

FORMATIVE E-ASSESSMENT OF SOFTWARE VERIFICATION SKILLS IN HIGHER EDUCATION

ABSTRACT

Conventional e-assessment systems often are not suited for examining analytic, creative and constructive skills; the few existing ones have very limited functionality. On this account the e-assessment system EASy, which focuses on the examination of formative assessments, has been developed. Besides exercise modules for multiple-choice questions, programming exercises and mathematical proofs the system has recently been extended by a module for the computer-supported examination of software verification proofs based on the Hoare Logic. In this work we discuss the module for automated assessment of these proofs. To demonstrate the feasibility of our approach, the applicability, usability and acceptance of the Hoare-Logic module have been evaluated in a lecture on formal specification.

KEYWORDS

E-Assessment, Computer Science Education, Formative Assessment, Hoare Logic, Computer-Supported Exercises

1. INTRODUCTION

Assessments help to identify and to evaluate teaching success. But due to mass lectures, decreasing resources and low personnel capacities, continuous and frequent assessments of learning progresses may cause excessive efforts and costs. For this reason, e-assessment systems have become of increasing interest in academic e-learning infrastructures (SQA 2003).

Especially the assessment of analytic, creative and constructive skills, which are essential in Computer Science education, is a very complex and time consuming process. But today's e-assessment systems mostly focus on multiple choice, inserting short text, and other simple forms of examination which commonly concentrate on factual knowledge. But most of them are not suitable to assess higher-order thinking skills (Heywood 2000; Chalmers & McAusland 2002). Thus, we have developed the **e-assessment system EASy** which is a modular and extendable web-platform. It supports computer-supported preparation, execution and post-processing of continuous and task-related exercises in Computer Science. As of now, the EASy platform provides exercise modules for simple multiple-choice questions, programming exercises, mathematical proofs, and recently also software verification proofs based on the Hoare Logic (Hoare 1969). This article focuses on the design, use, and evaluation of the EASy module for software verification proofs based on the Hoare Logic. This module helps to safeguard high quality formative assessments due to the identified shortage of resources.

This paper is structured as follows. In Section 2 we introduce the didactical scenario of formative assessments in Computer Science education as it is applied in Germany, give a short introduction to software verification proofs and evaluate existing e-assessment systems concerning a support of corresponding exercises. In Section 3, we briefly describe the conceptual design, functionality and handling of the EASy platform and the EASy module for software verification proofs. The results of an empirical evaluation of EASy in a lecture on formal specification will be presented in Section 4. In Section 5, we conclude and point out future work.