

**Learning Data Communication and Networking using Interactive Mobile  
Application**

By

Muhammad Hanis bin Roslan Affandi

Dissertation submitted in partial fulfillment of  
the requirements for the  
Bachelor of Technology (Hons)  
(Information and Communication Technology)

SEPTEMBER 2013

Universiti Teknologi PETRONAS  
Bandar Seri Iskandar  
31750 Tronoh  
Perak Darul Ridzuan

## **CERTIFICATION OF APPROVAL**

### **Learning Data Communication and Networking using Interactive Mobile Application**

By

Muhammad Hanis bin Roslan Affandi

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

Approved by,

---

(Nazleeni Samiha bt Haron)

UNIVERSITI TEKNOLOGI PETRONAS  
TRONOH, PERAK  
September 2013

## **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.

---

MUHAMMAD HANIS BIN ROSLAN AFFANDI

## TABLE OF CONTENTS

ABSTRACT.....	5
CERTIFICATION OF ORIGINALITY .....	2
LIST OF TABLES .....	6
ABBREVIATIONS AND NOMENCLATURES .....	6
ABSTRACT.....	7
ACKNOWLEDGEMENT .....	8
CHAPTER 1: INTRODUCTION .....	9
1.1 Background of Study .....	9
1.2 Objectives .....	10
1.3 Scope of study.....	10
1.4 Problem statement.....	10
1.4.1 Current implementation of learning DCN.....	10
1.4.2 Lacking of mobile apps in teaching DCN.....	11
1.5 Project Feasibilities .....	11
1.5.1 Technical feasibility .....	11
1.5.2 Economic feasibility .....	11
1.5.3 Operational feasibility.....	12
1.5.4. Schedule feasibility .....	12
CHAPTER 2: LITERATURE REVIEW .....	13
2.1 Mobile Learning Theory .....	13
2.1.1 Mobile Learning definition .....	13
2.1.2 Learning Theory for M-Learning (Constructive Theory) .....	13
2.2 Approaches in learning network .....	14
2.2.1 Benefits of Mobile Learning .....	17
2.3 Android (Operating System).....	17
2.3.1 What is Android? .....	17
2.3.2 Why Android?.....	18
2.3.3 Comparison on applications in Google Play Store .....	19

CHAPTER 3: RESEARCH METHODOLOGY .....	20
3.1 Research Methodology .....	20
3.2 Proposed Application Development Methodology .....	20
3.2.1 Requirement planning and analysis .....	21
3.2.2 Designing the interface .....	21
3.2.3 Functionality testing.....	21
3.2.4 Release of application .....	21
3.3 Tools used to develop application.....	22
3.4 Key Milestone .....	22
CHAPTER 4: RESULTS AND DISCUSSION .....	24
4.1 Literature Review Findings.....	24
4.2 Survey findings and discussions .....	24
4.3 Product prototype.....	30
4.3.1 Glossary .....	31
4.3.2 Tutorial.....	32
4.3.3 Simulation.....	32
4.3.4 Quiz.....	32
4.4 Early stage of development.....	32
4.5 Final Application .....	36
4.6 Breakdown of the application function.....	42
4.6.1 Tutorial.....	42
4.6.2 Quiz.....	42
4.6.3 Glossary .....	45
4.6.4 Simulation.....	46
4.7 Functionality Testing .....	49
CHAPTER 5: CONCLUSION AND RECOMMENDATION.....	51
References.....	52

## LIST OF FIGURES

Figure 2.1 Minimal personal computer network .....	15
Figure 2.2 Effectiveness assessment components for a small class in 2003 .....	15
Figure 2.3 Students' interests before and after taken the course .....	16
Figure 2.4 Percentage of Mobile Phone OS by March 2013 .....	19
Figure 5: Intended home page .....	32
Figure 6: Tutorial button navigation .....	33
Figure 7: Simulation button navigation .....	34
Figure 8: Quiz button navigation .....	34
Figure 9: Glossary button navigation .....	35
Figure 10: Flow of tutorial function .....	37
Figure 11: Flow of Quiz function .....	38
Figure 12: Flow of Glossary function .....	40
Figure 13: Flow of Simulation function .....	41
Figure 14: Feedback in toast .....	43
Figure 15: Score page for Quiz .....	44
Figure 16: Screenshot of Glossary .....	46
Figure 17: Drag and drop function .....	47
Figure 18: The red rectangle will have a shaking animation if user entered wrong answer .....	48

## LIST OF TABLES

TABLE 1: Simulation tools for introductory computer networking subject .....	16
TABLE 2. Android application comparison .....	19
TABLE 3. Key milestone for FYP 1 .....	22
TABLE 4: Key milestone for FYP 2 .....	23
TABLE 5: Gantt Chart .....	23

## ABBREVIATIONS AND NOMENCLATURES

DCN	Data Communication and Networking
OS	Operating System
OSI	Open System Interconnection

## **ABSTRACT**

Mobile learning is an informal learning in the process of obtaining knowledge other than lecture class. Mobile learning application has been developed based on different theories of learning. Data Communication and Networking (DCN) is one of computer networking subject offered in Universiti Teknologi Petronas. DCN subject studies about basic concept of networking from physical layer and all the way up until application layer in the OSI model. This research paper basically discusses the research on the chosen topic, Learning Data Communication and Networking using Mobile Application. Objective of this research paper is to design an application based on mobile learning theory. This paper also discusses on developing an application as a supplement other than lecture and lab session for student in understanding DCN subject. Statement of problem in this paper is that the current teaching method used in teaching DCN subject is not sufficient to make student understand computer networking. There is also lacking of Android application that is tailored to DCN subject in Google Play online store. The scope of study in this project is the contents of DCN as an introductory networking subject and Android has been chosen to become the platform for application development. The main content of application would be quizzes, simulation, tutorial and glossary. Quantitative research method was used to gather data from subject of DCN and results obtained will be used to design the content and interface of the application. User acceptance testing will be conducted to satisfy the interface design.

## **ACKNOWLEDGEMENT**

First and foremost, praises and thanks to God, the Almighty for his blessing and mercy throughout my project. I would like to express the deepest appreciation to my supervisor, Madam Nazleeni Samiha bt Haron who has shown guidance and professional advice upon my project. The dedication in helping her supervisee is very much appreciated. I would to thank her for all of the commitment and time that she had spent throughout the semester. Special thanks to Madam Azelin, lecturer from the Management and Humanities department who is willingly to help me in refining my research theories. I would like to thank my colleague, Arif Samin whom I refer when I did have a question about the coding.



# CHAPTER 1: INTRODUCTION

## 1.1 Background of Study

All Information Technology (IT) and Computer System (CS) undergraduates generally are required to take subject Data Communication and Networking (DCN). Basically the subject teaches the basic of computer networking based on Open System Interconnection (OSI) layer. DCN also compose of learning protocols and standards of computer interaction such as TCP/IP and UDP. An understanding of computer networking has becoming more and more important in a business world because they will be able to communicate cleverly with computer networking professionals (Chen C. , 2003)

The existing method of teaching DCN is through lectures and practical lab. During lectures, the lecturer will explain some theory and show calculations that are related to the theory. During lab sessions, tutors who are from post graduate students will replace lecturer and they will conduct 2 hour session of teaching. Students will be exposed to Packet Tracer and Wireshark which is the famous tool in computer networking.

Mobile Learning (M-Learning) is an informal type of learning which supports the standard method of conventional learning. Informal learning can be described as casual, unassigned, impromptu way of people to learn more about something (Ruan, Wang, & Li, 2009).Regardless of the location of the learners, M-Learning tools such as tablets, notebooks, smart phones would assist the learners during the process to obtain educational content.

## **1.2 Objectives**

- To design and develop a mobile application to assist students in understanding concept of DCN subject

## **1.3 Scope of study**

This project focuses on the course Data Communication and Networking offered in University Teknologi Petronas. This study will also include lecturers and students of DCN as they will become the subject for project testing. The application that is going to be developed will use Android as operating system. The main content of the application are quizzes, simulation, trivia, and glossary for terms often used in computer networking.

## **1.4 Problem statement**

Problem statement will be divided into two:

### **1.4.1 Current implementation of learning DCN**

Based on the experience of author in taking DCN, the subject heavily emphasis on memorizing what is needed for the test and final examination. Current learning process focuses more on theoretical approach. The subject put less emphasis on practicality of new chapter learnt. Students should be able to grasp the understanding of the theory by doing practical in the lab session. During lecture, usually the lecturer dominates the class thus making student afraid to ask something that they did not understand. This situation could worsen the chance for them to understand computer networking by being passive in the class. Besides, students also tied to time and location where lecture are done in class and practical are done in the lab. Therefore students are unable to practice if they are neither in the lecture or lab sessions.

### **1.4.2 Lacking of mobile apps in teaching DCN**

Most students own smart phone which can be installed with application. Other than materials that are being studied in lecture, student need can learn more on DCN by using application that teach them basics of computer networking. Existing apps that teach the basics of computer networking only provides reading materials which are not enough for students to visualize the abstract idea of networking. Non-free application has better quality and content than the free application however students will not purchase paid apps because they would rather choose free and quality apps. Learning in class is a formal way to acquire knowledge however informal learning would make student understand better because the learning can happen anywhere and anytime regardless of the time and location constraint.

The learning process of DCN can be improved by taking advantage of mobile devices owned by students in order to develop an application that can enhance their experience in learning networking. Current implementation of DCN can also be improved by adding content into the application which can help student to visualize networking process and able to relate with what they have learned in the class.

## **1.5 Project Feasibilities**

### **1.5.1 Technical feasibility**

This project requires knowledge and skills in programming and computer networking. The content of DCN will be integrated with the application features

### **1.5.2 Economic feasibility**

Currently, there is no extra cost needed to fund this project because the hardware used is the writer's mobile phone and the software used to develop the application is free.

### **1.5.3 Operational feasibility**

This project is able to satisfy the objectives identified earlier. Once the application is developed, it will benefit both lecturer and students of DCN respectively.

### **1.5.4. Schedule feasibility**

The time constraint has been given by coordinators during early assignment of the project.

Below are the timeframes which can be considered as timely feasible:

#### Final Year Project 1 (July – August 2013)

- Data gathering
- Interface development

#### Final Year Project 2 (September – December 2013)

- Development of the prototype
- User acceptance testing and changes to application
- Evaluation
- Documentation

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Mobile Learning Theory**

#### **2.1.1 Mobile Learning definition**

Mobile learning consists of two part which are learning and mobility. Learning can be defined as the process of acquisition of knowledge or skills through experience, practice or by being taught. Mobility on the other hand means ability to move freely and easily. Mobile learning can also be described as the learners can learn anytime, anywhere in their need through wireless and mobile devices and wireless communication network access to learning resources and communicate with others to learn (Bi & Yang, 2011).

#### **2.1.2 Learning Theory for M-Learning (Constructive Theory)**

Keskin and Metcalf (2011) had outlined current available learning theories that can be applied as mobile learning theories. From the theories that were outlined by them, Constructive theory was chose as the main learning theory for this project as its practicality suits well with the implementation for this research. Constructive learning is an activity process in which learners construct new idea or concepts based on their current and past knowledge.

This theory focuses on context and content-dependent mobile learning such as cases and examples, problem solving and decision making application, multiple representations and authentic contexts based information database.

This theory also focuses on collaboration and interaction in mobile learning such as collaboration and interaction between students and communication via mobile phones. Examples of constructive learning theory are handheld games, simulation and virtual reality.

Sakina (2011) summarised learning principles of constructivist learning environment into few important points. Firstly, learning activity that is student centered allows

student to take ownership of their own learning. This means that the student will have the flexibility because they control their learning process. Secondly, learning activity that provides multiple point of view from various resources. Thirdly, learning activity that is situated in a context. This means that the learning task need to be based on natural real world context. Fourth, learning activity that permits students engagement. Fifth, learning activities that promotes collaboration.

## **2.2 Approaches in learning network**

There are a lot of methods have been implemented by various learning institute to teach computer networking. Auckland University of Technology has been using practical laboratory exercise by giving chance their student to configure client and server settings. Each of the computer networking student have been given removable hard disk in the beginning of laboratory session (Sarkar, 2006). During the laboratory session, students will then be asked to reboot the server to see whether they have correctly installed the server configurations. The laboratory network also isolated from the backbone university network because the lecturer does not want the students to interrupt the whole network when doing some testing. It is also safe to isolate lab network from university because the configuration installed in the server such as the operating system itself might contain some vulnerabilities that can be exploited by hacker.

Another approach in teaching computer networking is by setting up a personal network and it is being implemented in Hong Kong Polytechnic University. In this process, students were asked to find resources that are required for them in order to setup the personal computer network (Chang, 2004). Students were divided into group and each group is responsible for setting network like figure below.

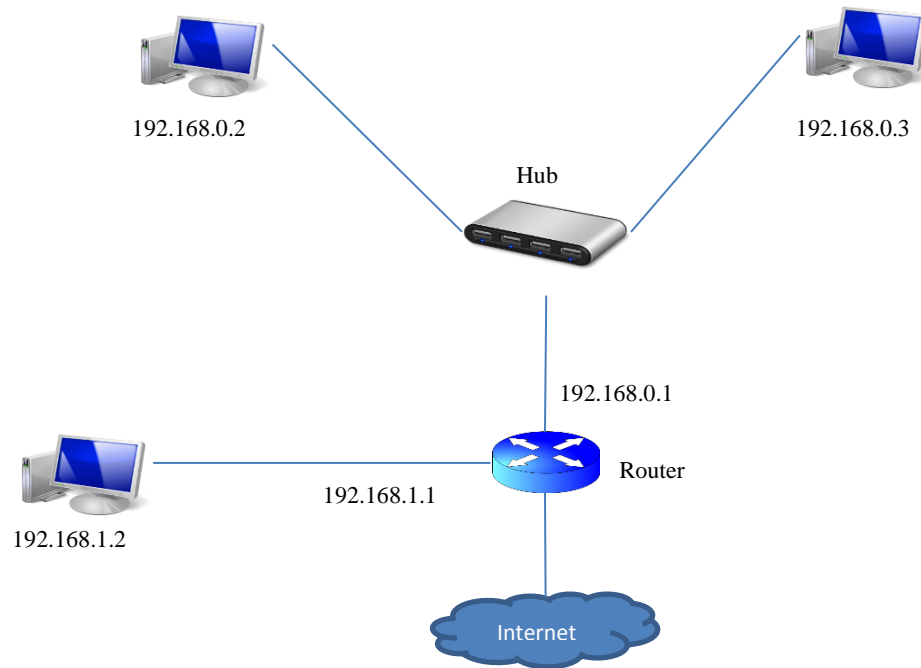


FIGURE 2.1 Minimal personal computer network

Feedbacks from student were taken for every year on the course Computer Networking and below are the result in year 2003. The metric of evaluation are based on the impact of group projects on the students' learning and the change of students' interests in the subject at the end of the course.

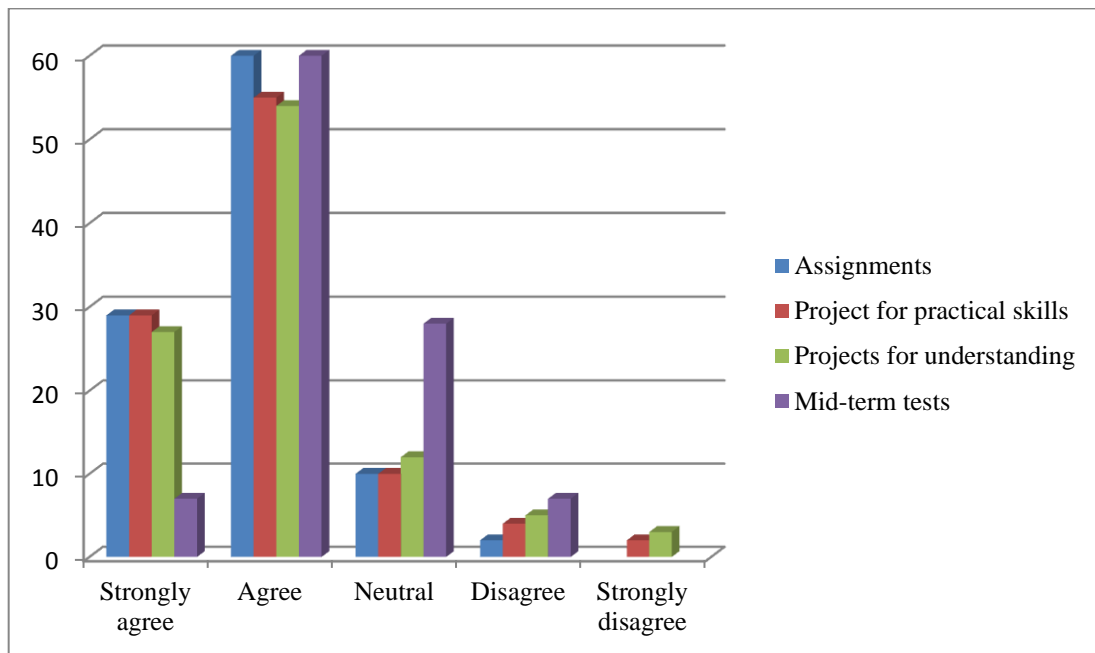
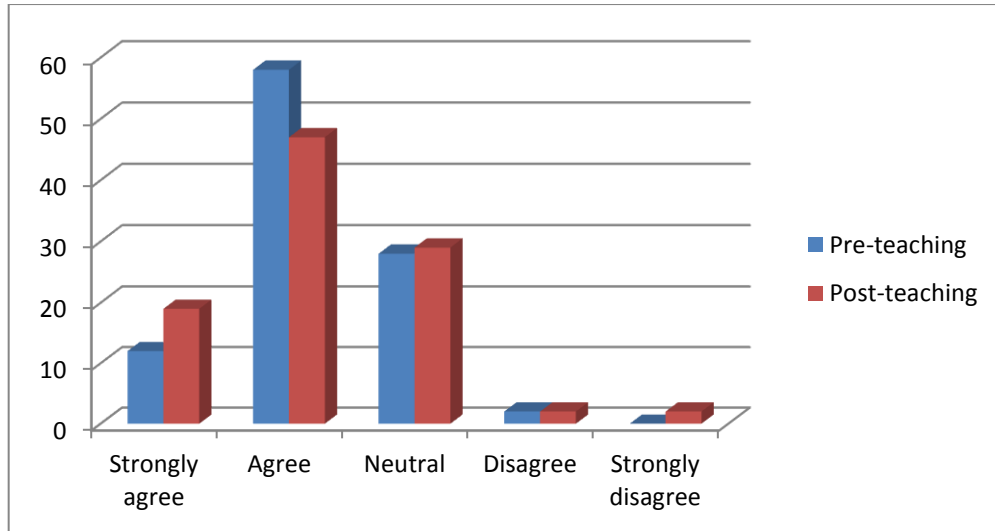


FIGURE 2.2 Effectiveness assessment components for a small class in 2003



**FIGURE 2.3 Students' interests before and after taken the course**

According to Chen, Chen and Lin (2010), to maximize the achievement of learning computer networking, students need to do hands-on exercise that simulates a real computer networking world. Computer networking students of Cheng Kung University in Tainan, Taiwan were given 16GB USB flash drive that stores images of created virtual machines. The research paper measure the effectiveness of their proposed strategies by taking pretesting and post testing on all students by the achievement scale developed in the research and counting the difference of achievement between two groups. However the research paper did not display the result of their findings as they were stored in SQL database.

**TABLE 1: Simulation tools for introductory computer networking subject**

<b>Product Name</b>	<b>Operating System</b>	<b>User level</b>	<b>Availability</b>
Cisco Packet Tracer	Windows, Linux	Introductory	Free for all Cisco Networking Academy members
GNS3	Windows, Linux, Mac	Introductory to high	Free from <a href="http://www.gns3.net">www.gns3.net</a>

Simulation tools are software used by the teachers to teach their student to help them simulate the network activity. Network simulators are different from network emulators. Ghazali, Hassan and Ali (2011) stated that simulator is software that pretends to be another software application or hardware while emulators execute the full function of what the software intended to be. Table 1 shows comparison between two famous network simulators that are suitable to be used for introductory level.



### **2.2.1 Benefits of Mobile Learning**

Mohamed Ally has written a research paper stating the benefits of mobile learning. In his paper, he wrote the benefits from the perspective of learners and teachers. Ally stated that usage of mobile technologies in education will enable people who do not have computer, access to simple education. Devices such as tablets and laptop are mobile technologies that can be brought to area of people who did not have computer and can be used to teach them. However, there are also disadvantage of using mobile learning which will be explained later.

Formal and informal learning can be achieved through the usage of mobile technology (Ally, 2013). He stated in his report, formal learning environment described through the ease of obtaining course material online anytime and anywhere when they want to learn. This also reflects the flexibility and convenience for student to acquire content for mobile learning which at the tip of the finger.

Meanwhile, Ally stated that informal learning does not associated with any program of study. Informal learning can occur during free time where user refers to device that contains materials for learning. He also reported that the feedbacks on a case study for student who were using mobile phones to study English grammar were mostly positive.

The usage of mobile technologies in mobile learning can also develop a community and the communities were able to reach each other from difference countries if it were taken to a large scale. Learner is able to collaborate and exchange information with other learners within the community.

## **2.3 Android (Operating System)**

### **2.3.1 What is Android?**

Android is a Linux-based operating system which was design to support primarily touch screen mobile devices such as smartphones and table computers. It was initially developed by Android, Inc., which was sponsored by Google and was later purchased by them in 2005.

Android is an open source software and Google releases the code under the Apache License. The licensing scheme enables Android to be freely modified and distributed by any device manufacturers, wireless carriers and enthusiast developers.

Android has a large developer community that extend the functionality of the device, which written primarily in a customized version of Java programming language. Android has become the world's second largest used mobile device platform as the operating system is open-source, customizable, lightweight and can be operated on high tech device without developing one from scratch. It has also been used in other devices such as televisions, game consoles and others.

### **2.3.2 Why Android?**

This project application will require a platform for it to run. According to (Areppim: information, pure and simple, 2013), Android is the largest operating system in Asia by March 2013. The number of Android operating system have been growing from March 2012 which is only 15.17% thus showing that Android OS is gaining stable position in the competition between operating system. Growth of Android application is very important to ensure sustainability of application.

Moreover, Android is an open-source operating system which is free and the development of application would be much easier with the support from online community. They are willing to help other developer by responding to questions posted on the forum such as XDA developer and Stack Overflow.

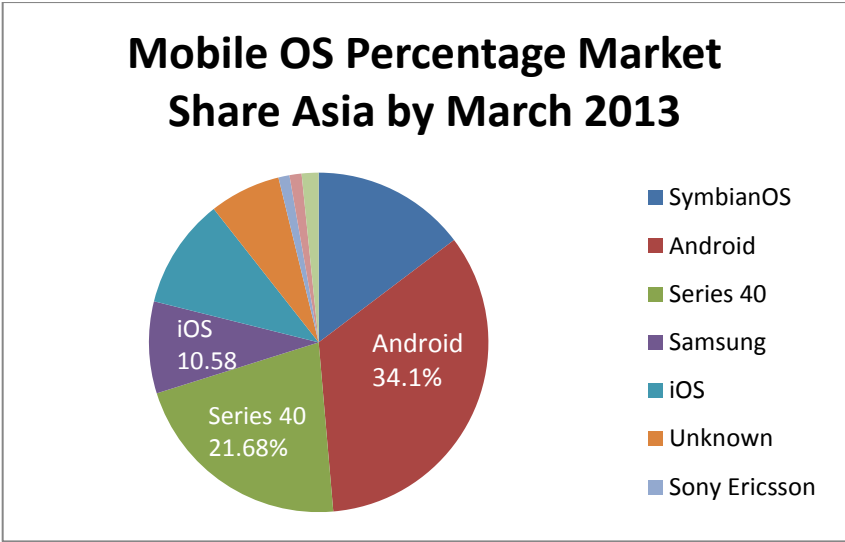


FIGURE 2.4 Percentage of Mobile Phone OS by March 2013

### 2.3.3 Comparison on applications in Google Play Store

Below applications are the most relevant search results from Google Play Store with the key word of “computer networking” and “networking”.

TABLE 2. Android application comparison

Logo			
Application Name	Networking Basics	Computer Networking	Networking 101
Price	Free	Free	US\$1.99
Description	Whole application is a reading material of computer networking	Main content is for quiz. Contains few information for quick reference and no simulation feature	Main content is reading materials. There is no simulation and quiz

## CHAPTER 3: RESEARCH METHODOLOGY

### 3.1 Research Methodology

For this research paper, quantitative research method is going to be used in order to gather data on the subject of the research which is lecturer and students of DCN. Questionnaire often seems the logical and easy option as a way to collect information from people. Since the subject of DCN is quite a large number, therefore interview is not the best option to save time and money. Questionnaire method of collecting information can reach to its intended audience by bulk. The questionnaires will be developed online by using Google Docs and the link to the survey form could be distributed easily to students and lecturer. However, the author will acquire the consent from lecturer before the questionnaire will be distributed. Moreover, data collected from questionnaire can be easily analyzed to prove a hypothesis regarding this research paper.

### 3.2 Proposed Application Development Methodology

Below is the flow for application development methodology:

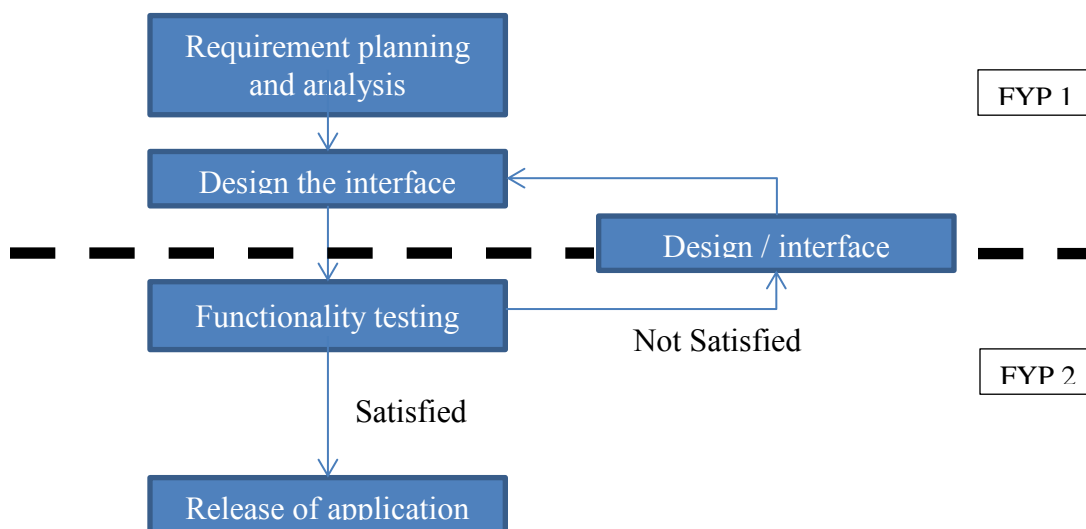


FIGURE 3.1 Process flow in developing DCN application

### **3.2.1 Requirement planning and analysis**

In this part, the author will compare existing approach of teaching computer networking in order to find the suitable learning model to be included in the application. Requirement such as content should be emphasis because main objective of this research is to help student understand the basic concept of DCN through mobile application

### **3.2.2 Designing the interface**

During this part, the author will design the interface by using the Eclipse drag and drop function. Still the main focus is designing the user interface is to minimize and displaying the required information. The features will be integrated with the application function during this stage of development. The features are quizzes, simulation, trivia and glossary. After all of them were put together, a prototype will be produced

### **3.2.3 Functionality testing**

In this part, functionality testing will be conducted in order to test whether each function in the application operates as it should be.

### **3.2.4 Release of application**

This is the final and most important part before the application can be released to the intended audience. All of the details that require improvement will be revised again and finalizing the features the application would offer to the students.

### 3.3 Tools used to develop application

Below are the list of software and device used in making the application:

- Eclipse with ADT Plugin
  - Advantage: Flexibility and have drag and drop function in designing the interface
  - Disadvantage: Buggy. Quite difficult to debug the application
- Samsung Galaxy Note 2 GT-N7100 (Testing device)
- Genymotion Android emulator (Google Nexus 4.1.1)
- FluidUI (Online application for wire framing Android application)

### 3.4 Key Milestone

Below are the key milestones for this project. The first activity need to be finished first before continue to the next phase.

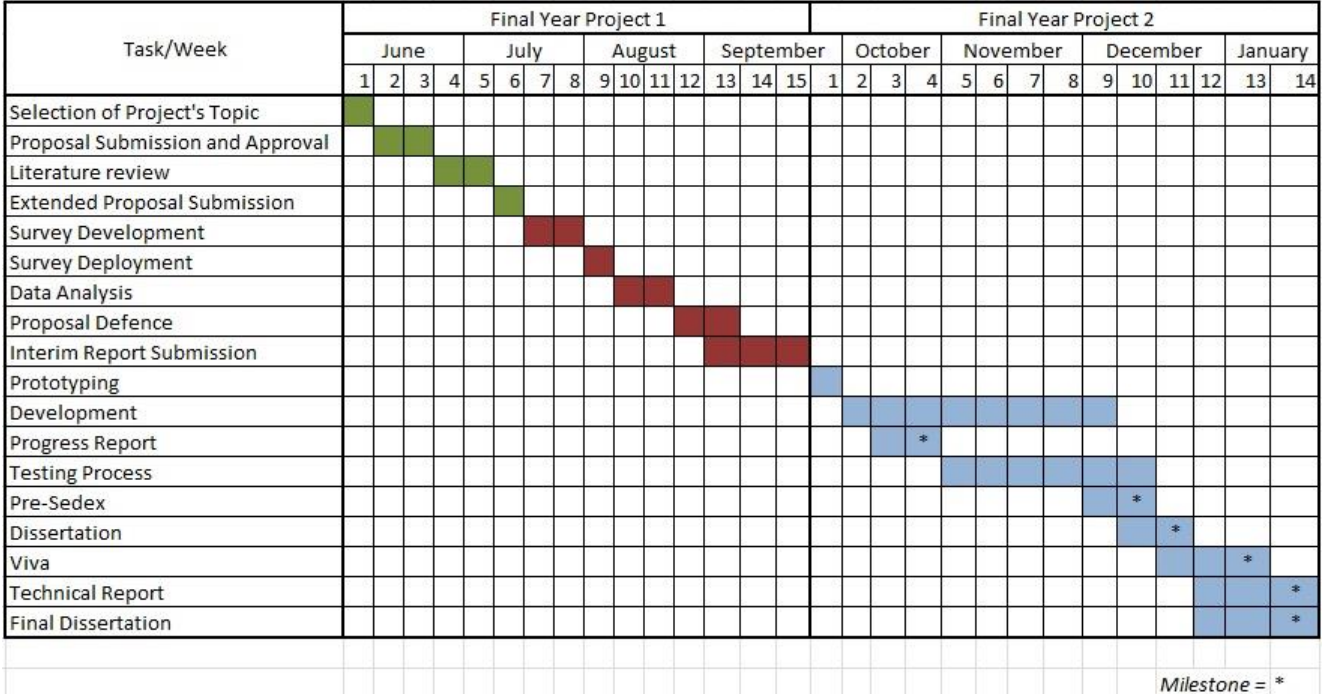
TABLE 3. Key milestone for FYP 1

Activities	Week
Selection of project's topic	1
Proposal submission and approval	3
Extended proposal submission	6
Proposal defense	10
Interim report submission	14

**TABLE 4: Key milestone for FYP 2**

Activities	Week
Progress report	4
Pre-SEDEX	10
Dissertation	12
Viva	13
Technical report and Final Dissertation	15

**TABLE 5: Gantt chart**



## CHAPTER 4: RESULTS AND DISCUSSION

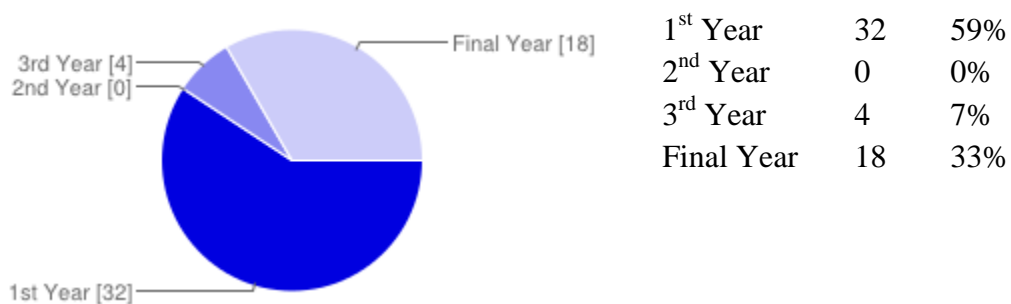
### 4.1 Literature Review Findings

- Constructive learning theory was the most appropriate to be implemented in this project. Mobile learning allows users (student) to take ownership of their own learning. Constructive theory promotes learning activity based on context of real world example.
- Simulation is the best way to teach computer networking followed by tutorial to support the user (student) to build examples in network simulator.
- Android is the most suitable platform for this project because it is open source, customizable and has extensive resource

### 4.2 Survey findings and discussions

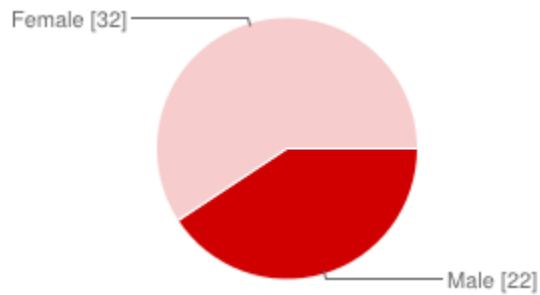
#### Section 1: Background Information

##### 1. Year of study



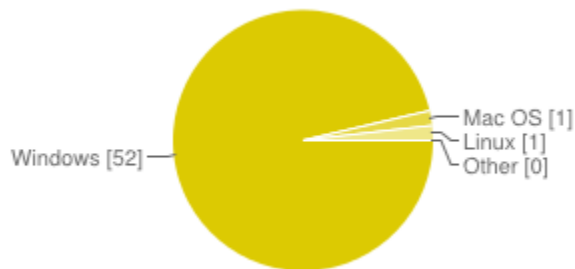


## 2. Gender



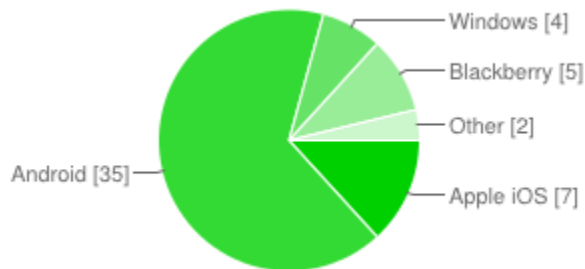
Male	22	40%
Female	32	60%

## 3. Computer operating system



Windows	52	96%
Mac OS	1	2%
Linux	1	2%
Other	0	0%

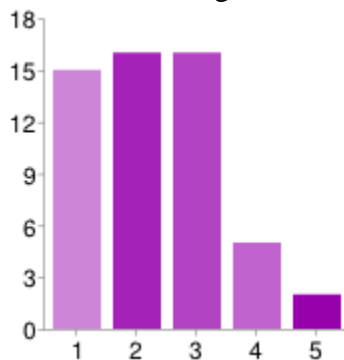
## 4. Mobile phone operating system



Android	35	64%
Windows	4	7%
Blackberry	5	9%
Apple iOS	7	12%
Other	2	3%

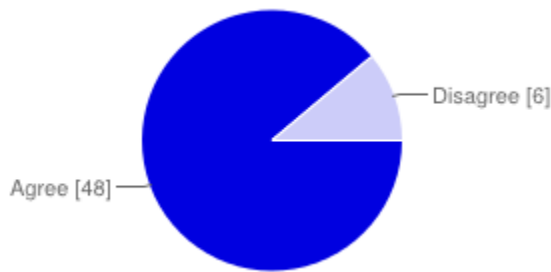
## Section 2: Mobile Application for DCN

### 1. Knowledge about computer networking before taking DCN



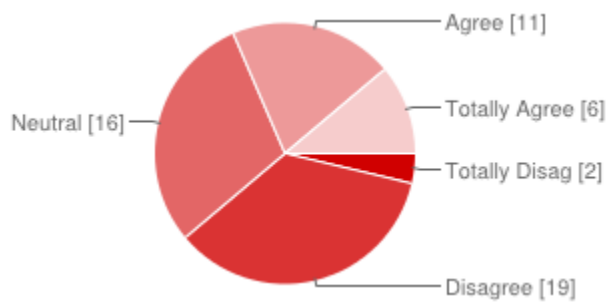
1 – Poor	15	28%
2	16	30%
3	16	30%
4	5	9%
5 – Good	2	4%

2. Do you think DCN is tough subject?



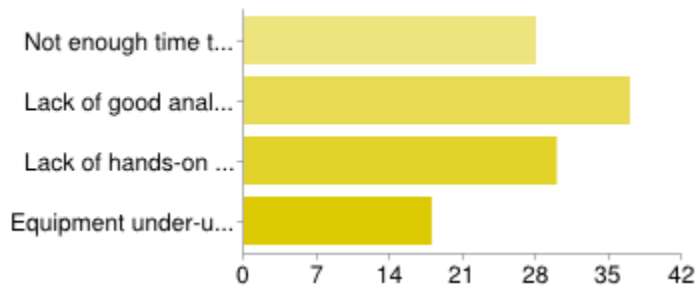
Agree	48	89%
Disagree	6	11%

3. Did you find 2-hour lab session useful/helpful in understanding DCN?



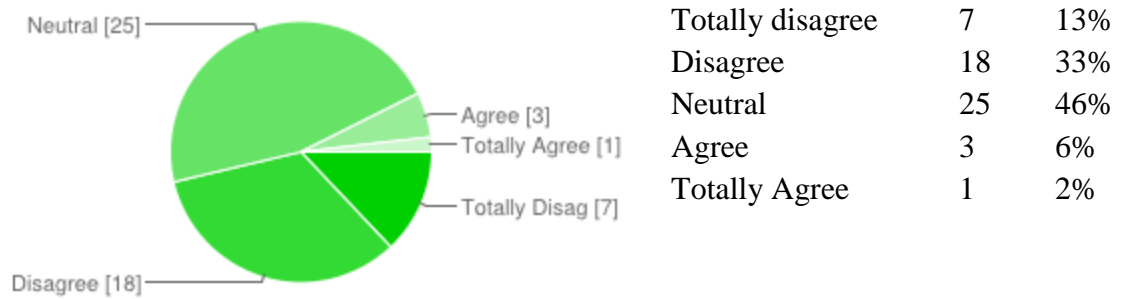
Totally disagree	2	4%
Disagree	19	35%
Neutral	16	30%
Agree	11	20%
Totally agree	6	11%

4. What do you think the reason(s) for poor lab session?

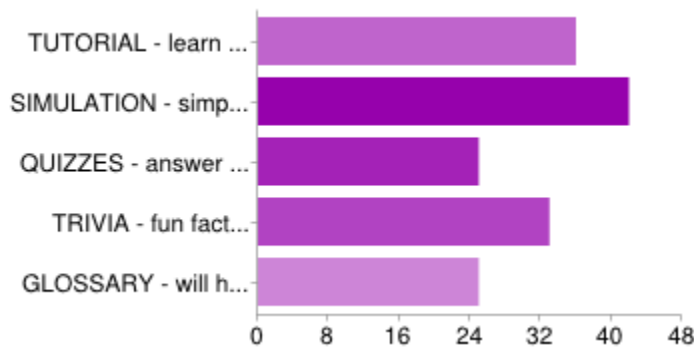


Not enough time to learn/practice in lab	<b>28</b>	25%
Lack of good analogy/comparison in explaining theory	<b>37</b>	33%
Lack of hands-on training	<b>30</b>	27%
Equipment under-utilized	<b>18</b>	16%

5. Learning theories in class is sufficient for me to understand DCN

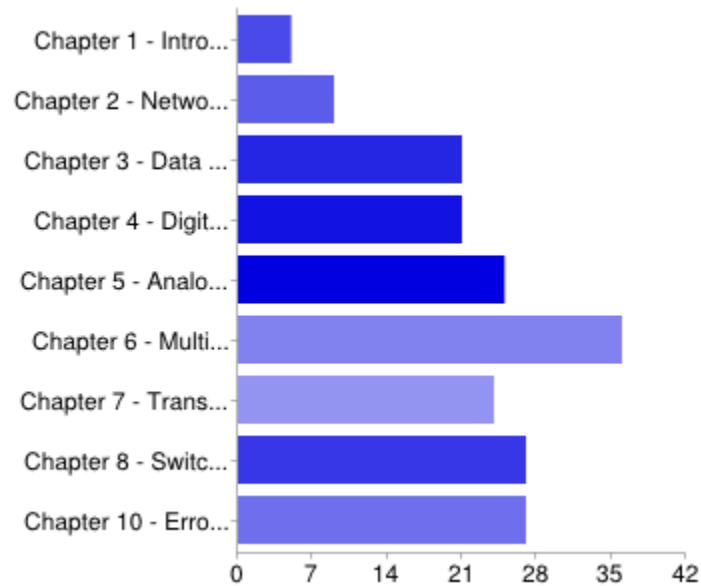


6. If mobile DCN application was going to be developed, what are the features that would benefit you as a user?



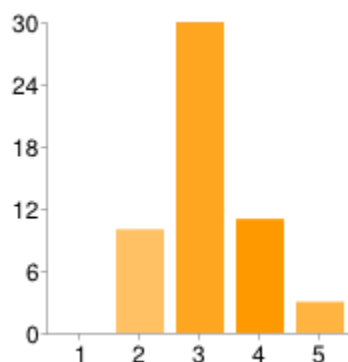
TUTORIAL - learn according to chapters in DCN	<b>36</b>	22%
SIMULATION - simple moving graphics to explain a theory	<b>42</b>	26%
QUIZZES - answer question according to chapters with limited time	<b>25</b>	16%
TRIVIA - fun facts that relates networking concept with everyday life	<b>33</b>	20%
GLOSSARY - will help you memorize terms	<b>25</b>	16%

7. Which chapter that you think is difficult?



Chapter 1 - Introduction	<b>5</b>	3%
Chapter 2 - Network OSI model	<b>9</b>	5%
Chapter 3 - Data and Signals	<b>21</b>	11%
Chapter 4 - Digital Transmission	<b>21</b>	11%
Chapter 5 - Analog Transmission	<b>25</b>	13%
Chapter 6 - Multiplexing and Spreading	<b>36</b>	18%
Chapter 7 - Transmission medium	<b>24</b>	12%
Chapter 8 - Switching	<b>27</b>	14%
Chapter 10 - Error detection	<b>27</b>	14%

#### 8. Knowledge about computer networking after taking DCN



1 – Poor	0	0%
2	10	19%
3	30	56%
4	11	20%
5 – Good	3	6%

Based on the result obtained from survey conducted on respondents who have taken DCN subject, it can be concluded that many of them find DCN subject is difficult to understand due to some reasons.

Students were unable to follow the learning in the class where lectures are focused on theories. Besides learning in class, students were also obliged to undergo 2 hour lab session with post-graduate tutors assigned by the lecturer. The lab session was supposed to support the theories learnt in class by teaching a practical and hands on training.

The main reason poor lab session is the lack of good analogy in explaining the theory learnt in class. Students were hoping to get more clarification on theories when they enter the lab session. There are equipment such as switch and router lying around in the laboratory underutilized by the lab tutors.

Network professionals such as network engineer and lecturer in networking subject suggested in their researches that learning through simulation is a great way to understand how networking works in real life operation. Moreover, the advantages of using mobile device which is mobility can improve DCN learning process. In addition, majority of the respondents prefer to have simulation for the expected application. Based on feedback during proposal defense, the feature “trivia” will be removed to make the structure of the application focused on learning DCN subject. The “trivia” feature was

intended to expose user with some fun facts that relates networking concept with real life situation.

### 4.3 Product prototype

The prototype and the interface were built using online application called FluidUI. The turquoise square shows where the screen is touched.

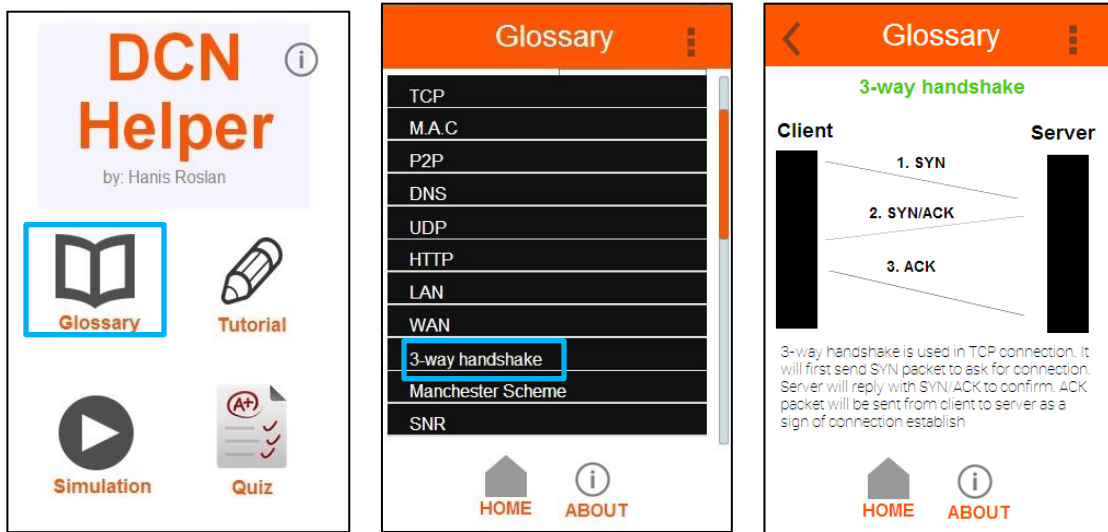


FIGURE 4.1 Glossary feature

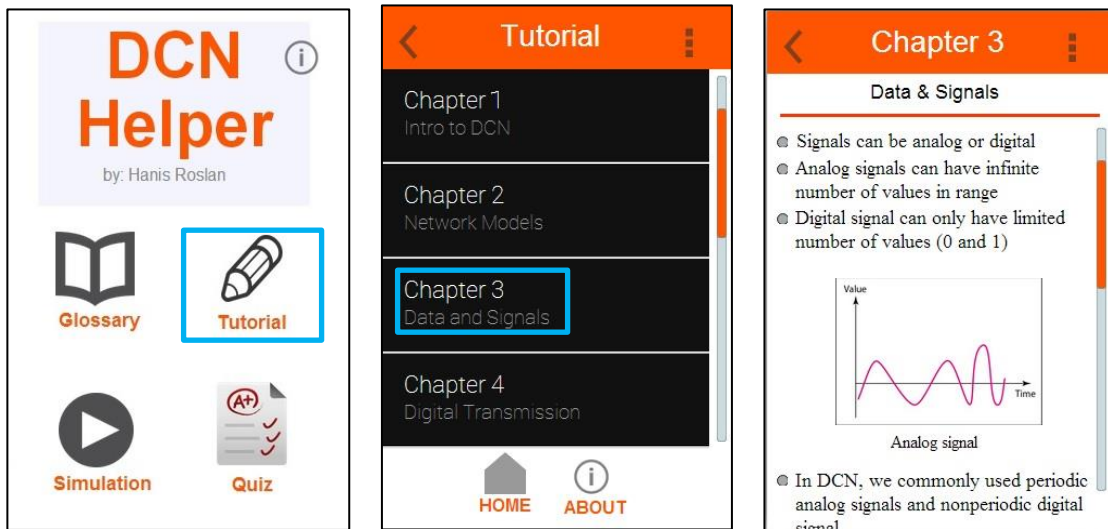


FIGURE 4.2 Tutorial feature

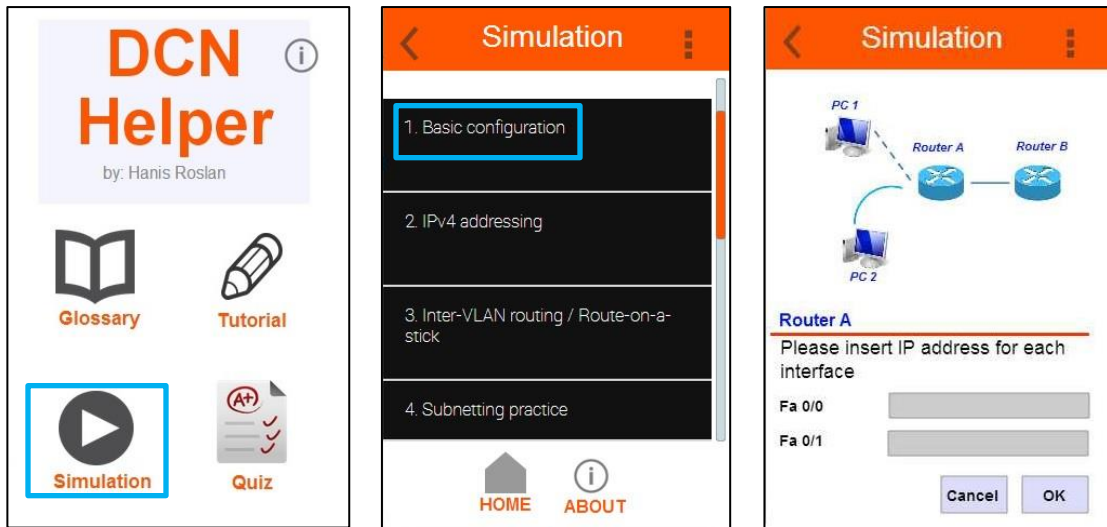


FIGURE 4.3 Simulation feature

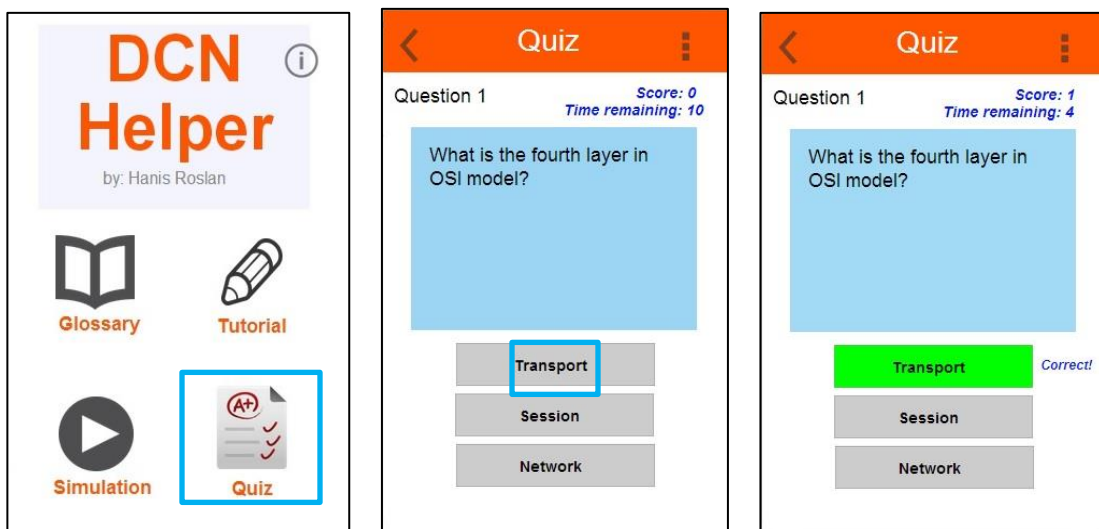


FIGURE 4.4 Quiz feature

### 4.3.1 Glossary

This feature was chosen to be implemented in this project because in DCN there are a lot of terms that need to be memorized. Glossary will enable user to quickly refer to term and the definition.

### 4.3.2 Tutorial

This feature will contain syllabus of DCN according to chapters. User will be able to view lesson learnt from lecture and lab session

### 4.3.3 Simulation

This feature will engage in user past knowledge and ability to relate the concept of networking in order to complete the question. There are simulations that will help the user to fill in the blanks.

### 4.3.4 Quiz

User will be able to test their knowledge of basic concept in DCN. User need to answer few questions within limited period of time.

## 4.4 Early stage of development

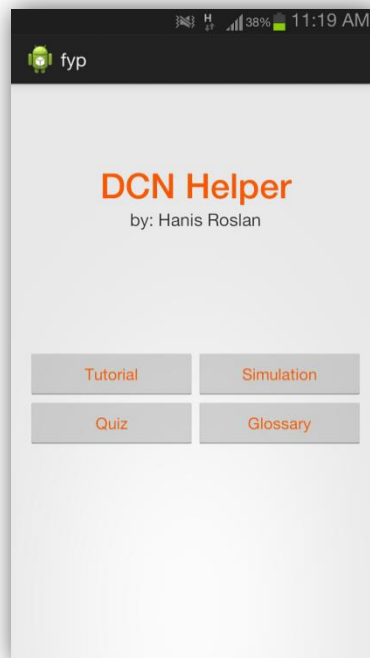


Figure 5: Intended home page



During the early stage of development, basic navigation for the home page has been made by linking activities using Intents. For example, user will be redirect to another page after clicking “Tutorial” button in the homepage.

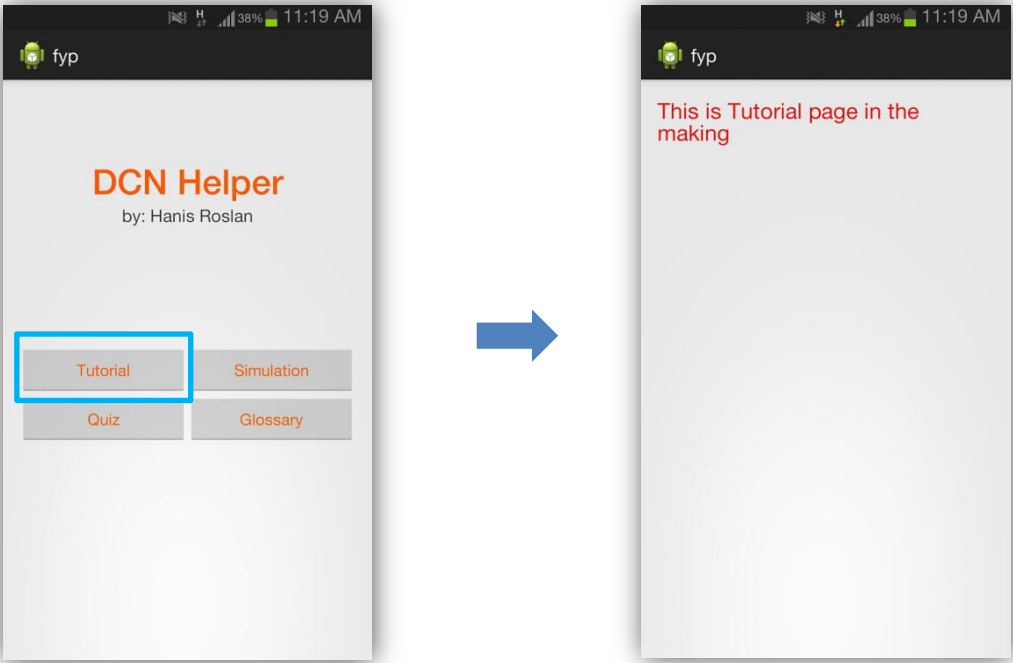


Figure 6: Tutorial button navigation

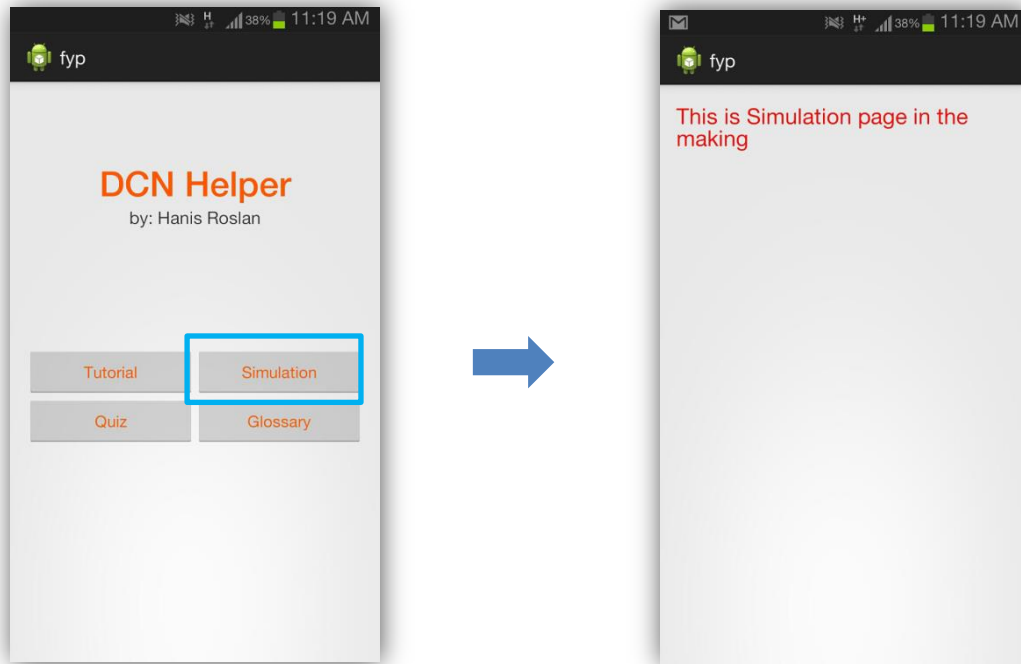


Figure 7: Simulation button navigation

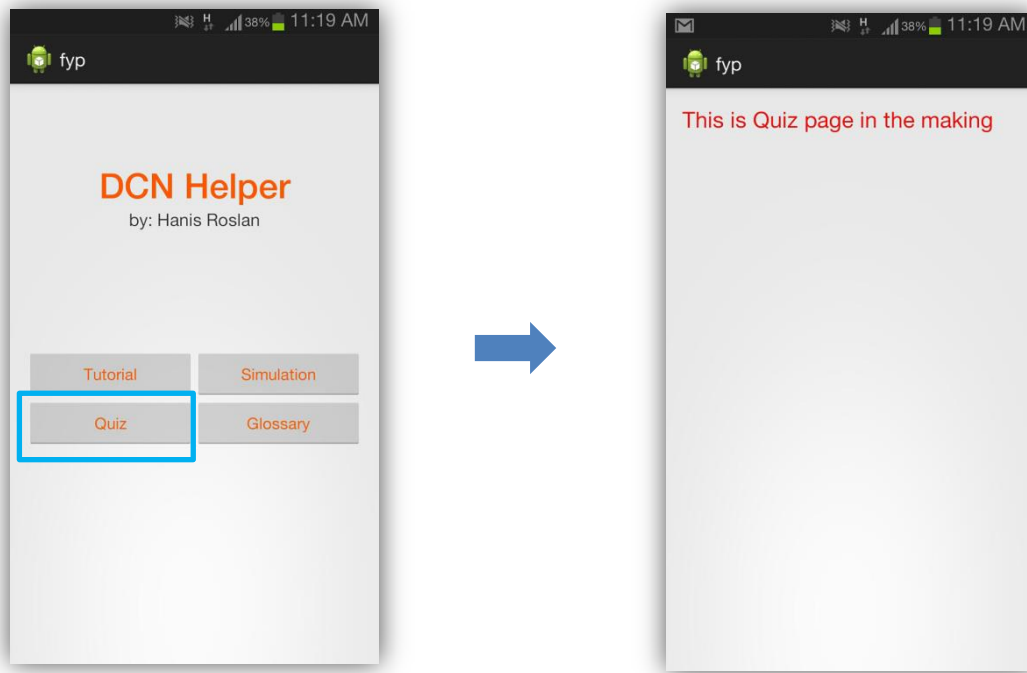


Figure 8: Quiz button navigation

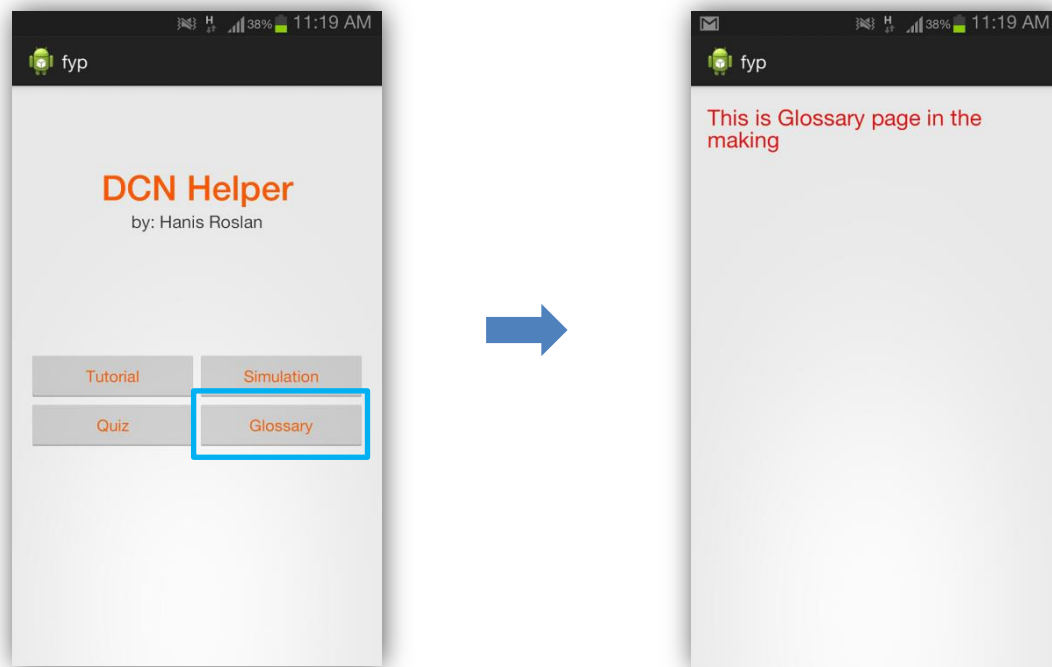


Figure 9: Glossary button navigation

Similarly, other button on the homepage will redirect the user to a page saying “This page is still in the making”. The linking activity must be declared in AndroidManifest.xml. Below is the example of code snippets to declare Quiz page in the manifest.xml file.

```
<activity
    android:name=".Quiz"
    android:label="@string/app_name" >
    <intent-filter>
        <action android:name="com.example.fyp.Quiz" />
        <category android:name="android.intent.category.DEFAULT" />
    </intent-filter>
</activity>
```

Below are the code snippets in Quiz.java file. In this code, setContentView will set the layout that will link to the page. In this example, the layout is quiz\_activity.xml.

```

import android.app.Activity;
import android.os.Bundle;

public class Quiz extends Activity{

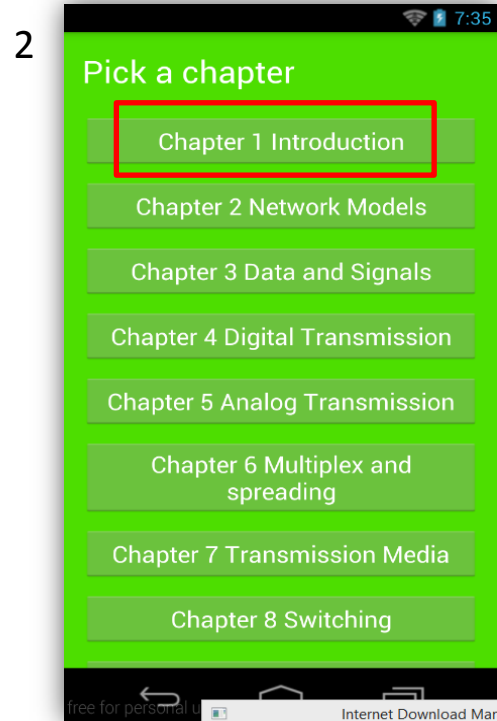
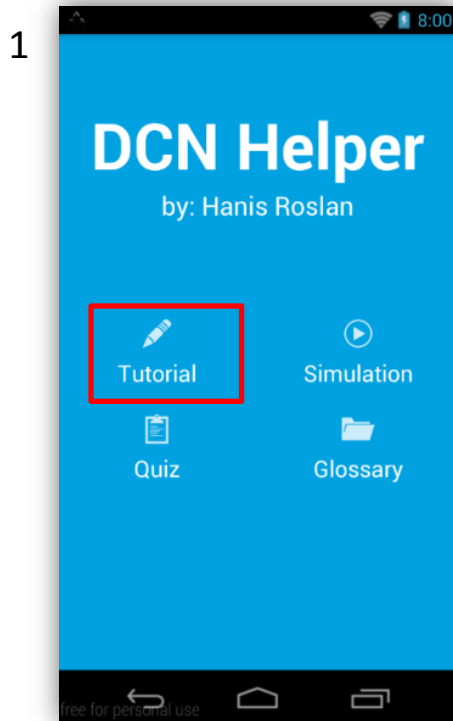
    public void onCreate(Bundle savedInstanceState)
    {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.quiz_activity);
    }
}

```

## 4.5 Final Application

The development had begun with the building of the landing page of the application each time user trying to open the application which is the main page. The home page consists of four different buttons that represent every function of this application. Below are the walkthrough for each of the function. The red colored rectangle is where the user is supposed to click.

### Tutorial



3

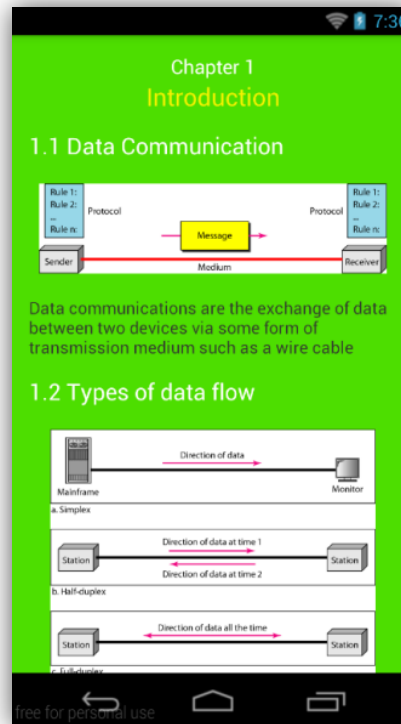


Figure 10: Flow of tutorial function

Figure 10 consist of 3 images. Below is the breakdown for each step:

Step 1: Here is the home page.

Step 2: User will have to choose which chapter he would like to read

Step 3: The content of the tutorials will be displayed here

All of the screenshot of the application was taken using Genymotion Android emulator software. Genymotion requires Virtualbox to be installed first in order for it to properly run on the system. The main advantage of Genymotion over the standard Android emulator is, Genymotion responds much faster since it runs on virtual machine which is the Virtualbox

## Quiz

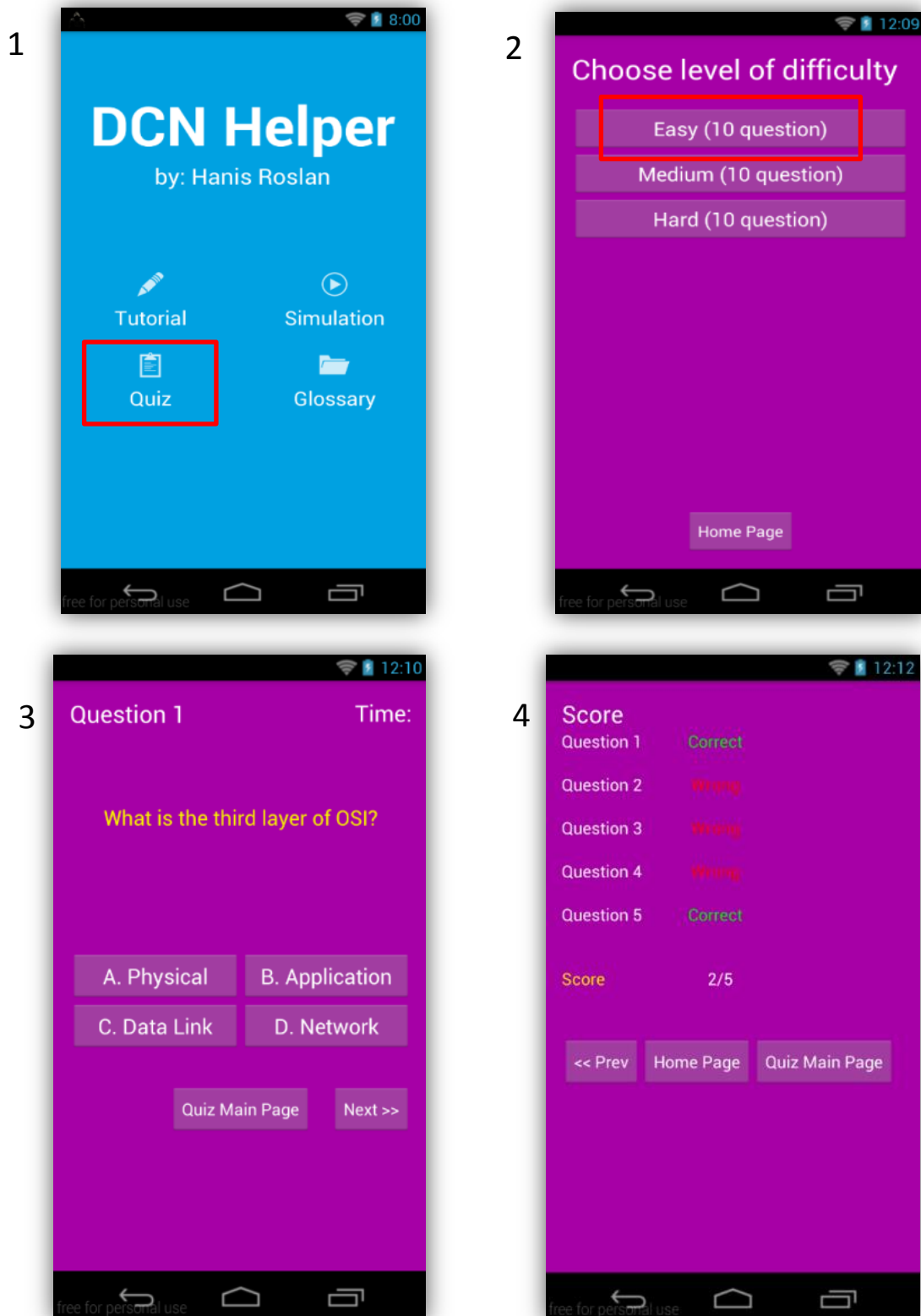


Figure 11: Flow of Quiz function

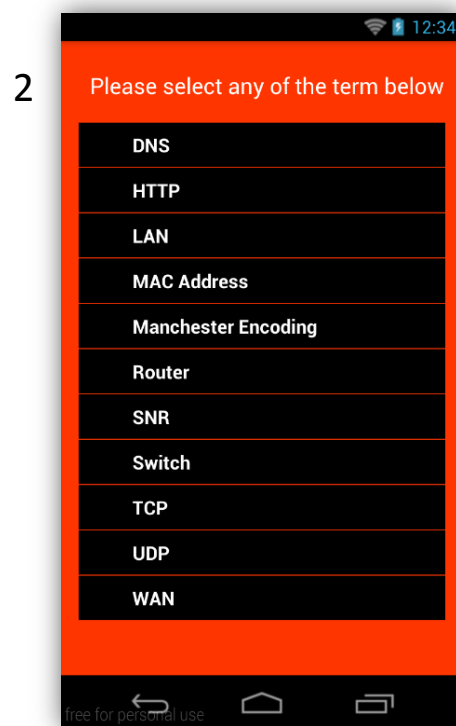
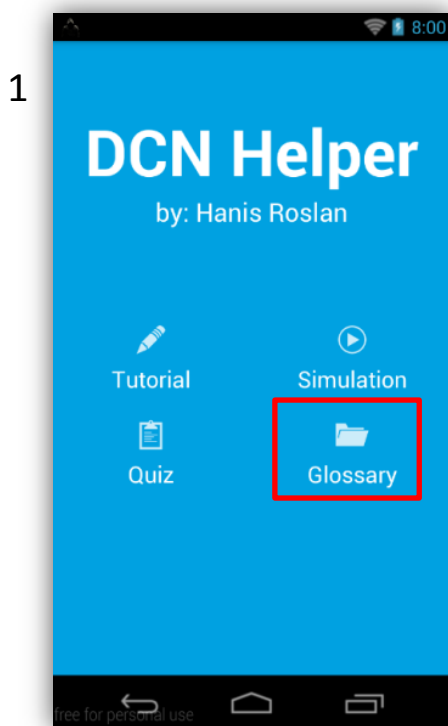
Step 1: User click Quiz button on the home screen

Step 2: User choose level of difficulty

Step 3: User will answer sets of question. User can skip question and returned to it later

Step 4: The result of the Quiz will be shown

## Glossary



3

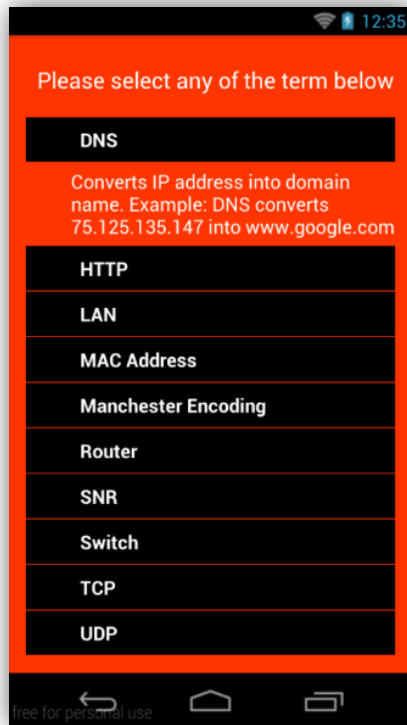


Figure 12: Flow of Glossary function

Step 1: User click Glossary button on the home screen

Step 2: List of computer networking terms will be displayed

Step 3: User have to click any of the terms for the meaning to be displayed through expandable list view



## Simulation

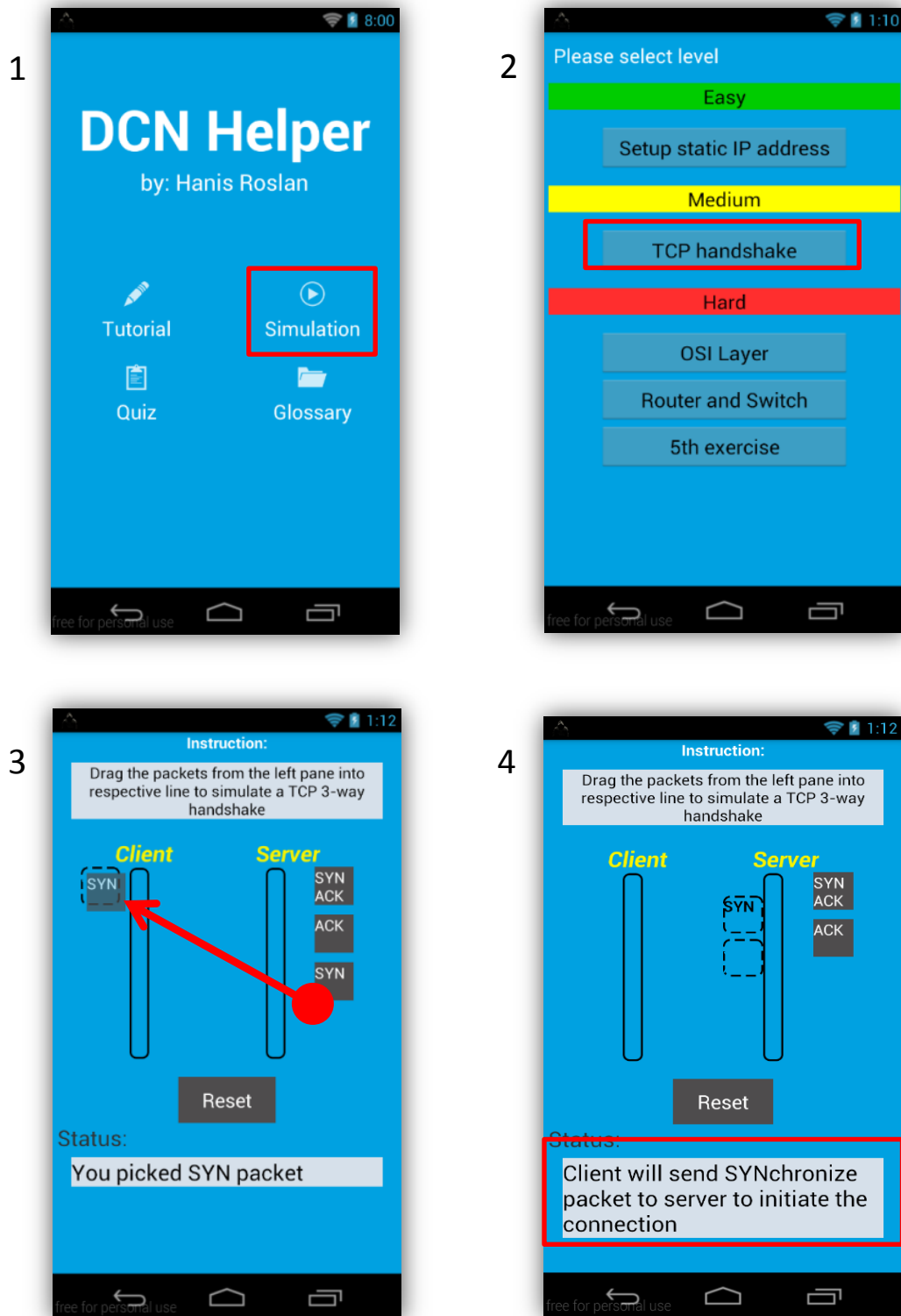


Figure 13: Flow of Simulation function

## Simulation

Step 1: User click simulation button on the home page

Step 2: User choose the exercise “TCP Handshake”

Step 3: For this exercise, user will drag the image of “SYN” towards respective box

Step 4: Feedback will be shown on transparent white box at the bottom of the screen

## **4.6 Breakdown of the application function**

### **4.6.1 Tutorial**

The tutorial was made so that user could revise each of the chapter in the mobile device. Each chapter contains explanation and pictures that were taken from the content of the textbook Data Communication Networking.

### **4.6.2 Quiz**

In the quiz section, user is required to answer a set of questions according to the level of difficulty. The score will be calculated and displayed when user have final reached the end of the quiz. There is also a function in Android programming called Toast, where a black box at be bottom of the screen displaying some text. In this quiz section, Toast was used to display give feedback on which answer has been chosen. This is shown in the red arrow in Figure 14. In future improvement, the application should make the button color change whenever user has answered a question. For the time being, all of the questions were hard-coded into the application thus the application does not used any database. However, in future improvement there will be an algorithm that will randomize the question every time user opens up Quiz.

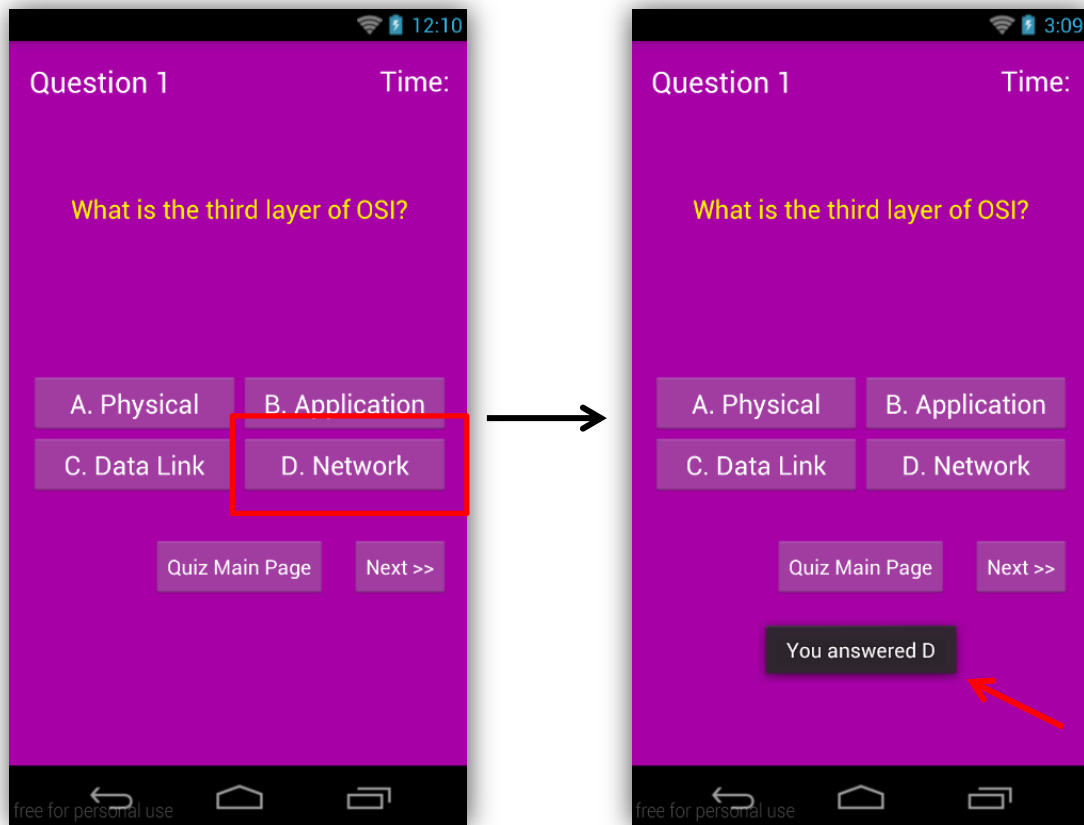


Figure 14: Feedback in toast

The most important part in the Quiz function is the scoring. Figure 15 shows the screenshot of score page after user have successfully finished answering the question. User can simply navigate back to the any particular question in order to correct the answer. The algorithm for calculating score marks in the Quiz is by using Shared Preferences. This function was originally built for the purpose of remembering specific user preference. However, it can also be simply used to get the answer from the user and save it to a preference called “Quiz\_Answer”.

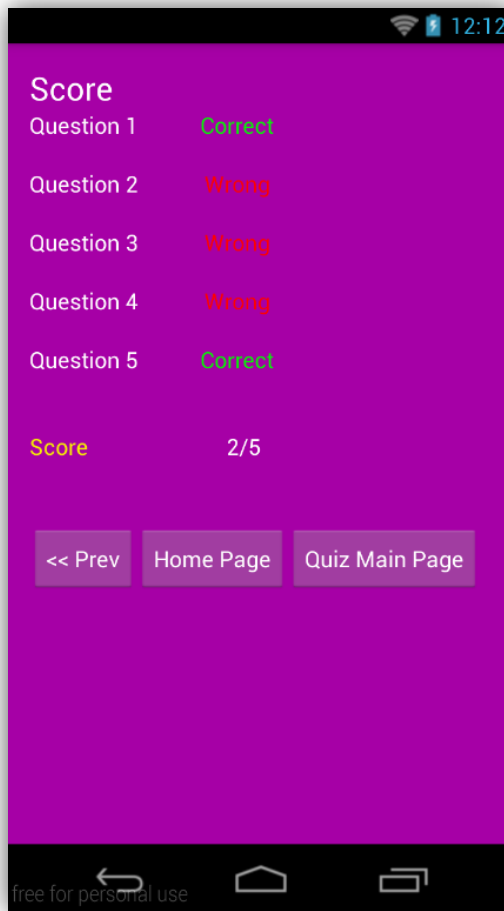


Figure 15: Score page for Quiz

Below is the code snippet from Quiz1.java class which uses the sharedPreferences in Android Java programming. When user press button which in this case is btnA or answer choice A, the value of 0 will be stored in the preference “Quiz\_Answer”. Value 0 indicates that the answer is false and otherwise. In this example, button A is not the correct answer for the question asked.

```

public final String PREFS_NAME = "Quiz_Answer";

btnA = (Button)findViewById(R.id.answerA);

btnA.setOnClickListener(new OnClickListener() {

    public void onClick(View v) {

        Toast.makeText(Quiz1.this, "You answered A",Toast.LENGTH_SHORT).show();

        answer_value =0;

        SharedPreferences settings = getSharedPreferences(PREFS_NAME,0);

        SharedPreferences.Editor editor = settings.edit();

        editor.putInt("answer1", answer_value);

        editor.commit();

    }

});

```

### 4.6.3 Glossary

In this section, a list of famously known terms and acronyms in computer networking were put in an expandable list view. When user click on any of the list view, there will be an explanation dropped down from it. Figure 16 shows the screenshot of the Glossary where the expandable list view is being used. The blue circle indicates where the user clicks on the screen.

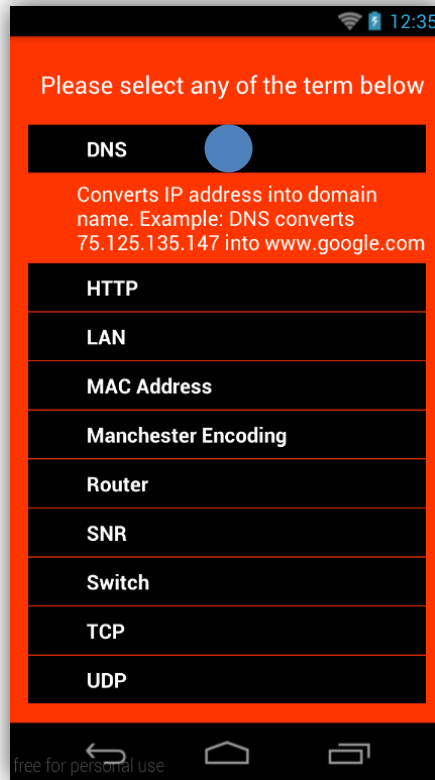


Figure 16: Screenshot of Glossary

#### 4.6.4 Simulation

The main purpose of this section was to make user interact with the interface while the simulation will responds to every action that the user made. The simulation section contains three level of difficulty which is easy, intermediate and hard. The difference of level indicates that the higher level more interaction is required from the user. For the time being, there are only 2 features of mobile phone that is being used:

1. Touch screen

The touch screen has been used in two ways where user able to click and also drag and drop in certain activity. Figure 17 shows a screenshot of the application where the user is required to drag the packet on the right hand side of the screen to their respective box. User will receive feedback on the bottom whether the answer is correct or not



Figure 17: Drag and drop function

Below is the code for making drag and drop function:

```
private class ChoiceDragListener implements OnDragListener
{
    public boolean onDrag (View v, DragEvent event)
    {
        switch (event.getAction()){
            case DragEvent.ACTION_DRAG_STARTED:
                final Handler handler1 = new Handler();
                View view1 = (View)event.getLocalState();
                final TextView dropped1 = (TextView) view1;
                final TextView statusBox1 = (TextView) findViewById(R.id.statusBox31);
                statusBox1.setTextColor(Color.BLACK);
                statusBox1.setText("You picked "+ dropped1.getText());

            case DragEvent.ACTION_DRAG_ENTERED:
            case DragEvent.ACTION_DRAG_EXITED:
            case DragEvent.ACTION_DROP:

                //final Handler handler = new Handler();
                final View view = (View) event.getLocalState();
```

```

        view.setVisibility(View.INVISIBLE); //this will make whatever option chose,
        disappear
        final TextView dropTarget = (TextView) v; //target box
        final TextView dropped = (TextView) view; //choice
        final TextView statusBox = (TextView) findViewById(R.id.statusBox31);

        if(dropped.getText().equals(dropTarget.getText()))
        {
            dropTarget.setTextColor(Color.BLACK);
            statusBox.setTextColor(Color.GREEN);
            statusBox.setText("Correct!!");
        }
        else
        {
            view.setVisibility(View.VISIBLE);
            statusBox.setTextColor(Color.RED);
            statusBox.setText("Wrong! Please try again");
        }
        case DragEvent.ACTION_DRAG_ENDED:
            default:
                break;
        }
        return true;
    }
}

```

## 2. Motor (vibration)

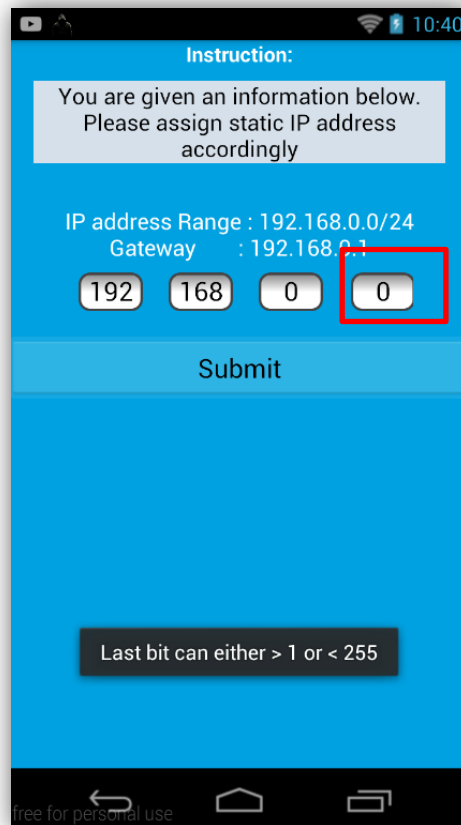


Figure 18: The red rectangle will have a shaking animation if user entered wrong answer



In this simulation exercise, user is require to input an IP address which will then be verified by clicking on the submit button. However, if user entered wrong answer, the respective bit will have a shaking animation to tell indicate the user location is the incorrect input as shown in Figure 18. Moreover, if this application is used on physical mobile phone, user will feel the mini vibration that set out whenever user input incorrect answer. Toast is also being used to tell the user what mistake they are doing. Below is the code snippet used to generate the mini vibration

```
Vibrator vib = (Vibrator) getSystemService(Context.VIBRATOR_SERVICE);
vib.vibrate(500);
```

Other function such as accelerometer, microphone and camera is still not being used in this project. It will however be included in the future development for the application. These features are very important to be developed for the application in order to enhance the interactivity between the user and the application.

#### 4.7 Functionality Testing

For the tutorial and glossary section, functional testing is not required since it does not have valid and invalid input.

Section	Type of input	Result
Quiz (Easy)	Valid input – click on only one correct answer choice	The score page display ‘correct’ as answer
	Invalid input – click on multiple answer choice that are incorrect	The score page will display ‘wrong’ as answer
	Valid input – test on each of the navigation button;	Application will invoke new activity correctly

	home, previous, next	which display the page user clicked
Simulation (Static IP address)	Invalid input – try to input alphabet instead of numbers into the box	Keyboard has been set automatically to receive numbers input only
	Valid input – input incorrect answer to more than one bit	All of the bits that are wrong will shake and phone will vibrates
(TCP handshake)	Invalid input – dropping incorrect packet into the target box	The status box on the bottom of the screen will output message stating incorrect answer by user
	Valid input – clicking reset button	All of the packets animation will be reset. However all of the target box will be visible after user pressed the reset button. The reset button was supposed to only reset animation of target box that user have interacted. Not all of them.
(OSI Layer)	Invalid input – dropping incorrect answer to the target box	The status box on the bottom of the screen will output message stating incorrect answer by user
	Valid input	Status box will output message stating that user have input the answer correctly.

## **CHAPTER 5: CONCLUSION AND RECOMMENDATION**

Learning networking requires practice in order to understand the basic concept. Students were hindered from understanding basic concept of networking due to lack of practice during lab session even though UTP has enough resource to conduct the construction of personal network. The outcome of this project was to improve previous version of application NetLab by adding more content into the application and also as an external material for student to learn concept of networking other than given in the class. Moreover the output of this project was to improve the current learning process for student to enjoy learning DCN and really understand computer networking for personal growth course.

The application was built for the purpose of supportive learning where it contains four main functions that are very crucial in learning computer networking. The functions are simulation, tutorial, quiz and glossary. Simulation was made in order to simulate some famous concepts in computer networking. Tutorial was made according to chapters in the textbook. Quiz function contains question that student needs to answer based on what was read in the tutorial. Meanwhile glossary contains computer networking terms with their respective explanation.

For the recommendation part, this project should be extended to other operating system development to ensure the sustainability of the application and to tackle heterogeneity issue. Besides, the application itself could be improved by adding more real life tutorials that students could actually do at their own personal time. This could promote practices outside of lab session by simply setting up a minimal networking space for their understanding. The application should also be added with contents so that user could learn more since current application is a minimum viable product.

As a conclusion, this project achieved the milestones and able to be developed to become a support for learning computer network.

## References

- (2013, March 19). Retrieved June 24, 2013, from Areppim: information, pure and simple:  
[http://stats.areppim.com/stats/stats\\_mobiosxtime\\_asia.htm](http://stats.areppim.com/stats/stats_mobiosxtime_asia.htm)
- Ahmed, S. F., Chang, M., & Kinshuk. (2012). Recommend Computer Studies Courses for Students Taken based on Supported Mobile Learning Modes. Edmonton, AB, Canada.
- Ally, M. (2013). Mobile Learning: from Research to Practice to Impact Education. 10.
- Bi, T., & Yang, W. (2011). Study of mobile learning theory. *IEEE*, (pp. 230-233). Weifang.
- Chang, R. K. (2004). Teaching Computer Networking with the Help of Personal Computer Networks. *Conference of Innovation and Technology in Computer Science Education*, (pp. 208-212). Leeds.
- Chen, C. (2003). A Constructivist Approach to Teaching: Implications in Teaching Computer Networking. *Information Technology, Learning, and Performance Journal*, 17-27.
- Chen, F.-G., Chen, K.-Y., & Lin, C.-Y. (2010). A cooperative Learning of Computer Networking with Portable Laboratories Using Virtual Machine. *IEEE*, (pp. 118-122). Tainan, Taiwan.
- Ghazali, K. W., Hassan, R., & Ali, Z. M. (2011). Simulation tool for active learning of introductory computer network subjects. *National Conference on Active Learning*, (pp. 119-122). Malacca.
- Keskin, N. O., & Metcalf, D. (2011). *The Current Perspectives, Theories and Practices of Mobile Learning*. Retrieved August 19, 2013, from <http://tojet.net/articles/v10i2/10220.pdf>
- M-Learning*. (2013, June 15). Retrieved June 24, 2013, from Wikipedia:  
<http://en.wikipedia.org/wiki/M-learning>
- Ruan, G., Wang, J., & Li, Z. (2009). Theoretical Foundations of Mobile Learning Mediated by Technology. *1st International Conference on Information Science and Engineering* (pp. 5435 - 5438). Xianning, China: School of Electronic and Information Engineering.
- Sakina, B. (2011). Designing Social Constructivist Mobile Learning Activities for HEI Courses in Malaysia. 8.
- Sarkar, N. I. (2006). Teaching Computer Networking Fundamentals Using Practical Laboratory Exercises. *IEEE Transactions on Education*, (pp. 285-291). Auckland.