

## Analysis of Student's Learning Log Data in Fill-in-the-Blank Programming Questions

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### Abstract

We have developed a programming education support tool *pgtracer* which provides fill-in-the-blank questions containing a C++ program and a trace table. In this paper, we analyze the study log and the answer log collected by *pgtracer*. We analyze student activities and incorrect answers to find the tendency and frequent mistakes of the students. We next classify the type of incorrect answers in the log data for 18 fill-in-the-blank questions with 127 blanks. We then identify the patterns of frequently observed errors using association analysis. Furthermore, we analyze the answering process to fill the blanks of the students and find that the right answer ratio affects the answering process. We expect that these analysis techniques and the results help to improve programming education through feedback to the class and the teacher.

*Keywords:* Computer programming education, e-learning, fill-in-the-blank question, Learning Analytics (LA), Moodle

### 1 Introduction

Computer programming is essential at national institute of technology and university majored in science and engineering. However, we often find students with low programming skills in an actual programming class. It is useful for a student to develop as many programs as possible to acquire practical programming skills. However, the students cannot practice enough in an actual class due to a limitation of teaching staff and time.

To cope with this problem, we are developing a programming education support tool *pgtracer* [1]. *Pgtracer* is developed as a Moodle plug-in so that a student can learn computer programming at any time and place as long as a personal computer and internet connection are provided. *Pgtracer* automatically evaluates student answer as soon as a student submit their answers. The automatic scoring function of the *pgtracer* reduces the teacher's workload and can provide a quick

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