

# Shifting the Process of Exam Preparation Towards Active Learning: A Crowdsourcing Based Approach

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**Abstract:** Students are usually only marginally involved in the preparation of exams. They are passive peers who write an exam predefined by the lecturer. Studies in educational theory indicate, however, that active involvement instead of (passive) consumption should be adopted in learning since active learning proved to be superior to passive learning. One concept of active learning is student peer evaluation where students are mutually responsible for peer reviewing. This paper extends student peer evaluation by a Crowdsourcing based approach within the process of exam preparation. Students are equipped with more responsibilities, they design, comment and evaluate exam questions and build a considerable question pool for exams. A system tracks all interactions when typing in exam questions. Thus, individualized exams can be provided. The large set of exam questions even allows for exams that are written at an individual time. We expect that such a formative knowledge acquisition by students might improve student achievements and even reduce the number of drop-outs.

**Keywords:** Crowdsourcing, self-assessment, active learning, individual exams

## 1 Introduction

The organization of (written) exams for large lectures (with several hundred students) is an essential task at universities. Particularly, high effort must be put into the preparation and marking of these exams. Due to a reduced effort for the marking of exams, electronically-based examinations (e-exams) are becoming increasingly common. The process of e-exams is comparable to the organization of conventional exams and is depicted in Fig. 1. First, the exam questions must be prepared by the lecturer. Subsequently the questions have to be composed to an exam where quality assurance is subject to the lecturer. At a predefined time, the exams are written either on paper or at a computer-based system and the exam is supervised by the lecturer. Next, the exams must be marked. Finally, the results have to be published. The marking of e-exams is performed by a system, while paper-written exams are marked by hand. Although a significantly reduced time for marking of e-exams favors them against paper-written exams, still, e-exams have to cope with the challenge that they do not foster individual capabilities of learners.

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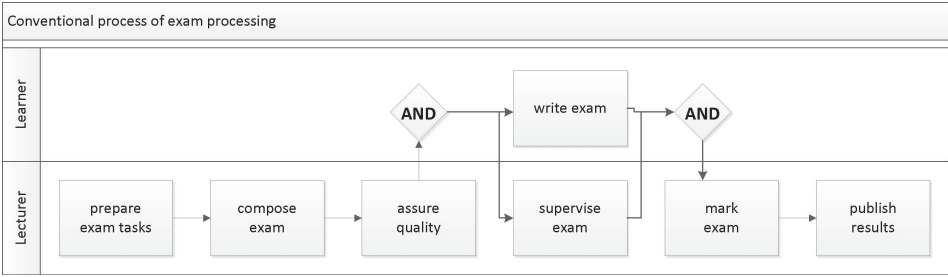


Fig. 1 Conventional process of exam processing

Looking at the process of preparation of e-exams from a role perspective, plenty a variety of activities are undertaken by the lecturer him/herself, who thus takes an active role. The students remain passive, which means that only their passive learning is demanded. Studies comparing active against passive learning, however, show that active learning outperforms passive learning [We07]. Active learning “*is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content*” [UM].

To exploit the benefits from active learning also in the process of preparing exams, this paper suggests a novel procedure as modeled with BPMN in Fig. 2. Inspired by the concept of Crowdsourcing [Ho06] this paper suggests an active involvement of students into the process of exam preparation. Instead of writing exams that have been predefined by lecturers, students provide questions and solutions for exams. They indicate levels of difficulty and scores for the questions. Within the frame of exercises students mutually evaluate questions and solutions. The final quality of the exam questions and solutions is assured by the lecturer or with support of an e-exam system being equipped with corresponding review options. When an exam should be conducted, then the system composes an exam out of the students’ questions.

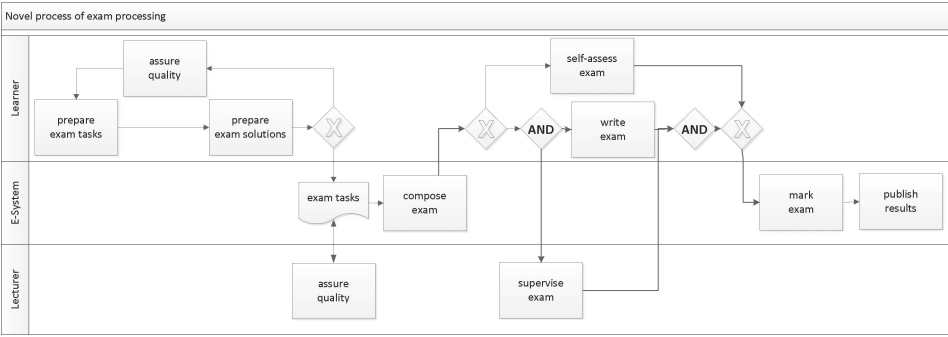


Fig. 2: The novel process of exam processing: a crowdsourcing-based approach

Such a high involvement of students into the process of exam preparation shifts the roles

of students and lecturers. The area of responsibility of lecturers decreases, while that of students increases. A Crowdsourcing based e-exam is a representative of formative learning. It fosters active learning since peers build a map of the learning material already when designing questions and commenting solutions.

Beside the benefits of active learning, such a Crowdsourcing based e-exam also supports the implementation of individual and individualized e-exams. The large set of questions is suitable to provide e-exams at individual time. When typing the questions into an e-exam system, also individual feedback can be returned to learners and lectures. Lectures can be informed about lacks of understandability with the learning material and learners can be pointed to vacant learning material. This feedback can be exploited to design individualized e-exams being capable of individual preferences with respect to the layout of questions.

The idea of Crowdsourcing based e-exams is currently implemented as a pilot study at the University of Cologne. Therefore, this paper can neither provide a proof of concept yet nor report on any significant experiences with Crowdsourcing-based individual and individualized e-exams. Instead, it discusses research challenges and reports the initial implementation of Crowdsourcing-based e-exams. Against this, the next section discusses related approaches and positions our approach while listing the differences. Research questions of Crowdsourcing based e-exams are listed in Section 3. Our pilot study is presented in Section 4. The paper ends with a conclusion in Section 5.

## 2 Related Work

Crowdsourcing-based individual and individualized e-exams refer to e-assessment and (student) peer evaluation.

E-assessment is a representative of formative self-assessments of online exams. Key challenges of e-assessment are the provision of a robust technical and spatial infrastructure. Usually, the question pool for e-assessment is provided by the lecturers [Ha16]. Open question pools of other universities might also be accessed in order to broaden the view of the learning material [Je16]. The key idea of a Crowdsourcing-based individual and individualized e-exam is a question pool that is not generated by lecturers but by learners. Learners also continuously improve the quality of questions.

Numerous references can be found for peer assessment [To98, Bo01, Le15]. Empirical studies show the positive effects for mutual feedback from students [Fa00]. Particularly, within student peer assessments or student peer evaluation students mutually evaluate the achievements of their peers and are involved in an active review process. Schlagwein [Sc15] recommends peer reviewing for seminar papers. The concept of Crowdsourcing-based individual and individualized e-exams goes beyond user-generated assessments or peer assessment. Within our approach additional requirements must be considered such as the preferences of learners (e.g., with respect to the layout of questions), agreement on

an appropriate level of difficulty or scales of questions.

Initial indications in favor of using Crowdsourcing in the learning process support our approach. For instance, Weld et al. [We12] recommends Crowdsourcing in combination with personalized online education in order to reach full potentials of online education. Anderson [An11] points to positive effects of Crowdsourcing for judging of answers by peers. Corneli and Mikroyannidis [Co12] found out that Crowdsourcing can offer additional richness for accreditation and assessment. To better understand how Crowdsourcing can fuel education, the taxonomy of Mitros and Kim [Mi15] should be used.

To sum up, Crowdsourcing in learning is in its infancy. However, initial empirical studies point to positive effects compared to conventional learning.

### 3 Research Questions

To implement a Crowdsourcing-based individual and individualized e-exam the following research questions need to be addressed:

(1) *How to prepare learners for e-exams?* To fully exploit the benefits of Crowdsourcing-based e-exams it is necessary to communicate the learning objectives to the students (for example, according to the taxonomy by Anderson / Krathwohl 2001 [An01]). Additionally, the eLearning system must be transparent to the students. Communication is required how the system tracks the tasks of students.

(2) *How to generate a sufficiently large and high-quality questions pool?* The formative involvement of students in the exam preparation requires defining appropriate complexity levels for questions (e.g., simple, advanced, complex). The levels of complexity must be checked and mutually confirmed by peers, which in turn should improve their self-assessment of the exam material. The evaluation of complexity levels might be proven within exercises.

(3) *What is a suitable incentive system?* Students will design “rich” questions only if an attractive incentive system is communicated. The incentive system should also prevent the students from false attempts. Particularly, questions should be developed, which reflect the situational application of knowledge and its justification of choice answers.

(4) *How can the effort be reduced for the validation of questions?* The effort for quality assurance of questions should be reasonable to the reduced marking effort for e-exams. This requires features that mostly automate the validation of questions.

(5) *How to guarantee the comparability of e-exams?* E-exams for the identical lecture should be comparable. For this purpose, the self-assessed complexity of questions by students should be taken into consideration as well as statistical measures, which rate the fulfillment of learning objectives per question type.

(6) *Can principles be observed from individual interactions with the e-exam system?* A wiki should be activated in the e-exam system, which allows observing individual interactions with the system. The observations should give hints how to individualize the exam.

(7) *How to integrate technically the Crowdsourcing-based e-exam into the existing technical conditions?* Finally, the individualization of e-exams should not be limited by technical conditions (e.g., data security).

## 4 Initial Implementation

A pilot study has been set up in order to validate the feasibility of Crowdsourcing-based individual and individualized e-exams. The opportunity of a bonus has been promised to students of the lecture “Foundations of Information Systems” (Grundlagen der Wirtschaftsinformatik) at the University of Cologne in the summer term 2016. Around 300 students attend this lecture. A bonus of at least 15 points (17% of the total score) will be granted to students if they submit to 5 out of 6 topics exam questions and solutions. The choice option 5 out of 6 should prevent that questions for only simple topics are preferred. To each question the students had to assign a complexity score (one to three stars). The learning objective of each topic was communicated to the students as well. One lecturer or teaching assistant was in charge of one topic in order to detect cheating and duplicates in the question pool. The Ilias system<sup>3</sup> is used as IT support system.

## 5 Conclusion

This paper introduced a Crowdsourcing-based approach for the process of exam preparation. The Crowdsourcing-based approach shifts the responsibilities of learners and lecturers. The active involvement of students into the process of exam preparation has several advantages. First, due to a formative learning the achievements of students (with respect to marks) can be improved. Second, the upload of exam questions and results into an e-exam system allows tracking interactions of students. From these interactions individual preferences with respect to visual or graphical representation can be derived as well as individual feedback for learners and lecturers about the learning material can be provided.

After the completion of the pilot study a report will follow. We plan to investigate other stages of learning that might be suitable for Crowdsourcing-based individual and individualized approaches.

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<sup>3</sup> <http://www.ilias.de>

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