A collaborative learning feedback framework integrating mobile and web application for hands-on activity in classroom

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Abstract

Educational learning systems have been moving to the new innovative methods that utilize mobile devices. The mobile technology becomes more demanding especially in higher educational organization to help many activities in the classroom in these days. Thus, we have proposed a new framework, referred to as HACS, which can control students' activities and give a feedback to students in a timely manner. This framework aims to improve learning impact and student success rate.

Keywords: Framework for assessment, mobile and web application, immediate feedback, Hands-on Activity Communication System (HACS)

1. Introduction

Classroom assessments mainly consist of lecture, homework, quiz, in-class-activity, and group projects that depend on an instructor. These student assessments might need some feedback in a timely manner to stimulate their interest and increase their performance. Traditional way of feedback is to give students a paper sheet that has comments or advise for each assessment they did. Electronic feedback has advantages for higher education to deliver timeless feedback [3], refer to as immediate feedback here. To achieve immediate feedback assessment, educational learning systems have been moving to the new innovative methods that utilize handheld devices such as smart phones, and Tablet PCs [1]. Handheld devices have a computational capability, support human friendly graphical user interfaces, and access network resources through wireless networks [5]. Many institutions or education researchers have made an effort to use handheld devices because it makes students easy to access their resources at anytime and anywhere [3]. Many educational researchers have developed feedback processes to support their educational backbone [2-4]. The immediate feedback from faculty is important for collaborative learning activities between faculties and students, and is critical to improve student success rate. Therefore, there is a need to develop a new system to help students as well as faculty to support more interactive and immediate response.

2. Motivation of Immediate Feedback

Practical activities such as Lab materials, In-class-activities, and project assignments, consolidate the concepts, and theoretical foundation covered in the classroom. If students missed some of the important concepts in the classroom, it might not be possible to complete practical activities successfully on time. Thus, we give students timely feedback to reduce failure rate of practical activities.

Most hands-on activities have feedback from faculty with a paper sheet including comments, advice and results of activities. If we can give fast and effective immediate feedback to students, students learning process will be accelerated [3]. Ekaterina *et al.* [5] briefly demonstrated that detailed immediate feedback to the students improves students' performance. Han *et al.* [4] emphasize that collecting immediate feedback data from students is important factor to analyze their performance. The current researches focus on combining users' handheld devices and their conventional education systems [3-5].

Therefore, we have proposed HACS such that faculties assign an activity, give a score, write comments, and control group members, and students are grouping themselves, decide group number, and input their results of activities. In order to make the system more flexible, we combined two systems – mobile and web application systems.

3. Mobile and Web app. architecture

The basic frame work has following features. The faculty should have all control power over the system meaning that the faculty can add, modify, and delete members for each group, and decide number of members for each group even students form a group. Additionally, the faculty can assign a number of activities, time for each activity, and maxi-mum score for each activity. The faculty also can assign special direction during activities which can give students other tasks to overcome current activities, referred to as the game changer. Once students finished their activities, the faculty can modify scores, and put comments for their activity results.

Students decide number of team member, put notes for each activity, and store them to the database. Each team should finish each activity in given time by faculty. The application has a time function so that it shows on the screen how much time is remained. The activity is to be designed to finish before they go to next activity. If students have not finished the first activity, they cannot move onto the second activity. Once they've done each activity, they can put notes what they earned through the activity. This is stored into the database. Each activity has limited time and score. It is decided by faculty through web. At the end of activities, the faculty can get the report through report section. It can show scores of each activity, members' name of each group, and contents of activities.

One important feature of this frame work is use of mobile devices for a student's activity. The mobile devices are used to input data into the database system. The smart mobile devices can provide the basic calling functionality, sending and receiving email and text messages to communicate with instructor while students are working on their activities.

Another important feature is that the website is implemented as a generic website as well as mobile website for the immediate feedback. Most smart devices have the smaller size than that of PC. Due to the non-identical device size, the generic website is unsuitably designed to support the smart devices. The mobile website developed supports the customized view for the smart mobile devices. Therefore, the faculty can access the website from anywhere in order to get students' submission and give students fast feedback.
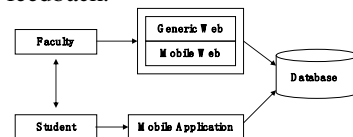

Figure 1. HACS Architecture

Our implementation has a security feature, *i.e.*, assessment of data is secured. Therefore, a user should not use a privilege of others to access the system. A user needs to get authentication to get into the system. Once a user gets into the system, the

session is established for users' own record.

We used the database for collecting data. The database is designed to perceive activities assigned from the instructor, members for each team, results of each activity, time for each activity, and special activity which should be done in the middle of regular activity. The database is installed and managed by a system administrator and easily accessed by faculty and students once they are registered to access HACS system. Figure 1 shows a general architecture of the system. The system is created using Fedora Core 15 Linux system and Android OS for mobile app. The Apache web server and MySQL Server are used for the web and database server. JQuery is used to develop mobile website for mobile devices. On the front end, an instructor uses their computer or mobile device to access HACS. Students use their own mobile devices to input data into the database.

As we mentioned early, instructor can create activities for students using smart devices. HACS allows creating up to five activities at a time. Activity questions become visible to students' mobile application as soon as an instructor creates them. Once students start each activity, the time function notifies students of the elapsed time left for each activity. Once it's done, they submit the result of an activity. The instructor keeps track of students' works and put comments for it. The HACS records the result of each activity and generates its report. The report can be either displayed on the Web or saved into the file.

4. Graphical User Interface Design

4.1. Mobile GUI Design

The Mobile GUI design of HACS should be simple and easy to use for students. Figure 2 shows the overview of Mobile GUI Design. It requests IP address or domain name of database server to get the activity description.
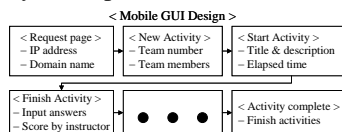

Figure 2. Overview of Mobile GUI Design

Students can choose two options – new activity or continue activity. Once students choose new activity, they decide team number and members. Students can easily decide how many students are in their team and input members' name to the database server.

Each group can start activities once they decide team and members. Title, description and time remaining of an activity are shown on the screen. Once they finish an activity, they can input their answers, and get the score given by an instructor. In some activities, students get their score by the instructor in the classroom and input it into the database. However, it can be modified by the instructor later. If students don't get score immediately, they leave it as a blank. Some activities need to submit a file.

In our system, students access Website interface to submit them. Students can do the next activity once they finish and submit answers for the current activity. The system does not allow students to go to next activity without finishing a current activity. The system notifies students that they finish all activities.

4.2. Web GUI Design

The GUI of website is to control and manage activities designed for students. There are two different web accesses – mobile access and generic PC access. The instructor can access the website in either way using password authentication. Figure 3 shows the overview of web GUI design. The Website is designed to control and manage the students' activities. The members, activities, and game chang-

ers are the main sections that can create, modify, delete, and display members of each team, activities, and game changers.

It is important for instructor to control members of each team even students forms their own team. The instructor can adjust the level of teams to increase students' learning ability with member control section. The instructor easily creates, modifies, and deletes activities with visible or invisible mode. With inactive mode, the activity is not shown up on the screen at students' mobile app.

The system has the feature that the instructor can assign special activity to help students' understanding of the activity. It is called game changer. The GUI of the Website is the same as the activity section. However, it is designed to assign special activities which should be done in the middle of the activity. It can be created, modified, and deleted by instructor.
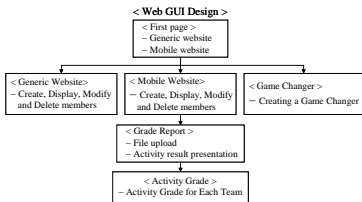

Figure 3. Overview of Web GUI design

5. Assessment test and Analysis

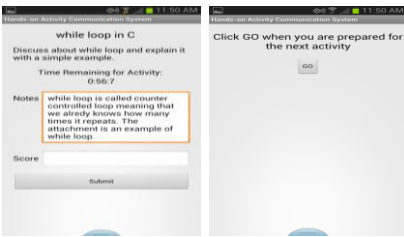### 5.1. Student side assessment test

Figure 4. Student side assessment test

For the purpose of the assessment test, we shows the designed interfaces for student side in Figure 4, which specifically shows how the assessment test works.

After students get into the activity, they can submit their answer and move forward to the next activity until they complete all the activities. This assessment test is intended to check students' knowledge, skill, and aptitude for the class. The test is designed on top of mobile application so that anyone with smart devices can easily access the assessment test.

5.2. Faculty side assessment test

For the purpose of the assessment test of faculty side, we show the interface of mobile web, that is intuitively designed to control and manage members of each team and the students' activities. We also designed the interface of generic web for the faculty side assessment test. Due to the limited space, we only show the interface of the mobile web in here. The following figure shows activity control, *i.e.* modify and delete activities, and create the game changer which can help students' work by assigning a special task during their activity.

Figure 5. Faculty side assessment test

The proposed framework is designed on top of the generic and mobile website. That means the faculty can use either the generic web or the mobile web where he/she currently access online database. That is one of strength of the proposed framework. There exists some commercial learning management system (LMS), such as Blackboard (www.blackboard.com) and D2L (www.desire2learn.com), which has been also developed to support mobile application for students and faculties. Existing LMSs are designed for accessing the

overall class assessments through the web and mobile applications, whereas the proposed framework is focused on more for hand-on activities, such as projects, in-class activities, and lab assignments to give students more instant interaction with an instructor.

5.3. Activity Results Presentation

Students can upload their files through website. Students are allowed to access only for the file upload, and presentation sections of the Website using password authentication. The instructor can add score and put comments for each question. The instructor easily input grade and comments for immediate feedback. The GUI represents the activity name, the description of the activity, students' answers, and a file they submit as soon as the instructor gets into this webpage. The instructor inputs scores and comments based on students' works for each activity. These are saved into the database server and students easily recognize this information by accessing result presentation for user feedback and assessment in collaborative work.

6. Conclusion and Future Work

We are moving to new era which uses small mobile devices in these days. The current education systems are evolving to use these new devices to give students faster and collaborative feedback for their learning process. In this paper, we are presenting an HACS system to support more interactive communication with students. The proposed system is especially designed for a classroom which conducts several different learning activities, and allows both instructors and students an active tool to provide immediate feedback through dynamic collaborative session. The GUI is well designed to support both instructor and students. The Mobile App. we developed gives students more interesting and motivates their stud-

ies. The generic Website and Mobile Website are designed to easily maintained and updated.

We need to continuously study the usability of this system. The mobile devices are getting more and more complicated in interface and capability. Students in the higher educational classroom are consisted of the similar age, background, and their expectation, whereas, the instructors are not all the same age, background, teaching styles and their preference to use technologies.

7. References

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