TEST-DRIVEN DEVELOPMENT AS A FORM OF IPSATIVE FEEDBACK IN AN ODL ENVIRONMENT

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Abstract

This article considers the use of test-driven development in a programming course as an ipsative assessment technique in the open distance learning environment. Ipsative feedback in the form of test-driven development in which assignments are accompanied by test cases designed to provide feedback to the student can aid in the student's development and understanding and provide the immediate feedback on progress that is missing from the ODL environment. The advantages of using this approach are discussed, and the approach taken to designing assignments is presented.

Keywords: Test-driven development, testing, ipsative feedback, ipsative assessment

1 INTRODUCTION

There is a growing emphasis on the importance of developmental feedback in higher education, especially in distance education (Hughes, Okumoto and Crawford, 2010).

To improve their performance, students need to know how they are progressing (Sadler, 1989). In a programming environment, test-driven development (TDD) can be used to test the correctness of the implementation. In a distance learning environment, ipsative feedback can provide the student with a form of iterative feedback before assignment submission, yet there is little to no reference to it in higher education (Hughes, 2011).

This paper argues for the use of TDD, in which students are provided with tests upfront as part of the assignment which they can use to measure their own progress, as a form of ipsative assessment. Our approach to designing the programming assignment is presented, with an example question based on the approach, and the expected advantages and disadvantages.

2 BACKGROUND

2.1 Ipsative assessment and feedback

Feedback is a key element in formative assessment (Handley, Price and Millar, 2008; Sadler, 1989), and is part of the same learning process (Hattie and Timperley, 2007; Nicol and Macfarlane-Dick, 2006). The point of formative assessment and feedback is to guide learning as it is meant to be feedback for, rather than of, learning (Hughes, 2011). Formative feedback provides the student with information about reaching the required goals (Nicol and Macfarlane-Dick, 2006), and should also point out how to improve on that performance (Handley et al., 2008). There is little evidence that feedback is used effectively by either teaching staff or students (Hughes, 2011), although Handley, Price and Millar (2011) argue for a shift to the study of engagement (Handley et al., 2011): to see feedback as a process as well as a product (Price, Handley and Millar, 2011), and it is here that ipsative assessment may have a role to play. Ipsative assessment is a student-referenced judgment based on comparing a student's previous performance to his or her current performance (Hughes, 2011). Ipsative assessment has, however, received little attention thus far as assessment is usually judged against some set of external attainment criteria (Hughes, 2011).

2.2 Test-driven development

Test-driven development is a test-first approach to programming that focuses on writing functional tests that can be used to check programs before the actual program code itself is written (Erdogmus, Morisio and Torchiano, 2005). The benefit of this manner of coding 2 is that the tests provide immediate feedback to the programmer, indicating whether the new functionality has been implemented as required and whether the new functionality interferes with what worked before (Erdogmus et al., 2005).

2.3 The open distance learning context

One of the major differences between open distance learning (ODL) and residential studies lies in the nature of the contact between the university, the teaching staff, and the students (Hughes et al., 2010) where ODL provides less “presence”. It has been noted by Hughes et al. (2010) that students in ODL environments are more reliant on formative assessment and its feedback (Sadler, 1989).

3 IMPLEMENTING THE PROPOSED TESTING REGIME

This approach will provide tests that will be passed or failed, indicating what is working and what is not. The tests will be provided with the assignment requirements. The design of programming assignments to make use of TDD with an ipsative component will be approached in the following way:

1. Ensure that program logic is separated from user interface.

2. Abstract classes will require students to complete the missing functionality.

3. The test cases will provide supportive feedback.

4. The interface of the abstract class will allow testing of “intermediate” functionality.

A sample assignment, based on the design principles above, will be discussed. The student will extend the provided class and provide the required implementation. The provided test cases will ensure that the program is functioning correctly. Feedback will be added to each failure to explain to the student what possibly went wrong.

4 ADVANTAGES AND DISADVANTAGES

TDD provides several advantages as concerns ipsative feedback to students:

1. Shorter feedback loop: TDD allows students to know before submission that there is a performance gap, and there is the benefit of the immediacy of that feedback.

2. Sense of progress: The use of tests provides a sense of progress as more tests are passed.

3. Providing clues: TDD provides the goals (pass the tests) and gives clear direction as to what to do to get more tests to pass.

4. Dialogue: Ipsative feedback provided by tests is part of a dialogue between student and test suite; feedback is thus both product and process (Handley et al., 2008).

There are certainly areas where caution needs to be exercised using this approach.

1. There is the danger that TDD could become purely criterion-referenced.

2. Using TDD in an ipsative, iterative sense, means assignments have to be more carefully designed.

3. There is the assumption that students can take the failed tests and re-interpret them such that it can guide their next step in the programming process.

4. May lead to solutions that focus on output correctness to the detriment of software design (Edwards, 2003).

5. There is no actual dialogue with the lecturer, although failed tests could lead to further communication with the lecturer.

6. The predefined interfaces that are provided to facilitate such ipsative assessment methodologies may constrain the solution space (Erdogmus et al., 2005).

5 CONCLUSION

TDD and the ipsative feedback it provides allow the student to reach the required standard within the constraints of an ODL, semestersised system, placing the emphasis on progress (Hughes et al., 2010). Students are thus encouraged to set their own goals in response to the ipsative feedback they have received, and decide for themselves how far they want to go in getting the test cases to work. This is an approach which has not yet been tried, and will still need to be investigated to evaluate its worth, and will support the call for more research on the use of ipsative assessment for distance learners made by (Hughes et al., 2010).

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