]. If students need fast responses from instructors or other students, they have to spend points to get quick answers. This economy of earning and spending points may be seen by students as an interesting game, and thereby encourage them to ask and answer more questions.

Fast Answers Are Not Always Better

Users in a question and answer board would like to get answers as fast as possible, so a fast answer is a critical aspect of performance. However, fast answers can decrease collaboration. Some questions in Naver, the most popular question and answer website in Korea, did not get additional answers, after users who are known to provide good answers posted their answers soon after questions were asked [9]. If teachers or TAs answer students' questions immediately, other students may not participate. Besides, questions that have only a teacher's answer lack the perspectives of students. Students will miss opportunities to develop their problem solving, debugging, and communication skills if they hesitate to post their responses after quick expert answers have appeared. Thus, fast answers can potentially take away many benefits students gain from a question and answer board.

Slow Down to Increase Collaboration

A mistake that inexperienced lecturers make is that they ask students questions, and then answer their own questions if they do not hear immediate answers from students. Students need time to collect their thoughts, find answers and mentally prepare what they are going to say. Fast answers in an educational question and answer board are similar to quick answers in classes in their potential to hinder students' participation and collaboration.

GD addresses this problem by alerting teachers and TAs that a question has been asked, but delaying publishing answers from them. Students do not have as much experience, so they may take more time to find answers than their teachers. Therefore, a teacher's

answer to a question is held for 24 hours after the question has been posted, and a TA's answer is delayed for 12 hours. If there are no answers from a teacher or TA after these time periods have elapsed, the system will send emails to teachers and TAs reminding them to answer the question. Thus, students will have enough time to propose solutions and start discussions without being intimidated by responses from expert or authoritative figures, so a question is likely to receive many answers with different student perspectives.

Conclusion

This poster described design ideas embodied in Green Dolphin, a novel educational question and answer board that crowd-sources the task of answering technical questions for students in introductory programming courses. While GD has some commonalities with systems such as Stack Overflow and Piazza, it also has several distinctive features that set it apart, such as automatic student expertise identification and code assessment, and delaying the publication of expert answers to encourage student participation. This latter feature was explained in some detail. These features are designed to increase student participation, collaboration and sense of ownership. A prototype of the system has been built, and will be evaluated in a large class shortly.

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