Turning Learners into effective better Learners: The Use of the askMe! System for Learning Analytics

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Abstract. Learning analytics is defined as the measurement, collection, analysis and reporting of data about learners in order to optimize their learning. It was recognized very early that the field of learning analytics offers promising possibilities for education and assessment. In this paper, the interactive and personalized e-assessment system *askMe!* is presented that makes use of learning analytics in order to turn learners into effective and better learners. The paper also shows how the system addresses future challenges in the field of learning analytics. Finally, a brief summary of the use and evaluation of the system in a real-life setting completes the paper.

Keywords: e-assessment; adaptivity; personalization; interactivity; learning analytics; askMe!

1 Introduction

During the last decade, Learning Analytics (LA) has emerged as a significant area of research in the field of technology-enhanced learning. It has been considered as one of the fastest growing areas of research related to education and technology [1]. In contrast to educational data mining, LA exclusively focuses on the learning process and tries to collect, manage, interpret and purposefully use (large) data sets in education. In this way, it offers promising possibilities for education and assessment. The focus of this paper is the presentation of an e-assessment system that makes use of LA in order to support and improve students' individual learning process.

2 Learning Analytics

According to the 1st International Conference on Learning Analytics and Knowledge (LAK'11), LA is defined as the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding

and optimizing learning and the environments in which it occurs". Simply put, the broad goal of LA is assisting students' learning process by giving feedback. The feedback is based on the results obtained by analyzing the data gathered by monitoring and measuring the individual learning process. It was recognized very early that the field of LA offers promising possibilities for education and assessment. LA provides a variety of information that can be used to adapt the students' learning and/or assessment to their individual strengths and weaknesses. Moreover, it can also supports students' self-regulation of learning by providing feedback in forms of visual data analyzes or visualizations. This allows students taking control of and evaluating their own learning process and behavior.

There are a lot of challenges that drive the research in this field. This includes the appropriate collection, protection and use of the large data sets, but also issues related to data protection, ownership and privacy are of particular relevance [1]. In 2012, Ferguson [2] identified four significant challenges that research in this field must address: Due to the fact that LA emerged from the fields of analytics and data mining, the first challenge is to build strong connections with the learning science. The second challenge is to support and incorporate a wider range of data sets. The third challenge is to focus on the perspectives of the learner and finally, the fourth challenge is to take decisions regarding the ownership and stewardship of the data into account.

3 The askMe! system

askMe! is a web-based e-assessment system that covers the whole life-cycle of e-assessments starting from creating questions, presenting them to the students up to preparing the results and presenting them to teachers, tutors, etc. The questions and tests can consider individual aspects so that e-assessments and their feedback can perfectly be tailored to students or groups of students [3]. Moreover, the author of the adaptive tests is not limited to traditional question types such as multiple-choice, but can use Interactive Content Objects (ICOs) to create sophisticated (interactive) e-assessments [4]. The latter aspect takes into account the assumption that learning is the result of interaction and more specifically, the result of engagement with the subject matter [5]. In order to deal with the different ICOs located elsewhere in the Web, a communication mechanism based on the Experience API (xAPI) specification has been developed. In this way, the *askMe!* system allows integrating and mining a wide range of data sets from multiple sources and thus, already addresses the second above-mentioned main future challenge of LA.

When a student has completed a test in the *askMe!* system, he/she will not be confronted with an abstract score, but will get detailed feedback on his/her strengths and weaknesses, which allows him/her to efficiently address specific deficits afterward. This information is presented in his/her *knowledge dashboard* (cf. Figure 1). This component not only provides students with a tabular and graphical overview of his/her testing results, but also with a detailed overview

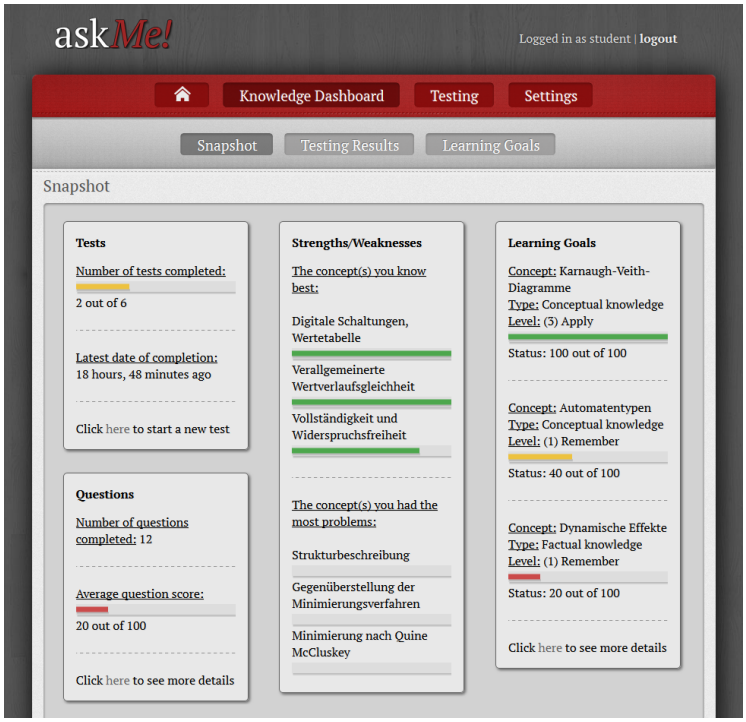

Fig. 1. askMe! knowledge dashboard (snapshot)

about his/her knowledge level according to the topics addressed by the respective question. In this way, the *askMe!* system assists students' learning process by giving feedback in form of expressive visualizations. This also increases students' self-awareness significantly. In addition, the system considers their needs when reporting and visualizing analytics data. This is done by letting students decide whether they want to have a compact view of the information at a glance (dashboard snapshot) or whether they want to have all information in detail. The system captures this behavior and automatically presents the view mostly selected by the respective student next time. With respect to the dashboard snapshot, it is also planned to let students freely decide which widgets they want to see and how they want to arrange them. Consequently, the *askMe!* system provides the degree of individualization and personalization needed to address the third main future challenge of LA.

The presentation of statistics in *askMe!* is not limited to students, but is also provided to authors, tutors, etc. The information for this user group is presented in *user and test statistics*. This component presents an overview of students' testing results to (adaptive or non-adaptive) tests as well as their individual learning progress. In addition, the system uses statistical techniques in order to predict, which students are struggling with the content. Tutors and teachers

can use this indicator (i.e., green, yellow and red) to intervene either online or face-to-face. Basis of the predictions are students' grades, but also their learning progress over time according to the learning goals set.

In order to get feedback whether the *askMe!* system is applicable for its intended use, it was used and tested in a real-life setting at the Ilmenau University of Technology [6]. The study was performed in the course digital systems design for about 80 students. The system was made available for students preparing for their final exam. All in all, 101 tests were completed and 714 question were answered over a period of 12 weeks. As a result, it can be stated that the system was rated very well by the test persons. In addition, the study has shown that the average grade of students that used the *askMe!* system for test preparation was much better than students who did not use system. Furthermore, the failure rate of students that did not use the system was four times higher than students that used the system for test preparation.

4 Conclusion

This paper has presented the *askMe!* system, a web-based e-assessment system that has been developed at the institute of the main author in cooperation with the institute of the co-author. The system aims at evaluating, but also supporting and improving students' individual learning process by providing real-time feedback to students and tutors/teachers. It has also been shown that the system addresses two main key challenges in the field of LA and thus, provides a decisive contribution to the research in this field. Finally, the use and evaluation of the system in a real-life setting has proven the educational benefit of LA in general and of the *askMe!* system in particular.

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