

Virtual Pair Programming for C++ Programming E-Learning

Siti Nuraini SAADUL BAHARIM* & Syamsiah MASHOHOR

Faculty of Engineering, Universiti Putra Malaysia, Malaysia

*ct_nuraini@yahoo.com

Abstract: This paper reports a brief research proposal that designs and develops an e-learning system that applies the concept of virtual pair programming (VPP) to support object-oriented programming learning with C++ programming language. The proposed system implements artificial intelligence (AI) using fuzzy logic method in programming tasks to accommodate students' programming capabilities. This interactive learning environment aids students in learning to program with C++, as an enhancement and addition to the conventional way of learning, which is face-to-face learning in classrooms.

Keywords: Pair programming, virtual pair programming, e-learning, C++ programming, object-oriented programming, artificial intelligence, fuzzy logic

Introduction

For undergraduate university students who are majoring in engineering, computer science and information technology, computer programming course is one of the core subjects which are compulsory in the first year of their studies. Programming is not an easy subject, whether it is to be learnt or to be taught.

1. Problems in Programming Learning

As Kollmann and Goedicke had mentioned in 2008 [1], learning to use a programming language is one of the most difficult steps in software engineering. Many students are facing problems in learning programming language.

One of the reasons is the course contents are quite difficult. Programming learning requires theoretical understanding and a lot of practical learning. Since the size of the student groups are usually large, there are limitations in terms of resources and instructors. Even though most institutions provide computer facilities for students to practice their programming skills, the computers available are insufficient to accommodate them. Some students are required to share the computers in small groups, which give them limited time to think, concentrate and do hands-on work on the programming task individually. This problem leads to difficulty in understanding the concept of programming. In addition, the low number of instructors causes the students to suffer from a lack of personal instruction. Learning takes place when the learning situations and materials are more practical and concrete [2].

Many researchers have proposed solutions to overcome the problems in programming learning. However, none of these approaches have efficiently solved these difficulties [3].

2. The Concept of Pair Programming

2.1 Pair Programming

An approach that has been accepted in programming learning is the concept of pair programming. Pair programming is a software development practice in which two programmers work together at one computer on the same programming task.

Side-by-side, a programmer (the driver) types in the programming source code while the other programmer (the observer or navigator) reviews each line of code and checks for potential errors or mistakes. The two roles are switched between them until the end of the programming session. The observer gives comments and thinks of ideas to solve the current programming assignment, enabling the driver to focus on the typing in the programming code. An instructor or tutor would be assigned to guide each pair and observe their performance.

The learning process takes place between the students as well as between the students and the instructor. Studies have shown that application of pair programming have managed to increase the students' enjoyment and confidence in practicing their programming skills [4]. It has been proven that pair programming is effective in solving difficult programming problems [5]. Other significant benefits of this practice are that programmers gain more knowledge in software development, take less time to perform programming tasks and design more efficient programs [6].

2.2 Virtual Pair Programming

As e-learning is the popular mode to acquire knowledge these days, another implementation of pair programming called virtual pair programming has been introduced. The concept of VPP is the same as pair programming, with the exception of the location of the two programmers.

The programmers would be working on the same programming task from their own computers at their own locations. This collaborative environment would apply various e-learning tools such as e-mail, online forum and online chat room to enable them to share the roles and ideas during the program development.

VPP is flexible and convenient as the learning process could be done at any place, time and at student's own pace. It is a practical option for those who have other commitments such as work and family. There will be no need to travel to and from the computer lab, thus provide benefits in terms of transportation, time and cost. Teague and Roe have agreed that this approach has the potential to effectively increase the students' programming skills [7].

3. E-Learning for C++ Programming Learning

The objective of this research is to propose and develop a prototype of an e-learning system that applies the concept of VPP for undergraduate students to learn computer programming. The scope of the proposed system is object-oriented programming, focusing on C++ programming language. AI will be used to adapt programming tasks and exercises via fuzzy logic method in order to accommodate students' programming capabilities.

Through series of selected questions, students' knowledge will be reviewed to determine their level of studies and programming skills. The course contents will be based on the students' current level of studies. In pairs, students will be given programming tasks

which need to be done by applying VPP. Towards the end, students' performance will be assessed to evaluate their understanding on the particular topic. The flow of the proposed system is shown in Figure 1. Accordingly, the difficulties of the programming tasks and exercises will increase as the students improve their skills. The system would be able to identify the weak topics and problems encountered by the students to assist the instructors to emphasize these specific topics.

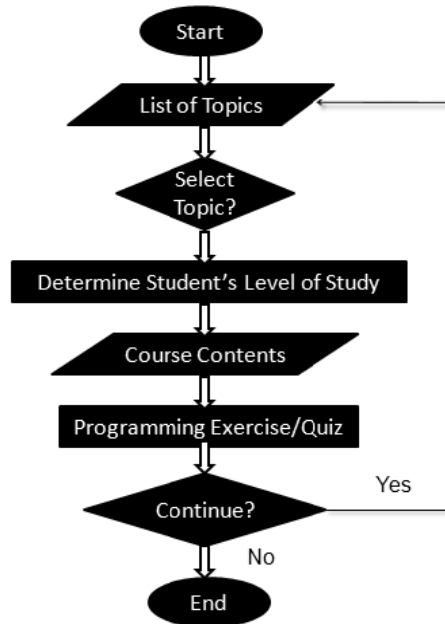


Figure 1: Proposed System Flowchart

4. Conclusion

This research proposes an e-learning system that applies VPP to support computer programming learning. The proposed system provides an interactive learning environment to assist students in learning to program with C++ programming language, which acts as an enhancement and addition to the conventional way of learning.

References

- [1] Kollmann, C. & Goedicke, M. (2008). A specification language for static analysis of student exercises. *Proceedings of the 23rd IEEE/ACM International Conference of Automated Software Engineering ASE 2008* (pp. 355-358). L'Aquila, Italy.
- [2] Lahtinen, E., Ala-Mutka, K. & Järvinen, H-M. (2005). A study of the difficulties of novice programmers. *Proceedings of the 10th Annual Conference on Innovation and Technology in Computer Science Education ITiCSE'05* (pp. 14-18). Lisbon, Portugal.
- [3] Gomes, A. & Mendes, A. J. (2007). An environment to improve programming education. *Proceedings of International Conference on Computer Systems and Technologies CompSysTech'07* (pp. 1-6). Ruse, Bulgaria.
- [4] Zin, A. M., Idris, S. & Subramaniam, N. K. (2006). Improving learning of programming through e-learning by using asynchronous virtual pair programming. *Turkish Online Journal of Distance Education*, 7(3), 162-173.
- [5] Lui, K. M. & Chan, K. C. C. (2006). Pair programming productivity: Novice-novice vs. expert-expert. *International Journal of Human-Computer Studies*, 64, 915-925.

- [6] Cockburn, A. & Williams, L. (2000). The costs and benefits of pair programming. *Proceedings of Extreme Programming and Flexible Processes in Software Engineering XP2000* (pp. 223-247). Italy.
- [7] Teague, D. & Roe, P. (2007). Learning to program: Going pair-shaped. *ITALICS Journal*, 6(4), 4-22.