DEVELOPMENT OF A WEB-BASED QUESTIONS AUTHORING AND MANAGEMENT SYSTEM

Jaemu Lee, Kyung-Tae Park

Department of Computer Education, Busan National University of Education, South Korea

ABSTRACT

This study focuses on supporting effective assessment for teachers and learners. Currently, in the case of on-line evaluation, teachers have only been able to choose from a limited number of questions, and students have only been able to answer the questions that were presented by their teachers. We have developed an evaluation system that both teachers and students can use to quickly find the questions suitable for their particular situation. This system provides various assessment templates with specific question types so that a teacher can easily create a customized evaluation form. The system also provides self-evaluation for students based on personal information about their learning level saved in the database. The students can view their assessment results categorized in various ways. The system provides feedback based on their answers and guidance for improvement.

KEYWORDS: *Computer-based Test, Evaluation System, Questions Authoring System, Questions Management System, Web-based Education*

I.   INTRODUCTION

Recently it has become commonplace to provide information using the web in all social areas whether scientific, political, economic, cultural, or technological because the network has become popular and computer systems are being developed [1]. Information technology has expanded further because excellent hardware was introduced into classrooms as teaching aids, and educational networks have been created using high-speed internet connections on a national scale. Furthermore, teachers' ability to apply technology has expanded and deepened in many areas over the past few years. These radical changes offer new ways such as diversification of educational forms and a break with standardization. In particular, the development of the Web allows people to approach a great deal of information easily. It also inspires new education environments and the creation of new equipment to attain knowledge.

Education assessment exists within the huge process called education. It checks whether education purposes are implemented or not. In addition, it implies the modification of content and the methods of education, and provides information concerning results [2]. Concerning the basic functions of education assessment, there has been insufficient effort applied to the many education assessments in network education systems until now.

There are some problems with most education assessment systems, and the management and evaluation of questions using the systems.

An appropriate assessment system is necessary to make assessment questions suitable for learners and to assess them because performance assessment is being emphasized [3]. Education assessment methods in most systems, however, just provide problem-solving or the searching of questions, so it is insufficient to assess the learners' personal level [4]. Some systems provide opportunities to choose

assessment questions but these are very limited [5]. It is difficult to maintain proper levels with respect to individual questions in existing item pools. In addition, there are several interfaces that were constructed independently, and this has caused confusion. They are also difficult to apply in some educational areas because the systems need to devote a great deal time to managing the questions.

This study develops a question authoring and management system. It allows teachers to make questions easily and to manage them. The learners can choose problems according to their level and can check their results multilaterally.

II.   RELATED WORKS

E-Learning is a promising and widespread development and has a variety of applications. Assessment is important in the application of E-Learning systems, but there has been little support for assessment or evaluation.

Typically, discrete-point testing; that is, multiple-choice or true-false tests are offered. In addition, most assessment systems support only teachers and tutors in the creation of handmade questions [6]. The following are some advanced studies with creative ideas.

Lennon and Maurer [3] proposed an assessment system that supports crossword puzzles for the learner, but this was a very simple assessment system.

Heinz et al. [7], at Curtin University in Australia, developed the E-tester system that is a computer-based tool for automatically generating questions. The E-tester enables the generation of auto-generated questions and the assessment of the answers. Interestingly, this system makes possible Automated Essay Grading (AEG) using innovative approaches.

Baniulis et al. [8] developed an on-line test system that supports self-evaluation by students. This system was implemented using JAVA and uses the Oracle DBMS system grounded on the constructivist model of education. This assessment system can only author traditional types of questions.

Cat et al. [9] present a question-generating software system. Their approach to question generation is based on lexical, syntactic, and semantic patterns described in a mark-up language. They attempt to help students ask questions better in virtually any learning environment. They obtained positive results from an evaluation.

Ogata et al. [10] developed an e-Learning assessment management system that can be used easily. They have developed many e-Learning teaching materials that include tests to evaluate the degree of understanding of the materials. Their proposed system could efficiently create tests with easy descriptive language or a Web-based authoring tool. They propose a system that uses only one assessment engine, which can generate a test by simply specifying the questions of the test in a test-configuration file without the need for additional programming. In their proposed system, the questions to be included in a test are registered in a library in order to easily reuse them in other tests. A new test can be defined just by creating a different test-configuration specifying the necessary questions from the library. In addition, the assessment engine of the proposed system can interpret several question formats and test formats specified with a descriptive language.

Romero et al. [11] developed a test editor, an authoring tool for building web-based tests. This tool facilitates the development and maintenance of different types of multiple-choice tests for use in web-based education systems. It also provides statistical information about test usage that can be used in test maintenance. This test editor can also be used in other web-based education systems as well.

Gouli and Gogoulou [12] developed the collaborative assessment system that supports peer assessment and collaborative assessment. This system supports self assessment, peer assessment, and collaborative assessment in an e-learning environment. The results from the evaluation of the environment reveal information that promotes and enhances the learning process. In addition, students have a positive attitude towards the environment, and this is important as assessment is central to the practice of education.

These studies have advantages that are only one-sided. We need to develop a system that takes into consideration multiple factors, and the system should consider both the teachers' and learners' perspectives.

III.   THE DEVELOPMENT OF A QUESTION AUTHORING AND MANAGEMENT SYSTEM

3.1. The Development Environment

This system is a server environment based on the operating system Linux. It uses Apache as a web server, and MySql and PHP as a database.

3.2. The System Composition

This system is composed of two parts: a teacher module and a learner module. Figure 1 shows the whole structure.
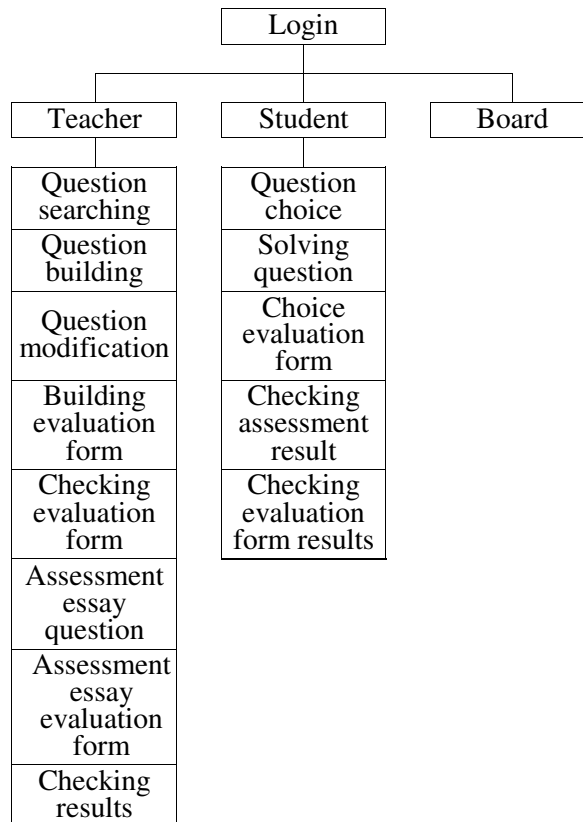

Figure 1. System structure

3.2.1. Login and User Enrolment

This system is an authorized teacher module and student module. The input ID shown in Figure 2 is a convertible main screen depending on the position, the teacher or the student.

Figure 2. Login screen

If the student or teacher clicks enrolment, it provides the individual information form as shown in Figure 3.

Figure 3. Enrolment form for new members

It requests that the student or teacher fill out the form with an ID, password, name, school, and essential information; self-introduction is optional information. To protect personal privacy, it does not request other personal information because it doesn't require further information. It does, however, require the student or teacher to provide the e-mail address used most frequently when he or she wants to receive an e-mail.

3.3. Teacher Module

3.3.1. Question Searching

Figure 4 shows an access screen where the teacher can search for questions, choose evaluation forms, and manage learners' assessment results. In this situation, the teacher can set up search options for several items. The students can quickly find questions that they need. The question-searching module is the same for teachers and learners. Thus, modification in the teacher's module will be reflected in the learner's module and vice-versa.
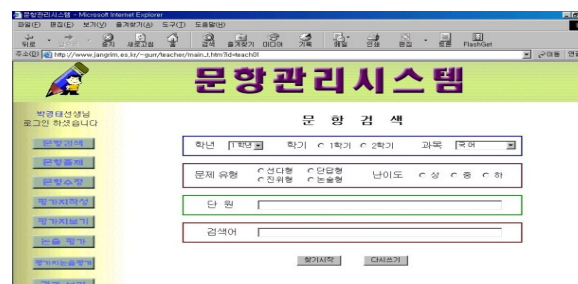
Figure 4. Screen representing searching options for the teacher

The list of search results shown in Figure 5 was used in other similar menus with a few changes. The method of obtaining information from the server is basically the same, and it has only slight changes in the menu and for each item. This way, it is easier to understand meta-data questions easily and to allow a more efficient use of the whole system.

Figure 5. Question searching results for the teacher

Teachers can prepare the evaluation form with the question cart function. After the teacher finds a question that he is looking for, the system will save the question so that the he can use the questions later and authorize the evaluation form.

Fig. 5 shows a result list from selecting linked keywords or lessons. We can check the questions in the question type that was selected. This type is used for checking detailed questions, authoring,

modification, and so on. It also reuses the form and types of input-output for the function and purpose of each menu; it provides a consistent interface for teachers and students.

3.3.2. Question Building

First, input some of the meta-data (grade, semester, class and level, type of question, lesson, and keyword) of the questions that are to be provided to the learners. A proper input form will then be presented after clicking the 'problem building' button as shown in Figure 6. This form is similar to the search option input form used in question searching. All input and output forms related to the meta-data of the questions are thus the same as these forms so that the teacher can use the system more intuitively.

Figure 6. Question examination – Meta-data input

The system presents different types of input questions depending on what the teacher selects. The teacher can therefore make various types of questions easily because the system provides the desired template whether it is multiple-choice, true-false, or otherwise. Figure 7, Figure 8, Figure 9, and Figure 10 are each typical forms for questions.

Figure 7. Closed-answer question form

Figure 8. Open question form

Figure 9. Multiple-choice question form

Figure 10. True-false question form

3.3.3 Question Modification

Figure 11. Question modifications

All of the teacher's evaluation forms that were saved for particular lessons are presented in Figure 11. If the teacher wants to modify a pre-existing evaluation form, he can choose from any saved lesson. The teacher can modify the evaluation form or questions from this screen. When the teacher selects a particular lesson, he is taken to a screen similar to Figure 12. Figure 12 shows an example of a closed-answer question modification.

Figure 12. Closed-answer question modification

3.3.4 Building Evaluation Form

The teacher combines the search options and searches for questions to build the evaluation form on the screen of the question-searching screen as in figure 4. The teacher can re-choose questions from the list and make another evaluation form with those questions.
An evaluation form can consist of several question types and questions.
An evaluation form can be used efficiently by teachers to intervene in the learners' results list when the students search or choose the questions that they want by the student' too narrow or restricted learning habits.

3.3.5 Check the Evaluation Form

It is possible to search for an evaluation form created by any of the teachers. First, select the title of an evaluation form and the questions will be shown. The teacher can see the number of students who completed each evaluation form.

3.3.6 Assessment Essay Question

The system can presents all essay questions answered by the learners. If the teacher chooses a specific evaluation form, he can assess the learners' response to that question. An essay question can be neither correct nor incorrect, so the teacher also assesses these answers qualitatively. Figure 13 presents an example of an essay question assessment.

Figure 13. State question assessment

An assessment result such as 'Excellent' or 'Not Good' is not only a simple assessment of the question, but can also be used to draw the learner's attention to the result.

3.3.7 Assessment the Essay Evaluation Form

The essay question items that are searched for in an evaluation form are assessed independently.

3.3.8 Checking the Result

Figure 14 shows the assessment result of a question for a teacher who has logged in and saved an evaluation form. It shows the level of the learners' results when some level differences occur between the learners' and teacher's result.

Figure 14. Check the assessment result of the question

3.4 Student Module

3.4.1 Question Choice

The students question searching method is essentially the same as the teacher's in order to maintain a similar interface for teachers and students.

The student will search for questions by keywords from the question search screen, and then will be given a list of the available questions. From that list, individual students will choose the questions that they want on their test. Once these choices are made, a test, specific to the student's needs, will be presented.

3.4.2 Solving a Question

Figure 15 is a question-solving example for a closed answer.

Figure 15. Question solving screen: closed answer

This shows selected questions for the question searching result screen for learners. A delete item on this menu excludes improper questions as an option. When learners choose to answer a question, the system provides similar questions for each type on the question-making form. It decides whether an answer is true or false immediately, and the results are saved in the database. According to those results, a recalculated level is presented on the teacher's result screen.

3.4.3 Choice the Evaluation form

This is the same form as in the teacher's module. When a learner chooses the title of an evaluation form, the question is displayed in a new evaluation form. This form is also completed and saved in the database.

3.4.4. Checking the Assessment Result

Figure 16 shows the results for each question. It helps learners to check their question solving, and they can get feedback and advice about wrong answers.

Figure 16. Learner assessment result checking

Learners can get the proper question, answer, and feedback that are on the assessment view, and advice when they choose a question. Even if learners answer the same question several times, it will show all the results. This helps the learners compare their results and observe their improvement. If an essay question has not yet been assessed by the teacher, the student will receive a message to this effect.

3.4.5 Checking the Evaluation Form Result

Learners can check their answers in an evaluation form during this period.

IV. CONCLUSION

This study developed a question authoring and management system to help with efficient assessment. There are some positive effects of using this system.

First, it is possible to make assessments that consider the learners' level. This system can assign the proper level to each question and can allow easy modification to the last assessment form that was made. This level is objective because it is appropriately based on the learner's answers. It also checks assessment results in many ways and saves learners' assessment results in a database. This information helps monitor student progress and can be used for future application. Furthermore, questions saved in the database can be used again later.

Third, the system is useful for authoring and managing questions. It offers a consistent environment for learners and teachers because it uses the same system in both input-output types based on question type and search type. It can thus usefully manage the assessment process for question searching, authoring, modification, and assessment.

Fourth, it is able to obtain the correct results rapidly using many question-searching options when the learners choose the proper level. Not only can it choose individual questions, but the teacher can also authorize the suitable assessment form. It will be useful for determining prior knowledge as well as diagnostic assessment.

With respect to this system, it should be calibrated to the students' learning process and learning style using these assessment results. In addition, proper feedback should be provided to the learners according to their learning style. A system that guides the whole learning process for each learner should be developed.

REFERENCES

[1] Richard Harper, Tom Rodden, Yvonne Rogers, & Abigail Sellen (2008) Being Human, Human-Computer Interaction in the year 2020 (Cambridge, England: Microsoft Research Ltd).

[2]   Febrice Hénard (2010) Learning Our Lesson: Review of Quality Teaching in Higher Education (Institutional Management in Higher Education) (Paris, France: OECD Publishing).

[3]   Jennifer Lennon & Hermann Maurer (2003) "Why it is difficult to introduce e-learning into schools and some new solutions", Journal of Universal Computer Science, vol. 9, no. 10, pp 1244-1257.

[4]   Niels Smits, Frans G Zitman, Pim Cuijpers, Margien E Hollander-Gijsman, & Ingrid VE Carlier (2012) "A proof of principle for using adaptive testing in routine Outcome Monitoring: the efficiency of the Mood and Anxiety Symptoms Questionnaire-Anhedonic Depression CAT", Medical Research Methodology 2012, vol.12, no. 4, pp 1471-2288.

[5]   Reza Foroughi & Nina Bhatti (2005) "Dynamic Test Generation", Visual Assessment and Modular Virtual Learning Worlds. Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2005 (E-Learn 2005), Vancouver, Canada, pp 2923-2928.

[6]   Paul Dan Cristea & Rodica Tuduce (2004) "Test authoring for intelligent e-learning environments", Proceedings of the IASTED International conference Web-Based Education, Innsbruck, Austria, 2004, pp 402-407.

[7]   Heinz Dreher, Robert Williams, & Christian Guetl (2005) E-Tester "A computer-based tool for auto-generated question and answer assessment", Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2005 (E-Learn 2005), Vancouver, Canada, 2005, pp 2929-2936.

[8]   Kazys Baniulis, Vytautas Reklaitis, & E. Stuopys (2001) "Interactive multimedia authoring tool for web-based testing", Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications, Norfolk, VA, pp 84-85.

[9]   Cristóbal Romero, Santiago Martín-Palomo, Paul De Bra & Sebastián Ventura (2004) "An authoring tool for web-based adaptive and classic tests", Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, Washington, DC, pp 174-177.

[10] Evangelia Gouli, Agoritsa Gogoulou, & Maria Grigoriadou (2008) "Supporting Self-, Peer-, and Collaborative-Assessment in E-Learning: The Case of the Peer and Collaborative Assessment Environment (PECASSE)", Journal of Interactive Learning Research, vol. 19, no. 4, pp 615-647.

BIOGRAPHY

Jaemu LEE has been a professor in the Computer Education Department at the Busan National University of Education in Korea since 1987. He obtained his Ph.D. in Computer Science from Hongik University at 1994 in Korea. He was vice president of the Korea Information Education Association from March of 2005 to February of 2007. His research interests include intelligent tutoring systems, adaptive learning systems, educational ontology, and instruction methods for the computer.

Kyung-Tae Park is working as a teacher at Sinchon Elementary School in Busan, Korea. He received his master's degree from the Department of Computer Educational at Busan National University of Education in Korea. His research interests include computer based testing systems, intelligent tutoring systems, and adaptive learning systems.