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The PASCA: a Mail Based Randomized Blinded Peer Assessment System for Complex Artifacts

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Abstract

Active learning and formative assessment techniques are the cutting edge of the modern education. This paper considers peer assessment automation and touches the topic of high actuality in advancing ICT for active learning. The roots of the study are obtained difficulties in adoption of the currently available peer assessment systems to engineering education introductory courses. The main goal of the paper is to collect software requirements and to build a peer assessment system, which may be easily agreed with standard educational routines (e.g. e-mailing) and which is be able to support complex artifacts interchange during a peer assessment session. The software requirements specification (SRS) for such a system has been created as a result of reviewing educational studies, technical reports and academic publications on common peer assessment processes and existing peer assessment systems. We also introduce the open source Mail-based Randomized Double-Blinded Peer-assessment System for Complex Artifacts called PASCA, which is developed according to this SRS and the results of PASCA adoption to an introductory programming course.

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Keywords: self-assessment, computer supported collaborative learning, active learning, computer science education, programming education, educational software, blinding, randomization, collaborative learning;

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1. Introduction

Active learning practices become more popular among the educators all over the world these last decades. At the very beginning active learning was introduced as a teaching approach[1], which expected students doing things and thinking about this things. Later, active learning has been expanded by including formative assessment techniques[2]. This techniques are strongly student oriented, involve students in educational planning, and provide feedback, which students may treat as an algorithm or a guideline in their next steps in learning. That is the reason why the questions related to this type of assessment are widely studied and discussed by the active learning practitioners of different fields of knowledge[3,4,5,6]. By now, formative assessment has settled as a powerful and effective education approach.

At the same time, the appearance of close relation between active learning and formative assessment causes the evolution of collaborative and cooperative assessment techniques[7,8]. *Peer assessment* (PA) seems to be one of the most popular and well-studied collaborative formative assessment methods[9,7,10]. Peer assessment means a learning procedure of evaluating where students revise each other's works, evaluate them according to priory formulated criteria and provide feedback.

Of course, the era of total computerization, telecommunication, and distributed systems brought into live lots of educational software for distance and *computer supported collaborative learning* (CSCL). For now, there are plenty *peer assessment systems* (PAS) have been developed along with *learning management systems* (LMS), e-learning and *massive open online courses* (MOOC) platforms. Besides that, the application of PASs, which support users' interaction while peer assessment, have been documented in plenty academic works[3,11,12,13].

Undoubtedly, CSCL seems to be appropriate to a such hi-technology area as *computer science education* (CSE). The trends of global education mentioned above stimulate such main streams in technical education as *Science-Technology-Engineering-Mathematics* (STEM) and *Conceive-Design-Implement-Operate* (CDIO)[14]. This in its turn forced CSE society to start the adoption of active learning and formative assessment methods. The meaningful changes have been done even in basic parts of the *Computer Science Curricular* 2013[15,16].

As a result of this high interest, several works about the practice of using formative assessment have been appeared in the variety of *computer science* (CS) courses[17,18]. But, the experience of automated PA implementation within such courses is not well-documented. Moreover, papers, which deal with PASs development[19] and adoption[20,4] to CSE are rare and leave several gaps.

First, there is no systematically analyzed and compared requirements of different educational domains. Thus, most of PASs[21,22] allow to submit only a set of text fields and do not support any other type of a submission or an attachment, for example an archive or several files. As far as some courses specific to CSE deals with sets of source-code files it is difficult to adopt these systems to anonymized PA without losing the anonymity of students.

Second, existed PASs are quite overspecialized and the flexibility of their preliminary installation is relatively low. It is well-known that PA may be randomized[23], contain a self-assessment step[9], be implemented by groups or by individuals, etc. Furthermore, PAS should have a possibility to be tuned in properly to support several variants of PA tracks.

Third, explicit *software requirements specification* (SRS) for the PAS suitable for the particular educational domain is missed (authors have dedicated the only SRS, which was published online as a result of education project [http://www.it.iitb.ac.in/frg/wiki/images/5/5c/Grp5_MOOCs_SDD_2013_06_26.pdf]).

Forth, PA is a complicated assessment procedure, which needs students to be familiar with[3]. If automated PA is used, the extra instructional problems are risen, because students should meet not only a new assessment procedure, but a new software as well. The pilot PA session is a good answer, but if we take into consideration first-year CS or humanities students, we ought to select PASs with as easy user's interface and use cases as possible. Moreover, for mentioned groups of students it is significant not to spend tons of time on learning extra educational software. Consequently, if PAS is stand-alone and is not implemented as a part of corporate *learning management system* (LMS) it should be integrated with routines, which are familiar to the most of students and teachers, for example, e-mailing.

The general purposes of this paper are: 1) to agree CS educational needs with worldwide PA practice; 2) to overview existing PASs' implementations; 3) to introduce the original Mail-based Randomized Double-Blinded Peer-assessment System for Complex Artifacts called PASCA in conjunction with requirements analysis and the findings of its first adoption.