Interactive Tutor Home Tuition

By

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Dissertation submitted in partial fulfilment of the requirements for the

Bachelor of Technology (Hons)

(Information Communications and Technology)

MAY 2011

Universiti Teknologi PETRONAS

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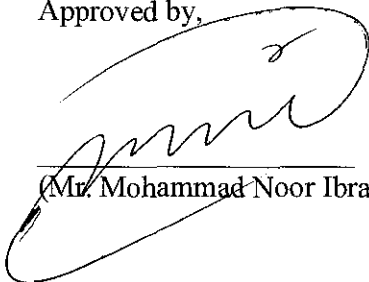
CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information Communication Technology Programme
Universiti Teknologi PETRONAS
in partial fulfilment of the requirement for the
BACHELOR OF INFORMATION TECHNOLOGY (Hons)
(INFORMATION COMMUNICATION AND TECHNOLOGY)

Approved by,

_____
(Mr. Mohammad Noor Ibrahim)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
May 2011

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

ASMA' BT BADRUL KAMAL

ABSTRACT

The Interactive Home Tutor's main objective is to provide a collaborative studying environment between student, tutor and parents through the use of mobile devices such as smart phones. Students, especially high school students do not know how to manage their studies well and fail to totally utilize learning outside school hours. Learning is only constrained to school and materials they can access online through desktop computers. It is also hard for parents nowadays to properly monitor their children's progress and performance at tuition centers. First step in the methodology is to create a feasibility study on 50 high school students and 25 parents. The feasibility study is used to determine the features needed to be incorporated in the application itself. The initial design of the prototype is created through storyboarding. Prototypes are developed using the Android platform and fully utilizes the use of the cloud database. The prototyping is an iterative process that evolves according to the needs of the users. This model of development focuses on user's involvement during iterative prototype cycles in order to ensure the system is developed according to the users' needs and preferences. Usability testing is done with potential users of the system and feedback is used to consider the potential improvement to be done to the system in the future. It helps student study while being on the go and allows students to interact with tutors when having problems with their studies. The application also helps parents in keeping track of their children's progress in their studies. Parents are able to keep up to date with their children's studies through progress reports and short message service (SMS). Future steps would be to fully incorporate the cloud environment in mobile learning and analyze the effectiveness of the system.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my supervisor, Mr. Mohammad Noor Ibrahim for his guidance. He offered me so much advice and always has faith in me. I am truly blessed to have him as my supervisor.

Special thanks to all my coursemates in Information Communication Technology for their support and ideas throughout this project.

And last but not least, I am grateful for my parents Mr. Badrul Kamal b Kamarul Bahrin and Mrs. Zaiton bt Abdul Rahim for their unconditional love and support.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Living in the 21st century, students are exposed to a highly competitive environment. Students these days are much attached to their mobile devices, such as phones and laptop, that they are gradually ignoring their studies. According to the latest report on The International Telecommunication Union (ITU) [1] the number of mobile phone subscriptions is more than 5 billion in the year 2010, which means that there is a mobile phone for every two persons in this world. Meanwhile, Jolie O'Dell [2] predicted that there will be an even bigger growth of integration between devices the network system in the future.

There will be an increase in the number of mobile internet users from the year 2010 to year 2020. A study by Harris Interactive Research [3] Firm also showed that 51% students find it useful to use their mobile devices in getting information. From these statistics, it could be deducted that students from the age of secondary school and above are also included. Of course, nearly most of the times they spend on their mobile devices are for social networking and online interaction. How about we make the most of their interaction time on the mobile devices by putting forth a platform where they can learn and interact while being on the go?

That is the idea behind the interactive home tutor. Interactive tutor home tuition enables kids to have their tuition at home by doing exercises and work modules on the smart phones, or tablets. These exercises are provided by a tutor specific to his or hers subject specialization and they are available online 24/7 anytime for the students to refer to. Students will do their work and submit it online for the tutor to check. The child and the tutor are able to interact incase the child needs help with their work and from the application also, parents are able to see the progress of their child's tuition through the tutor's evaluation of the child's work. This way, parents do not need to send their child

out alone to go to tuition center. The child would also be able to develop a self-learning capability rather than to depend on a group and a teacher to learn. The child would also have a one-on-one basis with the tutor, rather than a one-to-many basis when doing tuition at a service center. This gives the child a good chance to reinforce the new topics learned earlier from school, and they would be able to concentrate more on their topics [4].

1.2 Problem Statement

Parents are highly concerned of their children's education. Most of them send their children to tuition centers or acquire private tutor services for further learning outside school hours. This is where several issues arise. Nowadays, both parents are forced to work to manage the high living expenses and their children's education. They are too busy to send and pick up their kids from tuition centers and to hire a private tutor at home is very costly. The current state of the teenage culture and environment also pose a problem for parents to send their children for outside tuition. High crime rates and unsafe environments and bad influence are some of the reasons parents are reluctant to let their children out without proper supervision.

1.2.1 Parents hardly monitor the performance of their children at the tuition centers

Unlike school, most tuition centers do not have the system where the teachers will update the parents of the students on their child's performance. Most of the time, parents will send their children to tuition centers and let the tutors do their work. Parents will only check their children's performance through their examination results at school. This way, the student's actual performance cannot be measured by the effectiveness of the tuition.

1.2.2 Learning not fully utilized outside school hours

If it were up to students themselves to study after school hours by themselves without proper supervision and guidance, the studying would not be able to be done effectively. There are many factors of distractions such as the Internet and other activities other than studying. Even if they are sent to tuition centers, there is the possibility that they play truant and skip classes.

1.2.3 Learning only constrained within classes and desktop computers

Due to the lack of materials available on the Internet for high school students, they are unable to do their studying even when having the medium to do so. There is also the factor that most home tuition websites are not available in mobile version, therefore students are not able to do their revision and studying without the aid of a desktop computer. Because of these factors, their learning is only constrained with the materials provided by books and teachers and online tutor websites.

1.3 Objectives and Scope of Study

In order to overcome the problems outlined in the problem statement section, the creation of the Interactive Tutor Home Tuition using Android is recommended. This application lets tutors and students to interact and share resources within the cloud environment using the Android platform. Students are able to enroll under a specific or many tutors and have access to their learning modules. From these modules, students are able to learn, do exercises and communicate with the tutors wherever and whenever they want to on the Android platform. The application also provides a communication channel between the tutor and the students for a better synchronous learning process between the tutor and the students themselves.

1.3.1 Objectives

The objective of this project is to design a suitable architecture and develop a Mobile Learning application by applying Cloud Computing concept that could:

- provide a collaborative environment among parent, learner and tutor
- provide a controlled platform for parents who want home tuition for their children,
- provide an interactive at home mobile learning system process with a tutor using Android, and
- inspire a self-learning capability in students in their early ages.

1.3.2 Scope of Study

The main scope of study for this project is to help students and tutors to have a more interactive learning platform using the smart phone. Example of having a more interactive learning platform is that, students are able to directly communicate with their tutors in real-time rather than to limit the learning process for the students only during their school hours and during tuition time. Statistics from a study done by Yeowet. al [5] showed that students these days, especially between the secondary school and college students interact more with the online community rather than having and active conversation face to face.

1.4 Significance of Study

1.4.1 Mobility

By using the interactive home tutor, students are able to do their exercise modules wherever and whenever they are able to. The system would also notify the students on what subjects and modules that they need to work on, based on their results. Communication with the tutor is also not limited only during tuition hours of school hours, but anytime and anywhere; therefore it boosts the mobility factor for the students to learn while being on the go.

1.4.2 Interactive

Unlike the conventional home tuition and tuition centers, the interactive home tutor is able to detect and record each student's progress based on the exercise modules that they are provided to do. From the results of these modules, students and parents are able to view directly their own child's progress. For added functionality, the system can also send out Short Message Service (SMS) notification to parents on their children's progress. That way, the parents of the children are also able to keep up to date with their children's progress and be notified that if anything needs to be done to help the children learn.

1.4.3 Transparency

Other than being able to help students, the interactive home tutor also helps the parents in terms of making sure their children are getting the proper education they paid for. Children will be able to focus on their studying as the device provides a three way communication between students, teachers and parents. That way, there is transparency in regards to the child's studying progress. Even while being out, they can finish their studies. That will help the parents rest assured that their children are studying.

CHAPTER 2

LITERATURE REVIEW

2.1 From E-Learning to M-Learning

In the increasingly global connected world with endless information and idea to share, e-learning is reemerging as a solution for delivering online, synchronous and asynchronous learning regardless of physical location, time of day, or digital reception or distribution device type. E-learning is commonly recognized as a powerful and valuable extension to traditional educational initiatives and Learning Management Systems (LMS) are key tools that support these new educational models [6].

The growing number of devices with Internet connectivity features has widely improved mobility and flexibility in the quality of e-learning. The new generation of mobile devices support multi-touch displays, internet access over 3G networks or using Wi-Fi, and the ability to sense motion and react in such ways that is programmed by the application within the phones itself. These devices lets the users keep in touch with information and activities that needs to be done while being on the move. The new class of devices such as iPad and the Samsung Galaxy Tab provide users with more flexibility and power on the mobile platform but do not prefer to carry around a laptop or a netbook.

E-learning is a type of virtual learning environment (VLE), which is computerized learning. Many of the technologies that are associated with e-learning nowadays are supported by the cloud, such as Blackboard and Moodle [7]. These systems feature collaborative environments where multiple people can work within them at once and users are able to share information between them. Collaborative environments are virtual workspaces where students and teachers can communicate, share information and work together to achieve their goals. These online spaces are

created to support groups of students working together, regardless of where they are and practice relative teamwork [8].

2.1.1 M-Learning

According to the latest report on The International Telecommunication Union (ITU) [9] the number of mobile phone subscriptions is more than 5 billion in the year 2010, which means that there is a mobile phone for every two persons in this world. After gaming and music stations like mp3 players, most kids these days are techno savvy enough to have their own mobile phones and in this era, smart phones like Android and iPhone are the most popular mobile device around. Figure 2.1.1 below shows that between the years 2010 to the future, mobile internet will the most widely used mode of connection. At market-research firm Harris Interactive, it is discovered that most teens have a deep comfort levels with their mobile phones and 51% says that mobile phones are essential devices in their means for getting information [10]. At secondary level, nearly every student has their own mobile device, meaning that the target market acceptance is already established for mobile learning.
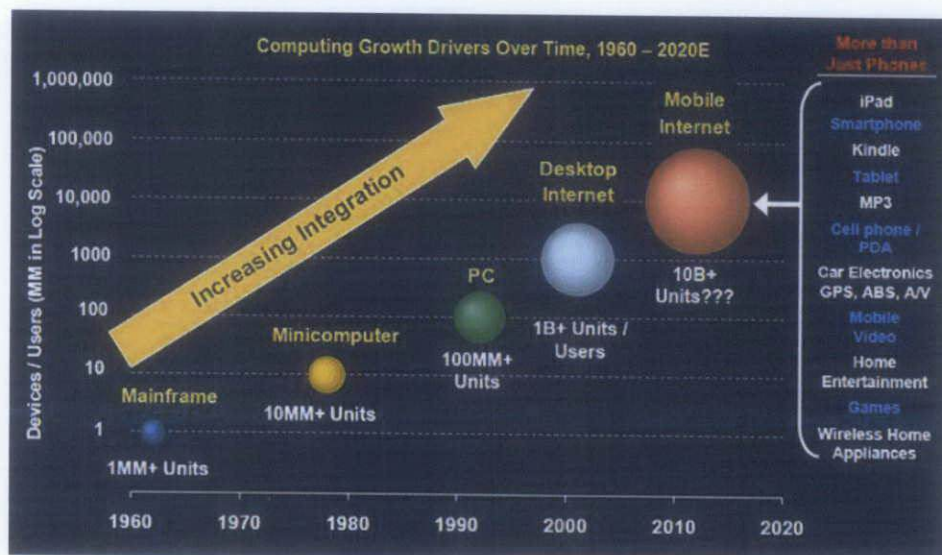

Figure 2.1 Competing Growth Drivers Over, 1960 - 2020E

Despite the many beliefs that mobile phones are a distraction to students in their studies, research and surveys has proven that mobile learning can be beneficial to students, regardless of age and area of study. Mobile computing has changed the way of communication between teachers and students and this fact can be used to improve the quality of m-learning. Students and teachers are able to get instant feedback due to the mobility advantage of a mobile device. The emergence of the latest mobile technologies with Internet connectivity has also allowed teachers to share materials online through e-learning and students are able to download and view it from their mobile devices. For any student it is important to have up to date information about current exercise assignments, lectures, upcoming appointments and other daily activities, and the most efficient way for both students and teachers to do that is through their mobile devices.

2.1.2   Challenges in Mobile Learning

Despite the statistics provided, mobile learning is not quite widely accepted as it does with the students. The gap between student use of technology in their educational activities (even though shallow) and faculty incorporation of technology in teaching and learning activities is ever widening. A recent survey by Allen and Seaman [11] indicates student use of technology rising (around 75%) but faculty acceptance staying steady (about 25%). From this we can see that even though the acceptance level of such way of learning is highly accepted by the students, but not the instructors or teachers. By having this platform is how we want to educate the public and the learning community to explore a new way of learning using other methods and devices.

2.1.3   Benefits of Mobile Learning

Asynchronous Learning

Asynchronous mode of online education is popularly termed as store and forward education. Due to the mobility advantage of mobile learning, the students and teachers are able to develop asynchronous mode of learning, where there exists a two-way communication between both parties in regards to the learning process. Students are able to directly communicate with the teachers through instant messaging or by exchanging

emails and posting messages on online bulletin boards and discussing groups. This way of learning offers more convenience and flexibility to the students and they can decide the pace and schedule for their education and training. Self-paced courses are the examples of asynchronous online education where the students communicate with the teachers and amongst themselves.

Education on the Go

Kennedy et al. [12] note that in excess of 90% of students agree that a computer is useful for general study with special emphasis on document creation and searching for information (e.g., Google). They also note that a mobile phone is useful to assist with university studies to send or receive text messages (84%) and as a personal organizer (60%). By having such technology at the palm of their hands, students are able to expand their knowledge whenever and whenever they need it. The existence of m-learning supports this by becoming one of the platform for students to be able to get their education on the go. Learning should not be constricted to being in class and listening to the lecturer or surfing and reading the articles on the internet, but it should be accessible whenever and wherever the students need it. By having such platforms, students are also able to discuss and share their information whenever and wherever they acquire it, as fresh input is always the best input.

2.1.4 Existing Systems

Mobile Moodle (MoMo)

Mobile Moodle is a mobile-based application based on the Moodle e-learning website, but this application currently is only available in Japan. It works on various mobile platforms, such as iPhone, iOs, Android and Symbian. Mobile phone users have to install the MoMo client, which is basically a Java based application on their mobile phones. Only through this client that they are able to access to their resources whenever and wherever they are. Administrators of the MoMo systems are also required to install the MoMo client on their servers to make sure that the materials used for the MoMo is compatible to run on the user's mobile phones.

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The beauty of MoMo is that the administrators are even able to control and maintain the system through the integrated administration system interface which is included with the MoMo. Teachers are able to design courses with either mobile elements or complete mobile scenarios using tools and methodologies that are available within the Moodle environment. Like most E-learning systems, the MoMo features a login function, course navigation function, multi-language support and the quiz and feedback module.

Blackboard Mobile

Blackboard Mobile Learn is simply the mobile representation of the Blackboard E-learning itself and it comes with lesser functions that the website version of Blackboard. There are eight main function so the Blackboard Mobile; 'Announcements', where students have immediate access to the latest announcement regarding the university or their courses and it is a platform for instructors to post their latest announcements and tasks for the students;' Grades', where the students are able to view their grades once logged in according to their respectful universities/communities; 'Blogs', where students and instructors are able to have their own blog for posting articles or media for public sharing; 'Roster', where this includes the complete list of their course mates, in cases where they might need their contact details for group collaborations or study groups; 'Journals', where the students are able to post journals and read other people's journals. The instructors and students are able to comment on the journals, making it a way of learning; 'Discussions', where a forum-like mechanism resides. Students and instructors are able to post questions and answers and they are able to review the threads of discussions and post to these threads. Students are also able to start their own thread of discussion, even while being on the go. They are also able to upload files and attachment, though this only applies to iOs and Android phones; 'Media', where the students and instructors are able to share media files within the community and 'Tasks', a place which works as the student's personal calendar. Students can mark their progress and or have reminders and track their assignments submission dates.

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Others

The use of mobile devices in classroom settings is also supported by the student's independent learning is experimented using SMS and web based systems. For example, Edutxt, an online application developed and supported by txttools.co.uk, whereby the students are required to submit answers to multiple choice questions (MCQ) via SMS at the end of lecture sessions. Students are also encouraged by the university to use the Edutxt system to comment, give suggestions and questions based on the module learned that day [13]. Luzia Research (luziaresearch.com) has also created a Java application for mobile phones that is named "UELuHavePassed". The application lets lecturers to upload questions on the server and the students are able to download and use it as a type of formative assessment. The system consists of 80 MCQ questions from different topics . Students are able to study and do exercise wherever and whenever they want, therefore they are able to make full use of their time. The system also provides instant feedback to each question and it is free of charge for the students. However, "UELuHavePassed" is more appropriate to support independent study rather than classroom interaction. The students, who downloaded the application, have given positive feedback of using it.

2.2 Online Home Tuition

Home tuition is a service where the process of learning outside the classroom is done privately within the student's home. Hence the name, "home" tuition. The approach used by the tutor is one-on-one, where the tutor concentrates on teaching only one student and on one subject. Online home tuition, however, use the same concept, but this method learning is web based. Students are given resources to download and do, answer questions online, communicate with tutors through online methods, such as instant messaging or e-mail. This way there could be a many-to-many communication between tutors and students. A tutor can have many students under their supervision and each student is able to enroll with many tutors at one time. Therefore, even though there are many tutors for each student or many students for each tutor, the one-on-one concept can still be applied.

2.2.1 Benefits of Home Tuition

The performance of each and every kid is different, and it can't be compared with the other. Certain students are extremely brilliant and certain require additional attention to make sure they are able to put up a good performance. Because of this, home tuition is becoming necessary for every student. According to CheeYong[14], the Founder for Education Haven Pte Ltd, a tuition agency specializing in finding quality tutors at reasonable prices, most parents are satisfied with the results of home tuition. More than 80% of the parents could see a difference in 1-3 grades of their children within 3-6 months. As Russel[15] said, "[t]here is no official information on the extent of private tutoring because it is in nobody's interest to collect it....", but there is a definite impact of improvement regarding grades. There was a rare study on tuition in Singapore by Quigley and Gan [16], which explored how tuition has affected the students' academic performance across different academic abilities. According to the authors, private tuition has slightly greater impact on the academically weaker students than on the higher achieving students, and does not really support the general belief. Still, there are many confounding factors that could have affected students' academic achievements.

Higher achievement rates

Students will be able to gain knowledge and information that may not be taught effectively and sufficiently in school. A tutor can impart knowledge that may not be taught in sufficient details in school, such as easy ways to do mathematical formulas and simple ways to remember important dates in History. Students can discover new learning style, and also they can change how they study in the class. Private tuition can help them develop self-confidence and therefore, accelerate their learning process. This is essential for students to find out the best way for learning to ensure that they can succeed in their studies, as well as their career in adult life.

Involvement of parents, engagement of students

In private tuition, parents are able to communicate directly with the tutors after every session and are able to get up to date with the performance level and learning progress of their children. Tutors and parents are also able to engage and sit down to discuss further on what can be done to improve their child's performance and learning. This way, the tutors are able to communicate the expectations of the parents indirectly onto the students and in the same time help the student in becoming a better student. However, it is essential that the parents also communicate with their child to see whether the child is suited and not stressed out with the tutor's way of learning to ensure the child is able to fully maximize the use of the tutor. If there is no communication between the tutor and the child, it also would not work.

Extra attention, personalized connection

Students are also given the opportunity to ask questions in class to their tutors directly rather than having to speak out in class. It is a norm to see students, even in the higher institutions these days, being too shy to ask questions in class because there are too many people. By having an online home tuition with an interactive tutor, students are able to directly ask their tutors what problems they are currently having and getting immediate feedback to their questions and problems. This, above all instill a sense of satisfaction to the students and make them want to work more. Students are also be able to get more practice under supervision of a private tutor as they will be more conscious of their work and have to make an effort to do work, rather than during self-study or studying in a large group at tuition centers, where the tutors are not able to give personalized attention to each student. In private tuition, the student is able to share the opinions and ideas with his teacher and they feel closer and tell them about the weaker subjects and fears which usually are not possible in the regular class rooms. This will help both student and teacher to work towards improving them.

2.2.2 Challenges in Home Tuition

Home tuition has become one of the necessities a student needs to have during their early learning period, mostly during primary and secondary school stages. With the appearance of many excellent programs such as GradTutors and ScoreA, parents are able to find alternative ways to enhance their children's school performance without having to go to the long distance to find a good tuition center.

The problem with home tuition is that the fees are quite costly. The starting fees for the GradTutors is RM100 for selecting a tutor from their agency and the parents would still have to pay monthly fees or session fees to the tutor. Even without an agency, private tutors outside would demand at least RM250 a month for their private tutoring service. Meanwhile, the ScoreA programs, despite the services they offer, parents have to pay thousands for one year's membership. That is quite a lot to consider compared to normal tuition centers where the fees are comparably cheaper.

With home tuition, there is also a need for the parents to still continuously monitor the tutor and their child during the studying process. It is unlikely that the parent would leave their child and their house unattended in the hands of a stranger. This problem does not appear when dealing with online home tuition such as the ScoreA program as students are able to easily access the program from their own laptop or personal desktop and the parents are able to monitor the child's performance through the progress report mechanism within the program itself. The most prominent drawback with online home tuition that it is mostly focused on the output learning where students are unable to directly or indirectly interact with their instructors or ask questions regarding their problems with learning through doing questions online. The learning process does not promote a two-way learning process between the teacher and the students are there is no clear way of communication, only the students doing questions online and the system corrects it for the student.

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2.2.3 Existing Systems

GradTutors

In some countries, private tutors are hand-picked directly by organizations that specialize in providing private tuition services to students. For example, in Singapore, there is GradTutors, a service organization which provides tutors from various backgrounds, such as professional tutors, current/ex school teachers or part time university students. The tutors are able to submit their profiles on the organizations website and parents and students are able to view the tutors experience and rates online and decide from there. If within the first and second session that the parents and the child are not satisfied with the service of the tutor, the organization will provide a new tutor without extra charge to the parents.
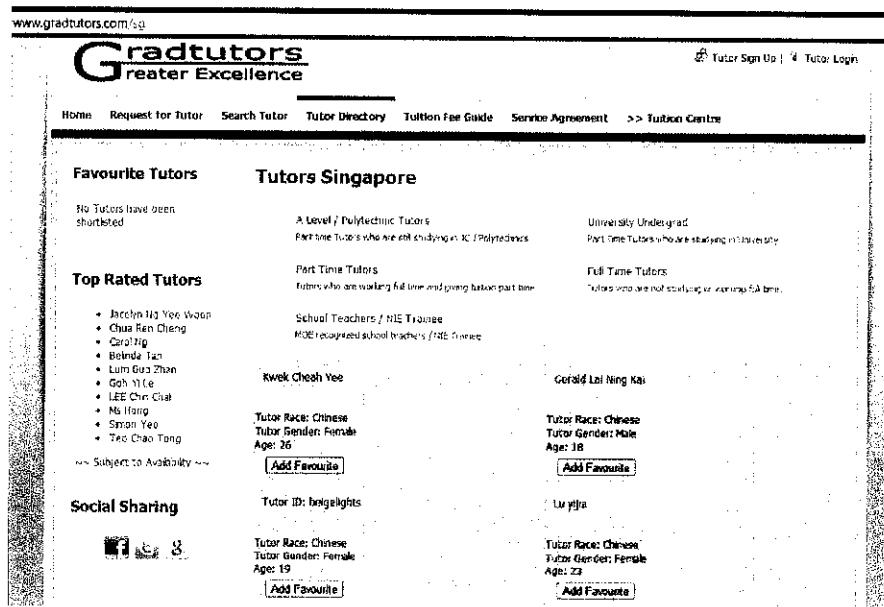

Figure 1.2 GradTutors Official Website

ScoreA

ScoreA is a web-based home tuition program based in Malaysia that implements the Output Learning method to teach its students. Output learning is the method of learning what students have already studied in school through specially conducted assessments. ScoreA programs require students to sign up as a member of the website and students are given different modules of subjects to do. The questions are all objective based as ScoreA believes that the mastering of multiple choice questions will help students to do well in subjective questions.

From Output Learning, students are able to increase the students' understanding of topics taught in school. As all tutoring session goes, ScoreAprogramme complements the other tuition classes or classes at school that is already taken by children as it is built mainly according to the Malaysian education syllabus. The ScoreAprogramme also has the eReport card feature where the parents of children who are enrolled into the system are able to keep up to date with the academic progress of their children. Through the eReport card, parents are informed of their childs weak and strong points in learning even before the school report cards are able to identify them.
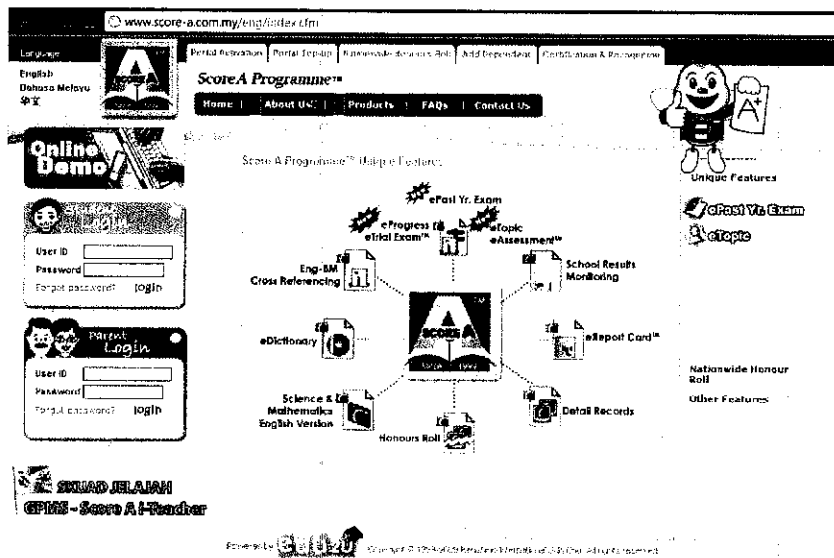

Figure 2.3 ScoreA Official Website

Other features inside the ScoreAprogramme include ePastYear Exam, which allows students to practice actual past year's exam papers that are released by the Ministry of Education of Malaysia. Students are able to select the questions they want by year or random option and they have to complete the papers by the specific time allocated; eTopic, which is a revision module which focuses on the Output Learning method. Students are given short objective questions to do and this allows them toa directly see their mistakes.

For each question, there are four choices. For each choice made wrong, 1/3 point will be taken. By using this method, students will be forced to re-read the question and this would let them get used to the notion that one should always read the question carefully and understand it before answering; eProgress, which is just a progress chart to let parents see their child's performance; eTrial Exam, a simulation of eFinal Exam and eAssessment, which is allows the children to do exercises which are based on Output Learning also.

2.3 Collaborative Environment : Cloud Computing

Cloud computing is the new technological trend that signifies a major change in how we store information and run applications. Instead of running programs and data on an individual desktop server, everything is hosted in the "cloud" – a nebulous assemblage of computer servers accessed via internet [17]. The "cloud" refers to a collection of computers and servers publicly accessible through the Internet. This system is basically run by a third-party on a consolidated basis in one or more data center locations. Cloud computing lets you access all your application and documents from anywhere in the world, without any constraints of using data from your desktop only and easier for group collaborations.

With cloud computing, the software programs you use aren't run from your personal computer, but they are stored on a collection of servers accessed via the internet. Unlike network computing, cloud computing encompasses multiple companies,

multiple servers and multiple networks as its services are available anywhere in the world over an Internet connection.
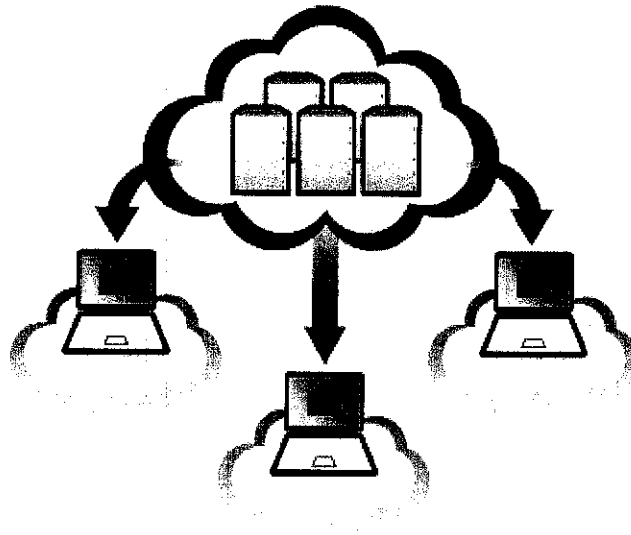

Figure 2.4 How users connect to the cloud

As shown in Figure 1, individual users connect to the cloud from their own devices; it could be a desktop, a notebook or even a smart phone, over the Internet. To these devices, the cloud will seem like a single application, device or document. The hardware in the cloud, which is the operating system that manages the hardware connections, is invisible.

2.3.1 Challenges in Cloud Computing

In the context of cloud computing, the learners are able to concentrate on the synchronous mode of learning and develop their own learning style and plans, and use the cloud environment to communicate with the instructors for self-directed and self-monitoring process. They are also able to evaluate their own performance through accessing their own learning outcomes. Using the cloud as the network database, storage and hardware resource, instructors are able to give the students a wide range of self-study space but at the same time help the student by offering their services. This enables the students to develop a sense of independency and improve learning ability; enhance

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learner's emotional, psychological abilities such as passion, self-confidence and so on, train special qualities of thinking such as creative thinking and self-expression. Humanistic psychology say that learning is that learners acquire knowledge, skills and intellectual development, while exploring their own feelings, and learn to communicate with teachers and other collective members, to clarify their own values and attitudes, to realize their potential, and finally to achieve the best possible state.

There are a few challenges [18] are to be considered when developing a mobile cloud community service which could be considered and applied in this project. First of all is, User & Community Management, in which other than user management, such as authentication and authorization, it is crucial that the application is able to organize in social networks, such as forming communities (between tutors and students), maintaining friend's list and etc.

Since privacy & trust are important success factors for virtual communities, it is also important to instill a fine-grained security management API for the definition and enforcement of access control. Other than that, following the Web 2.0 idea of mashing up new services by combining existing ones, we need to reuse and combine existing services. The services should be decoupled by communicating over standard protocols and metadata, thus ensuring interoperability. When building such cloud computing environment, support for the deployment of services during runtime is a critical factor. With this feature at hand, communities are able to shape their community cloud by dynamically plugging or unplugging services. As the data generated from mobile phones' sensors needs to be processed and exchanged at real-time with the cloud, real-time communication between members is essential to the community. For example, the Extensible Messaging and Presence Protocol (XMPP) provide ways to achieve this communication.Context information in mobile applications is also important as it includes spatial, temporal, environmental, social information, resources that are nearby, availability of resources, physiological measurements, and so on. Services must be

aware of the current user and community context and self-adapt to context changes. Privacy control must be implemented as well.

2.4 Android versus J2ME

In the early mobile development field, one of the most famous and widely used programming languages is the J2ME, which is Java, the Micro Edition. J2ME is Java 2, Micro Edition (J2ME) is designed for small devices with a limited processor power and small memory size. Mobile phones, personal digital assistants (PDAs), consumer electronics, and embedded devices are common examples of J2ME capable devices. Today's mobile phones and entry-level PDAs use Mobile Information Device Profile (MIDP) combined with Connected Limited Device Configuration (CLDC) as the J2ME run-time environment. Announced in June 1999 at the JavaOne Developer Conference, J2ME brings the cross-platform functionality of the Java language to smaller devices, allowing mobile wireless devices to share applications. With J2ME, Sun has adapted the Java platform for consumer products that incorporate or are based on small computing devices. [19] Due to the rapid growth of mobile development, more new platforms are being used, such as Android for Android phones and iOs for iPhones.

Android was introduced by the Open Handset Alliance on the November 5th, 2007 [20] as the world's first open and complete mobile platform. The Android SDK 1.0 was first released in the 2008 and the Android Open Source Project, which was led by Google, is tasked with the maintenance and further development of Android. The primary purpose for the Android Open Source Project is to build an excellent software platform for everyday users. A number of companies have committed many engineers to achieve this goal, and the result is a full production quality consumer product whose source is open for customization and porting. Android supports application framework which enables the reuse and replacement of components, Dalvik virtualmachine which is optimized for mobile device, integrated browser based on the open source webkit engine, optimized graphics powered by a custom 2D graphics library; 3D graphics based on the OpenGLS ES 1.0 specification (hardware acceleration

optional, SQLite for structured data storage, media support for common audio, video, and still image formats, Camera, GPS, compass, and accelerometer (hardware dependent) and rich development environment including a device emulator, tools for debugging, memory and performance profiling, and a plugin for the Eclipse IDE.
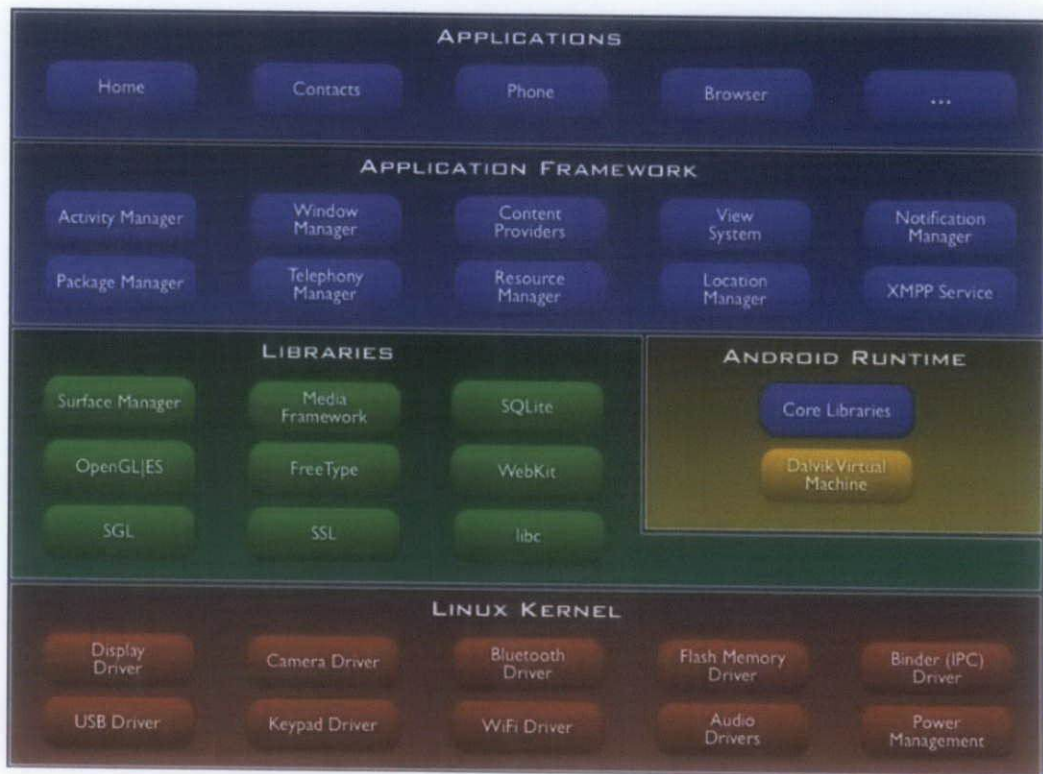

Figure 2.2 The Android Architecture Platform

2.3.2 Benefits of Android

The Android mobile platform has attracted more than 180,000 developers and deployment of 50,000 mobile applications in the Android Market since it was first open sourced by Google in November 2007. Today, more than 60 smart phones from major manufacturers run the Android platform. In addition, within the last two years, the number of web searches through mobile phones (both Android and non-Android platforms) has increased five times. All these number show how the Android project has gained its momentum to move forward and how mobile applications will become more

widely-used by smart phone users. A larger percentage of these users are young adults that include college students [21].

Every Android application runs in its own process, with its own instance of the Dalvik virtual machine. Dalvik has been written so that a device can run multiple Virtual Machines efficiently. The DalvikVirtual Machines executes files in the Dalvik Executable (.dex) format which is optimized for minimal memory footprint. The VM is register-based, and runs classes compiled by a Java language compiler that have been transformed into the .dex format by the included "dx" tool. The DalvikVirtual Machines relies on the Linux kernel for underlying functionality such as threading and low-level memory management [22]. Therefore, by using Dalvik virtual machine within Android, users are able to save memory space on the phone or memory card within the phone as the development process of an Android application only takes little space.

A mobile phone is a highly personal, always-on, always-present gateway to the Internet. Android devices are more compatible to customization compared to other mobile platforms. Due to the highly inextensible Android open source, users are able to develop their own customization within the phone itself. Other than that, the Android Market (http://market.android.com) provides a huge selection of free and commercial apps for users to customize their phone. The Android Market is also a platform for developers put their applications on the market and tests it out on available market of users. Due to the existence of the Android Open Source Project, it is aimed to make it as easy and open as possible for developers to build apps by providing the platform for the developers to build applications.

2.3.3 Challenges in Android Development

One of the major challenges in any mobile development is the heterogeneous factor [23]. Data are being represented in many different form and people are getting busier and busier and wanting their information on the go. Therefore, it is hard for mobile devices to cater to these user needs and specification by having all of them within the device itself as it would make the device heavy. The

customization factor helps in overcoming this challenge, but even so, there are still improvements needed to be done. Features and functions on the Android devices are also quite limited, but then again, the customization advantage might just be able to help overcome the heterogeneous factor. This also leads to resource constraint.

CHAPTER 3

METHODOLOGY

3.1 Rapid Application Development

The Rapid Application Development is made up four main phases; Analysis and Quick Design, Prototype Cycle, Testing and Implementation as shown in Figure 3.1. The first stage for analysis and quick design is where the user requirements and software planning is done for this application. Surveys and questionnaires is conducted to get the users requirements and a rough flowchart and diagrams will be drawn out to make sure the workflow of the software is able to run smoothly. The next stage is the prototype cycle, where the prototype of the software will be developed in phases and run through each phase to make sure each phase is as planned. Next is the testing stage, where the finalized prototype is tested with potential users and the last stage is implementation for the application.
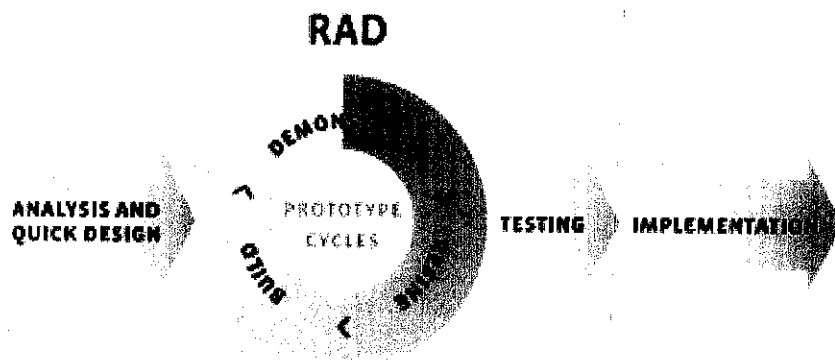
Figure 3.1 The RAD Model

There are many advantages to using Rapid Application Development Model for the development of the application. One of them is the increased speed of development and increased quality. During the prototype cycle, developers are required to develop systems and do error checking and test run according to phases. The cycle continues until all phases of application development is finished. At the end of the day, the finished product is a working prototype of the application. Rather than waiting for the

application to be wholly finished by the end of the development process before doing a test run and error checking, rapid application development promotes iterative prototyping, which saves a lot of time for the developers for the testing and error checking processing.

Quality of the application is also improved as the development is done through phases rather than doing a whole program first before error checking. During each phases, developers are required to make sure their system works according the phases planned during the analysis and quick design of the software. Quality in development was both to the degree to which an application conforms to specifications and a lack of defects once the application is delivered. In Rapid Application Development, quality is defined as both the degree to which a delivered application meets the needs of users as well as the degree to which a delivered system has low maintenance costs. Rapid Application Development attempts to deliver on quality through the heavy involvement of users in the analysis and particularly in the design stages.

3.2 Analysis and Quick Design

3.2.1 Data Gathering through Survey and Questionnaire

The main method for data gathering for the research is through survey and questionnaires. The survey was done through researching the available existing systems and available technologies, such as online home tuitions and cloud computing. For the Malaysia market, currently there are many online tuition services provided. The most used example is the ScoreA tuition service. This method of survey is effective for this research as it allows a bird-eyes' view of the current system and allows developers to see what changes could be made to make the learning process more interactive and effective for all audiences.

Questionnaires are also one of the main methods for doing data gathering for this research. By doing questionnaires, the data gathering process is standardized, whereby

the answers are multiple choice formats. Standardized data is easier to analyze and separated into specified clusters. With questionnaires, the data can be collected swiftly from a large number of respondents. Not to mention, there are also free services for online surveys and questionnaires. There is also the factor that respondents to the questionnaire are able to answer more honestly due to the fact that they are answering the questions anonymously.
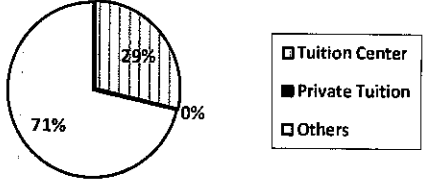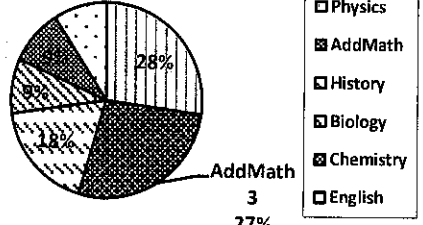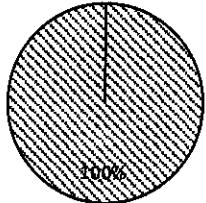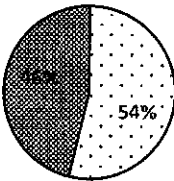
The targeted audiences concentrated for these questionnaires are 50 high school students and at least 25 parents. The students age range is between 15 to 18 and their family background are mostly tech-savvy people living in the urban areas with moderate income. The questionnaire was distributed using an online survey system, surveymonkey.com, and hardcopies are given to high school students and their parents. Questionnaires used for the survey can be seen in Appendix A and B at the end of this document.

In order to develop this system, their feedbacks are important as they are the main users of the system. The objective of this survey and questionnaire collection is to conduct a feasibility study on the audience market on the software and get their opinions regarding learning-on-the-go. Their input is particularly important as the application is developed with the user in mind. Through this questionnaire, the features and functionality of the application is to be decided in order for the users to fully utilize the application to their advantage. For an example, if the result from the questionnaire shows that parents are not really concerned about getting updates about their child's progress and would rather see it from their exam results, then there is probably no need for the notifications feature. Detailed explanation on the important features of the application can be seen in table 3.3 (Prioritized List of Requirements using the MoSCow approach) in the Project Actions section.

Another objective behind these questionnaires is to conduct a market research survey for the Interactive Tutor Home Tuition project. Through this market research survey, many types of information pertaining to the development of the project are
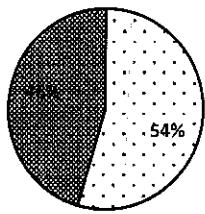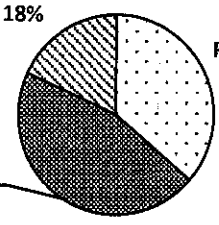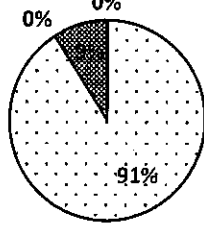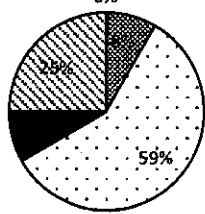
gathered. Information such as issues that the target market are having and what are their thoughts on the solutions provided by the product, their knowledge in using such technology, their interest in using such products in helping their everyday life, whether they would buy it or not and knowing their thoughts on the relevance of the product in their lives. The tables in the next page show a summary of the results for both questionnaires.
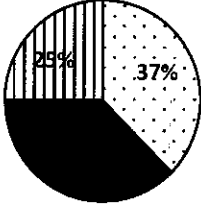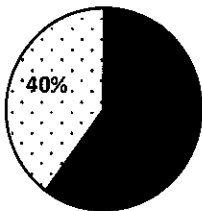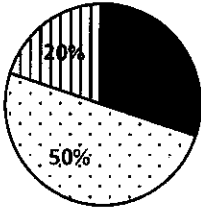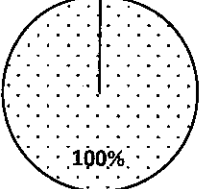
Table 3.1 Questionnaire Results for Teenagers

Question	Result
1. How do you study outside school hours?	**Student** 29% 0% 71% □ Tuition Center ■ Private Tuition □ Others
2. What is the hardest subject to study at school?	English Student 1 9% 28% 18% AddMath 3 27% □ Physics ▧ AddMath □ History ▨ Biology ▨ Chemistry □ English
3. Do you have a mobile phone?	**Student** 0% 100% ▨ Yes ▨ No
4. Do you go online on your mobile phone?	**Student** 54% □ Yes ▨ No

5. What activities do you do with your mobile phone? (multiple answers)	**Student** Learning 6 2% 28% 38% Googling 30 12% Downloads 18 7% ☐ Phone calls and SMS ☒ Internet, social networking ☒ Downloads ☐ Googling ☒ Learning
6. Would you consider doing revision questions on your mobile phone? If such system exists?	**Student** 19% ☒ Yes ☐ No
7. What format of questions do you prefer to do on your mobile phones?	**Student** Objective 44.2 44% Both 53.8 54% Subjective 1.9 2% ☐ Objective ☒ Subjective ☒ Both
8. What do you think of an application that provides resources and interact with your tutor/teacher while you to study, anytime and anywhere, using your mobile phone?	Student No, I don't want to use it 3.8 4% **Student** 42% Student I'd love to use it 53.8 54% ☐ I'd love to use it ☒ It's okay ☒ No, I don't want to use it

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Table 3.2 Questionnaire Result for Parents

Question	Results
1. Are both of you (mother and father) working?	**Student** Pie chart showing: 54% Legend: □ Yes, ⊠ No
2. How much is your monthly income?	**Student** Pie chart showing: < 5,000: 18.2 (18%) > RM10,000: 36.4 (36%) > 5,000: 45.5 (46%) Legend: □ > RM10,000, ⊠ > 5,000, ⊠ < 5,000
3. Level of education?	**Student** Pie chart showing: 0%, 0%, 0%, 91% Legend: □ SPM, □ Dip/Degree, □ Masters, ⊠ PhD
4. How many children currently studying in secondary school do you have?	**Student** Pie chart showing: 0%, 59% Legend: ⊠ 3, □ 2, ■ 1, ⊠ 0, ■

5. Do you send them to tuition centers or have private tutors at home for them?	**Student** 25% 37% ☐ Tuition Center ■ Private Tuition ⊞ Online Tuition
6. Would you prefer to have a mobile version of the online tuition, whereby the students can do their studies on their mobile phones whenever and wherever they want?	**Student** 0% 40% ■ Yes ☐ No ☐
7. Are you up to date with their performance during tuition? Does the online tuition provide you a system to check your child's progress? Or do you just check from their exam performance?	**Student** 20% 50% ■ Yes ☐ Exam performance ☐ Not up to date
8. Would you want to receive notifications on your child's academic progress?	**Student** 0% 100% ☐ Yes ☐ No

3.2.2 Analyzing the Results of Questionnaires

The questions for the questionnaires were separated for each students and parents respectively. These questionnaires were done on high school students between the age of 15 to 17 of SMK Saujana Impian in Kajang, Selangor and the parents of these students. 60 results were returned for the student's questionnaire and 30 were returned for the parent's survey.

From the results of the questionnaire, it can concluded that high school students are mostly up to date with the mobile world and are open to new ideas of learning, other than being sent to tuition centers to study outside school. From the results, it can also be concluded that most students have trouble studying subjects that require more than just theory, but calculations and explanations, such as Additional Mathematics and Physics. This supports one of the project's main goals, to provide interactivity between students and teachers when it comes to discussions. The questionnaire result also shows that high school students are not only looking to study for objective questions, but also subjective questions.

The second questionnaire, which is for parents of the children shows results that support the notion that most parents are quite concerned with their child's education. They want to receive updates on their children's current performance when sent to tuition centers. They are open to new ways of learning for their children too.

3.2.2.1 Description of Processes

After the analysis it is clear that certain modules of the application need to be implemented.

Mobility

The application is mobile based and developed on and Android platform, therefore, it is compatible with all Android based mobile devices.

Student

Each application is accessible to one student at one time. Students are differentiated using their login i.e. their name used when operating the application. Each student has their own user profile, and access to the tutor's database. By having access to the tutor database, students are able to subscribe to the tutors of their choice and have access to the subscribed tutor's materials. Students can also unsubscribe from the tutors if they do not want to do the exercise sets anymore. Students also have access to communicate with their subscribed tutors via messaging.

Tutors

Tutors are displayed in a database. Each tutor has their own set of exercise modules that the students can access once they have subscribed. Each tutor will have their own set of students and is able to communicate with them through messaging.

Progress Reports and Notifications

Progress reports will be automatically generated based on the students exercises results and will be sorted by each tutor and their modules. The notification will be generated based on the progress report and be sent to the parents of the students. Notifications will also include reminders for the student to do certain exercises or when they have a message from their tutor and etc.

Login

After launching the application for the first time, the student is required to sign up for a profile for the application. From then, any activities done on the phone will be used as the student's registered profile. The most important thing is the username and password, in order to differentiate between numerous numbers of students within the system.

Edit Profile

Student is able to edit their profile, such as their display name, their phone number, email and etc. This information will be kept in the phone's local database and to

be referred by the application when doing transactions over the internet, such as retrieving the student's progress report or when the student is subscribing and unsubscribing to tutors.

View Profile

Student is able to view their own profiles within their Android devices. Profiles include student's name, phone number, email address, grades, and school information. This information will be used later for other activities done in the device itself.

Choose Tutor

Each student will be able to have access to the tutors that they have already subscribed to. For example, Student A has subscribed to Tutor A, B and C. Therefore these tutors will appear in the list of tutors and students will be able to choose which tutor they want to do modules from.

Choose Module

After choosing the tutor, student will be directed to choose which exercise modules that the tutors currently have. For example, Student A has chosen Tutor B. Tutor B has 3 modules, Module 1, Module 2 and Module 3. Students will be able to choose any of these modules. Once chosen, students will be able to have access to notes and exercises within that module.

View Notes & Do Exercises

Notes are retrieved based on the modules that the student has chosen. For example, Student A chose Module 1: Pre-historic Era. Therefore, notes on that module will appear for the students to read and access to. There will also be other media, such as pictures and links to videos, for students to access and view. Another feature is the exercise feature. Students will have access to a number of objectives questions which they can do. Their answers will be evaluated and their results will be recorded and kept in the cloud database for further usage later.

View Progress Chart

The progress chart is made up of all the exercises that the student has done. Chart will be generated based on each tutor and their modules that the student has done. This way, the progress of each student will be determined and the effectiveness of exercises by which tutors prove to be effective can be seen clearly. This helps in students to make decisions whether to unsubscribe or subscribe to certain tutors in the future.

Subscribe & Unsubscribe to Tutors

Each student will have access to the tutors database through he application itself. By being able to access this database, students will be able to subscribe or unsubscribe to the tutors that they want to. For example, if student A does not think that exercises provided by Tutor Z to be beneficial to him, he can simply unsubscribe from Tutor Z and subscribe to any other tutor of his choice and start doing the exercises provided by the newly subscribed tutor. This ensures the function of the application which is to share and help students improve their education through the cloud. Multiple students can subscribe to multiple tutors at one time.

Send message to Tutor

By subscribing to tutors, students will have access to their contact information and is able to contact them through text messaging anytime they want.

Sending notification

Notification will be generated with the progress report and it will be send to the student's parents, in order to make sure the parents of the student is aware of   their children's progress in doing exercises. Notification will also include reminders for when a student has already done certain exercises or when they have not done any exercises and is required to do so. Notifications can also be in form of results for each exercise that the student has done or when they have a message from their tutor and etc.

Detailed explanation on the important features of the application can be seen in table 3.2.2.1 (Prioritized List of Requirements using the MoSCow approach) below.

3.2.2.1 Prioritized List of Requirements using the MoSCow approach

M - MUST have this	-Subscribe to tutors
	-Unsubscribe tutors
	-View subscribed tutor's work modules and do exercise
	-Submit answers
	-Get feedback from tutors
	-See progress
	-Send notification messages to parents
	-Message tutor
S – SHOULD have this	-Receive notification on progress updates
C – COULD have this if it does not give effect on anything else	-GPS enabled learning
W – WONT have time for this but would like to in the future	-QR Code scan

Table 1.3 Prioritized List of Requirements using the MoSCow approach

3.2.3 Quick Design

3.2.3.1 Storyboarding

The design method used in the quick design phase this project is storyboarding. The storyboarding method focuses attention on the people who will use the application. Because stories capture in detail the real-world context in which a new technology will be used, they help determine which functions will be useful, how they should be presented, and what integration with other tools, people and information are important [24].

For this project, the storyboarding is visualized through drawings and screenshots of how the actual prototype will work. The main purpose for this method is to help the developers and users to understand the expected behavior of the system and

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its capabilities. This method of quick design is also helpful in helping users to explore, understand and reason about the behavioral requirements of the system, especially how the users will interact with the system. The storyboard will also be able to show actions the user can take, or requests the user can make on the system and information that is present to, or entered by, the user. This way, it will be most helpful to the developer and the users of the system to see the most important parts and make changes as seen on the story board. It will be able to make the initial development of the project start sooner.

Storyboards are drawn as shown below in Figure 3.2 for the exercise modules, Figure 3.3 for progress reports, and Figure 3.4 for sending messages to tutor.
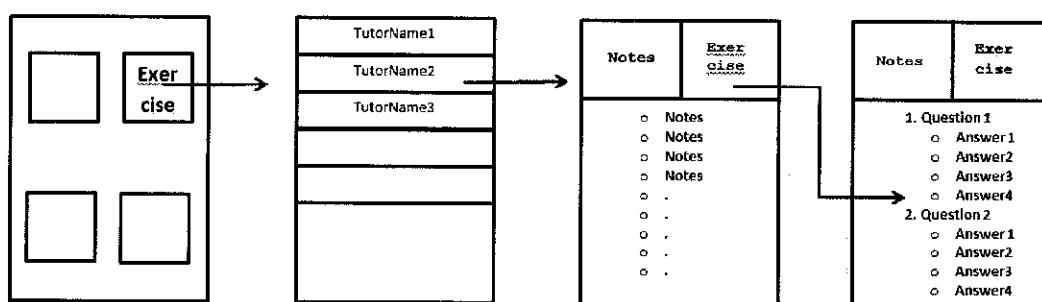
Figure 3.2 Storyboard for Exercise

The application starts from the main menu page. The main menu page has four main icons; profile, exercises, progress and tutor. The Exercise icon is selected for the student to do the exercise. After selecting the exercise icon, the student is then directed to a list of tutors that they have subscribed. From that list, the student selects the tutor of their choice and then will be directed to another page to show a list of modules that the tutor has in their database. After selecting the module of their choice, which is based on the chapters of the subject, the student is then directed to another page with two tabs. The first tab is simplified notes of the chapters and the second tab is the questions.

Figure 3.3 Storyboard for Progress Report

Next icon is the Progress icon. After the student has selected the Progress icon, a list of the tutors that they have subscribed to will be displayed. After selecting any one of the tutors, they will be directed to the chart page. The chart will show them the marks of their latest exercises based on each tutor. This way, they will be able to be able to differentiate which tutor helps them more in term of performance and such.
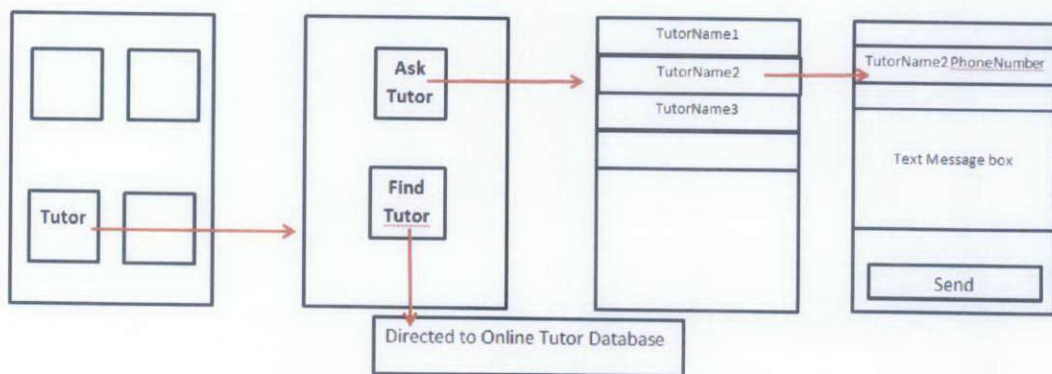
Figure 3.4 Storyboard for Tutor icon

The third most important feature in the application is the Tutor icon. The tutor icon leads the student to another page whereby the student has the option to choose whether to "Ask Tutor" which leads them to a list of tutors that they have subscribed and they can choose which tutor they want to send a message to, in regards of any problems in doing their exercises. The other option is the "Find Tutor" option. This option will

lead them to an online database of tutors, where they will be able to view available tutors in the tutor database and subscribe to any tutor of their choice.

3.3 Project Actions

3.3.1 Project Gantt Chart

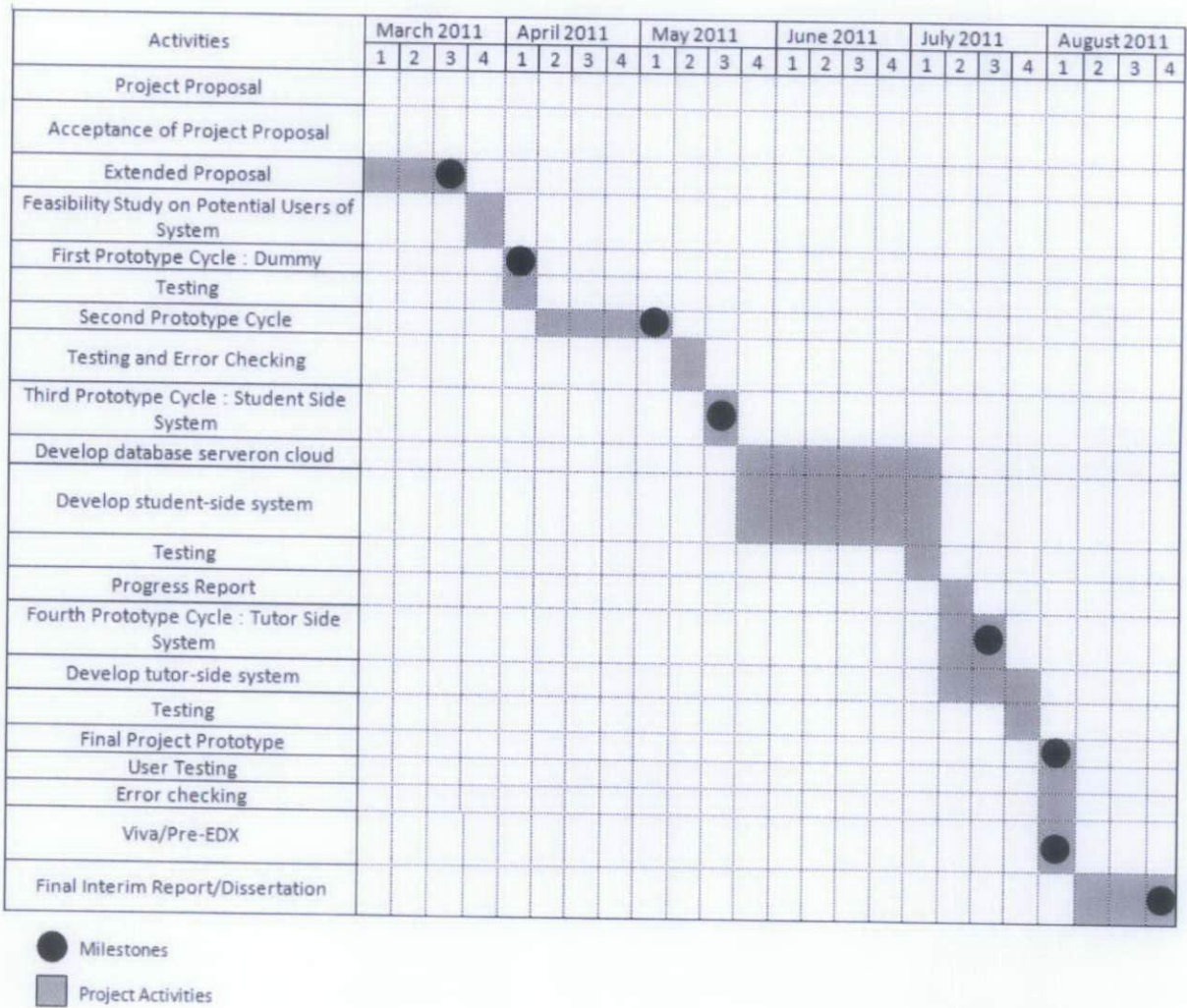| Activities	March 2011				April 2011				May 2011				June 2011				July 2011				August 2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Project Proposal																								
Acceptance of Project Proposal																								
Extended Proposal																								
Feasibility Study on Potential Users of System																								
First Prototype Cycle : Dummy																								
Testing																								
Second Prototype Cycle																								
Testing and Error Checking																								
Third Prototype Cycle : Student Side System																								
Develop database serveron cloud																								
Develop student-side system																								
Testing																								
Progress Report																								
Fourth Prototype Cycle : Tutor Side System																								
Develop tutor-side system																								
Testing																								
Final Project Prototype																								
User Testing																								
Error checking																								
Viva/Pre-EDX																								
Final Interim Report/Dissertation																								

● Milestones

▨ Project Activities

Figure 3.5 Gantt Chart and Milestones

3.3.2 System Framework

The system framework for the Interactive Tutor Home Tuition is made up of five main components; the server on the cloud environment, system database, and the three users; students, tutors and parents. The main backbone of the system is located on the server on the cloud. The tutors will be uploading the materials onto the cloud using their Android devices. Once subscribed to the tutor service, the students would be able to view and do the exercises and materials provided by the tutors on the cloud server through their mobile devices.
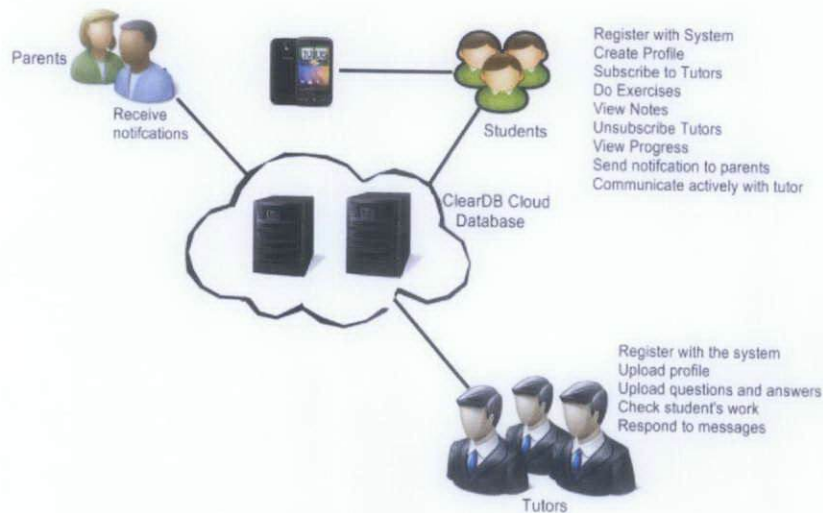

Figure 3.6 System Framework

The main functions that the tutors would be able to do is register with the system, submit tutor profile to the tutor database in order for students to see available tutors, upload materials on the server, receive students answers and post their feedback back to the students. The students will then be able to view which available tutors on the cloud and subscribe to the tutors in order to gain access to their materials and gain access to contact them. Students would be able to do the questions on their Android devices and send the answers back to the tutors. From there, the students can also view the tutors feedback on their Android devices and graphs of their current work progress based on different tutors would be able to be seen. Parents will then be able to receive updates of their child's progress through their mobile devices too, through SMS or MMS.

3.3.4 Class Diagram

The class diagram below shows the initial database structure of the Interactive Tutor Home Tuition. There are five main tables in the database structure. The Student database handles all information about the student and the functions that the students are able to do with the application, such as subscribing to tutors, get tutor modules, view their own progress and etc. Each student is uniquely identified by their studentID that will be set after their one-time registration before having access to the application. The student table is connected to two other tables, the Progress table and the Answer table. The progress table keeps each students work progress and the answer table keeps track of the student's answers for each modules that the student is subscribed to.
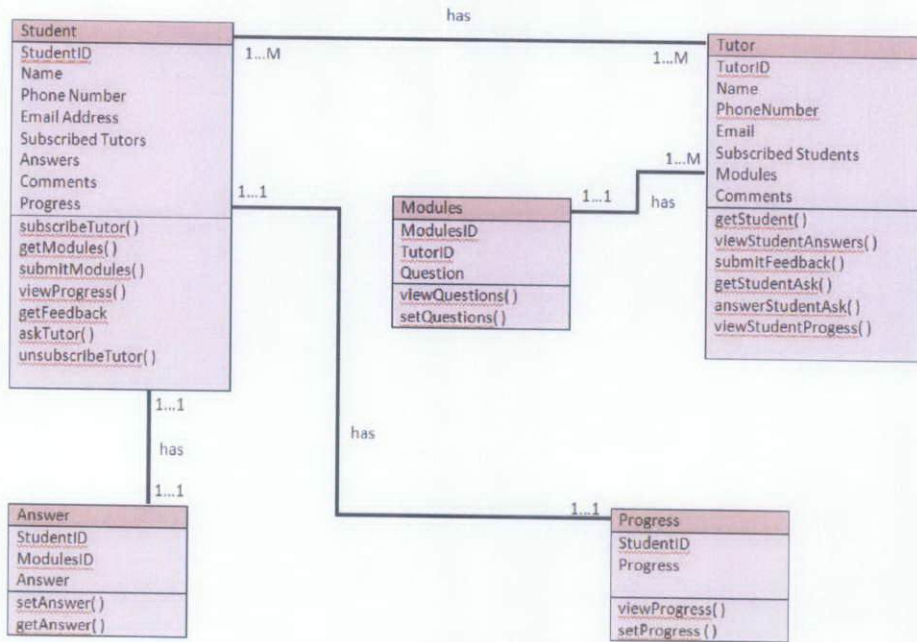

Figure 3.7 Class Diagram

The Tutor table also functions the same as the student table, keeping the necessary information about each tutor and the function that each tutor would be able to do, for example, get access to subscribed student's answers and give feedback on their progress. Each tutor is differentiated by their tutorID. Each tutor's ID will also be connected to the modules table, where their materials will be kept for the students to access.
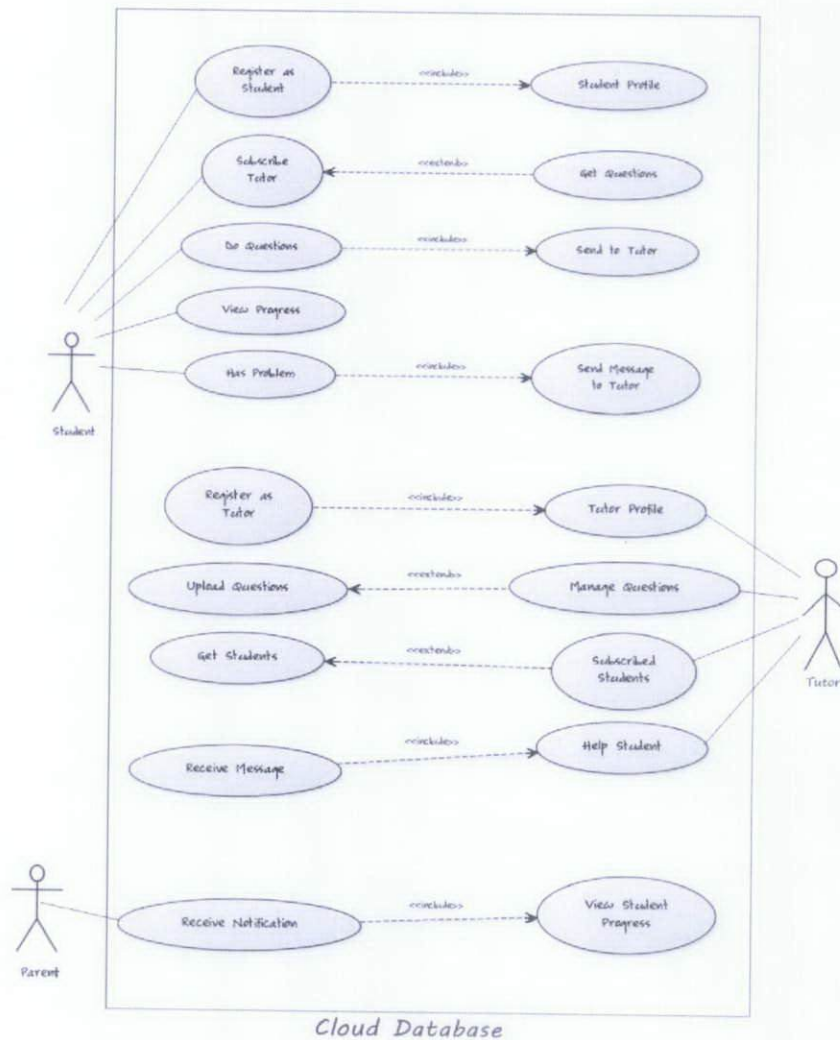
3.3.5 Use Case Diagram

Figure 3.8 Use Case Diagram

The use case diagram in Figure 13 above shows the relationship among actors and use cases within the cloud database. There are three main actors in the application, which is the student, the tutors and the parents. The use cases are as such above. For example, the students subscribe to a tutor, they will immediately get access to the tutor's materials and when the parents of the child receive notification, it means they will be able to see their child's current progress in doing the exercises on the application.

3.4 Prototype Cycles

3.4.1 Build

The application is made up of two sides, one for the students, and another for the tutor. The student side of the application is developed as the Android mobile application, while the Tutor side of the application is web-based. Mobile application for the Tutor side will be developed if the current milestones are finished earlier than the planned time. More focus will be directed to building the Student side Android application as it takes the most time to integrate with various parts, such as the cloud database, charting software and the Android messaging system for the progress reports.

As the project methodology used is the RAD, the development of the application will be done in cycles. Cycles were done in a parallel fashion whenever possible, due to time constraint. In estimate, it will be done in four cycles. In the first cycle, it is most important to be able to create the cloud database and populate it. Next process in the first cycle is to extract the data from the cloud database into the Android application.

The student side is made up of four sections. The most important section is the questions part. In this part, students will be able to already be able to view the questions from the database and answer them correctly. Results from their exercises will be kept and displayed in a graph format. This is one of the most hardest and important part as it requires integration with the cloud database in order to do checking for the questions.

In the third cycle, the progress of each exercise will be displayed in a graph format. After displaying, it is most important to have a mechanism, such as cron job, to automatically check the progress of student and send a notification text message to the student's parents to inform them of their child's progress with the exercises. Notifications will also include notifying the students which exercise modules they have done or not done yet.

Lastly in the fourth cycle, the profile page of the students is set up and the message board for communication between student and tutor is set up. The communication is basically using normal text message, or online messaging.

3.4.1.1 Student Side

Tools for building the Android application for the Student side is the Helios Eclipse Software Development Kit (SDK) 3.6.1 version installed with the Android SDK. The Android SDK is crucial during the building and testing of the application it makes the codes compatible to run within the Android environment. Hardware used for testing will be an Android smartphone, the HTC Desire.

Connecting to the ClearDB cloud database

For this application, the cloud database used is a database hosted on ClearDB.com cloud, which can be accessed manually from http://www.cleardb.com/. Unlike normal databases, the cloud database has their own Java API client, in order to connect the Android application to the cloud database. This makes the development of the application with cloud environment easier as both entities are compatible with the Java language. In order to connect the ClearDB to the Android device using the Java API Client, it is most important to have the API key of your database and to have the knowledge of extracting JSON format data into data that can be manipulated into the Android.

The code snippet in the next page describes how to connect to the Android device using the cleardb Java API Client. As illustrated in Figure 3.9 next page, the first step is to import the necessary packages form the ClearDB java client into the Android. These statements will be used to connect the the Android device with the ClearDB database.

```
import com.cleardb.app.ClearDBQueryException;
import com.cleardb.app.Client;
import org.json.JSONObject;
import org.json.JSONArray;
```

Figure 3.9 Importing cleardb APIs into the Android package

Next step is to assign the API key and App ID to the device. The API key and App ID will be generated by the ClearDB database after the user finish building the database. After assigning the API key and App ID, it is important to initialize the client. The code used to initialize client between device and database is as illustrated in Figure 3.10.

```
/** Called when the activity is first created. */
final String APP_ID = "b64f410fe168a2a829ff28186972e37a";
final String API_KEY = "2e394e905cd9585a50e46901d4c27a3113de351b";
com.cleardb.app.Client cleardbClient = new com.cleardb.app.Client(API_KEY, APP_ID);
```

Figure 3.10 Initializing database client and device

After initializing connection between the cloud database and Android device, the next step is to extract the data from the cloud database itself. The ClearDB database is naturally a SQL database; therefore the usual query can be fired in order to capture data from the database. Data from an online database is usually in JSON format; therefore it is essential to have the JSON packages imported beforehand, as shown in Figure 14. In order to extract and change the JSON data, this coding is used. (Figure 16) First of all ,the query String in figure 3.11 is executed and the data will be returned in a JSON Object format. From there, the data is transformed to an array or rows and columns. After that, each row is extracted accordingly. For example in the coding snippet below, the StudentTutor column, which is the column name for the tutors that the students have subscribed to, is being extracted according to which Tutor that student 'Asma' is currently subscribing. The result will then be displayed in a list, as illustrated in Figure 3.11.

```
private List<String> makeQuery(String query){

    List<String> tList= new ArrayList<String>();

    JSONObject queryLoad;
    try {
        queryLoad = cleardbClient.query(query);
        for (int i = 0; i < queryLoad.length(); i++){
            String a = queryLoad.toString(i);
            JSONObject JSONa = new JSONObject(a);
            JSONArray rArray = JSONa.getJSONArray("response");
            String b = rArray.getJSONObject(i).getString("StudentTutor").toString();
            tList.add(b);
        }
}
```

Figure 3.11 Extracting JSON data into Android
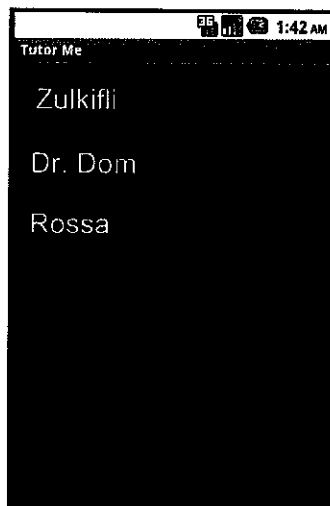
Figure 3.12 List of Tutors student Asma is
currently subscribing

Displaying the Chart

In the progress report part of the student side, the progress is shown in a graph format. For this chart, the tool used is the AChartEngine tool. It is an Android based charting tool which enables users to map their own graphs and charts within Android. The coding for the chart currently is in progress, but the outcome will be displayed to be like in Figure18. This is only a model of what the chart is supposed to look like, as the coding and development of the chart is still in progress.
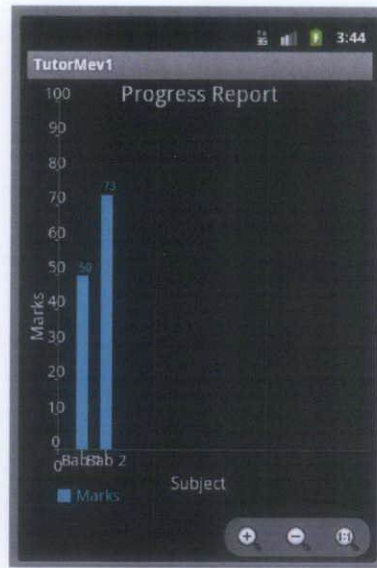
Figure 3.13 Model of the progress chart

3.4.1.2 Tutor Side

Tools for building the Tutor side of the application will be Adobe Dreamweaver and a web hosting service on the Internet. The tutor side will be developed in HTML, CSS, Javascript and PHP as it is a web based application. The Tutor side of the application also needs to be connected to the cloud database, for it to communicate with the Student side. Aside from being compatible with Java, the cloud database also has an API client for PHP, which makes it compatible to connect any website hosted on the Internet to connect with the ClearDB database. Figure 3.14 in the next page shows how to connect to the ClearDB database using the PHP API client. Like the Android device, it is also important to have the API key and App ID in order to connect to the ClearDB database.

```php
<?php

// Set your own API Key here.
define('CDB_API_KEY', '468063b1a15979b30300d2c54079669218874f7d');

// Set your own App ID here.
define('CDB_APP_ID', '029ee231519ffc5b5d15cd4f5ee30cdf');

// Include the ClearDB PHP API Client for Apps into our code.
require_once('cleardb_app_client.php');

// Create a new instance of the ClearDB class.
$cleardb = new ClearDB_App_Client();

// Retrieve an object array as results from ClearDB.
$users = $cleardb->query("SELECT * FROM user WHERE username = 'Frank'");
?>
```

Figure 3.14 Connecting to the ClearDB database using the PHP API Client

3.4.2 Demonstrate

Demonstration of each cycle will be done on the HTC Desire Android phone in front of the supervisor of the project.

3.4.3 Refine

After demonstrating each cycle to the supervisor, modifications will be made as required and instructed by supervisor.

CHAPTER 4.0

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RESULTS AND DISCUSSION

4.1 Data Gathering/ Data Analysis

Data gathering and analysis for the system was done through usability testing. Usability testing is the empirical study of a product's usability by observing users do real tasks on with the product. This usability testing process involves real users, real tasks, specific usability goals and concerns, observation and data analysis.

Users are defined to be high school to university students that range from the age of 16 to 24 with the education level up to high school at least. Currently 5 respondents are involved in the applications usability testing. Both genders are considered, male and female. Most of the respondents come from the suburban area whereby they are used to the high level of technology around them. Their experience level with mobile devices and products of the same genre are within moderate to high. The testing is done in their normal everyday environment while they went with their normal everyday routine.

All of the respondents are given a list of real tasks to do on the real application and their feedback after using the system is recorded in the questionnaire provided during the testing session. Time for each task to be done is also recorded for each of the task given.

4.1.1 List of real tasks and description

- Fill out user profile

  Students are required to fill up the user profile for the first time and save the information.

- Change user profile

  Students are required to edit their student profile on the application.

- Do a set of exercises

  Students are required to choose a tutor, select preferred module and finish a set of exercises.

- View progress

  Students are required to view their progress chart after they are done with the exercise

- Sending message to tutor

  Students use the "Ask Tutor" function and send a message to the tutor in regards of the tutorial that he/she has done

- Subscribe to tutor

  Students are required to visit the Tutor Me online database and browse through the tutors available and make a subscription.

4.1.2 Analysis of usability testing results

4.1.2.1 Time required doing each tasks

Table 2.1 Time on Tasks Table

Time (seconds)	Fill out user profile	Change user profile	Do a set of questions	View progress report	Send message to tutor	Subscribe to Tutor
User 1	90	85	655	30	183	252
User 2	80	78	804	35	175	200
User 3	85	83	765	32	160	235
User 4	87	85	810	28	173	246
User 5	94	90	630	35	172	190

Table 4.1 above shows the time needed by each user when doing specific tasks. From the observation we can conclude that the time difference between each user in doing the same specific tasks does not differ, which means there is a consistency in each person's way of using the application. Without much instruction, the respondents are able to use the application without much supervision from the developer.

4.1.2.2 Usability Questionnaire

The usability questionnaire is made up of seven questions. Each of the questions is aimed to discuss the graphics, interface and navigation aspects of the application. From the result we can gather that the respondents does not have any hardships in using any features of the application.

Most of the respondents also commented on the ease-of-use of the system due to the simplified icons and less text for them to read. In terms of fonts and backgrounds, some of the respondents commented that the font should be a little more formal and to change the black background as it makes the application rather unattractive.

In terms of content, they find the notes part of the application very boring as it is all text. Some also commented that it is unnecessary to fill in personal information for the student profile. Most of the respondents agree that most people won't have a problem in using the system as the interface is very user friendly, straightforward and simple, but it may pose a problem for people who are not used to learning using mobile devices.

4.1.2.3 Usability Rating Scale

1. I think that I would like to use this system frequently.

   Analysis : More than 75% of the respondents wants to use the system after testing it. This means that the system has potential to be exposed to a wider market of students.
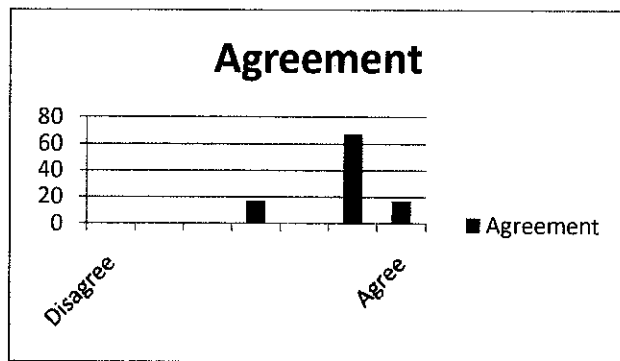
2. I found this system unnecessarily complex.

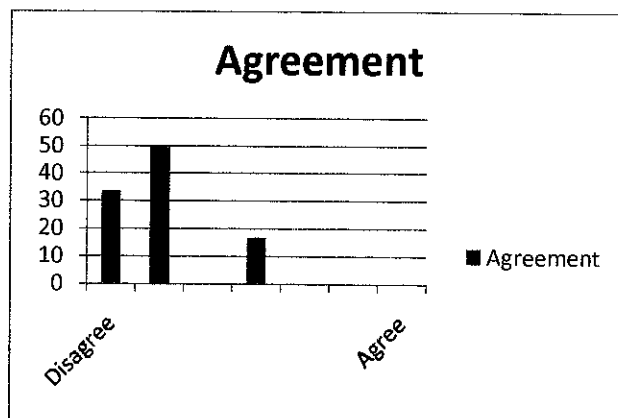   **Analysis :** More than 75% of the respondents feels that the system is moderately simple.
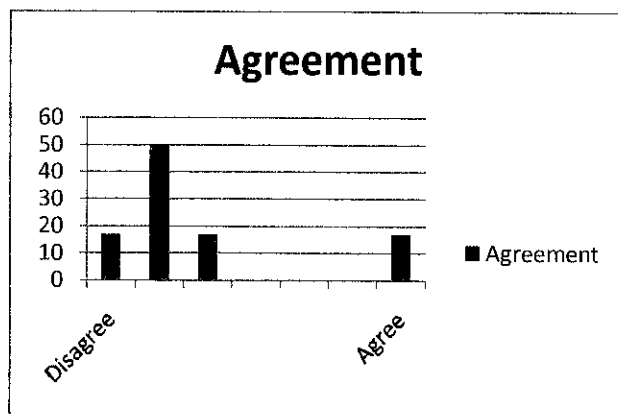
3. I thought this system was easy to use

   Analysis: Most of the respondents agree that the system is easy to use.

   Agreement
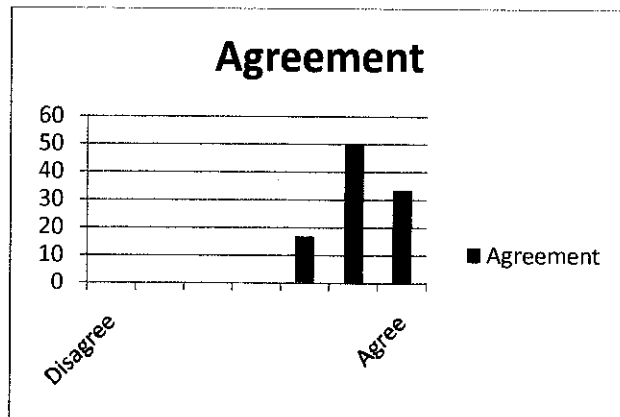
4. I think that I would need assistance to be able to use this system

   Analysis: More than 75% of the respondents is able to use the system without the need of guidance from the facilitators.
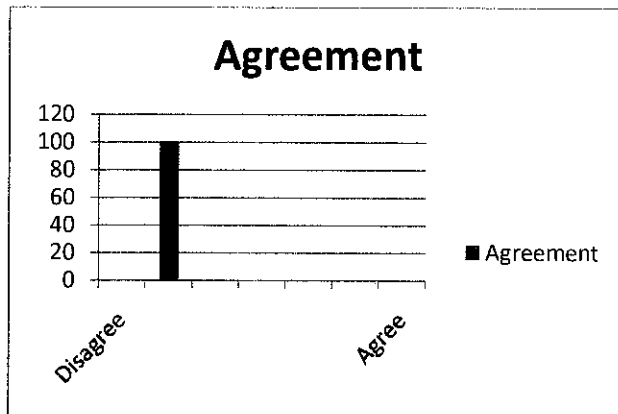
   Agreement

5. I found the various functions in this system were well integrated.

   Analysis: Nearly all of the respondents agree that the system is well integrated and well built to use.
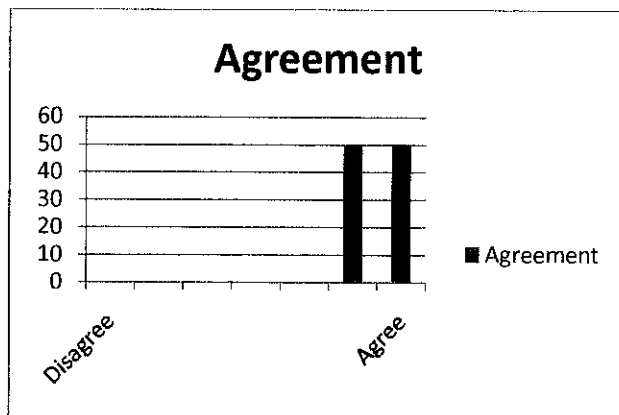
   Agreement
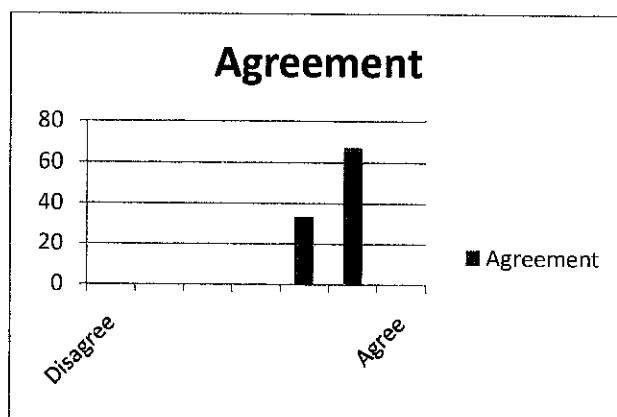
6. I thought there was too much inconsistency in this system.

   Analysis: All of the respondents agree that the system is very consistent in its operations and functions.
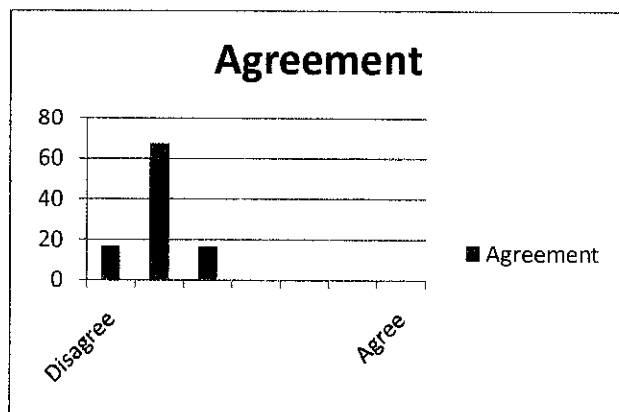

7. I would imagine that most people would learn to use this system very quickly.

   Analysis: Nearly all of the respondents felt that it is easy to learn how the system works.
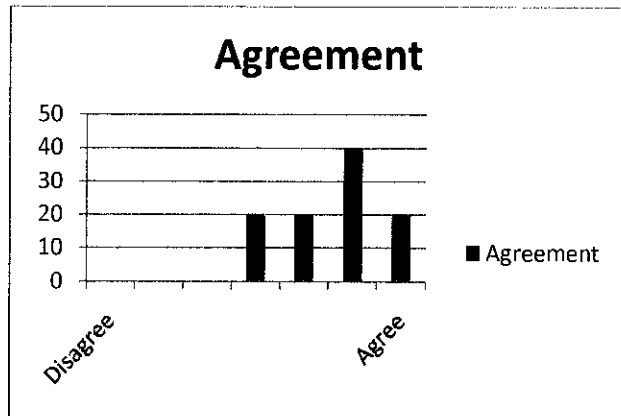

8. I found this system very cumbersome/awkward to use.

   Analysis: Most of the respondents find it very comfortable to use the system.
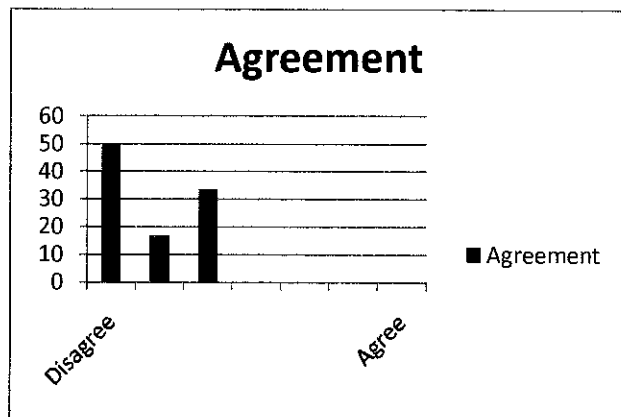
9. I felt very confident using this system.

Analysis: Most of the respondents is confident in using the system and its functions.

10. I needed to learn a lot of things before I could get going with this system.

Analysis: Most of the respondents find it easy to start using the application without the need of many instructions.

4.2 Modeling/Prototype

A prototype is the early model built in the development of the application in order to represent the concept of the system during the development stages. The prototype of the Interactive Tutor Home Tuition is build to represent the four main functions of the system; Student Profile, Exercise Module, Progress Report and Sending SMS to the tutor. The function of sending notification to parents is also implemented, but the coding is done background and no specific visual output can be seen within the application itself, therefore it will not be shown in the prototype here.

The prototype focuses more on user-experience and in order to fully capture the user's needs and preferences according to the survey done earlier in the research. As the target users and respondents are mostly between the ages of 16 to 24, the system is designed to suit their tasted. The prototype is made with a simple interface with the use of familiar icons in order to make it easy for the users to navigate their way through the application. The text sizes are also made big enough in order to ensure the user's comfort in using the application. As the prototype is programmed using Android, it can only be deployed with Android supported phones.

Figures 4.1, 4.2, 4.3, 4.4 in the next pages show the prototype and walkthrough of the application for the Exercise Module.
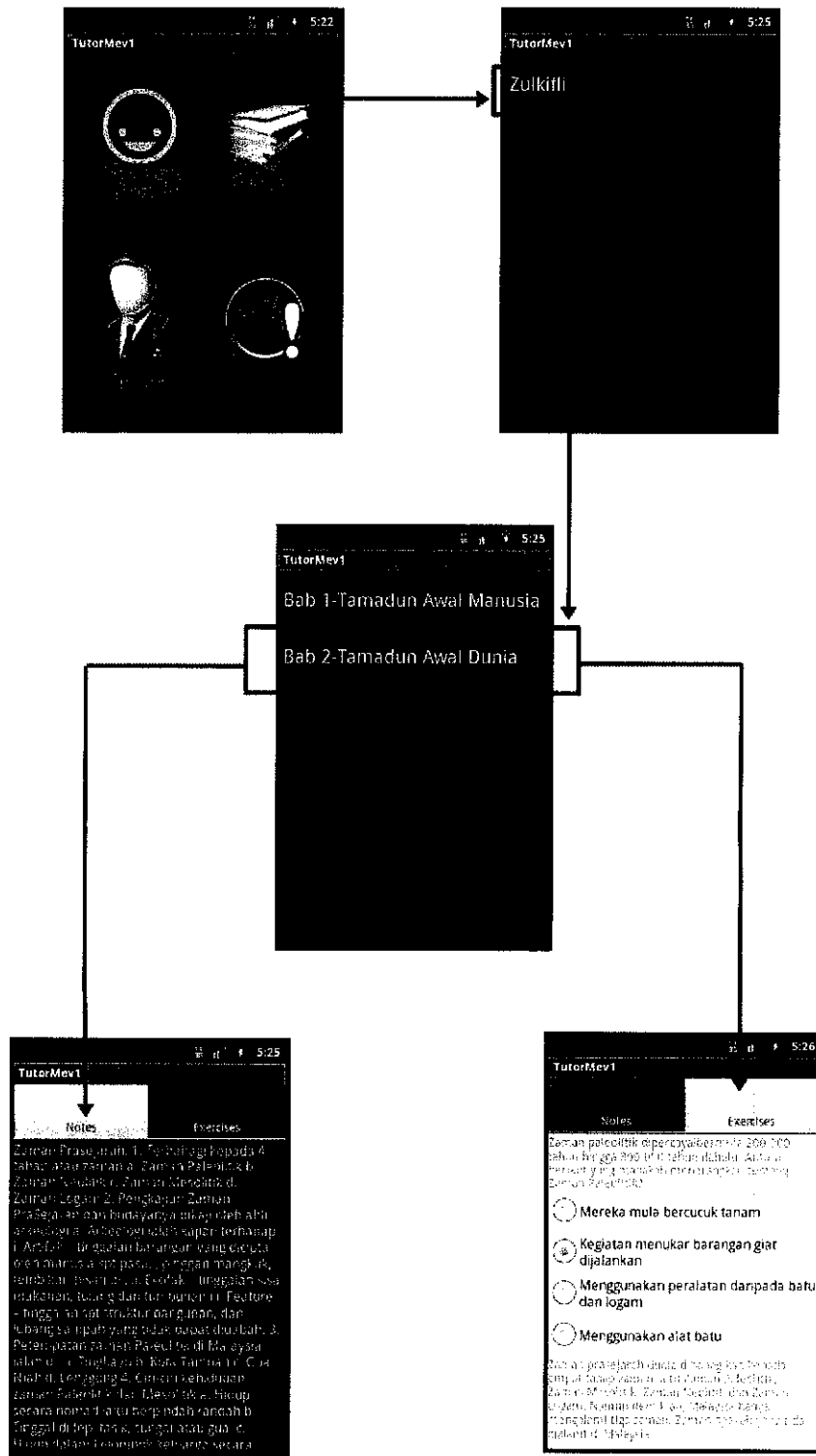
Figure 4.1 Prototype Screenshot for the Exercise Module

The application starts from the main menu page. The main menu page has four main icons; profile, exercises, progress and tutor. The Exercise icon is selected for the student to do the exercise. After selecting the exercise icon, the student is then directed to a list of tutors that they have subscribed. From that list, the student selects the tutor of their choice and then will be directed to another page to show a list of modules that the tutor has in their database. After selecting the module of their choice, which is based on the chapters of the subject, the student is then directed to another page with two tabs. The first tab is simplified notes of the chapters and the second tab is the questions

Figure 4.2 below shows the prototype and walkthrough of the application for the Progress Report.
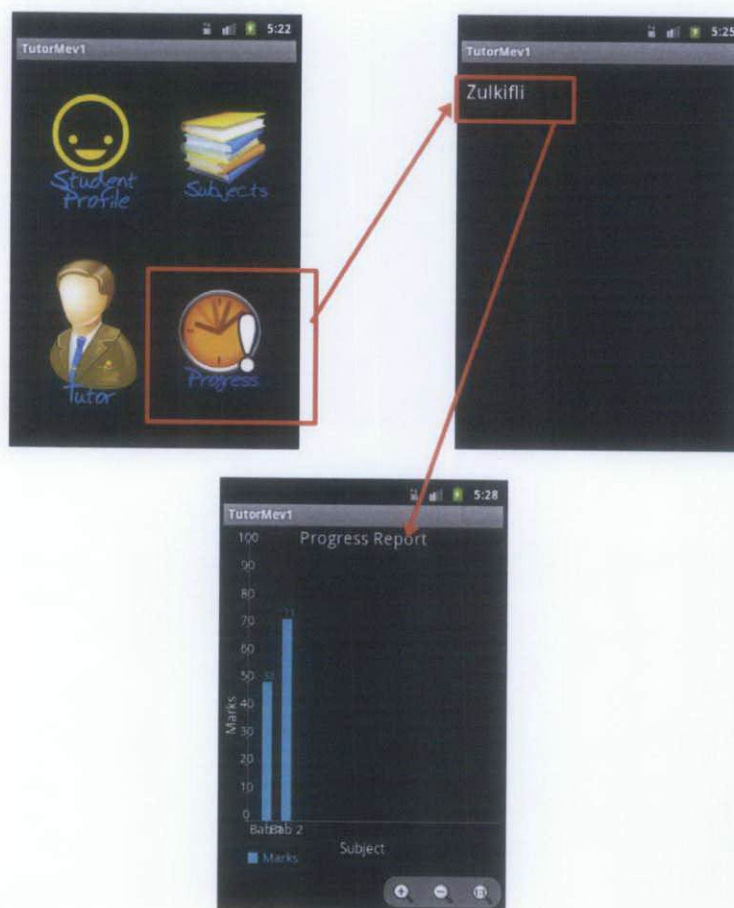

Figure 3 Prototype Screenshot for the Progress Report

After the student has selected the Progress icon, a list of the tutors that they have subscribed to will be displayed. After selecting any one of the tutors, they will be directed to the chart page. The chart will show them the marks of their latest exercises based on each tutor. This way, they will be able to be able to differentiate which tutor helps them more in term of performance and such. The marks are shown in a bar chart in order to make it easy for users to view their current performance. For example, they'll be able to see whether they're improving or not by the behavior of the graph. If the graph is getting higher in every module, it means that the student is doing good with the current tutor's exercise materials. If not, the student will probably want to unsubscribe to that tutor and try to search for another tutor instead from the tutor's database.

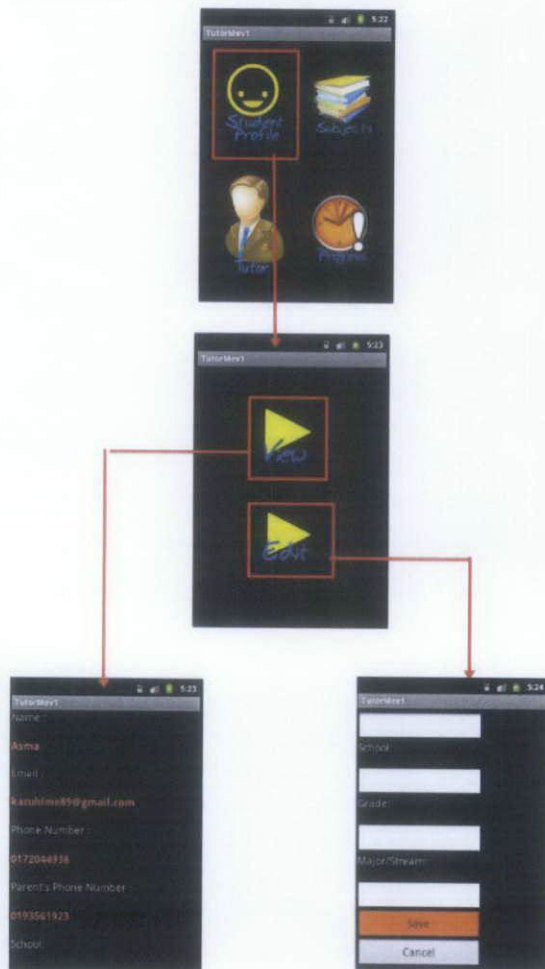Figure 4.3 in the next page shows the prototype and walkthrough of the application for the Profile.

Figure 4.3 Prototype Screenshot for Profile

The Profile page is very simple. Once selecting the Student Profile option on the main menu, the user is directed to another page where they can choose whether to View their profile or to Edit their profile. If the user chooses to view, they will be shown their details as shown in the third panel of Figure 22. If the user chooses to edit their profile, they will be directed to another form where they can just fill in the changes that they want. Figure 23 below shows the prototype and walkthrough of the application for Sending Message to Tutor part.
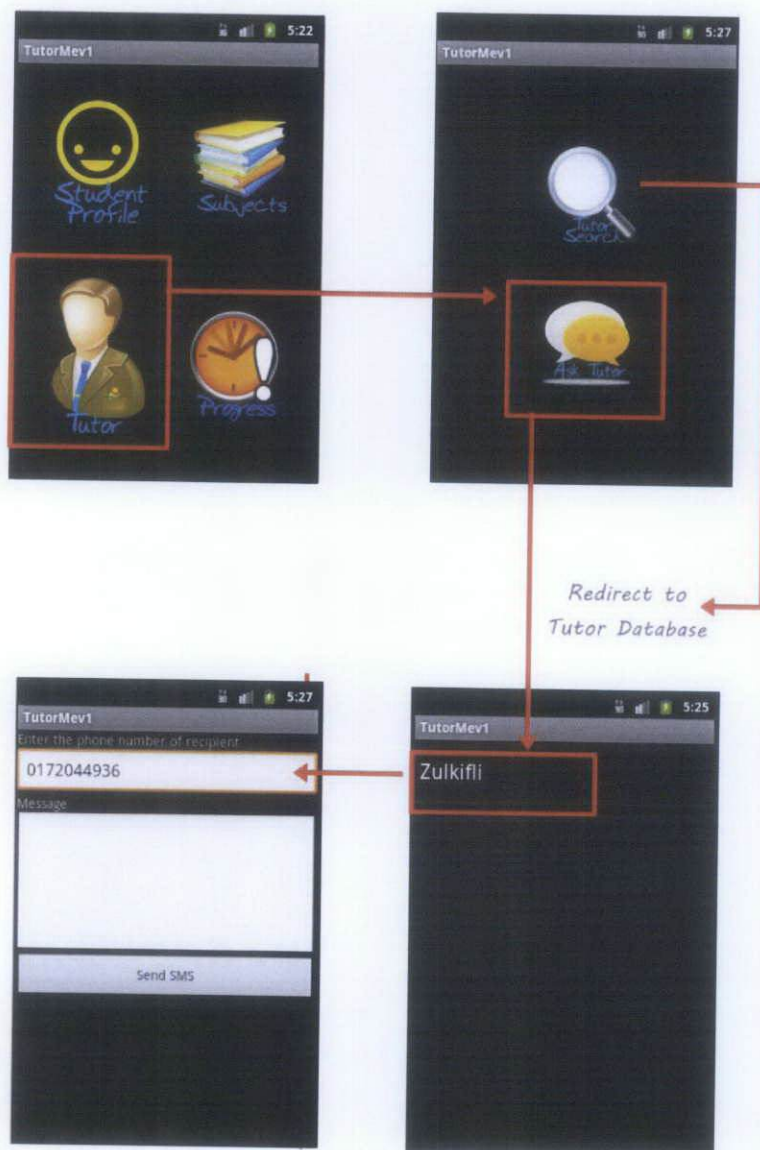

Figure 4.4 Prototype Screenshot for the Send Message to Tutor Function

The tutor icon leads the student to another page whereby the student has the option to choose whether to "Ask Tutor" which leads them to a list of tutors that they have subscribed and they can choose which tutor they want to send a message to, in regards of any problems in doing their exercises. The other option is the "Find Tutor" option. This option will lead them to an online database of tutors, where they will be able to view available tutors in the tutor database and subscribe to any tutor of their choice.

4.3 Discussions

4.3.1 Limitations

Small screen, small keyboard and input method

Due to the small screen of most Android phones, it might pose a problem certain users who has problems in viewing small fonts. The keyboard for the Android is a bit small and the letter are set very near to each other, making it difficult for users to type in whatever they needed in order to use the application, for example, when trying to change their profile, the user might have typed in their name wrongly and that could have brought to the possibility of a mistake. The small keyboard and input method may not also be too user friendly to those people with big hands.

Interface is too simple

The interface is done with a black background and basic fonts in white as the writing. Basically as people are doing serious revision or work, which is quite tedious work, they would prefer to have a more interesting interface rather than a too simple one. Significantly, white font on black background makes for easy readability, but the it makes the application looks rather demotivating, rather than motivating.

Use of Internet fully to use the application

Most of the application available on the Android Market usually does not require a constant internet connection. Constant internet connection means that the user's will

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have to pay to use and view materials from the application every time they need to do an exercise. It is inconvenient as it makes the user pay to use the system, even though the amount needed is not much.

Only compatible with Android phones

One of the major drawbacks of the system is that it is only available in one type on mobile operating system, which is Android. The application will not be able to run with other types of smart phones, such as the iPhone or Windows Mobile based phones.

Only one way communication with parents

The application promotes a collaborative environment between students, tutors and parents, but there is only a one way communication between parents and tutors, whereby the parents will get update from the database on the child's study progress based on the tutor's evaluation.

4.4 Recommendations

For future work expansion and continuation, this project will continue to perform research on the relationship between mobile learning and student's performance in studying. Further improvement will also be done to the system in order to fully achieve the research objective. This is aimed to truly emphasize the effectiveness of implementing mobile learning in the future for education. The current system is focusing on implementing a collaborative environment between the student, tutor and parents within the cloud environment. With the proper mobile system and user experience analysis to help these students study using their mobile devices and proper procedures, the potential of the system is able to be deduced. The result from the mobile system and user experience analysis can identify the effectiveness of mobile learning in the future and to be incorporated in the education system.

CHAPTER 5.0

CONCLUSION

In conclusion, the main scope of study for this project is to help students and tutors to have a more interactive learning platform using the smart phone in learning. The interactive home tutor is a new innovation in mobile learning. It is able to help student study while being on the go and is interactive in a way that students are able to interact with tutors when having problems with their studies rather than wait for school hours or during their tuition sessions. The application also helps parents in keeping track of their children's progress in their studies. Parents are able to keep up to date with their children's studies through progress reports and short message service (SMS).

This application also solves the problem of students not utilizing their time enough. Instead of just using their mobile phones for games and social networking, there are also able to study and improve their studies through this application. The interaction between the students and the tutor is also helpful for the student. As studies shown, one-on-one tutor-student relationship is much more beneficial for the student as the tutor would be able to concentrate on one student at a time and focus on their strength and weaknesses, instead of studying in a larger working group where the ratio of tutor to students is 1:10 when studying in tuition centers. This application also helps to promote the three way relationship between students, teachers and parents.

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APPENDIX

Appendix A – Survey Questionnaires for Students and Parents

Survey on the Use of Mobile Phones for Learning for High School Kids

The objective of this questionnaire is to conduct a feasibility study for the Interactive Home Tutor project. The feedbacks from students are important as the application is built with their needs in mind. This application uses a mobile phone as a platform for students and tutors to interact and help the student to study well together. Parents will be able to keep up to date with the progress of their child through SMS and such.

1. Are both of your parents working?
   - o Yes
   - o No

2. What form are you in now?
   - o Form 3, age 15-16
   - o Form 4, age 16-17
   - o Form 5, age 17-18

3. How do you study outside school hours?
   - o Go to tuition centers
   - o Private home tuition
   - o Self study/ group study
   - o Others. Please state :_____

4. What subjects do you find the hardest?

   _____

5. What subjects do you find the easiest?

   _____

6. Do you have a mobile phone?
   - o Yes, proceed

o No, please go to the end of this questionnaire

7. What type is it? Please state.

_____

8. Do you go online on your mobile phone?

   o Yes

   o No

9. How often do you use your mobile phone?

   o Hardly

   o Moderate

   o Always

10. What activities do you do with your mobile phone? (multiple answers)

    o Phone calls and SMS

    o Internet, social networking (Facebook, Twitter)

    o Downloading stuff

    o Googling

    o Learning

    o Others : _____

11. Would you consider doing revision questions on your mobile phone? If such system exists?

    o Yes

    o No

12. What subjects would you think suitable for you to do on your mobile phone? Please   state:

_____

13. What format of questions do you prefer to do on your mobile phones?

    o Objective

    o Subjective

    o Both

14. What do you think of an application that provides resources you to study anytime and anywhere, using your mobile phone?

    o I'd love it

- o It's okay

- o No, I don't like it

Question 15 and 16 is only for students who has private tutor, if you don't have a private tutor, please ignore this question

15. Do you have problem interacting with your tutor?

- o Yes

- o No

16. If you do, please state.

_____

Survey on the Use of Mobile Phones for Learning for Parents

The objective of this questionnaire is to conduct a feasibility study for the Interactive Home Tutor project. The feedbacks from parents are important as parents nowadays are actively involved in their student's studies. This application uses a mobile phone as a platform for students and tutors to interact and help the student to study well together. Parents will be able to keep up to date with the progress of their children through SMS and such.

1. Are both of you (mother and father) working?
   - o Yes
   - o No

2. How much is your monthly income?
   - o >RM20,000
   - o >RM10,000
   - o >RM5000
   - o <RM5000

3. Level of education?
   - o PhD
   - o Masters
   - o Degree/Diploma
   - o SPM

4. How many children currently studying in secondary school do you have?
   Please state: _____

5. Do you send them to tuition centers or have private tutors at home for them?
   - o Tuition center *, proceed to question 4*
   - o Private tutor *, proceed to question 4*
   - o Online tuition, eg. ScoreA, A-Tutor

o None, *please proceed to the end of the questionnaire*

6. Would you prefer to have a mobile version of the online tuition, whereby the students can do their studies on their mobile phones?
   o Yes
   o No

7. Are you up to date with their performance during tuition? Does the online tuition provide you a system to check your child's progress? Or do you just check from their exam performance?
   o Yes, I am given updates on my child's progress during tuition
   o Exam performance
   o Not up to date

8. Would you want to receive notifications?
   o Yes
   o No

9. If you do, how do you prefer to get the notifications?
   o Face to face conversation
   o Email
   o Weekly SMS
   o Phone conversation

10. Do you think parent-tutor interaction is important?
   o Yes
   o No

Appendix B – Usability Questionnaire

What You Think About This Program

(Please note, any information you provide is for internal use only.)

Usability Feedback

1. What features of the simulation program were vague or confusing to you, if any?

   _____

   _____

2. What is your impression about navigating the system? Does it seem easy or difficult? What makes it that way?

   _____

   _____

3. What else should be included on the simulation program?

   _____

   _____

4. What did you like best about the program?

   _____

   _____

5. What did you like the least?

   _____

   _____

6. Do you think some people would have problems using the simulation program? What kinds of people? What kinds of problems?

   _____

   _____

7. Would you like to make any other comments about the program?

Appendix C – Usability Rating Scale

Gender: _____   Profession: _____   Date: ___ / ___ / ___

System Usability Scale

Instructions: For each of the following statements, mark <u>one</u> box that best describes your reactions to the program *today*.

		Strongly Disagree				Strongly Agree
1.	I think that I would like to use this system frequently.	☐	☐	☐	☐	☐
2.	I found this system unnecessarily complex.	■	■	■	■	■
3.	I thought this system was easy to use.	☐	☐	☐	☐	☐
4.	I think that I would need assistance to be able to use this system.	■	■	■	■	■
5.	I found the various functions in this system were well integrated.	☐	☐	☐	☐	☐
6.	I thought there was too much inconsistency in this system.	■	■	■	■	■
7.	I would imagine that most people would learn to use this system very quickly.	☐	☐	☐	☐	☐
8.	I found this system very cumbersome/awkward to use.	■	■	■	■	■
9.	I felt very confident using this system.	☐	☐	☐	☐	☐
10.	I needed to learn a lot of things before I could get going with this system.	■	■	■	■	■

Please provide any comments about this system: