Mohd Ayub A. F. et al. (Eds.) (2011). Workshop Proceedings of the 19th International Conference on Computers in Education. ChiangMai, Thailand: Asia-Pacific Society for Computers in Education.

Utilizing the HTML5 to Build a Classroom Response System

Yoshiyuki Tabata[1], Chengjiu Yin[*1], Amy Yu-Fen Chen[2]
[1]*Research Institute for Information Technology,*
Kyushu University, Fukuoka, Japan
[2] *Dept. of Computer Science Information Engineering,*
National Central University, Taiwan
**yin@cc.kyushu-u.ac.jp*

Abstract: Until recently, there have been many studies which confirmed the effectiveness of the Classroom Response System (CRS). However, many of the existing CRSs use multiple-choice questions. In this paper, utilizing HTML5 technologies, we proposed a short answer collaborative learning CRS, called CLARES, to support group discussion. By the manner which the teacher determines right and wrong answers on-site, we propose that utilization of the CLARES may raise students to a sense of excitement and encourage a sense of expectancy and raise motivation.

Keywords: Collaborative learning, Group discussion, Classroom Response System, Smart phone

Introduction

A Classroom Response System (CRS) is also known by other names such as a Personal Response System, Audience Response System, and Student Response System. The CRS is a system where learners can answer the teacher's questions immediately with mobile devices, and the system will then display the statistics result. According to this result, the teacher can grasp the level of understanding of each learner on the course content. The system turns every learner into an active learner. For instance, 'ClassTalk' [http://www.bedu.com] is a classroom response system that shows teachers the statistics of learners' answers in the classroom immediately [1]. By using the CRS, the students who usually tend to silence in the classroom can participate actively in class. The CRS has the following advantages:

- It allows students to submit their answers immediately.
- It collects the students' answer results, and produces statistical results showing how many students chose each of the answer choices.
- It is easy to participate in class even if he is a shy student.
- Teachers can check on students' understanding on site.
- Most of the traditional classes are conducted in a one-way teaching mode that is from teacher to students. CRS changes the one-way mode to a two way mode.

Moreover, with the development of the web technologies, such as HTML5, we can only use the Java Script and HTML to develop the application, which can be run on the web browser. Many web browsers, which were published after 2008, support the corresponding HTML5 function[1]. HTML5 is the latest technology in internet to look forward to. HTML5 supports animation, local storage and canvas technology which would make the web faster and

[1] http://ja.wikipedia.org/wiki/HTML5

elegant. Utilizing of HTML5, many developers have already started developing HTML5 applications.
In this paper, utilizing the HTML5 technologies, we proposed a short answer question based classroom response system, which called CLARES, to support group discussion and collaborative learning. Students can access CLARES not only from their PC (personal computer), but also from their notebook, PDA or smart phone. In CLARES, we used HTML5 technologies such as building tables dynamically, changing fonts or images dynamically and controlling mouse action. This system is not only support 1 to 1 (One computer to one person), but also support "one to many" (one computer and a group of students).

1. Related Works

Until now, we have developed some teaching assistant systems such as Quiz [2] and Web Drill [3]. Quiz is an iPhone based quiz system to help students to understand the linguistic culture in a mobile-learning environment; Web Drill is a web-based system to support building and managing teaching materials. As a teaching assistant system, CRS is a kind of major research topics, which has been conducting various studies. In this section, we did a survey of two systems (BeeDance and Clicker) and do a comparison among BeeDance, Clicker and CLARES.

1.1 BeeDance

BeeDance is a iPhone/iPod touchs based CRS system which was developed by CSK Corporation company[2], Japan. It is a two-way communication system to faculty the interaction between the teacher and students. BeeDance is a famous system in Japan, however, some problems are as follows:
a) BeeDance can be used only on iPhone/ iPod touch, however there are not many students have iPhone/ iPod touchs. Some schools provide students iPhone/iPod touchs during class., however, they have to lend iPhones to the students before the class, and maintain and recover iPhones after the class. It becomes a burner for teachers to lend and maintenance equipment such as charging the battery.
b) BeeDance not only supports the multiple-choice questions, but also supports short answer questions. However, it is not easy to input words by the keyboard of the Smartphone, so BeeDance is not suitable for short answer questions.
c) In order to avoid students to remember the number of the correct answer, it is better to randomly each time. BeeDance does not support to arrange answer alternatives, so the teacher has to take care about this problem when s/he creates questions.
d) Using BeeDance, the client software running on iPhone/iPod touchs can be downloaded freely, however, we have to pay for the software of server.
e) Sometime the teacher wants to pose questions on site. However, using BeeDance, the teacher has to prepare questions in advance.

1.2 Clicker

Clickers are broadly used on college campuses to record student responses to questions posed during a lecture in the world. The teacher uses a computer and a video projector to project a presentation for the students to see. The presentation slides built with the audience

[2] http://csklc.jp/product/bee.html

response software display questions with several possible options, more commonly referred to as multiple choice questions. The student participates by selecting the answer they believe to be correct and pushing the corresponding key on their individual wireless hand-held devices. The hand-held remote control that students use to convey their responses to questions is often called a "clicker."

After reviewing the literature, Caldwell (2007) reports "Most reviews agree that 'ample converging evidence' suggests that clickers generally cause improved student outcomes such as improved exam score or passing rates, student comprehension, and learning and that students like clickers [4]."

However, the Clicker has the following problems.

a) It needs specialized mobile equipment, "clicker".
b) We have to pay for the system as well as the remote control.
c) Using "Clicker", the teacher has to prepare questions in advance.

2. CLARES

As shown on table 1, the characters of CLARES are as follows:

a) There is no device limit. CLARES can run on PC or smart phones. As long as there is Internet, you can use CLARES anytime.
b) CLARES does not support individual learning, it supports a group of students to discuss the answer, and then submit their discussion results to the system.
c) CLARES is short answer questions system, we consider that it is effective to make students to think about the questions and give out a short answer.
d) We will public CLARES as free software.
e) Using CLARES, teacher can pose oral questions on site, so it needs not to prepare questions in advance.

Table1. Comparison

	BeeDance	Clicker	CLARES
Devices	iPhone/iPod touchs	Specialized device	No limit: PC/iPad/SmartPhone
User	Individual	Individual	Group(Collaborative learning)
Question format	1.Multiple-choice 2.Short answer	Multiple-choice	Short answer
Fees	Have to pay for server license	Have to pay	Free
Creating Questions	Have to prepare questions in advance	Have to prepare questions in advance	Support posing question on site

Moreover, the correctness is determined automatically in BeeDance and Clicker. As the results are shown immediately, it couldn't help feeling a sense of excitement, and the knowledge isn't left in the impression. In contrast, the correctness is not determined by system in CLARES, it will be determined by teacher himself/herself. After all the answer results of each group were projected on the screen, teacher can determine the correctness on site, in the same time, the teacher can comment on each group's answer, add to explanations to the answers if necessary. By the manner which the teacher determines right and wrong answers on-site, students can think and reflect during the teacher explained, the CLARES may make students to feel a sense of excitement and encourage a sense of expectancy and raise motivation. In addition, CLARES allows students to think again before the correct answer is displayed.

2.1 Check the Adequacy of the questions

If you use this system in the foreign language classes, the system can check the adequacy of questions. That is, the system can check whether the question suit the students' current level.

2.1.1 Determine the adequacy of the questions
In this system, we use a simple way to determine the suitability of the question.

1) Checking the words which are not yet learned
The system will check the question whether it contain the words are not yet learned. The words, student learned in every class, will be stored in to database. By matching the question content with the database, the system can check the suitability of the question. Some language such as German and French are inflected languages. By storing the basic type of the words, the system will determine the inflection automatically.

2) Checking for duplication
The system can check the duplication of question. In order to check the duplication, the system will search and match by the words of the question title and content from database. If there are questions which is matching over 80% , the question will be presented to teacher, and the teacher will determine whether it is a duplicate or not.

2.1.2 Inappropriate questions
If all the groups are incorrect, we can consider that the question is too difficult and not suitable for the students. If it is not a suitable question, the system will set an unsuitable flag for the question. After the lesson, the system will collect the questions with flag for teacher to urge reconsideration. The reconsideration question will be stored to database to reuse.

3. Implementation

3.1 Architecture of system.
This system can be accessed not only from PCs, but also from mobile devices such as a Smartphone, iPod touch. We used wireless LAN (IEEE 802.11b), Tomcat 5.0 as the server on the CentOS5.0. Database schema is designed and implemented using PostgreSQL. Utilizing the Struts framework, the system was developed as a web-based application with JAVA. The Struts framework is a web-based application framework which facilitates rapid application development, and it adopts MVC (Model-View-Controller) design pattern as it naturally fits into the web architecture. Figure 1 is the architecture of the system, there are 2 parts of CLARES:

1. Web Browser.
Teachers, students use a web browser to send request (HTTP) to the web server through PC or mobile devices such as Smartphone, PDA, iPad, iPhone and iPod touch. The answer results can be projected on screen through projector.

2. Web Server.
There are 3 parts of Web Server: teacher component, student component and manager component.
a) Teacher component.
After login with an ID and password, the teacher can:

1) prepare questions in advance,
2) give out question on site,
3) determine correctness of answers,
4) commend on the answers.
5) make answer results project on screen
6) make the aggregate results project on screen

b) Student component.
The student can:
1) discuss and answer questions,
2) upload the group's answer

c) Manager component .

The manager component does the following things:
1) set the access authority
2) store data
3) calculate aggregate results
4) manage groups
5) check the adequacy of the questions
6) accumulate answer result

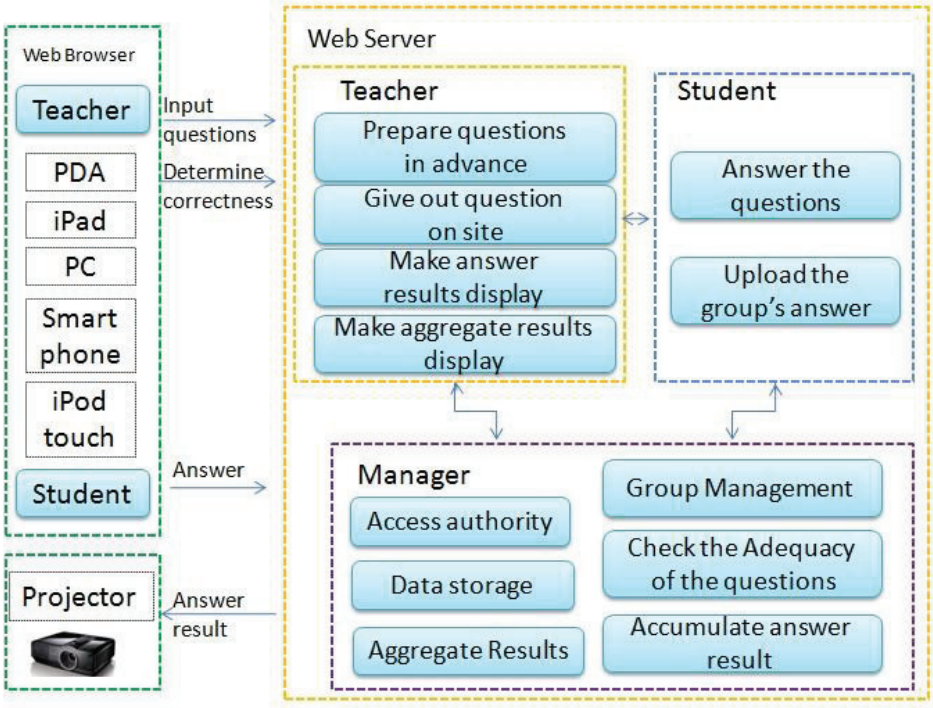

Figure 1. System architecture

3.2 Interface

3.2.1 Login interface.
The group user must register an account to use the system by "Register new account" interface. After login with the registered user account, the interfaces will be displayed according to the authority. There are three kinds of authority: "teacher", "manager", and

"group". The default authority is "group" and we can change the authority by "authorities' manager" interface.

3.2.2 Teacher interface.

Teacher can set the group number by selecting the number of "Columns" and "Rows". As shown on the figure 2, it is a sample of 4 groups. By selecting the pull-down menu of "Columns" and "Rows" and clicking "Setting Matrix" button, the interface is split in to 4 groups A, B,C and D. The group name are displayed in the top left of each group area. The answer of each group will be shown on their group areas.

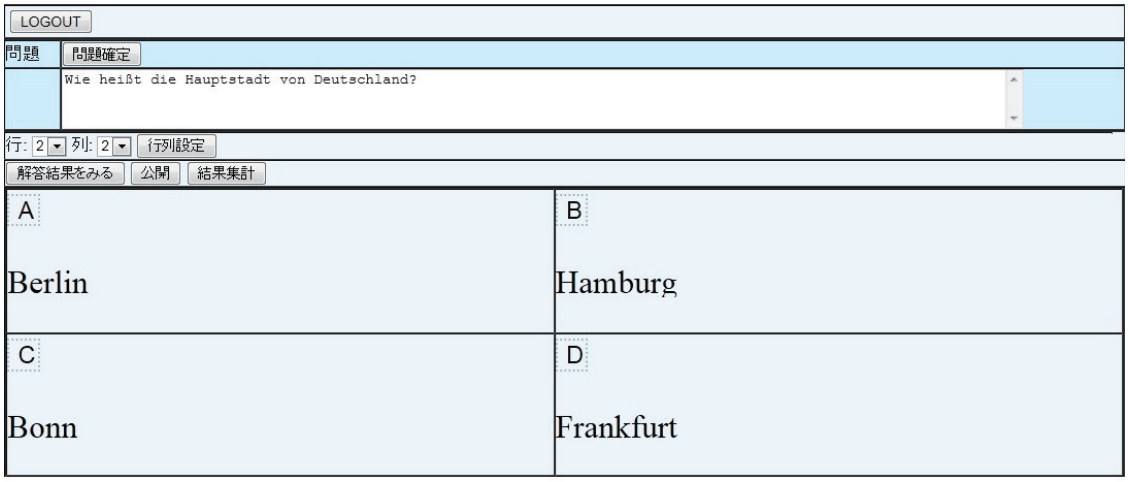

Figure 2. Teacher interface

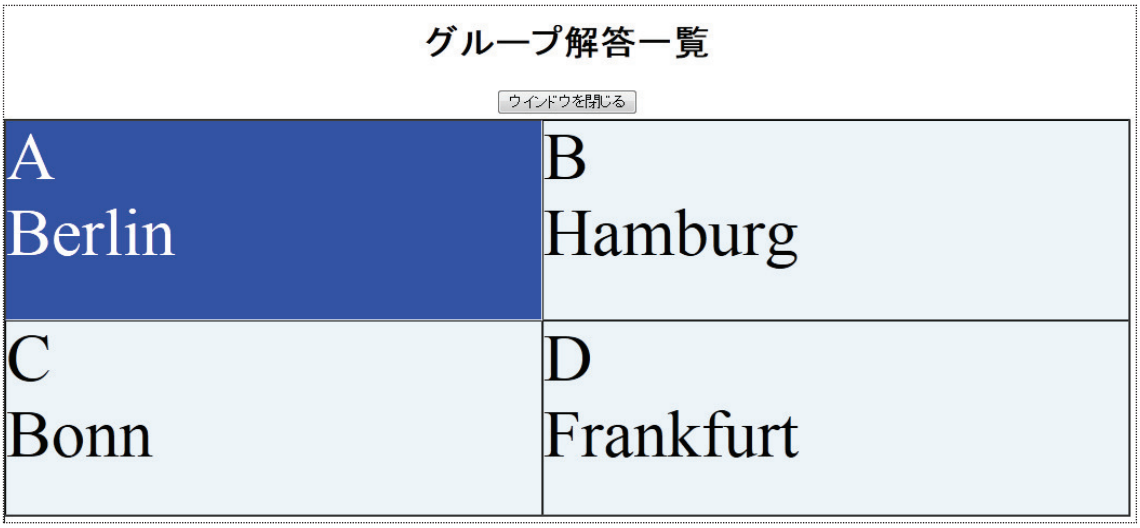

Figure 3. The interface, which is projected on screen.

After all groups submitted their answers, teacher click the "Open" button, and then Figure 3 will be shown on the screen of projector, which teacher can use it to determine the correctness of each group. As this is a short answer based system, the correctness is not determined by CLARES, it will be determined by teacher himself/herself. If the answer is right, teacher will click this group area, and this area will be highlighted in blue. As shown on Figure 3, "Berlin" is a right answer and the "A" group area was highlighted.

In order to go to the next question, teacher should click the "Public" button again, and the interface which was shown on projector is disappeared. In the same time, the performance of each group (correct or incorrect) will be recorded in the database.

3.2.3 Student interface

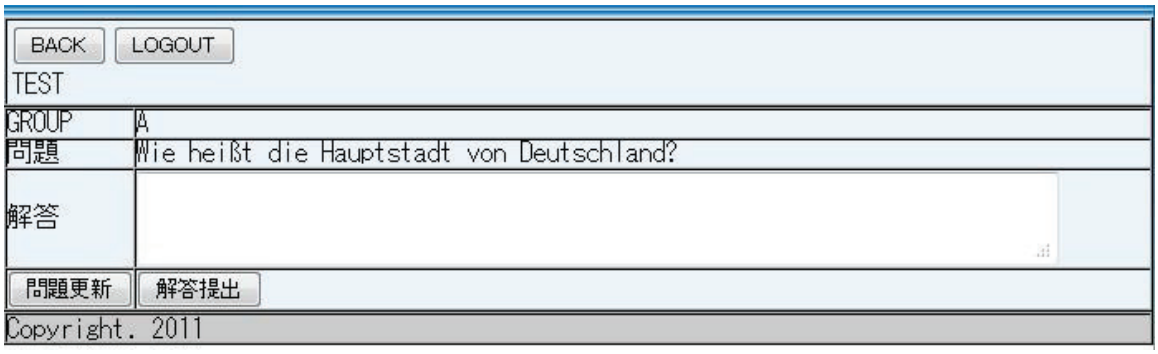

Figure 4. Answer question interface.

Figure 4 is the interface for students to answer questions. Students should login with group name, not the individual name. It allows four or five students to discuss in a group and then submit their group discussion results to the system. The system not only supports to submit answer by PC, but also supports to submit answer by mobile devices such as iPod touch, iPad , Smartphone.

The questions were prepared in advance will be show on this interface. There is a situation in the classroom where a teacher come up with a question on site and want to ask verbally to questions and know the understanding of students. In order to support this situation, CLARES allows only to input answer options while doesn't to input the contents of question.

3.2.4 Displaying answer results

グループ	正解数	不正解数	正解率
A	7	3	70%
B	6	4	60%
C	9	1	90%
D	8	2	80%

Figure 5. Aggregate data of each group.

After a few questions were answered, teacher can click "Aggregate result" button to collect the results and calculate the right answers of each group. The number of correct answers of

each group will be graphically shown as Figure 5. By showing this graph, it can form competition and confrontation among the groups to raise learning motivation. The aggregate result can be saved as Excel file to evaluate the performance of students.

4. Conclusion and future works

In the paper, utilizing HTML5 technologies, we proposed a short answer system, called CLARES, which is a CRS. By using the CLARES, teacher can ask questions and determine right and wrong answers on-site. Students can think and reflect whenthe teacher explains. To comparison with the existed system, a sense of excitement and expectations has been long-lasting, so it increases the game element than the existed CRSs. Moreover, students discuss the question in a group and submit a short answer together, this facilitate collaborative learning among students.

As future works, we are planning to check the grammar automatically. By storing the grammar pattern into database, the system can check whether the same pattern is existed. Then we can know whether the pattern is learned or not. It is very difficult to check all of patterns automatically; so we only check the basic grammar.

In this paper, we only use simple function of HTML5. We are planning to use the functions such as Canvas. The Canvas can run on the low-spec devices, which cannot support the Audio, Video and Flash etc. By using the features of HTML5, we are planning to create question in audio and video format. It is also a future challenges to collect the data from Website and create questions automatically.

References

[1] Yin, C., Ogata, H. and Yano, Y. (2007). 'Participatory simulation framework to support learning computer science', Int. J. Mobile Learning and Organisation, Vol. 1, No. 3, pp.288–304.

[2]Yoshiyuki Tabata, Chengjiu Yin, Hiroaki Ogata and Yoneo Yano. (2009). Mobile Phone-based Quiz System for Learning Foreign Culture, ICCE2009, pp.603-607, Hongkong, China, Nov.30-Dec.4, 2009.

[3] Tabata Yoshiyuki. (2009). The functions and characteristics of WebDrill -- a web-based system to build and manage teaching materials, Language Sciences ,Vol. 43, pp.95-105,2008.03 (in Japanese).

[4] Caldwell, J.E. (2007). Clickers in the large classroom: current research and best practice tips. CBE, Life Sciences Education. Vol. 6, Spring, 8-20.