Immediate Assessment of a Class Lecture Using a Handheld Device

GRADUATE PROJECT REPORT

Submitted to the Faculty of
the Department of Computing and Mathematical Sciences
Texas A&M University-Corpus Christi
Corpus Christi, Texas

in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Computer Science

by

Himanshu Singh Pundir
Spring 2006

Committee Members

Dulal C. Kar, Ph.D.
Committee Chairperson

David Thomas, Ph.D.
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ABSTRACT

Handheld computers offer some potential supports for broadening the range and frequency of the teaching assessment for a group of students. Because handheld devices are computers, they make the gathering and aggregation of data for use by teachers easier to accomplish. Their portability means that assessment can be easily integrated into any phase of inquiry, anywhere in the classroom or in the field. This project deals with creation of a Web based class assessment applications compatible with handheld devices. This application is made outlining the activities like creation, registration and deletion of courses, creation of question banks and quizzes. One of the main objectives of this application is to provide automated quiz assessment to the instructor that helps the instructor to determine which part of the lecture not understood by most students. This application is for the use of instructor and students at Texas A&M University-Corpus Christi. All the scripts are written using ASP.net and SQL Server is used as database source.
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1. INTRODUCTION AND BACKGROUND

This project provides enhanced teaching and learning through the use of personal digital assistants (PDAs). The educational advantages of handhelds over full-sized, varied-functioning computers range from cost to size to ease of use.

Handhelds usually range in price from as low as $250 to as high as $1,000 depending upon the capabilities. A basic handheld for the typical student can be found in the $250–$300 range, with educational discounts available for large quantities. Mobility is possibly one of the biggest advantages, since handhelds can be taken practically anywhere instead of being confined to the lab or classroom. The ability to transfer or share data and programs wirelessly overcomes the need for a more hardwired infrastructure and adds to the mobility. Because of their small size, it’s not necessary to have a separate lab for a classroom set. Particularly with the more basic educational applications, teachers do not have to spend a lot of time teaching students how to use them.

There are many educational organizations that are implementing or are in the process of implementing a similar kind of utilization of handheld devices for the benefit of students and teachers. At the Carnegie Mellon University-Pittsburgh, one research was done for evaluating students’ progress using handheld computers such as Palm in the conjunction of a wireless network. [Chen 2000]

This method was used to determine whether the material just covered by the teacher was understood. Thus a teacher could change the contents or topics for
the rest of the lecture. It was found that most of the students were in favor of using handheld devices in the class and there were no problems with the class size in such applications.

In the present system at Texas A&M University-Corpus Christi (TAMU-CC), when a teacher wants to conduct a quiz in a class he/she usually uses paper and the results of the quiz are not available to the teacher instantaneously. This process of assessing quiz consumes valuable time of the teacher.

There are always some students in the class who never ask any questions and are very shy or they think that their questions are not worth asking. Due to
such thinking such students might fall behind in the class and the teacher never comes to know what their problem is.

To overcome such problems we have developed this applications for handheld devices with which students will have mobile access to course-related material inside or outside the lecture halls using a wireless Local Area Network (LAN) as shown in Figure 1.2. The instructor can now conduct a quiz after a lecture in a class and students’ answers on quiz questions are immediately recorded in the database through an online system using handheld devices. The systems summarize students’ performance for each question and then immediately make the result available to the instructor. This helps the instructor to discover problem areas or the parts of the lecture, not understood very well by students. Another part of this project includes the application by using which students can send questions in email to the instructor anonymously and the instructor can reply to these questions, or the instructor can discuss these questions during the lecture. The benefit of anonymous questions helps shy students to ask what they need to ask. Questions posted by students are anonymous but in case of misuse of this application, the instructor could know the identity of the student.

The following chapters discuss the project’s implementation from both a user’s and programmer’s view. Chapter 2 gives a detailed description of the User Interface. Different screen-shots are used to aid in understanding the interface design. Chapter 3 gives the system design. This section describes the analysis, design of the interfaces, design of the database and implementation of the design.
to achieve the results. Chapter 4 describes the testing and evaluation of the system. Finally Chapter 5 gives the conclusion of the project.

Figure 1.2 Quizzes Data Flow
2. IMMEDIATE ASSESSMENT OF A CLASS LECTURE USING A HANDLED DEVICE

2.1 Overview

The Web enabled applications for wireless PDAs provide instructors with day-to-day assessment of his/her students in the classroom. The instructors can select a quiz to be taken by the students, then that particular quiz becomes available to the students of that particular class, for a certain time period. Once the students completes the quiz the results of that quiz appear on the instructor’s computer by just refreshing the Web page. This provides a faster assessment of the class performance and thus the instructor can discover the problem areas of the lecture. In case a student needs to ask some question in the class he/she can do so anonymously by using the mailing application, which sends a message to the instructor and he/she can answer the question without disclosing the identity of that student.

2.2 Features

This program is Web-based system and so it is accessible to students as well as to the instructors via wireless internet connection in the classrooms. This program can also be used through regular computer or laptop due to its Web based design. It has the following features:

- The administrator has privileges to create a new instructor login and could add courses offered by the instructor in a particular semester.
- The instructor can create login and password for students.
• The instructor can create a new quiz.
• The instructor can preview the quiz in order to confirm details before adding it to the database.
• During the class the instructor can select a quiz for students and that particular quiz becomes available to the students.
• Students can take the quiz after they are logged into the quiz application, using their login names and passwords.
• Results of the quiz become available to the instructor by refreshing the Web page.
• A student can send question to the instructor using the message application.
• The instructor can reply to that message or can discuss the solution of that question in the classroom.

2.3 Description of the User Interface

The user interface is Web browser based. There are three types of users associated with this program and each have a different type of user interface for them as shown in Figure 2.1. The first type of user is the administrator. The second type of user is the instructors who conduct quizzes and use the program for his/her class assessment. The third type of user is the student who participates in the class quiz and can interact with the teacher through mailing application.

All the above user interface have a common login.
2.3.1 Login Page

This is the first page all users sees on entering the site. It consists of a header and asks for the username and password. The link of the TAMUCC is also provided. After implementation, the login page looks as shown in Figure 2.1. After the users log in, they are presented with different, their own specific kind of screen which is automatically decided depending upon the user’s login id. If the user fails to log in, then the interface prompts the user to try again, which is depicted in Figure 2.2.

![Figure 2.1 Login Page](image-url)
2.3.2 Administrator Interface

The administrator can use a regular computer, laptop. As he/she has to do various tasks, the administrator can go through following various Web pages.

**Administrator View**

The Administrator page gives a list of the instructors in the system, as depicted in Figure 2.3, and options to create an instructor account with a login id and a password, and to add a course to the teacher’s login account.
Create Instructor Account Page

Upon entering this page the administrator can create an instructor login. This process contains a form where the administrator can ideally enter the name, email address, phone number of the instructor and activate the Continue button as shown in Figure 2.4. This gives a preview of the just completed form, should he/she need to edit the information he/she can do by activating Edit button or he/she can activate the Save button which will save the details of the instructor account into the database and generate an automatic login id and password for respective instructor. Also, the application sends an email to the newly added instructor about his/her account information.
Add Course to Instructor’s Account

This process allows the administrator to add new course to the account of any instructor in the system. Here the administrator sees a list of names of all the instructors having accounts with this application in a drop down menu. On the selection of name of an instructor, the administrator hits the Go button as shown in Figure 2.5. This takes the administrator to the next view where the administrator sees the drop down menu to select a course for add-on. The drop down menu is generated from the pre-defined list of courses in the database table. This is shown in Figure 2.6. After selecting a course, administrator activates the Preview button and he/she sees the Preview page. Should administrator need to change the course he/she can do so by activating the Back button or if everything
is correct then they can activate the **Add Course button** and the new course gets added to the database table corresponding to the instructor’s account. This process is depicted in Figure 2.7. Finally the administrator sees a confirmation screen with a course addition confirmation as shown in Figure 2.8. The system also checks for the duplication of the course for the instructor or if some other instructor is offering the same course.

![Figure 2.5 Select an Instructor for Addition of Course](image-url)
Figure 2.6 Select a Course with respect to Semester and Year

Figure 2.7 Previews before Addition of Course
Delete Course from Instructor’s Account

This process allows the administrator to delete a course from the account of any instructor in the system. This process is somewhat opposite to the addition of course process, except if there are students enrolled to the course then all the students must be dropped from that course and then only administrator can delete the course from the database. This process is depicted in Figure 2.9.
Figure 2.9 Select a Course need to be Deleted for Instructor

Change Password

This process allows the administrator to change his/her password, in order to this he/she has to enter the current password and new password two times and hit a Go button. This simple process change the password as shown in Figure 2.10.
2.3.3 Instructor Interface

The Instructor Interface map provides a list of all processes involved. It lists all the different options to be performed. The faculty can select the appropriate functionality depending on the operation needed to be performed. Various options provided by the Faculty Interface map are summarized as in Figure 2.11.
Once the instructor successfully logs into the system, his/her View Page displays options to create a student account, create question bank and create new quizzes. This view page also includes a quiz selection option, result of the quiz, and the instructor can change his/her password from this page and logout from the system.

At this view instructor gets a list of courses he/she has offered or is offering, as shown in Figure 2.12.
Create Student Login Page

With this feature instructor can create student login. The form has the following fields: student’s name, student SSN, student email address, and phone number. After filling these details the instructor can activate the Preview button, which, as usual, takes the instructor to the Preview Details page, should he/she needs to edit student details he/she can activate the Edit button else activate the Save button if everything is correct, as shown in Figures 2.13, 2.14 and 2.15.
Figure 2.13 Create Student Login Form

Figure 2.14 Preview Student Login Details
Figure 2.15 Student Login Creation Confirmation Page

The login name of the student is his/her first name followed by the first letter of last name and the password is the first letter of the student’s first name and the last name followed by the last three digits of the student SSN. If student already exists with the same name but different SSN then he/she gets a login id with a number at the end, for example “johnc2”

*Question Bank Management View*

In this process instructor can create a question bank for a respective course. At this view instructor sees a list of courses offered by the instructor, where he/she selects a particular course upon which he/she sees a list of questions, if there is any, for this particular course. Here the instructor can add a new
question to the question bank by clicking on **Add New Question Link Button**, as shown in Figures 2.16 and 2.17.

![Figure 2.16 Question Bank Management View Page](image1)

**Figure 2.16 Question Bank Management View Page**

![Figure 2.17 Add/Edit Question in Question Bank](image2)

**Figure 2.17 Add/Edit Question in Question Bank**
Now the instructor can add new questions with up to four answers and one correct answer, as shown in Figure 2.18 and activate Add Button. This provides a confirmation message and options to add another question to the same course or add question to another course, as shown in Figure 2.19.

As shown in Figures 2.20 and 2.21, the instructor can click on the edit option in the front of the question in the question list and edit the question. This list is paginated which allows the instructor to see more than ten questions on the same grid by just clicking forward or backward arrow at the bottom of the list, instead of scrolling a huge list up and down.

Figure 2.18 Add New Question to Question Bank
Figure 2.19 Confirmation of Question Addition

Figure 2.20 Select a Question to Edit from Question List
In this section the instructor can create a new quiz. The first step in this process is to select a course for which the instructor needs to add a quiz, as shown in Figure 2.22. Then the instructor sees a list of quizzes already set up for that course, if any, as shown in Figure 2.23. Here the instructor can add a new quiz or edit an old quiz. To add a new quiz he/she can activate the Add New Quiz Link Button. This takes them to the Add new quiz view where he/she enter name of quiz, start time and end time of quiz and adds questions with score from the question bank of this particular course, all in the same view, as depicted in Figure 2.24.
Figure 2.22 Quiz Management View

Figure 2.23 Add New/Edit Quiz View
As the instructor builds a quiz he/she may decide when to activate the quiz by selecting a particular start time and end time, so that the student can attempt that quiz only during that time frame. The instructor can change this time period any time after creation of the quiz in edit mode. In edit mode, he/she can delete or add new questions to the quiz too, as shown in Figure 2.25.
Results of Quiz

After the completion of a quiz by the students, the instructor would be interested in checking the results of the quiz. The instructor can do this by going to the View Results Section where he/she can select a course, and corresponding quiz and activate the Show Results button. This generates an assessment bar graph which tells the instructor how many students answer a particular question correctly. As shown in Figure 2.26.
From this information the instructor can have an idea of which portion of the class lecture most students did not understand.

Mail Message from Students

This section provides the instructor the capability of receiving messages from his/her students. The instructor receives the message in the form of email and then instructor can decide on taking this question during the lecture or reply the mail. Students can send this message to the instructor once log in the system.
2.3.4 Student Interface

The student interface is relatively different from the instructor and the administrator’s interface. Students have fewer options. Students can enroll, drop a course, attempt a quiz and sends message to instructor. The students will be using just PDAs for their interface and fewer options for students are the reason we chose PDAs.

Student View Page

A student upon successful login into the system he/she sees links to enroll and drop a course, take a quiz and send an email message, as shown in Figure 2.27.
**Enroll to Course**

After getting into this section, a student can select a particular course from the drop down menu of course name, course semester and course year, as shown in Figure 2.28. If student is already enrolled in the course, or if no instructor offers that course the system provides an appropriate message to the student.

![Figure 2.28 Enroll Student to Course](image)

**Drop Course**

In this process a student can drop a course. In this section, a student sees a list of the courses he/she are enrolled in, as shown in Figure 2.29, and there he/she can select the course to drop. Students cannot drop a course after the semester is over.
Quiz Selection

A student can enter in this section by clicking **Quiz link button**, where he/she sees a list of courses he/she are already enrolled in, as shown in Figures 2.30 and 2.31. After entering a course the student can click on the available quiz name. Students see one question at a time with answers options and can choose one of the answers and activate **Next button**, as shown in Figure 2.32, which takes them to the next question and so on. Once the student is done with the quiz he/she can activate the **Submit Quiz button**, as depicted in Figure 2.33. The quiz is also be controlled by time constraint set by the instructor. The time constraint tracks the time student starts the quiz and does not accept any further answers from the student once the time for the quiz is over.
Figure 2.30 Select a Course for Quiz

- Computer Architecture Fall 2006
- Database Management Fall 2006
- Operating System Fall 2006

Figure 2.31 List of Quizzes to Select

- Test Quiz 10 3/27/2006 2:00:00 PM
- Test Quiz 10 3/27/2006 2:00:00 PM
- New Quiz 3/26/2006 7:00:00 PM
- Test Quiz 6 3/23/2006 8:30:00 PM
- Test Quiz 2 3/20/2006 8:00:00 AM
- Test Quiz 4 3/19/2006 8:00:00 AM
- Test Quiz 3/12/2006 8:00:00 AM
- Test Quiz 5/3/12/2006 8:00:00 AM
- Test Quiz 1 2/12/2005
Figure 2.32 Attempt Quiz

Figure 2.33 Submit Quiz
View Result

After entering into a course, the student can select **View Result option**, select a course and see a list of quizzes participated by him/her. From these quizzes he/she can select any of the quizzes and can view his/her result for that quiz, as shown in Figure 2.35.
Mail Message to Instructor

Once the student is inside a course he/she can choose the **Message to Instructor option** and student sees a small window with a text area and the **Send button**. Students can write their question in this text area and activate Send button. This message is emailed to the instructor of that course and the instructor can either discuss this question in class or send a reply to the student, as shown in Figure 2.35.

![Figure 2.35 Send Email Message to Instructor](image-url)
3. SYSTEM DESIGN

The background, main objectives and a description of the user interface of this project were explained in the previous chapters. In this chapter, an overview of the analysis, design and implementation phases of this project are presented.

3.1 Initial Requirement Analysis

This project was the idea of Dr. Dulal C. Kar, Associate Professor of Computer Science at Texas A&M University-Corpus Christi. He explained the background information about the existing system and how other universities are implementing the online assessment of class performance. He suggested the sources of getting information about this project and explained the importance of this project. He also told me that he is planning to write a grant for the implementation of such a project at the Texas A&M University-Corpus Christi campus, so the success of this project will provide a very positive impact on his grant.

I also held an informal meeting with one of the Network Managers on campus, Mr. Rahul Kulkarni, to discuss the possibility of using the Visual Studio .NET platform to develop the Web pages for the end user and SQL Server as the database.
3.2 Project Development Environment

The SQL Server relational database system is used as the back end database server [Dobson 2002]. The Mobile Web Application feature of Active Server Pages (ASP).net is used to write Web pages and display that same page on any wireless mobile device (PDA) or desktop computer, with no required knowledge of Website Meta Language (WML) or other markup languages. [Moore 2003]

The mobile application developed in ASP.net has limitations due to the limitations of the operating system of PDAs. These pages cannot be as fancy in appearance as normal ASP.Net page and we had to do some compromise on the functionality part too, such as grid, which are not as flexible as regular ASP.net. But this mobile application developed using ASP.NET mobile controls are compatible with different range of mobile devices like PDAs and Cell phones [Ruvalcaba 2004].

Scripts written using the same features of ASP.net are used to access the SQL database. Structured Query Language (SQL) is used to query the database. This system uses sessions for making the applications more secure.

3.3 Design Process

The designing of system is done keeping in mind different kind of users and what kind of hardware they are going to use, so compatibility was a big issue. Security was another important issue we addressed during designing. We now start with entities and their relations.
3.3.1 Entities and Relationships

- An entity relationship diagram shows the list of all possible entities and the relationships that exist among these entities [Pressman 2001]. The entities of the project are illustrated in Figure 3.1. An instructor can offer more than one course, a student can be enrolled in more than one course and one course can have multiple quizzes and one question bank. One course can have many scores.

![Figure 3.1 Entity Relationship Diagram](image-url)
3.3.2 Database Schema

The database schema [Date 1999] for the software of the system comprises of the following tables:

- **Administrator**(admin_id, admin_name, admin_loginname, admin_password)
  
  It contains the details of administrator’s name, login information and password, admin_id is the primary key, which is a unique number.

- **Instructor**(instructor_id, instructor_firstname, instructor_middlename, instructor_lastname, instructor_email, instructor_phone, instructor_loginname and instructor_password) :
  
  It contains all the contact information related to instructor, his/her login name and password, primary key is instructor_id which is also a unique number.

- **Student**(student_id, student_firstname, student_middlename, student_lastname, student_social, student_email, student_phone, student_loginname, student_password) :
  
  It contains all the contact information, login name and password of the student.

- **Course_name_list**(course_code, course_name) :
  
  This table contains only names of all the courses and a respective unique code which is the primary key.
- **Course** *(course_id, instructor_id, course_code, course_semester, course_year):*

  This table contains each course offered by each instructor with respective instructor_id and course_code as foreign key. It also holds course semester and year details, course_id is primary key here.

- **Course_student(course_student_id, course_id, student_id):**

  It contains a relation between student and course with course_id and student_id as foreign keys and course_student_id as primary key.

- **Question_bank(question_id, course_id, question, answer1, answer2, answer3, answer4, correct_answer):**

  This table holds all the questions, up to four answers and correct answer for a course. Primary key for this table is question_id.

- **Quiz(quiz_id, course_id, quiz_name, starttime, endtime):**

  It contains name, start time and end time for all the quizzes in a course. Primary key for this table is quiz_id.

- **Quiz_question(quiz_id, question_id, question_score):**

  It gives a list of all the questions and their respective score points for a quiz. Here quiz_id and question_id both are primary keys.

- **Score(score_id, quiz_id, student_id, question_id, answer, score):**

  This table holds the score for each question attempted by each student for each quiz. Primary key is score_id.
3.4 Data Flow Diagram

As shown in Figure 3.2, the user enters the Uniform Resource Locator (URL) of the system’s Website into his/her browser as input. The browser forwards the request to the Web Server. We are using Internet Information Server (IIS) for the executing scripts [Tulloch 2003] and Hypertext Markup Language (HTML) pages. The Web server uses this request to determine the file to be returned to the browser or the ASP script to be executed on the Web server. If an ASP script is activated, the script uses SQL queries to insert, update and retrieve data from the system’s database tables, and returns the data to the browser as an HTML formatted document. The HTML document returned to the browser contains links to other HTML pages or ASP scripts on the Web server. Some ASP scripts requests the Mail Server to create and send an email to the User. In this way, the user is able to navigate among the various pages of the system.
Figure 3.2 High Level Data Flow Diagram
3.5 Security features

Security is one of the most important features today in any Web based database application because some of the information on the database needs to be kept confidential. Security implemented in this project can be explained by means of the following topics:

- Session Id
- Password authentication
- Using SSL (secure sockets layer)
- Lock out mechanism
- Backing up data
- Password expires

3.5.1 Session Id

Each user is identified by means of a Session Id. All the scripts checks whether the Session Id is still valid or not. If by any chance the session is expired the user is directed back to the main login page. If the user doesn’t use the application for more than 20 minutes he/she is required to login again.

3.5.2 Password Authentication

Passwords are encrypted and stored in the database and every a time user tries to login the password provided by the user is encrypted by the same key and is matched with database entry of password.

3.5.3 Using SSL (secure sockets layer)

The protocol used is HTTPS and not HTTP. HTTPS is the secure version of
HTTP. Instead of using plain text socket communication, HTTPS encrypts the session data using SSL (Secure Socket Layer) protocol, thus ensuring protection from eavesdroppers. SSL enables the server and the user’s browsers to communicate at the most secure level. The SSL layer exists between the transport layer and the application layer. It modifies the data from our HTTP application before giving it to the transport layer to send it to its destination.

3.5.4 Lock Out Mechanism:

Using this feature the number of attempts to login is restricted. After a certain number of wrong attempts, the user is not allowed to log in and that will prevent the user from random guessing of username and password.

3.5.5 Backing up Data:

The SQL database is backed up frequently by the systems administrator. This is done in order to recover from any disaster that forms an integral part of disaster recovery plan.

3.5.6 Password Expire Periodically:

This mechanism is implemented in order to make sure that the username and password expires after a 90 days. In order to know the new username and password the Systems Administrator needs to be contacted.
4. TESTING AND EVALUATION

The project is a Web-based system to replace a very frequently used and manual paper-based method for conducting quizzes and class assessment. This project deals with very critical information, which may affect students’ grades. The testing and evaluation of this system was a very important factor in the success of the system. A major effort is made to test the usability of the system, insure security and perform stress testing.

4.1 Usability Testing

The system was designed to make sure that is easy, robust and friendly to use. This pilot module could be implemented by any department of the University. Feedback and suggestions are taken regarding the interface design and usability of the system. Feedback was taken from the users regarding the various interfaces of this system, sample evaluation form is shown in Appendix A. Based on the feedback, and changes were made to the system to satisfy maximum users of this system.

4.2 Security Evaluations

Security was a major feature to evaluate in this system. The long term and effective success of this system depend on highly effective security. One of the evaluations is to monitor the database transactions. There was maximum emphasis on not leaving the database connection open unnecessarily for longer
time. Various test cases were designed to check that only eligible users log in the system. Sessions are very important in a web-based system to prevent unauthorized access. Due to the use of ASP.net the system becomes more secure because it encrypts all the data in view state and even if some one try so see the HTML code they cannot get the values of the variables used in the script.
5. CONCLUSION

This project, Immediate Assessment of a Class Lecture Using a Handheld Device is an important project for the instructors of our University. The system provides better efficiency over the whole manual process of organizing quizzes. The system provides a better, faster and more convenient system.

Some major outcomes of this system are as follows:

- Faster creation of quizzes
- Faster evaluation of students’ performance
- Online records of students for future references.

The project is implemented as a Web based system using ASP.net and SQL Server as the Database Management System. Various tests are conducted as mentioned in the testing and evaluation section. Results of these tests are used to evaluate the success of this system.

Thus this project makes the whole process of the assessment a fast, efficient and convenient system.
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BIBLIOGRAPHY AND REFERENCES


APPENDIX A

USABILITY EVALUATION FORM

Name: __________________________________
Title: ________________ Department: __________________________

1. Was navigating through the interface comfortable?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

2. Is it easy enough to find information?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

3. Is the content legible and easy to read?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

4. Are the colors and graphics pleasing?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

5. Is there a consistency in the layout and menu?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

6. Is the interface clear and easy enough to understand how to use?
   - [ ] Strongly Agree  - [ ] Agree  - [ ] Somewhat Agree  - [ ] Disagree

Comments: