ECE 1778 Creative Applications for Mobile Devices

Final Report for StudiBuddies, an educational app for Android OS

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1. Introduction

StudiBuddies is a mobile app designed to create an informal mobile learning environment for students and their teachers. Traditionally, teachers have extended classroom learning with homework. Many educational apps have entered the marketplace to enhance learning but almost all of them are designed for self-teaching. In very few cases do apps allow for an interaction between students and their teacher or students with each other. StudiBuddies addresses both of these issues by providing a quiz function/generator and a means by which a struggling student can locate and signal to another student that he or she needs a "study buddy" for a designated subject.

StudiBuddies requires a teacher who is engaged in a learning style that embraces anytime, anywhere learning. This teacher approach to learning is one where the teacher encourages learning between students without the teacher present, where students of similar ability can help each other improve their skills and develop a community knowledge base. StudiBuddies can help all students to achieve a learning benchmark before the teacher moves on to the next level of study.

The quiz function is both flexible and easy to use. Students can take quizzes in a mobile environment and create them as well. Again, the functionality of the quiz is as versatile as the teacher who instructs students on its use. For example, a teacher may assign a different student each day to create a quiz for the class. If the quiz is too easy and everyone scores high, the learning community will collectively provide feedback, which should increase the difficulty of the next quiz.

StudiBuddies provides students in the same classroom or grade with the ability to see when they are in close proximity to one another. A student who is struggling with a quiz can choose the subject area and use the community function to see who is in the vicinity. The teacher can reinforce both seeking help and providing help by rewarding both behaviours. The app's matching algorithm matches students with similar abilities based on the theory that students of similar ability can better help each other reach learning plateaus together.

Our team's beta tester, Maria Paulovic-Serevetas, a grade nine science teacher and department head, had this to say about StudiBuddies.

> "I would like students to use it so that they don't have to wait for the next day in class to ask the "teacher", who apparently has the right answer. In other words, it encourages the students to group together [to] form learning communities and solve those type of questions on their own. They are engaging in social circles, which is how humans learn."

This app is a manifestation of our Apper's research in informal learning. Informal learning is learning which can happen anywhere and at any time. It is important for our Apper's research to create a mobile environment that does not require the presence of the teacher, that allows students to learn from each other and provides a platform for learning moments that can

only happen outside the classroom. The app is capable of augmenting the curricular goals of the teacher while providing students with an easy method for seeking help outside of the classroom. StudiBuddies therefore facilitates an environment for incremental learning and creating a knowledge community where students learn from and with each other.

2. Overall Design

Location Manager

- Manages user locations and study requests
- Maps out user location per subject

Profile Manager

- Manages user data
- User authentication

Profile Matcher

- Analyzes user quiz scores per subject to determine "study buddy" matches.

Quiz Management

- Manages all quiz related information such as quiz scores and actual quiz

Quiz Reader/Writer

- Renders XML format quiz
- Provides quiz template for creating a new quiz
- Verifies quiz responses from touch screen or sensor inputs

Sensor analyzer

- Analyzes all the hands-free gestures (gyroscope sensor signals) when user is taking a quiz

Fig. 1: Second Class block diagram

2.1 Profile Manager

The profile manager component is responsible for managing user information such as the user name, email, password, class code, and grade on the server database. This component also performs user login authentication on the server.

2.2 Quiz Management

The quiz management component is responsible for managing quiz related information such as the quiz scores, and quiz on the server database. The quiz score data consists of the user name, quiz score, and subject. The quiz data consist of the quiz file name and class code. The quiz file is stored in XML format on Google cloud storage.

This component retrieves all quizzes per class code from the server and stores the quizzes on the local database for later use. This component also retrieves all quiz scores per subject to feed to the profile matcher component.

2.3 Quiz Reader/Writer

The quiz reader/writer is a sub-component of the quiz management component. It allows a user to create new quizzes, and renders existing quizzes to users. It also keeps tracks of the current quiz score while the user is taking the quiz by analyzing all touch-screen and/or hands-free gestures.

2.4 Sensor Analyzer

This component analyses all the hands-free gestures when user is taking a quiz. It feeds every movement detected from the gyroscope sensor to the quiz reader/writer for further analysis.

2.5 Location Manager

This component manages student location and study request related information. The student location data consists of the user name and latitude/longitude location. The study requests data consists of the latitude/longitude location, subject, "study buddy" user, and location name.

The location manager is responsible for mapping student locations per subject, as well as providing the option to only map the matches obtained from the profile matcher component. This component also provides the option to send study request invites to other students, and map the study requests received from other students.

2.6 Profile Matcher

This component matches students based on their quiz scores. We use the following algorithm to match students: If student A has a quiz score that is 10-30% higher than student B,

then student A is a match for student B.

3. Statement of Functionality & Screen Shots

The StudiBuddies app is fully functional with the quiz function and the community function. The quizzes are multiple choice or true/false and can be taken hands-free or utilizing the touchscreen. The community function allows a student to find a range of students in close proximity, both in terms of physical location and learning ability, to organize a study or tutoring session. Subject to teacher direction, students are able to create quizzes for the rest of the class. Below are the details of our app's functionality and screenshots.

3.1 Login

The app allows students/teachers to sign up with a username and password. The user information is saved on the server database and is used to authenticate the user at login. See figures 2 and 3 for signup and login. The main menu shown after user login provides the option to select Learning or Community sections of the app as shown in figure 4.

3.2 Learning

Students create and take quizzes in the learning section. Students can view/take the quizzes available to them with the option of using touch-screen or hands-free as shown in figure 5. Students/teachers can write a new quiz using the template as shown in figures 6-9.

Students choose the appropriate quiz from the dropdown menu. The quiz is composed of multiple-choice questions, as shown in figure 10. For hands free mode, the four perimeter options allow for discrete hand movements to make the answers mirror the direction of the gesture. To choose an answer in hands-free mode, the student simply tilts the phone in the appropriate direction. There is also an option to adjust the sensitivity of the sensor as shown at the bottom of the screen in figure 10. Alternatively, students can touch the perimeter buttons to select their answer. To keep track of choices students have eliminated, they have the option of crossing out those choices by striking out the choices on the screen.

At the end of the quiz, students are shown their score breakdown. The final score is uploaded to the server as shown in figure 11.

3.3 Community

The community section of the app manages student matching and study requests. The main community screen displays the five main high school subjects for which students can find matches as shown in figure 12. Students can filter on a sliding scale the exact distance between themselves and prospective study buddies. By clicking "Map My Tutors", students within that distance are mapped, which then displays the map as shown in figure 14. The student is given the option to only display their "study buddy" on the checkbox shown in the top left corner of the screen. To form a study session, the student selects other students on the map and sends study request invites as shown in figures 15-17.

The student can view the study session locations they have been invited to by other

students by clicking on "Map my requests" on the main community page, as shown in figure 18.

3.4 Screen shots
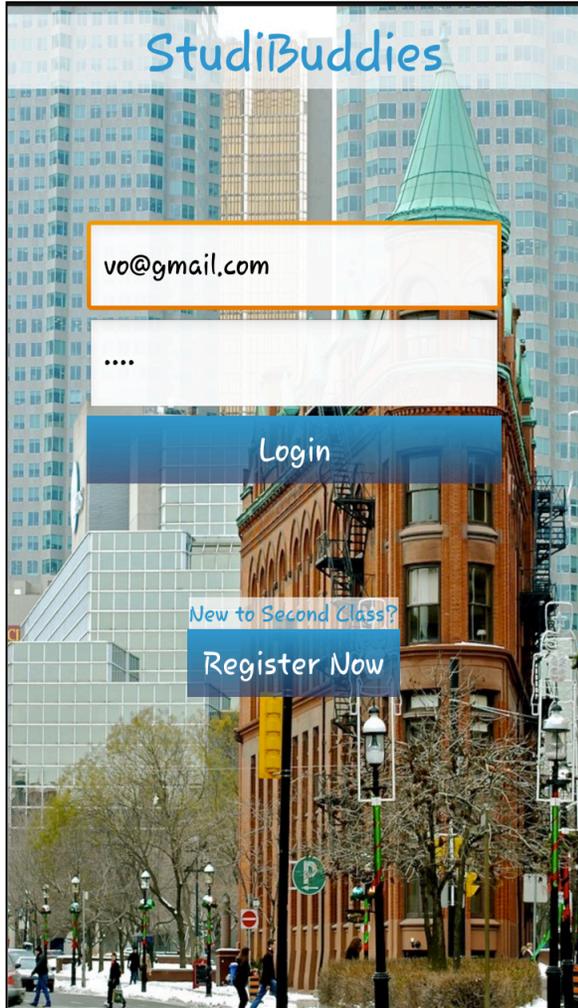
Fig. 2: Login screen
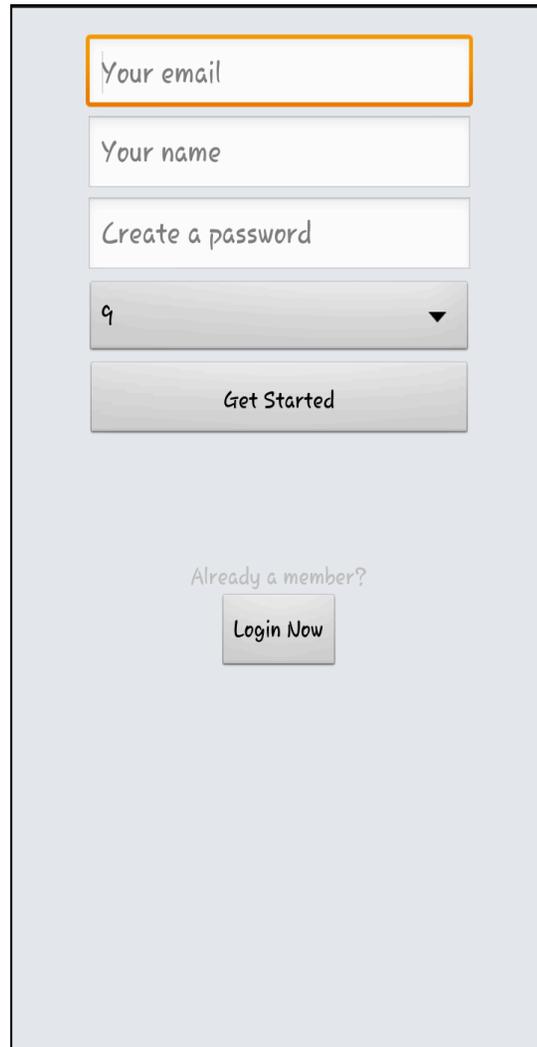
Fig. 3: Signup screen

Fig. 4: StudiBuddies main
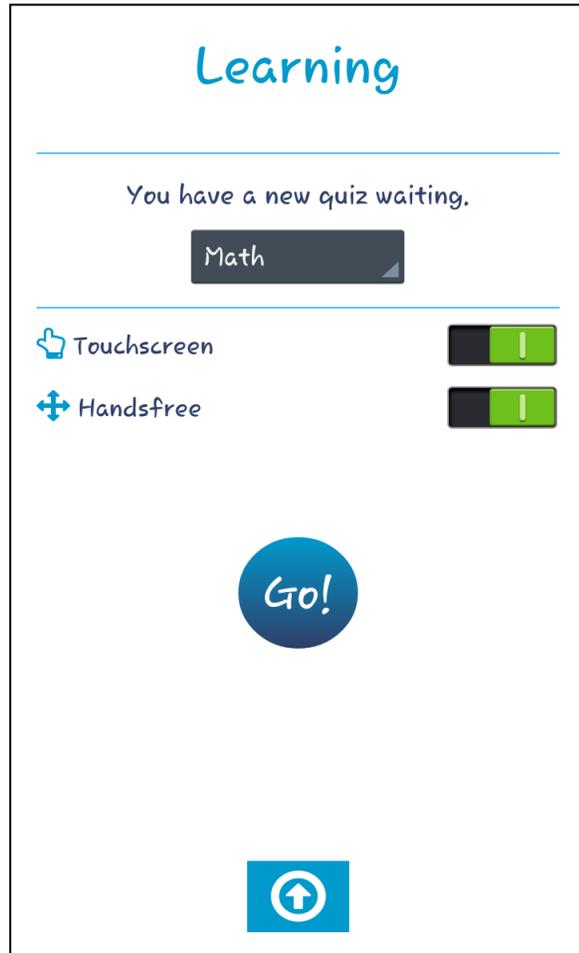
Fig. 5: Learning main
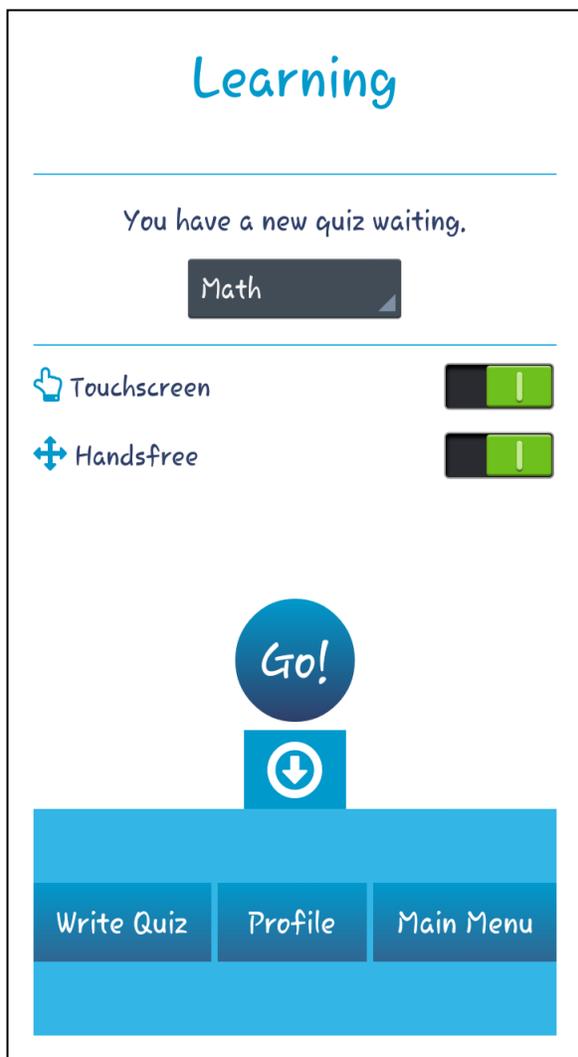
Fig. 6: Learning main (Write Quiz)
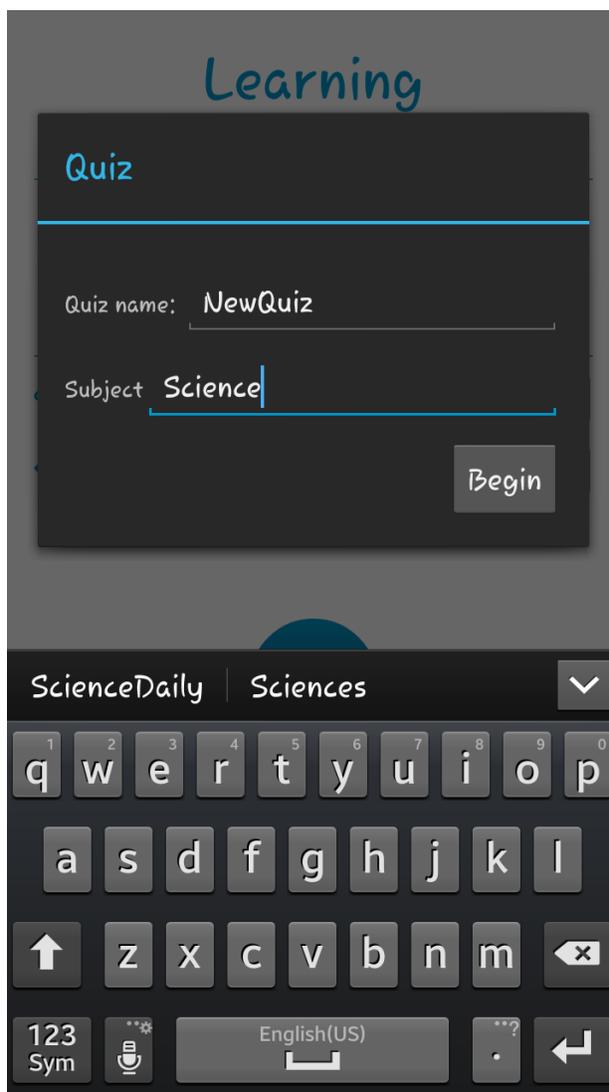
Fig. 7: New quiz dialog prompt

Fig. 8: New quiz template


Fig. 9: New quiz sample question
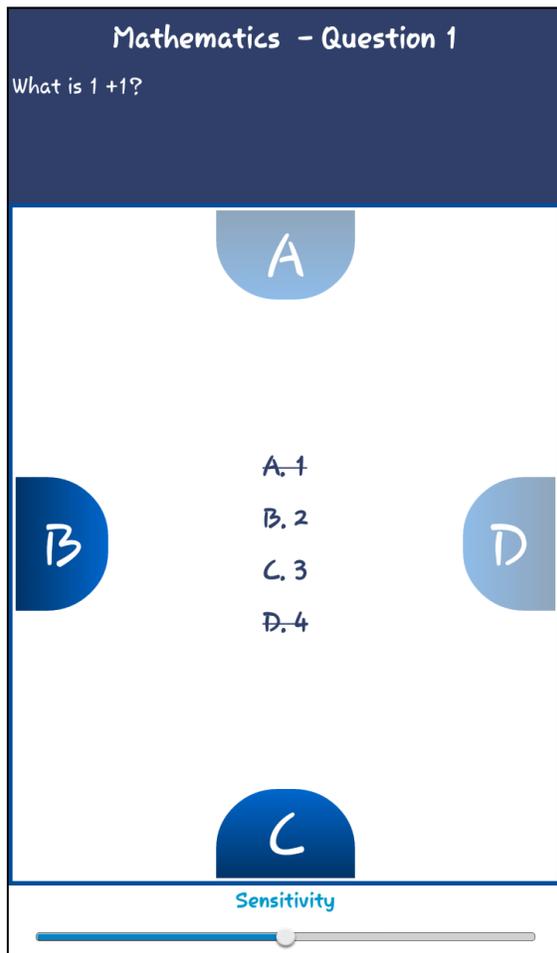
Fig. 10: Quiz taker
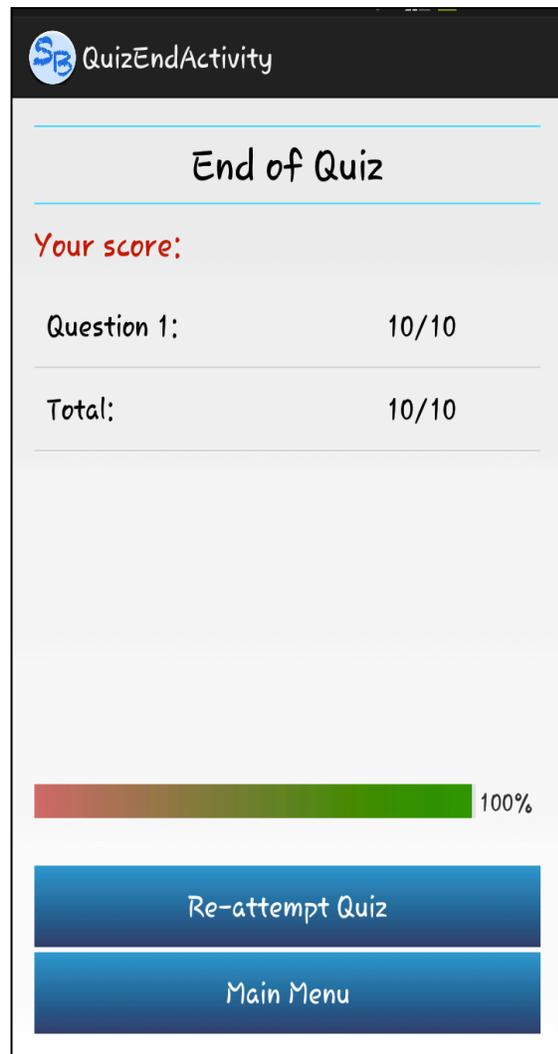
*Fig. 11:* Quiz score result
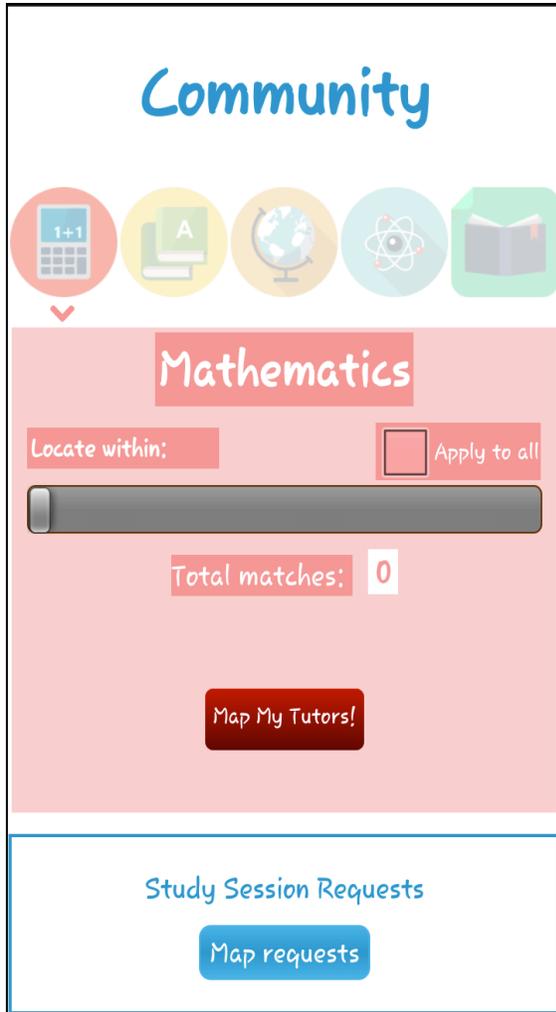
Fig. 12: Community main
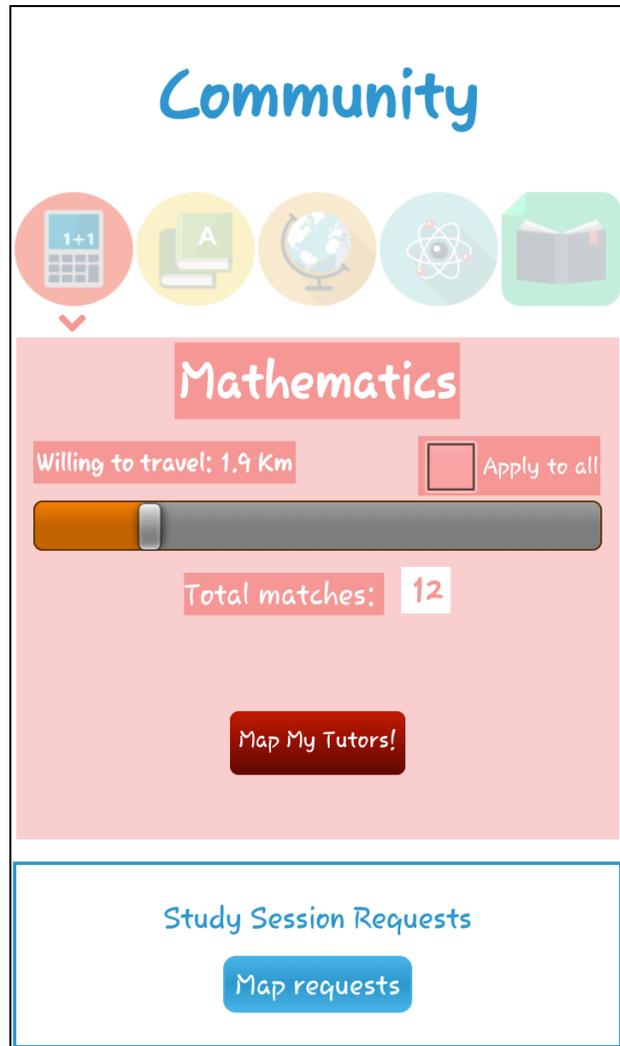
*Fig. 13:* Community main (proximity setting)
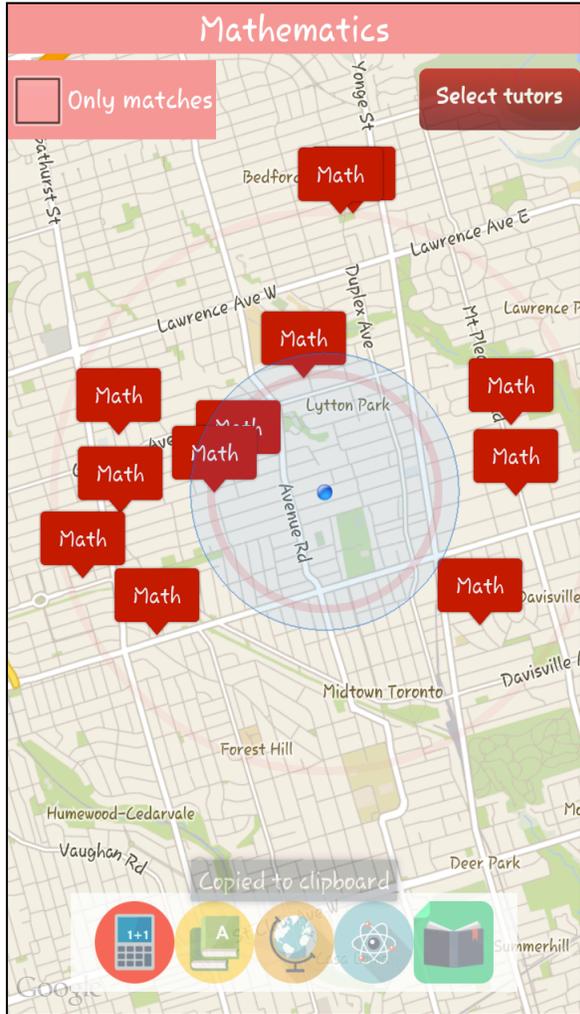
Fig. 14: Map of students in Mathematics
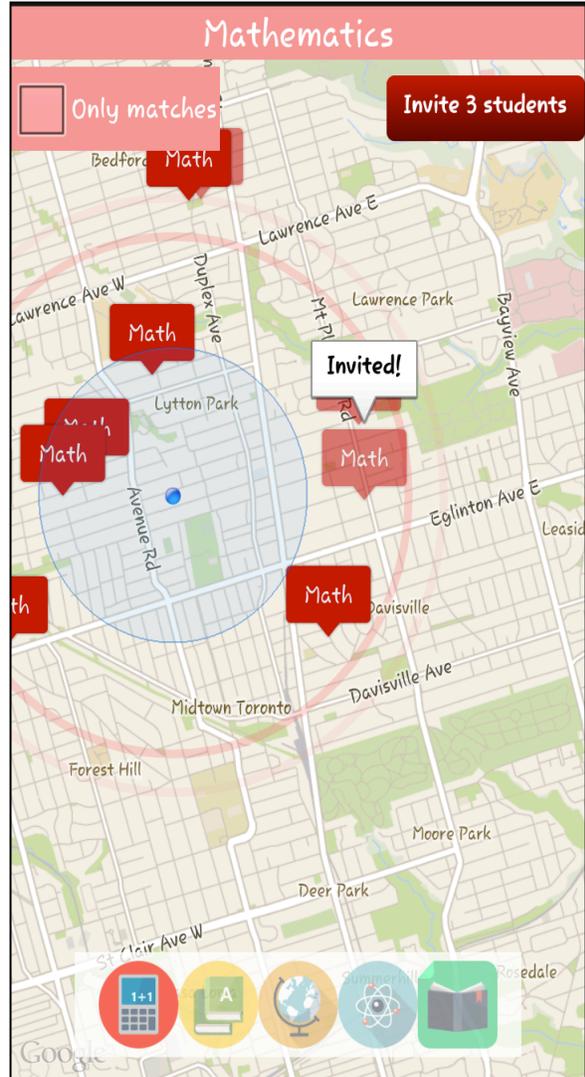
Fig. 15: Invite students
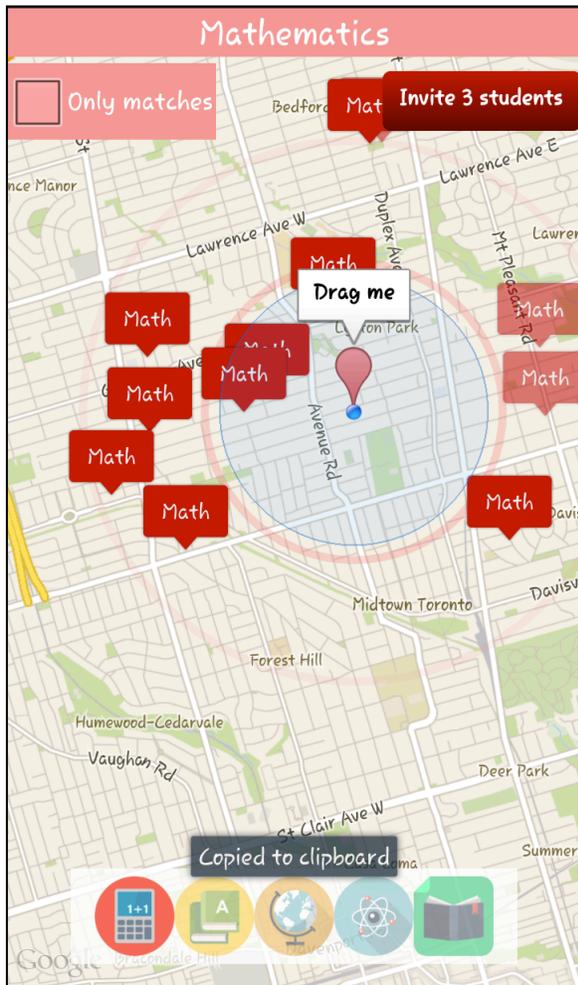
Fig. 16: Send study request
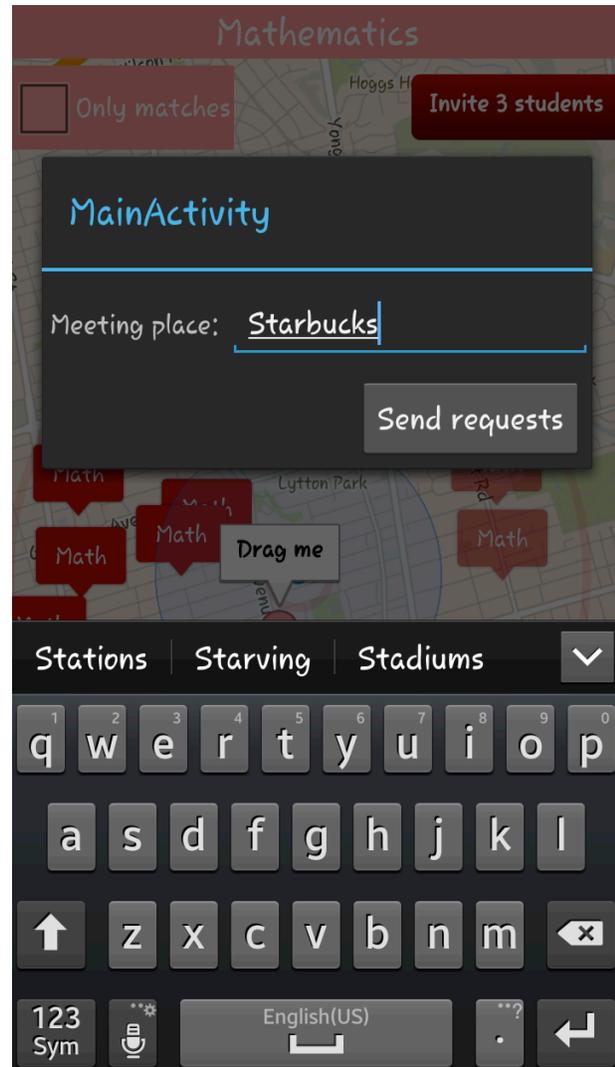
*Fig. 17:* Study request location name prompt
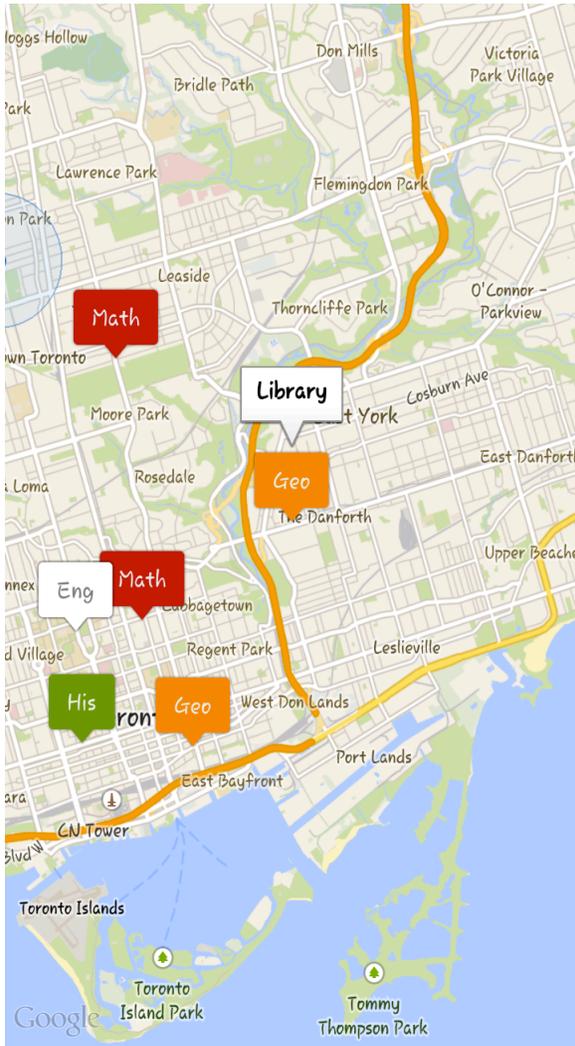
Fig. 18: Map of study session locations

4. What we learned

Apper

I learned many aspects of app development. I have a solid understanding of smart phone sensors. I did not know what wire-framing was but quickly adapted to the concept and functionality of Moqups. The learning-teaching assignment taught me the mathematics behind signal processing. I gained experience in group work where members' skill sets and education are completely different from my own which was both challenging and exciting.

Programmers

It was a challenge to choose which web service technology to use for the back-end of our app. Initially, we experimented with Amazon web services (AWS), and Google App Engine (GAE) but we ended up choosing GAE because it was fairly easy to set up and deploy in comparison to AWS. We were unfamiliar with GAE data store and cloud storage therefore it took some time to learn. Had we known the learning timeline for GAE concepts/implementation, we would have used familiar web service technologies so that we could focus on additional features for our app.

5. Contribution by Group Members

Victoria

I was in charge of the overall design of our app from a technical perspective. I setup GAE for the web services part of our app. I implemented the web services required to gather data from the user interface. I was responsible for integrating the web service calls with our user interface data. I wrote the Login function and contributed to the overall enhancement of our app's user interface. I was also responsible for unit-testing the entire user interface flow, and provided suggestions on enhancements.

Hasam

I implemented the quiz reader/writer, as well as the quiz function. The quiz involved converting sensor (gyroscope) readers to the appropriate gestures. I also handled the student matching which was based on the matching algorithm explained earlier. Finally, I was responsible for the user interface aspect of the app, which includes the general layout and design. I also implemented the animations as well as mapping the students.

Steven

As required, I developed the concept for the app from my research interest in informal mobile learning and building student knowledge community using technology. I also helped with the wire-framing, design elements and functionality. We jointly built all of our presentation slides. I filmed, edited and produced the video for our final presentation. Finally, I provided a space conducive to group bonding and the many face-to-face meetings we had

during the term. The RTA School of Media's Transmedia Centre was a perfect environment for weekend and evening brainstorming, writing up assignments and rehearsing our presentations.

RTA's Transmedia Centre

6. Apper Context

The desktop computer and its software were first designed to emulate our analog experience. The user interface became a desktop and the mouse an extension of our hand. But the user was still tied to his or her desk. Even stylistically, as recently as iOS 6, iPhone icons were designed to resemble their analog counterparts, a design element known as *skeuomorphism*, e.g. email icons shaped as envelopes or the torn page in Notes. But the ties to the analog past are receding. First the laptop freed us from the desk and now the smart phone has made mobile computing how we mediate many of our social and learning activities.

This mobile digital revolution is only beginning to impact pedagogy and propel the study of the epistemological factors by which students learn and gain knowledge with the aid of their smart devices. My research interests include the use of technology to aid collaborative learning. This can happen in the classroom as well as outside of it. Mobile learning is a facet of my research interests. The app we have created has application that goes well beyond the prototype. But let's discuss the prototype first. How does a high school teacher use this app to create learning opportunities outside the classroom? One way is to create a contextual quiz. For instance, if the class is on a field trip, the quiz could be used as a kind learning scavenger hunt. Students who discover a 'clue' could use the community app to draw other students to where they are currently located. In future iterations of the app a teacher will be able to adapt the quiz function to augment a subject area in a manner that cannot occur in class. For example, the teacher might request each student to take a picture of an H_2O molecule in its three states on the way to school (provided it's winter). The quiz would alert the students to the task and the quiz could be used as a poll instead a testing procedure. The community function could be expanded to include the creation of group formation, much like Professor Rose's Team Chooser functions.

One of my friends at OISE is the grade nine science teacher quoted in Section 1. We share similar research interests and she was a help to our group in creating the quiz and

exploring its potential. She has agreed to use the prototype in her classroom so that both of us can assess its potential as a meaningful pedagogical tool for further research. We both desire to provide teachers with technology that unfetter learning from the classroom. StudiBuddies is a step in that direction. Mobile learning is a burgeoning field of study and this project has helped me focus on its application and effect. I hope to move beyond the prototype and create, if not a commercial version, an app that educators can freely use.

7. Future Work

In order to increase the app's popularity and usability we plan to create an iOS version of the app. Both Android and iOS devices will work seamlessly together so that the quiz and community actions will function similarly across devices.

There are a number of functions we intend to add to the StudiBuddies app.

1. A polling function: As mentioned above, this would allow teachers to program questions for a specific environment and create tasks that are situational.

2. An assignment function: An example of this function is the H_2O molecule search stated in section 6.

3. Gamification: Teachers will be able to award badges for both seeking and providing help in the community section. These can then be redeemed for whatever reward the teacher decides.

4. Camera function: The camera will be used internally as part of assignments like the H_2O example in section 6. Later iterations will use augmented reality function where, for instance, slides sent home by the teacher can be augmented with videos created by the teacher to add incremental information to the slide, and provide hints, again, only subject to the imagination of the teacher.

[Please note: We are willing to have our final presentation uploaded to YouTube but not to make the source code publicly available.]