Abstract - With the goals of engaging students in learning programming, increasing students’ learning confidence, and improving retention of CS students, this paper presents an innovative inquiry-based online real-time Java programming assessment system for introductory Java programming course to facilitate the interaction between the instructor and students, the student collaboration in problem solving, and to enhance the student’s “learning by doing” and “learning from failure” activities. The system allows instructor to assess student learning progress in class instantly. The concept-proof prototype of the system is demonstrated and the preliminary in-class experiment receives positive feedbacks from students.

Index Terms - Java, Online Assessment, CS1, Inquiry-based Learning.

INTRODUCTION

A study on student enrollment data in our CS undergraduate program showed that a huge fraction of students dropped out in their first or second academic year.

Students come to an introductory programming class with diverse backgrounds. Some of them have little or no previous experience in programming and are thus at high-risk of dropout or failure. Students might lose interest in learning because they continuously face problems but don’t have any chance in school to get their problems solved. The lack of unsuitable teaching methods and limited use of learning/teaching tools also contributes to this setback. Especially in a large introductory programming class, an instructor must find an effective way to engage students in study get insight into common student issues and misconceptions and know students’ needs in class immediately. Students also need to validate their learning in class.

In observation of this demand, we have developed an innovative active learning environment by an Online Automated in-class Instant Assessment System (OASIS) for the introductory Java Programming course with the goals of engaging students in learning the material, increasing student learning confidence, and improving student retention rate. This system is designed to facilitate the interaction between the instructor and students, student collaboration in problem solving, and enhance student “learning by doing” and “learning from failure” activities.

Many efforts have been made in attracting and retaining CS undergraduate students, such as APOGEE [1], Problets [2], and JavaBat [3], etc. Our strategy focuses on the enhancement of student involvement in class learning, interaction between instructor and students in the classroom, and collaborative exploration among students via a real-time online Java learning assessment system. Student involvement is the essence of inquiry-based learning, which leads to hands-on learning and understanding rather than just listening and remembering.

SYSTEM OVERVIEW

The overview of the system is shown in figure 1. At the backend, OASIS is supported by an online runtime execution server engine with Java compiler and tester, called JCRT engine. It can test Java console, GUI programs. At the front end, the learning and assessment logic is implemented by the Spring MVC & Web Flow, a state-of-the-art Java lightweight development framework.
Basically, there are two types of users for in the system: the instructor and students. The instructor can generate query problem and associate test cases with system GUI and students can program solution and get feedback from the system instantly.

PRELIMINARY APPLICATION OF THE SYSTEM

OASIS provides a timely, controlled environment for the synchronous delivery of interactive teaching and learning modules with instant assessment of student progress in the classroom.

For instructors, OASIS provides an online GUI interface as shown in Figure 1 to design and upload programming assessment problems. After the program is compiled and tested, the instructor uses the provided GUI interface to set the test cases so that OASIS will automatically test and validate student solutions based on the test cases. Students may be asked to write a complete Java program fragment or fill in a few blank lines of a given Java program. With the OASIS, instructors can analyze student understanding and assess the student’s progress immediately based on the instant statics report.

The OASIS provides a problem library for instructor to use.

With the OASIS, students can actively participate in class learning exercises through hands-on programming practice and build their confidence in problem solving. For one problem there may be many different way to program. As long as program logic is correct the system will validate it based on the predesigned test cases.

Students provide their answers by fill in the blank lines in the inquiry problem GUI interface as shown in Figure 2. Students can also share their solution to other students in a collaboration mode as shown on the right side of the screen in or after the session.

Students can also select the programming problems in the bank to review Java programming concepts outside of class.

CONCLUSION AND FUTURE WORK

This novel real time Java online assessment system promotes students’ learning interest in programming and enhances their practical ability via learning by doing. Also, it helps instructors automatically assess students’ submissions and better understand the student learning status.

We have conducted a preliminary testing for Java class students. The feedbacks manifest a promising effect of the system in helping students with practicing the “learning by doing” methodology, engaging students in learning and practicing the programming. We are current expanding the system to cover Java Web Applet testing and conducting more security and usability testing for Java class.

REFERENCES