



UNIVERSITI PUTRA MALAYSIA

MOBILE APPLICATION DESIGN FOR M-LEARNING CONTENT

\$60\$¶ %\$'58/ . \$0\$ /

FSKTM 2015 33



UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

MOBILE APPLICATION DESIGN FOR M-LEARNING CONTENT

By

ASMA' BADRUL KAMAL

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, on
Fulfillment of the Requirements for Master of Computer Science**

JUNE 2015

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Masters of Computer Science

MOBILE LEARNING APPLICATION CONTENT DESIGN

By

ASMA' BADRUL KAMAL

June 2015

Supervisor: Ainita Ban

Faculty: Faculty of Computer Science and Information Technology

Nowadays, the use of mobile devices as a medium of getting information through the Internet is getting wider. Many transactions and operations are automated and available to be adapted to mobile devices. There is also a rapid growth mobile application and if designed to tailor to education needs, could be very beneficial to society. However, while many “classic” software engineering techniques can be transferred easily to the mobile application domain, the development of mobile application in the education domain is still new and in need of further research and development. Over the last two decades, learning institutions have become accustomed to the growing use of mobile technology and it has become the most current trend, forcing educators to evaluate the merits and limitations of a new technology. Changes in technology continue to alter possibilities for learning and create new challenges for pedagogy. Therefore, the objective of this project is to design a mobile application that allows active and synchronous learning process between students and educators in and outside classes. Content design is widely taken into consideration during the design process. The current project emphasis is on subjects for university students and their acceptance and performance after using the designed mobile application. For the research methodology, this project focuses the agile development methodology. A qualitative research acquired from the feedback of students and their experience in using existing systems through questionnaires and survey and their opinions of the existence of the new application as a method of learning.

All material contained within the report, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



ACKNOWLEDGEMENT

First and foremost, I would like to thank both of my parents, for their endless love and support in my journey to complete my Masters in Computer Science at UPM as a full-time student. Without them, I would not have been able to have the strength to quit my job to pursue my goal in life to obtain a Masters, and hopefully to pursue a PhD in the future.

I would also like to extend my gratitude to my supervisor, Puan Ainita Ban, who has been with me all through my year of final project for my Masters. Her faith in me and her positive attitude has always motivated me all the time while doing this project. She has also supported me with various ideas and insights of her own whenever I am in a pinch while doing this project.

I also sincerely thank my accessor, Prof. Madya Dr. Abu Bakar Bin Md Sultan, for objectively listening to my project and providing me with building comments to improve my project.

Lastly I would like to thank all my friends and colleagues who have supported me throughout my journey in Masters, without their words of motivation and companion; I would not have made it through to this day.

APPROVAL SHEET

This thesis is submitted to the Faculty of Computer Science and Information Technology of Universiti Putra Malaysia and has been accepted as fulfillment of the requirements for the degree of Master of Computer Science.

Accepted and approved by,

Pn. Ainita Ban

Department of Software Engineering
& Information System

Faculty of Computer Science &
Information Technology

Universiti Putra Malaysia

Date:

DECLARATION

I hereby confirm that:

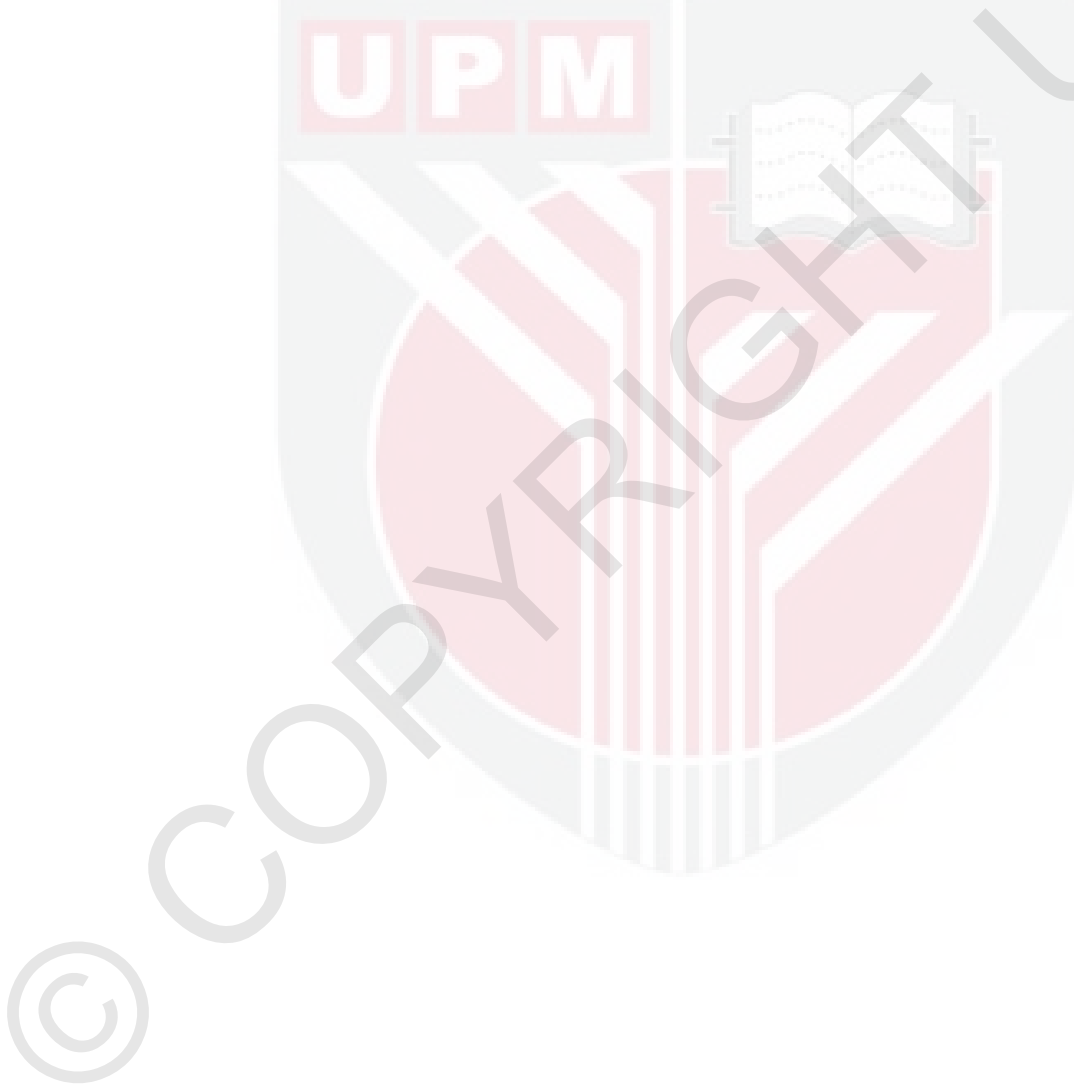
- This thesis is my original work;
- Quotations, illustrations and citations have been duly referenced;
- This thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- Intellectual property from the thesis and copyright of the thesis are fully-owned by Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and Innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: _____ Date: _____

Name and Matric No.: _____

LIST OF TABLES

Table Name	Pages
Table 2.1 Summary of Approaches to Mobile Learning Content	16
Table 3.1 Gantt Chart Table	23
Table 4.1 Pilot Study Results	30
Table 4.2 Roles and Functionalities available of Student and Lecturer	38
Table 5.1 Usability Rating Scale	54
Table 6.1 Time required doing each tasks according to each user	69
Table 6.2 Usability Rating Scale Result	71
Table 6.3 Comparison of prototype system with others based on requirements	78



LIST OF FIGURES

Figure Name	Pages
Figure 2.1 Distributed mobile learning platforms architecture	12
Figure 3.1 Project Gantt Chart	24
Figure 4.1 System Framework	37
Figure 4.2 Use Case Diagram	42
Figure 4.3 Class Diagram representing the Database Structure	43
Figure 4.4 Main Page	46
Figure 4.5 Notes Function	46
Figure 4.6 Quiz Function	47
Figure 4.7 Projects Function	49
Figure 4.8 Media Function	49
Figure 4.9 Contact Lecturer Function	50
Figure 5.1 Login Page	57
Figure 5.2 Main Page and Side Bar Navigation	58
Figure 5.3 Student Profile	59
Figure 5.4 Notes	60
Figure 5.5 Assignments	61
Figure 5.6 Project	62
Figure 5.7 Exercises	63
Figure 5.8 Quiz	64
Figure 5.9 Contact Lecturers	65

TABLE OF CONTENTS

		Pages
ABSTRACT		ii
COPYRIGHT		iii
ACKNOWLEDGEMENT		iv
APPROVAL SHEET		v
DECLARATION		vi
LIST OF TABLES		vii
LIST OF FIGURES		viii
CHAPTER	INTRODUCTION	
1	1.1 Overview	1
	1.2 Problem Statement	3
	1.3 Objective	4
	1.4 Project Scope	5
	1.5 Project Contribution	5
	1.6 Thesis Organization	5
2	LITERATURE REVIEW	
	2.1 Introduction	7
	2.2 M-Learning	7
	2.3 Challenges and Opportunities in Mobile Learning	9
	2.4 Mobile Learning Application Content	11
	2.5 Summary of Chapter	19
3	METHODOLOGY	
	3.1 Introduction	20
	3.2 Agile Development Methodology	20
	3.3 Project Activities	23
	3.4 Software and Equipment User	27
	3.5 Summary of Chapter	27
4	REQUIREMENTS AND DESIGN	
	4.1 Introduction	28
	4.2 Feasibility Study	28
	4.3 Pilot Study on Student's Mobile Content Preferences	29
	4.4 Proposed System Framework	36
	4.5 Proposed System Functionalities	39
	4.6 UML Diagrams	42
	4.7 Prototype Storyboard Design	45
	4.8 Summary of Chapter	50
5	TESTING AND IMPLEMENTATION	
	5.1 Introduction	51
	5.2 Usability Testing	51
	5.3 Prototype Implementation in Android	55
	5.4 Summary of Chapter	66
6	RESULTS AND DISCUSSION	

	6.1 Introduction	67
	6.2 Analysis of Usability Testing	67
	6.3 Analysis of Usability Questionnaire	69
	6.4 Discussion	76
	6.5 Summary of Chapter	79
7	CONCLUSION	
	7.1 Summary	80
	7.2 Improvement	80
	7.3 Limitations	82
	7.4 Recommendation for Future Works	84
REFERENCES		85
APPENDIX		87



CHAPTER 1

INTRODUCTION

1.1 Overview

Advanced mobile devices such as smart phones and tablets are currently very popular amongst people mostly because they let people communicate and get information while being on the go. Due to the high increasing rate of mobile users [1] and business opportunities, the mobile device industries have been rapidly developing devices that are able to function at multiple levels. For example, a mobile device may be able to make calls, but they are also able to function as a GPS or a health monitoring device at the same time. The application development for mobile devices has gone back more than 10 years since the emergence of the first IBM Smartphone. Since then, many comprehensive programming environments have been made available for the major mobile platforms. The tasks of implementing a mobile application have been greatly simplified by these powerful development tools. On the other hand, it has become necessary to apply software engineering process towards the development of high-quality mobile applications as they have become able to adapt to multiple functionalities. Mobile devices currently have moved on from supporting inexpensive recreational applications to more business-critical uses. While many “classic” software engineering techniques such as the waterfall technique will transfer easily to the mobile application

domain, there are other areas such as medical, business and agriculture, which still need deeper research and development [4] in the mobile application section.

One of the research areas that are garnering interest in mobile application content development is the learning domain. Over the last two decades, learning institutions have become accustomed to and utilized the Internet, email, instant messaging, course management software, and much more to assist them in teaching and communicating with students. The growing use of mobile technology at learning institutions is the most current trend forcing educators to evaluate the merits and limitations of a new technology. Changes in technology continue to alter possibilities for learning and create new challenges for pedagogy. However, if not utilized properly, these devices will be a distraction to students, especially in the learning context [3].

Various e-learning solutions and related tools have been produced but mobility and interactivity is still a lacking quality in e-learning. In light of this, there is a need for educators and institutions to consider the implications of the use of mobile devices in the teaching and learning environment. In such environment, having an enhanced design [2] and providing an educational mobile application in learning not only create a better learning environment for students but also increase their motivation for learning.

1.2 Problem Statement

The limitation to a mobile device is a challenge itself to developing a mobile application in an educational context. Mobile devices typically have a smaller display and different styles of user interaction. This impacts the interaction design for mobile applications, which leads to impact on the whole development process. The mobile user interface paradigm is based around widgets, touch, physical motion, and keyboards (physical and virtual) rather than the familiar WIMP (Windows, Icons, Menus, Pointer) interface style of Android OS and Microsoft Windows. User interfaces may be replicated from their traditional web application but it is presumed to be redesigned [21] to ensure optimum use of the screen and the mobile user interface paradigm, including both the user input and the associated motion and location information.

Another limitation of current educational mobile applications is the lack of interactivity. While research shows that most students are more comfortable in passive learning, they yearn for concise directions on everything from assignments and assessments to when and how to access course information [22]. Collaborative technologies can also support [23, 24] social construction of learning, assessment, motivation, differentiation and personalization of, and engagement in learning for students; but they are usually poorly implemented or not incorporated at all [22] in educational applications.

There is also a growing need for students to move out of classroom and formal learning [25] due to the growth of mobile devices. Students are expecting the ability to work and learn while being on the go is applied in their learning process. Immediate access to information has proven to have many benefits in many learning and professional contexts.

1.3 Objective

Mobile devices are not originally built for learning purposes. However, many factors of mobile devices such as mobility, connectivity to the internet, ease of use are highly beneficial to the learning environment. Current software engineering methods may be adapted to mobile application content design but they do present several requirements and limitations, as explained in Section 1.2, that are less commonly found in conventional software content design process. Based on that, the objective of this project is;

- To study the design principles and requirements in developing m-learning course content.
- To propose the suitable m-learning course content prototype that allows active and synchronous learning process between students and educators based on the identified requirements and principles.
- To validate the prototype design in a learning environment.

1.4 Project Scope

This study focuses on the design principles and requirements in developing a mobile application for educational content. The expectation of the prototype is to have a design that provides an enhanced experience for educational content. This study aims to create an enhanced learning environment for students but also increase their motivation for learning.

1.5 Project Contribution

Ultimately the main contribution of this study is the mobile learning application prototype to represent the output of the requirements and design principles adopted from best practices in previous studies. Through the usage of the prototype, the active and synchronous learning process between students and educators is explored.

1.6 Thesis Organization

The rest of this paper is organized as follows. Chapter 2 presents a review of literature and relevant research associated with the problems addressed in this study. Chapter 3 presents the methodology and procedures used for the pilot study, data collection and analysis. Chapter 4 contains the requirements and design process of the mobile application prototype that is derived from the results of the pilot study. Chapter 5 elaborates on the procedures for testing and implementation of the mobile application in

its environment. Chapter 6 contains an analysis of the data collected during the testing and implementation period and presentation of the results. Chapter 7 offers a summary and discussion of the student's findings, implications for practice, and recommendations for future research.



REFERENCES

- [1] Ericsson Mobility Report. (2014, June 1). Retrieved October 16, 2014, from <http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-june-2014.pdf>
- [2] Huang, Y.-M., Hwang, W.-Y., & Chang, K.-E. (2010). Guest Editorial – Innovations in Designing Mobile Learning Applications. *Educational Technology & Society*, 13 (3), 1–2.
- [3] Lenhart, A. (2012). Teens, smartphones & texting. Pew Internet & American Life Project. research (pp. 397-400). ACM.
- [4] Wasserman, A. I. (2010, November). Software engineering issues for mobile application development. In Proceedings of the FSE/SDP workshop on Future of software engineering
- [5] Reveiu, A., Smeureanu, I., & Dardala, M. (2008, July). Content adaptation in mobile multimedia system for m-learning. In *Mobile Business, 2008. ICMB'08. 7th International Conference on* (pp. 305-313). IEEE.
- [6] Hashim, A. S., Ahmad, W. F. W., & Rohiza, A. (2010, December). A study of design principles and requirements for the m-learning application development. In *User Science and Engineering (i-USER), 2010 International Conference on* (pp. 226-231). IEEE.
- [7] Kamaludin, H., Kasim, S., Selamat, N., & Hui, B. C. (2012, May). M-learning application for Basic Computer Architecture. In *Innovation Management and Technology Research (ICIMTR), 2012 International Conference on* (pp. 546-549). IEEE.
- [8] Mandula, K. U. M. A. R., Meday, S. R., Muralidharan, V., & Parupalli, R. A. M. U. (2013, January). A student centric approach for mobile learning video content development and instruction design. In *Advanced Communication Technology (ICACT), 2013 15th International Conference On* (pp. 386-390). IEEE.
- [9] Pocatilu, P. (2010). Developing mobile learning applications for Android using web services. *Informatica Economica*, 14(3), 106-115.
- [10] Pemberton, L., Marcus, W., & Fallahkhair, S. (2009). A user created content approach to mobile knowledge sharing for advanced language learners. In *World Conference on Mobile and contextual Learning (mLearn)*.
- [11] Cavus, N., & Al-Momani, M. M. (2011). Mobile system for flexible education. *Procedia Computer Science*, 3, 1475-1479.
- [12] Andrew Begel, Nachiappan Nagappan, “Usage and Perceptions of Agile Software Development in an Industrial Context: An Exploratory Study”, *First International symposium on empirical software engineering and measurement*, pp. 255-264, 2007
- [13] Peter Maher, “Weaving Agile Software Development Techniques into a Traditional Computer Science Curriculum”, *Proc. of 6th IEEE International Conference on Information Technology: New Generation*, pp. 1687-1688, 2009
- [14] Anfanzuo, Jing Yang, Xiaowen Chen, “Research of Agile Software Development Based on Formal Methods”, *International Conference on Multimedia Information Networking and Security*, pp. 762-766, 2010.
- [15] Michael J Rees, “A Feasible User Story Tool for Agile Software Development”, *Proc. Of 9th Asia-Pacific Software Engineering Conference (APSEC' 02)*, 2002.

- [16] Outi Salo, Pekka Abrahamsson, “Integrating Agile Software Development and Software Process Improvement: a Longitudinal Case Study”, pp. 193-202, 2005
- [17] Richard Mordinyi, Eva Kuhn, Alexander Schatten, “Towards an Architectural Framework for Agile Software Development”, 17th IEEE International Conference and workshops on Engineering of Computer Based Systems, pp. 276-280, 2010
- [18] Jeffrey A. Livermore, “Factors that impact implementing an Agile Software Development Methodology”, pp. 82-85, IEEE 2007.
- [19] A. Ahmed, S. Ahmad, Dr. N. Ehsan, E. Mirza, S.Z. Sarwar, “Agile Software Development: Impact on Productivity and Quality”, pp. 287-290, IEEE 2010
- [20] Ying Wang, Dayong Sang, Wujie Xie, “Analysis on Agile Software Development Methods from the View of Informationalization Supply Chain Management”, 3rd International Symposium on Intelligent Information Technology Application Workshops”, pp. 219-222, 2009
- [21] Wasserman, A. I. (2010, November). Software engineering issues for mobile application development. In Proceedings of the FSE/SDP workshop on Future of software engineering research (pp. 397-400). ACM.
- [22] Armstrong, D. A. (2011). Students' Perceptions of Online Learning and Instructional Tools: A Qualitative Study of Undergraduate Students Use of Online Tools. Turkish Online Journal of Educational Technology-TOJET, 10(3), 222-226.
- [23] de Winter, J., Winterbottom, M., & Wilson, E. (2010). Developing a user guide to integrating new technologies in science teaching and learning: teachers' and pupils' perceptions of their affordances. Technology, Pedagogy and Education, 19(2), 261-267.
- [24] Enriquez, A. G. (2010). Enhancing student performance using tablet computers. College Teaching, 58(3), 77-84.
- [25] Johnson, L., Adams, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). The NMC horizon report: 2013 higher education edition.
- [26] Doyle, J., Farley, H., & Martin, N. (2013, December). Getting the full picture: Storyboarding our way to Stand Alone Moodle. In Proceedings of the 30th Australasian Society for Computers in Learning in Tertiary Education Conference (ASCILITE 2013) (pp. 247-251). Macquarie University.
- [27] Rutter, A. (2011). Lesson 1 – Storyboarding. Multimedia Design and Communication: Lessons of Teacher and Lecturer. A. Rutter. 2013.
- [28] Hashim, A. S., Ahmad, W. F. W., & Ahmad, R. (2011). Usability study of mobile learning course content application as a revision tool. In Visual Informatics: Sustaining Research and Innovations (pp. 23-32). Springer Berlin Heidelberg.
- [29] Hashim, A. S., Ahmad, W. F. W., & Ahmad, R. (2011, June). Mobile learning course content application as a revision tool: The effectiveness and usability. In Pattern Analysis and Intelligent Robotics (ICPAIR), 2011 International Conference on (Vol. 2, pp. 184-187). IEEE.
- [30] Johnson, L., Adams Becker, S., Estrada, V., Freeman, A. (2014). NMC Horizon Report: 2014 Higher Education Edition. Austin, Texas: The New Media Consortium.
- [31] Traxler, J. (2009). Learning in a mobile age. International Journal of Mobile and Blended Learning, 1(1), 1–12.

- [32] Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34, 177–193
- [33] Bradley, C., Haynes, R., Cook, J., Boyle, T., & Smith, C. (2009). Design and development of multimedia learning objects for mobile phones. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training* (pp. 157–182). Edmonton, AB: Athabasca University Press.
- [34] Bradley, C., Haynes, R., Cook, J., Boyle, T., & Smith, C. (2009). Design and development of multimedia learning objects for mobile phones. In M. Ally (Ed.), *Mobile learning: Transforming the delivery of education and training* (pp. 157–182). Edmonton, AB: Athabasca University Press.
- [35] Dumas, J. S., & Redish, J. (1999). *A practical guide to usability testing*. Intellect Books.
- [36] Lewis, J. R. (1995). IBM computer usability satisfaction questionnaires: psychometric evaluation and instructions for use. *International Journal of Human-Computer Interaction*, 7(1), 57-78.
- [37] Moodle Mobile. (n.d.). Retrieved June 26, 2015, from https://docs.moodle.org/29/en/Moodle_Mobile
- [38] Blackboard Mobile Learn | Features. (n.d.). Retrieved June 26, 2015, from <http://www.blackboard.com/Platforms/Mobile/Products/Mobile-Learn/Features.aspx>