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Information Technologies in Education: The Learning Assessment Tools

Ulan Brimkulov
Kyrgyz-Turkish "Manas" University, Chyngyz Aytmatov Avenue, 56, Bishkek, Kyrgyz Republic
ulan.brimkulov@manas.edu.kg

Kasym Baryktabasov
Kyrgyz-Turkish "Manas" University, Chyngyz Aytmatov Avenue, 56, Bishkek, Kyrgyz Republic
kasym.baryktabasov@manas.edu.kg

Chinara Jumabaeva
Kyrgyz-Turkish "Manas" University, Chyngyz Aytmatov Avenue, 56, Bishkek, Kyrgyz Republic
chinara.jumabaeva@manas.edu.kg

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Abstract: Information technologies (IT) are increasingly used in education all around the world. The examples of such application are massive open online courses, learning management systems, e-courses, e-books, video lectures, learning assessment tools etc. The learning assessment tools are of particular interest, because assessment is very important part of education. This paper describes the purposes of IT usage for assessment and the different assessment approaches. The paper also presents the web-based computer assisted assessment system developed in the Kyrgyz-Turkish "Manas" University and shares experience of implementation of the system in that university. As a result of this work the authors argue that there are more advantages of implementing such a system for assessment of the large amounts of students comparing to drawbacks like depending upon the technical issues and preliminary work for the item bank development.

Keywords: *Education, learning assessment, computer assisted assessment, computer based assessment, e-assessment, information technologies.*

Информационные технологии в образовании: инструменты оценивания знаний

Аннотация: Во всем мире растет использование информационных технологий в образовании. Примерами таких приложений могут послужить массовые онлайн курсы с открытым доступом, системы управления обучением, электронные курсы, электронные книги, видео-лекции, инструменты оценивания знаний и т.д. Особый интерес представляют инструменты оценивания знаний, поскольку оценивание знаний является очень важным элементом обучения. В данной статье описываются цели использования информационных технологий в оценке знаний и различные методы оценивания знаний. В статье также представлена автоматизированная система тестирования на базе веб-технологий, разработанная в Кыргызско-Турецком Университете "Манас" и приведен опыт внедрения разработанной системы в рамках университета. В результате этой работы авторы делают вывод, что при оценке знаний большого количества студентов с помощью разработанной системы, преимущества ее использования преобладают по сравнению с недостатками (возможные технические проблемы и необходимость предварительной работы по формированию базы данных вопросов для тестирования).

Ключевые слова: *Образование и обучение, информационные технологии в обучении, оценка эффективности обучения, электронная оценка.*

1. INTRODUCTION

Information technologies (IT) are increasingly used in education all around the world. The examples of such application are massive open online courses, learning management systems, e-courses, e-books, video lectures, learning assessment tools etc. These systems and tools can be used in both distance learning and full-time study at an educational institution. The learning assessment tools are of particular interest, because "assessment is an essential component of learning and teaching, as it allows the quality of both teaching and learning to be judged and improved" [**1**]. Moreover "Research and experience tell us very forcefully about the importance of assessment in higher education. It shapes the experience of students and influences their behavior more than the teaching they receive" [**2**].

Using information and communication technologies (ICT) for learning assessment appears in literature under a variety of names. For example, computer assisted assessment (CAA) is "the use of computers for assessing student learning" [**3**], or CAA "encompasses the use of computers to deliver, mark or analyze assignments or exams" [**4**]. Another term: electronic management of assessment (EMA) is "the way that technology can be used to support the management of the whole assessment and feedback lifecycle, including electronic submission of assignments, marking, feedback and the return of marks and feedback" [**5**]. There is also E-assessment which is "the end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity and the recording of responses. This encompasses the end-to-end assessment process from the perspective of learners, tutors, learning establishments, awarding bodies and regulators, and the general public" [**6**]. M. Thelwall in his study uses the term "computer-based assessment" (CBA) that stands for "using computers for assessment" [**7**]. CBA "involves a computer program marking answers that were entered directly into a computer" [**8**]. In this study we will use all of these terms interchangeably.

CAA has many advantages compared with paper-based assessments. It allows for more complex item types, such as using of audiovisual materials and more complex interactions between learner and computer. Many CAA systems provide richer data about the students than were available from paper-based assessments. Thus the development of online assessments has important pedagogical implications [**8**]. The benefits of CAA include rapid formative feedback to students, reduced marking load for staff, and a closer match between the assessment and learning environments [**9**].

There are plenty of commercial and open source learning assessment software. That is why it is important for educational institutions to know the types, differences, advantages and possibilities of this kind of software.

The main objectives of this study are to present the purpose of implementation and usage of the learning assessment tools by the educational institutions, to examine the known types of learning assessment tools, and finally to share experience of using the learning assessment software in Kyrgyz-Turkish "Manas" University (KTMU).

The following section describes different purposes of using of the learning assessment tools and provides different methodologies or types of learning assessment. Section three presents computer based assessment (CBA) system developed in Kyrgyz-Turkish "Manas" University. Section four discusses experience of implementation of the above mentioned CBA system in KTMU. Section five concludes the paper.

2. THE TYPES OF THE LEARNING ASSESSMENT TOOLS

The Learning Assessment Tools can be used for diagnostic, formative, summative and self-assessment purposes **[7, 8]**. Diagnostic assessment is used to determine students' prior

knowledge [**3**]. This kind of tests usually performed before the course. The main objective of formative assessment is to "give feedback to assist the learning process" [**8**]. Summative assessment takes place after the course of instruction and aimed to give grades [**8**]. Self-assessment usually used by students in order to find the gaps in knowledge or to prepare to the exams.

The CAA tools can be categorized as optical mark readers (OMR), e-portfolios, electronic pear assessment tools, objective tests, and systems based on rubrics.

In the cases where a large amount of students have to be tested simultaneously it is hard to prepare enough computers for everybody. In such cases OMR is a convenient tool to use. Optical mark reading uses a computer to mark scripts originally composed on paper [**8**].

E-portfolio is the use of a computer to collect scripts or written work of the learners [**8**]. E-portfolios can help students to develop reflection, critical thinking, learner autonomy, professional development, and the ability to organize and self-regulate the learning process [**10**]. They can also boost motivation in learning and facilitate the acquisition, assimilation, and accumulation of knowledge.

Peer assessment modeled on the journal publication process of an academic society and based on social constructivism [**11**]. Online peer assessment utilizes anonymous online marking and feedback by learners. The study [**12**] showed that "on-line peer assessment significantly enhanced students' quality of projects, as it provided students with opportunities of learning not only from other peers but also from evaluating other peers' work". Authors of that study also found that correlations between peer assessment scores of learners and teacher were significantly high, implying that peer assessment could be perceived as a valid assessment method [**12**]. Peer assessment can be used in the fields, such as writing composition, project evaluation and others.

A rubric is a tool for interpreting and judging students' work against the set of criteria and standards. In other words, rubrics are the criteria sheets that are aimed to enable assessors to evaluate the quality of student work as well as guide student learning by making explicit the evidence needed to demonstrate the requirements of the assessment task. They are designed to help assessors make judgments about quality, and justify that quality by using appropriate standards descriptors. They are also an excellent mechanism for giving detailed feedback to students [**13**]. The rubrics can make assessment tasks more transparent for students and provide them with the tools to understand the assessment process by involving students in it. The rubrics can also help students by providing the option to undertake self-assessment. Authors of the study [**10**] combined rubrics and e-portfolios and observed that students found rubrics "useful, specifically in that that the rubrics helped them both to understand assessment better and to become more aware of competences".

Objective tests are in use since the middle of the 20th century. At that time they were based on the multiple-choice questions (MCQ). The first computer programs delivered MCQ appeared in 1970s. Along with the progress of computers from year to year the more sophisticated question styles have been emerged enabling more diverse assessment methods. The main groups of question styles can be defined as point and click, move object, text entry and draw object [**4**]. There were plenty of concerns related to objective tests such as guessing, security, and interoperability. But many approaches have been developed to date to address these problems. For example, Instructional Management Systems – Question and Test Interoperability Specification (IMS-QTI) is aimed to address the problem of interoperability. Despite that fact, there is concern in literature relating to ability of objective tests to assess higher cognitive skills, such as analysis, synthesis, and evaluation [**4**]. On the other hand, research in linguistics and computer programming concluded that the higher-level skills can

be assessed via CAA through innovative approaches [**14**]. There is also another research related to generating randomized questions [**15**] and development of the item banks [**16**].

3. CAA SYSTEM DEVELOPED IN KYRGYZ-TURKISH "MANAS" UNIVERSITY

The CAA system have been developed in Kyrgyz-Turkish "Manas" University in order to address the problem of conducting formative and summative assessment of the large amount of students for the mandatory "Introduction to Information Technology" course. The former paper-based approach restricted the staff to organize the exams in every semester for more than five hundred students simultaneously, spend time to create, print and copy thousands of question and answer sheets, and required considerable efforts for giving grades.

The developed CAA system is the web-based objective testing system that uses an item bank of multiple-choice questions. The system consist of the administrative unit for administering purposes, students testing unit for delivering questions and obtaining the answers from the learners, and the database containing all the related data (see Figure 1).

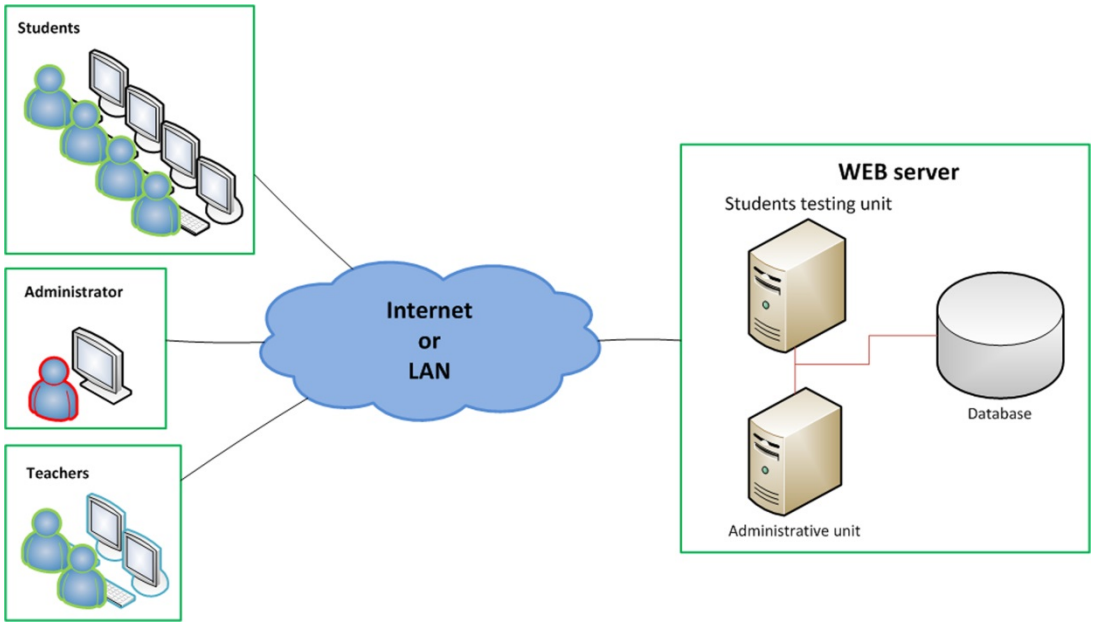

Figure 1. KTMU CAA system.

The system allows grouping the students according to their departments, and to assign the teachers to the groups. To create an exam the system administrator should assign the course, groups of students, date, and the length of time. There should be also assigned the topics, difficulty and number of items. Once an exam created the system generates the unique one-time passwords for every student of the assigned groups to have access to that exam.

Once a student enters to the exam using his id and password, the system selects randomly the items from the item bank according to given topics, difficulty and number of items. The responses for questions are also presented in random order. Every question showed on the separate page. During the exam, the student can scroll the questions back and forth, as well as directly go to any question by clicking on its number. Student can also change the selected answer to another one until the exam is completed. After finalizing the exam by the student or by the end of time, the system records in the database the items selected, the student's responses, and grade. The students cannot re-pass the exam, because the generated password becomes invalid as soon as the student completes the exam and receives a grade.

Teachers can access to the system in order to obtain the exam results (students' grades, answers and mistakes).

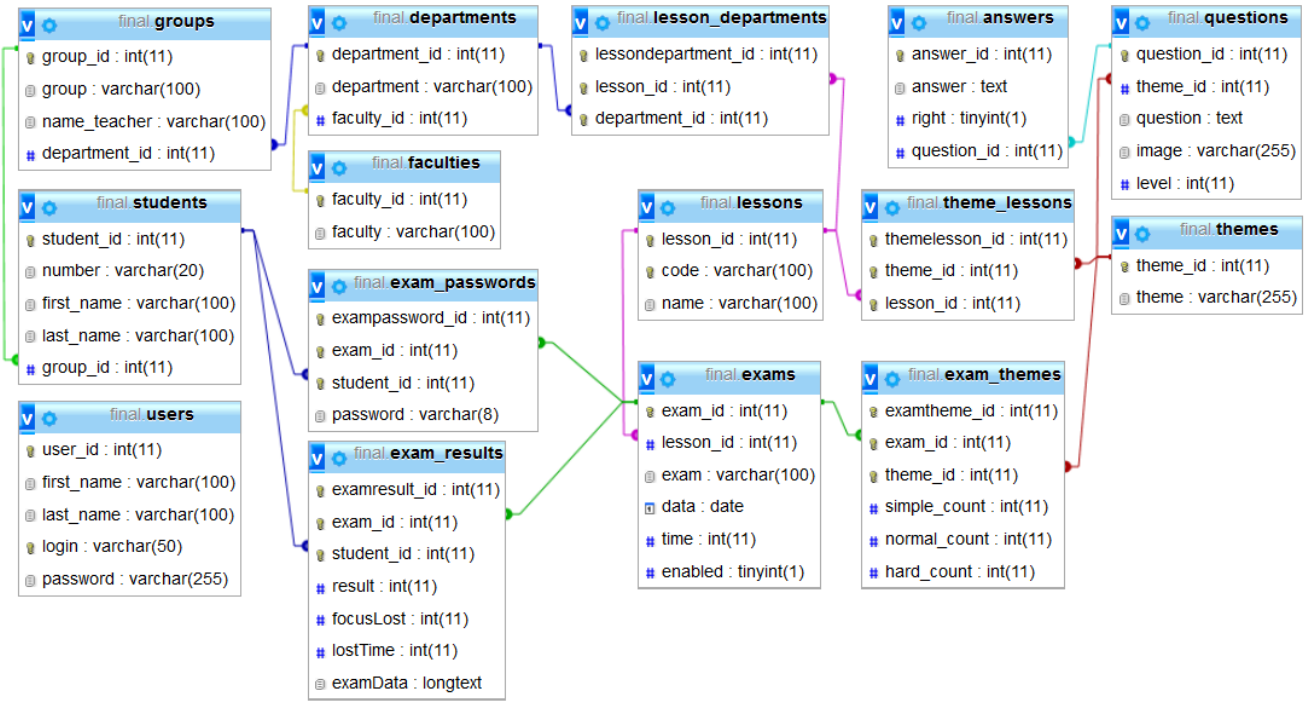

Figure 2. The database structure of the KTMU CAA system.

The physical location of the students and the server hosting the CAA system is not important if there is an access to the internet.

4. EXPERIENCE OF IMPLEMENTATION OF CAA SYSTEM IN KTMU

The CAA system of KTMU is in use since 2014. During this period of time more than 3600 students have been assessed using the system. The assessment performed as invigilated exams consisting of 40 or 50 items. More than two hundred items in the item bank have been developed and peer-reviewed by the academic staff and grouped by the topic and difficulty. For the purpose of addressing the problem of guessing the staff asked to prepare questions with the fixed number of responses for every item (five responses per item). The item bank is still being expanded.

Implementation of the system allowed avoiding the need of bringing hundreds of students together at the same time for examination (usually at weekends, because the students have different schedule of lessons during the weekdays). It became possible because there is no pair of learners with the same set of items and response order, thus the risk of cheating minimized. On the other hand, the system guarantees the equivalent level of complexity of the exam for all the learners, because of the same number of questions in the test for each topic, as well as the level of their difficulty.

Time saved by minimizing efforts for organizing the observers, examiners and venue planning. Every teacher can perform an exam for his groups separately at different time. The system shows the grade immediately after finalizing the exam, thus there is no time loss for giving grades any more. The students can apply to see the result of the exam in order to learn the mistakes and find out their area of weakness. Now the staff has more time to create the high quality questions for future use.

Sometimes the staff faced the technical problems such as an electrical outage and connection fails. There have been also the human based errors. For example, some students accidentally pressed the button of completing the exam and agreed with the confirmation message. But

these problems did not affect the overall performance. Some may express their concern related to the fairness of the exam because of the different set of selected items for every student. Although there is no explicit proof of the students' perceptions of the used approach, no one of the students that have been assessed raised a claim related with the fairness.

5. CONCLUSION

Many different kinds of tools have been developed to date in order to assess the learners' progress, to facilitate self-assessment, to give the grades and other reasons. But the future assessment strategies should go beyond testing factual knowledge, and should be able to capture the less tangible themes underlying Key Competences of 21st century, such as problem-solving, reflection, creativity, critical thinking, learning to learn, risk-taking, collaboration, and entrepreneurship in order to foster and develop these skills [**17**].

Regarding the CAA system developed in KTMU it could be argued that there are more advantages of implementing such a system for assessment of the large amounts of students comparing to drawbacks like depending upon the technical issues, preliminary work for the item bank development etc.

The future direction of research may be related to the students' perception of the approach related to randomized selection of items from the item banks, so that every student have the unique set of questions, in order to proof or disprove positive attitude to the system.

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