

MOBILE GAME-BASED LEARNING (mGBL) ENGINEERING MODEL

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by
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Syamsul Bahrin Zaibon
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ABSTRACT

Mobile game-based learning (mGBL) is a game played on any handheld devices such as mobile phones. It is among the most recent growing research areas whereby its main aim is to use game play to enhance motivation in learning, engage in knowledge acquisition, and improve the effectiveness of learning activities through mobile environment. To fully utilize the potential of mGBL, researchers suggest looking at the most important part, which is the development methodology of mGBL. In relation to this, various game development methodologies have been introduced for different types of game genres and platforms. These methodologies propose different numbers of steps and activities; some focusing only on the learning design; some concentrating on the mobile technologies; and others on the complete life cycle. Although many game methodologies have been introduced, studies show that customized phases and steps to develop games for learning in mobile environment are substantially required. Therefore, the study discussed in this thesis addresses this gap by proposing an mGBL Engineering Model based on a number of games and learning theoretical and developmental foundations. In particular, the study identified the key steps of development methodology to be considered in developing mGBL applications which consist of phases, components, steps, and deliverables. In accomplishing this aim, a design science research methodology was adopted, comprising of five phases; (i) awareness of problem, (ii) suggestion, (iii) development, (iv) evaluation, and (v) conclusion. Subsequently, eight mGBL evaluation dimensions were put forward: visibility, complexity, compatibility, flexibility, clarity, effectiveness, manageability, and evolutionary. Model evaluation was conducted in three phases, namely; expert review, prototype development with heuristics evaluation, and experimental study. Generally, the proposed mGBL Engineering Model was well accepted by the experts contacted in this study. The model was also employed by a game company while developing an mGBL prototype. Here, the findings have implied that the model is useful to follow and it provides an easy guideline for fellow developers. In the experimental study phase, four learning or game methodologies; Analysis-Design-Development-Implementation-Evaluation, Input-Process-Output, Game Life Cycle, and mGBL Engineering Model; were studied and compared by 70 respondents. The findings have indicated that the proposed mGBL Engineering Model scored mean above 7.0 (out of 10) of all dimensions compared to the other three models (scored less than 7.0). The ANOVA results show that there are significant differences between all groups in six dimensions except complexity and compatibility. Although complexity and compatibility dimensions are not significantly different, the scores for the mGBL Engineering Model are higher than the other three models. All these results have demonstrated that the proposed mGBL Engineering Model exhibits useful development indicators for mGBL applications and is indeed a theoretical and practical contribution of the study. In addition, the other significant contributions are the eight evaluation dimensions together with the validated instrument. Furthermore, the artefact produced, which is the mGBL prototype is also a functional contribution.

ABSTRAK

Permainan pembelajaran mudah alih (*mGBL*) merupakan permainan yang dimainkan pada peralatan mudah alih seperti telefon mudah alih. Bidang ini antara bidang penyelidikan yang sedang berkembang di mana tujuan utamanya adalah menjadikan corak permainan sebagai jalan untuk meningkatkan motivasi dalam pembelajaran, penglibatan dalam mendapatkan pengetahuan, dan meningkatkan keberkesanan aktiviti pembelajaran melalui persekitaran mudah alih. Untuk mempertingkatkan potensi *mGBL*, para penyelidik mencadangkan untuk menumpukan aspek yang paling penting iaitu metodologi pembangunan *mGBL*. Oleh itu, banyak metodologi pembangunan permainan telah diperkenalkan dengan pelbagai jenis permainan dan platform. Metodologi tersebut mencadangkan pelbagai langkah dan aktiviti, antaranya ada yang lebih menekankan reka bentuk pembelajaran, ada pula teknologi mudah alih, dan ada juga kepada kitaran hayat. Walaupun banyak metodologi diperkenalkan, kajian menunjukkan bahawa fasa dan langkah yang boleh disesuaikan dalam pembangunan permainan untuk pembelajaran di persekitaran mudah alih adalah sangat diperlukan. Oleh itu, kajian yang dibincangkan dalam tesis ini mencadangkan penyelesaian melalui Model Kejuruteraan *mGBL* yang berpandukan kepada teori dan asas pembangunan permainan dan pembelajaran. Secara khususnya, kajian ini mencari langkah utama dalam metodologi pembangunan *mGBL* iaitu fasa, komponen, langkah, dan hasilnya. Bagi mencapai tujuan tersebut, metodologi kajian sains rekabentuk digunakan yang mempunyai lima fasa iaitu (i) kenal pasti masalah, (ii) cadangan, (iii) pembangunan, (iv) penilaian, dan (v) kesimpulan. Selain itu, lapan dimensi penilaian *mGBL* diketengahkan: keterlihatan, kerumitan, kesesuaian, kelenturan, kejelasan, keberkesanan, pengurusan, dan evolusi. Penilaian model dilakukan dalam tiga cara iaitu; penilaian pakar, pembangunan prototaip dengan pengujian heuristik, dan kajian eksperimen. Umumnya, model yang dicadangkan ini diterima baik oleh pakar-pakar yang terlibat dalam kajian ini. Model ini juga digunakan oleh sebuah syarikat permainan dengan membangunkan prototaip *mGBL*. Di sini, hasil dapatan menunjukkan bahawa model tersebut berguna untuk diikuti dan memberikan garis panduan kepada para pembangun. Dalam fasa kajian eksperimen, empat metodologi permainan atau pembelajaran; *Analysis-Design-Development-Implementation-Evaluation*, *Input-Process-Output*, *Game Life Cycle* dan Model Kejuruteraan *mGBL*, dikaji dan dibandingkan oleh 70 responden. Hasil dapatan menunjukkan bahawa model cadangan mendapat skor min melebihi 7.0 (dari 10) untuk semua dimensi jika dibandingkan dengan tiga model tersebut (skor kurang dari 7.0). Keputusan ANOVA menunjukkan terdapat perbezaan signifikan antara enam dimensi penilaian kecuali kerumitan dan kesesuaian. Walaupun dimensi kerumitan dan kesesuaian tidak berbeza secara signifikan, skor diperolehi model cadangan ini lebih tinggi. Keputusan ini menunjukkan bahawa model cadangan tersebut boleh diaplikasikan dalam pembangunan *mGBL* yang menjadi sumbangan secara teori dan praktikal dalam kajian ini. Selain itu, sumbangan lain ialah lapan dimensi penilaian melalui instrumen yang telah ditentukan sah. Artifak yang dihasilkan, yang merupakan prototaip *mGBL* juga merupakan satu lagi sumbangan fungsian.

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TABLE OF CONTENTS

PERMISSION TO USE	ii
DECLARATION.....	iii
ABSTRACT	iv
ABSTRAK	v
ACKNOWLEDGEMENT	vi
LIST OF FIGURES	xiv
LIST OF TABLES	xviii
LIST OF ABBREVIATIONS	xx
LIST OF PUBLICATIONS	xxi
LIST OF AWARDS AND RECOGNITIONS	xxiii
CHAPTER 1: BACKGROUND OF STUDY	1
1.1 Introduction	1
1.2 Research Motivations	1
1.2.1 Current State of Mobile Phone Subscriptions in Malaysia	1
1.2.2 Government Supports and Initiatives	4
1.2.3 Advances in Mobile Learning	5
1.2.4 Summary of Research Motivations	8
1.3 Preliminary Study	9
1.3.1 A Survey on Student Preferences for M-learning	9
1.4 Problem Statement	14
1.4.1 Research Gaps	17
1.5 Research Objectives	18
1.6 Research Questions	18
1.7 Research Scope and Limitations	19
1.8 Contributions of the Study	19
1.8.1 mGBL Engineering Model	19
1.8.2 A Prototype of mGBL Application	20

1.8.3 Instrument to Evaluate mGBL Engineering Model	20
1.8.4 Adapted Heuristics Evaluation for mGBL Application	20
1.8.5 Comparative Analyses of Development Models	21
1.9 Significances of the Study	21
1.10 Research and Theoretical Framework	22
1.11 Operational Definition of Terms	23
1.12 Thesis Structure	26
CHAPTER 2: LITERATURE REVIEW	29
2.1 Introduction	29
2.2 Game Definition	29
2.3 Game-Based Learning (GBL)	30
2.3.1 The Widespread Use and Trends of GBL	31
2.3.2 Categories of GBL.....	31
2.3.3 Characteristics of GBL.....	33
2.4 mGBL	36
2.4.1 Characteristics of Mobile Game	38
2.4.2 Characteristics of mGBL.....	40
2.5 Learning Theories in mGBL.....	42
2.5.1 Behaviourism	43
2.5.2 Cognitivism	44
2.5.3 Constructivism	45
2.5.4 Implications of Learning Theories to the Study.....	47
2.5.5 Experiential Learning Theory.....	48
2.6 Learning Approaches	52
2.6.1 Multiple Intelligences	52
2.6.2 Nine Events of Instructions	54
2.6.3 Problem-Based Learning	55
2.7 Appreciative Inquiry Theory	57
2.7.1 Discover	58

2.7.2 Dream	58
2.7.3 Design	58
2.7.4 Destiny/ Deliver	59
2.8 Game Theory	60
2.9 Theory of Play	61
2.10 Game Design and Instructional Design	64
2.11 Instructional Design Models	66
2.11.1 ADDIE Model.....	67
2.11.2 Dick and Carey Instructional Design Model	68
2.11.3 Keller's ARCS Model of Motivation	70
2.11.4 ASSURE Model	72
2.11.5 Morrison, Ross and Kemp Model	74
2.11.6 Implications of ID Models to the Study	75
2.12 Game Design Model and Development Methodologies.....	76
2.12.1 Input-Process-Outcome Game Model.....	77
2.12.2 Experiential Gaming Model	79
2.12.3 Integrated Model for Educational Game Design	80
2.12.4 The FFIDGE Model	81
2.12.5 Four Dimensional Framework	83
2.12.6 Adaptive Digital GBL Framework	84
2.12.7 Games for Activating Thematic Engagement	85
2.12.8 The Digital Game Involvement Model.....	86
2.12.9 Framework for Designing GBL for Children	88
2.12.10 Digital GBL Model for History Educational Games Design	89
2.12.11 Comparative Analysis of GBL Design Models	91
2.13 Mobile Game Development Methodologies	95
2.13.1 Best Practice for Mobile Game Development	95
2.13.2 Scrum Methodology	97
2.13.3 Game Development Methodology.....	98
2.13.4 Game Life Cycle.....	99

2.13.5 Design-Protect-Build-Test-Market-Sell	101
2.13.6 Comparative Analysis of the Mobile Game Development Methodologies	102
2.13.7 Implications of Comparative Analysis to the Study.....	104
2.14 Summary.....	104
CHAPTER 3: METHODOLOGY.....	106
3.1 Introduction	106
3.2 Design Research	106
3.3 Rationale of Using the Design Research	109
3.4 Phases in Methodology	109
3.5 Phase 1: Awareness of Problem	111
3.5.1 Literature Review and Content Analysis.....	111
3.5.2 Comparative Studies	111
3.5.3 Preliminary Study- a Survey	113
3.6 Phase 2 & 3: Suggestion and Development	113
3.6.1 Study on the Flows and Cycles of mGBL Development	113
3.6.2 Expert Consultation	114
3.6.3 Combine mGBL Learning Model with the Proposed Model	115
3.6.4 mGBL Engineering Model Development	115
3.7 Phase 4: Evaluation	115
3.7.1 Pre- Evaluation and Expert Review	118
3.7.2 Prototype Development and Heuristics Evaluation	118
3.7.3 Pre-Selection Study on the Preferred Models for mGBL Development	119
3.7.4 Experimental Study	119
3.7.5 Instruments Developed for this Study.....	120
3.7.5.1 Instrument for Expert Consultation.....	121
3.7.5.2 Instrument for Pre-Evaluation Review.....	121
3.7.5.3 Instrument for Pre-Selection Study	122
3.7.5.4 Instrument for Expert Review and Experimental Study	122
3.7.5.5 Instrument for Heuristics Evaluation Strategy.....	128

3.8 Phase 5: Conclusion & Analysis of Findings.....	131
3.9 Samples and Unit of Analysis	131
3.10 Summary.....	133
CHAPTER 4: THE PROPOSED MODEL: mGBL ENGINEERING MODEL	134
4.1 Introduction	134
4.1.1 The Expert Consultation	135
4.2 The Proposed mGBL Engineering Model	138
4.2.1 Pre-Production Phase	140
4.2.2 Review and Sign-Off After Pre-Production Phase	149
4.2.3 Production Phase	150
4.2.4 Review After Production Phase	155
4.2.5 Post-Production Phase.....	155
4.2.6 Flow of Documents and Deliverables	159
4.3 Summary	160
CHAPTER 5: EXPERT REVIEW AND PROTOTYPING OF mGBL ENGINEERING MODEL...	162
5.1 Introduction	162
5.2 Pre-Evaluation Review	162
5.3 Expert Review	164
5.3.1 Methods and Instruments	164
5.3.2 Expert Review Findings.....	164
5.4 mGBL Prototype Design and Development.....	166
5.4.1 Pre-Production Phase	166
5.4.2 Review and Sign Off After Pre-Production Phase	175
5.4.3 Production Phase	175
5.4.4 Review After Production Phase	178
5.4.5 Post-Production Phase.....	178
5.5 Screen Shots of 1M'sia mGBL	180
5.6 Heuristics Evaluation for mGBL	185

5.6.1 Evaluation Sessions	186
5.6.2 Findings	188
5.7 Summary	191
CHAPTER 6: EXPERIMENTAL STUDY OF mGBL ENGINEERING MODEL	192
6.1 Introduction	192
6.2 Pre-Selection Study for Preferred Choice of Methodology for mGBL Development	192
6.3 Experimental Study	195
6.4 Findings of Experimental Study	196
6.4.1 Results from the One-Way ANOVA Test	197
6.4.2 Results from Post Hoc Test: Multiple Comparisons	199
6.5 Hypothesis Testing	203
6.6 Summary	204
CHAPTER 7: CONCLUSION	205
7.1 Introduction	205
7.2 Research Question 1: How to engineer a mGBL in a systematic way?	205
7.3 Research Question 2: What are the main components of the proposed model?	206
7.4 Research Question 3: Which ID models should be included in the engineering model?.....	208
7.5 Research Question 4: Is the proposed mGBL engineering model applicable?	210
7.6 Objective of the Study – Revisited	211
7.7 Limitations of Study and Recommendations for Future Works	212
7.8 Conclusion	214
References	216
Appendix A: Instrument for Expert Consultation	237
Appendix B: Instrument for Pre-Evaluation Review	240

Appendix C: Instrument for Pre-Selection Study	243
Appendix D: Instrument for Expert Review and Experimental Study.....	245
Appendix E: Instrument for Heuristics Evaluation (with the findings)	248
Appendix F: List of Experts (Academicians)	250
Appendix G: List of Experts (Game Industries)	251

LIST OF FIGURES

Figure 1.1: Penetration rate of mobile phone subscriptions in Malaysia from 1998 to 2010 (MCMC, 2011).....	4
Figure 1.2: Research and Theoretical Framework	24
Figure 1.3: Relationship between design model, development methodology, and engineering model.....	26
Figure 1.4: Thesis structure based on research objectives.....	27
Figure 2.1: Experiential learning stages (Kolb, 1984).....	49
Figure 2.2: Learning model of mGBL using the experiential learning theory (Kolb, 1984)	51
Figure 2.3: mGBL elements mapped with PBL characteristics.....	56
Figure 2.4: Appreciative inquiry stages of 4-D model (Cooperrider et al., 2003).....	57
Figure 2.5: AI stages interrelated to mGBL development phases	59
Figure 2.6: ADDIE model	68
Figure 2.7: Dick and Carey Design Model (Dick & Carey, 1996)	70
Figure 2.8: ARCS model with Gagne's events of instruction (Keller, 1993)	71
Figure 2.9: ASSURE model (Heinich & Molenda, 1993)	72
Figure 2.10: Morrisonson, Ross and Kemp Model (Morrison, Ross & Kemp, 2004)	75
Figure 2.11: Phases alignment in Instructional Design model and Game Design	76
Figure 2.12: Input-Process-Outcome Game Model (Garris et al., 2002)	78
Figure 2.13: Integrated Experiential Gaming Model (Kiili, 2005)	80
Figure 2.14: Integrated Model for Educational Game Design (Paras & Bizzocchi, 2005).81	
Figure 2.15: The Fuzzified Instructional Design Development of Game-like Environments (FIDGE) Model (Akilli & Cagiltay, 2006)	82
Figure 2.16: Four Dimensional Framework (de Freitas & Oliver, 2006)	83
Figure 2.17: The Digital Game Involvement Model (Calleja, 2007)	87
Figure 2.18: Framework for Designing GBL for Children (Noor Azli et al., 2008)	89
Figure 2.19: Proposed components in DGBL Model for History educational games design (Nor Azan et al., 2009).....	90

Figure 2.20: Best Practice for Mobile Game Development (Dholkawala, 2005)	96
Figure 2.21: Scrum methodology (McGuire, 2006)	97
Figure 2.22: Game development methodology (Dynamic Ventures, Inc., 2007)	99
Figure 2.23: Game development life cycle (Janousek, 2007)	100
Figure 2.24: Overview of the literature study.....	105
Figure 3.1: Research Phases	110
Figure 3.2: Phase 1- Awareness of Problem	112
Figure 3.3: Phase 2 & 3 – Suggestion and Development	114
Figure 3.4: Phase 4 & 5 – Evaluation & Conclusion	117
Figure 3.5: 10-point semantic scale	124
Figure 4.1: mGBL Engineering Model.....	139
Figure 4.2: Phase 1, Pre-Production.....	140
Figure 4.3: Component 1- Requirement Analysis & Planning.....	141
Figure 4.4: Component 2- Mobile Interaction & Technical Analysis	142
Figure 4.5: Component 3- Learning Content Design.....	144
Figure 4.6: mGBL Learning model adapted from Kolb’s experiential learning theory ...	148
Figure 4.7: Component 4- Game Features Design	149
Figure 4.8: Phase 2, Production	150
Figure 4.9: Component 5- Learning Content Development	152
Figure 4.10: Component 6- Game Assets Development.....	153
Figure 4.11: Component 7- Coding & Core Mechanics Development.....	153
Figure 4.12: Component 8- Game Features Integration.....	154
Figure 4.13: Phase 3, Post-Production	155
Figure 4.14: Component 9- Game Porting & Deployment	157
Figure 4.15: Component 10- Playability, Usability & Mobility Testing	157
Figure 4.16: Component 11- Educational Testing.....	159
Figure 4.17: Component 12- Distribution	159
Figure 4.18: Flow of Documents & Deliverables.....	161
Figure 5.1: Radar graph for the evaluation score	165
Figure 5.2: 1M’sia main environment game flow	170

Figure 5.3: Menu 1- Humility	170
Figure 5.4: Menu 2- Traditional Costumes	171
Figure 5.5: Mix & Match Game of Traditional Costumes	171
Figure 5.6: Menu 3- Mutual Respect to Others	172
Figure 5.7: Menu 4- At School.....	172
Figure 5.8: Pick & Run Game of School Rules	173
Figure 5.9: Menu 5- Acceptance	173
Figure 5.10: Menu 6- Religious Places	174
Figure 5.11: Mix & Match Game of Religious Places	174
Figure 5.12: The aspiration values of 1Malaysia concept.....	176
Figure 5.13: Main Character	177
Figure 5.14: Main environment of 1M'sia	181
Figure 5.15: Situation and value in 1M'sia.....	182
Figure 5.16: Humility simple quiz.....	182
Figure 5.17: Traditional costume store.....	183
Figure 5.18: Mix-and-match game	183
Figure 5.19: Correct answer	184
Figure 5.20: School rules game	184
Figure 5.21: Final score	185
Figure 5.22: Visitors playing 1'Msia mGBL.....	187
Figure 5.23: Visitors playing 1'Msia mGBL.....	187
Figure 5.24: Conducting the evaluation.....	187
Figure 5.25: Game usability components	189
Figure 5.26: Mobility components.....	189
Figure 5.27: Playability components.....	190
Figure 5.28: Learning content components.....	191
Figure 6.1: Comparison of mean scores between four models for eight variables.....	197
Figure 6.2: Scores of Visibility between mGBL and other models.....	201
Figure 6.3: Scores of Compatibility between mGBL and other models.....	201
Figure 6.4: Scores of Complexity between mGBL and other models	201

Figure 6.5: Scores of Flexibility between mGBL and other models	201
Figure 6.6: Scores of Clarity between mGBL and other models	202
Figure 6.7: Scores of Effectiveness between mGBL and other models	202
Figure 6.8: Scores of Manageability between mGBL and other models	202
Figure 6.9: Scores of Evolutionary between mGBL and other models	202
Figure 6.10: Maths Mania mGBL.....	203
Figure 6.11: Hungry Mouse mGBL	203

LIST OF TABLES

Table 1.1: Mobile phone subscriptions in Malaysia (MCMC, 2011)	2
Table 1.2: Example of M-learning Systems	6
Table 1.3: Popularity of Game-Based Concepts (based on Sawyer & Smith, 2008).....	8
Table 1.4: Demographic profiles of respondents (ages and races)	10
Table 1.5: Having access to Mobile Phone	11
Table 1.6: Play Mobile Games.....	11
Table 1.7: Purpose for Playing Games (all types of games).....	12
Table 1.8: What do you want to learn from game?.....	12
Table 1.9: Preferred Device for Learning	13
Table 2.1: Characteristics of GBL (Gee, 2005).....	34
Table 2.2: Elements of engaging in GBL as described by Prensky (2001).....	35
Table 2.3: Example of mGBL Projects	37
Table 2.4: Summary of Learning Theories	47
Table 2.5: Learning theories for mGBL characteristics	48
Table 2.6: Theories of Play (Verenikina, 2003)	63
Table 2.7: Comparative Analysis of GBL Design Models.....	91
Table 2.8: Examples of Studies Adopting the Reviewed Models.....	93
Table 2.9: Comparison of steps involve in mobile game development methodologies	102
Table 2.10: Comparisons of Mobile Game Development Methodologies	103
Table 3.1: Design science research guidelines (Hevner et al., 2004).....	108
Table 3.2: Design evaluation methods and techniques (Hevner et al., 2004).....	116
Table 3.3: Comparison of evaluation dimensions from 10 studies	123
Table 3.4: Construct Descriptions for mGBL Engineering Model	124
Table 3.5: Case Processing Summary	125
Table 3.6: Reliability Test	125
Table 3.7: Factor Analysis and Loadings for Each Item.....	126
Table 3.8: Game usability components (Korhonen & Koivisto, 2006).....	128
Table 3.9: Mobility components (Korhonen & Koivisto, 2006)	129

Table 3.10: Playability components (Korhonen & Koivisto, 2006)	130
Table 3.11: Learning Content (LC) Components	131
Table 4.1: Activities performed prior to proposing the model.....	135
Table 4.2: Responses from the experts.....	136
Table 4.3: Activities and phases suggested for mGame development.....	137
Table 4.4: Learning theories for mGBL learning content design	144
Table 4.5: Multiple Intelligences connect to mGBL learning content	145
Table 4.6: Gagne’s Nine Events of Instructions associated with mGBL.....	146
Table 4.7: PBL characteristics mapped to mGBL	147
Table 5.1: Comments and Suggestions	163
Table 5.2: Mean scores of the mGBL engineering model.....	164
Table 5.3: 1M’sia mGBL Characteristics.....	169
Table 5.4: Demographics profiles	188
Table 6.1: Demographics profile of respondents.....	193
Table 6.2: Preferred Rank of the mobile game development methodologies	193
Table 6.3: Preferred Rank of the ID models.....	194
Table 6.4: Preferred Rank of the GBL models.....	194
Table 6.5: Experimental and control groups.....	195
Table 6.6: Means and Standard Deviations for Four Models and Eight Variables	196
Table 6.7: One Way Analyses of Variance for Four Models on Eight Variables	198
Table 6.8: Post Hoc Test- Multiple Comparisons.....	200
Table 6.9: One Way Analyses of Variance for Four Models on Applicability.....	204

LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation and Evaluation
AI	Appreciative Inquiry
ANOVA	Analysis of Variance
ARCS	Attention, Relevance, Confidence, and Satisfaction
CBT	Computer Based Training
CD	Compact Disk
GBL	Game-Based Learning
GD	Game Design
GLC	Game Life Cycle
GPS	Global Positioning System
ICT	Information and Communication Technology
ID	Instructional Design
IGDA	International Game Developer Association
IPO	Input-Process-Output
ITU	International Telecommunication Union
MCMC	Malaysian Communications and Multimedia Commission
MMORGP	Multiplayer Online Role-Playing Game
mGame	Mobile Game
mGBL	Mobile Game-Based Learning
MMS	Multimedia Messaging Service
PBL	Problem Based Learning
PDA	Personal Digital Assistant
SMS	Short Messaging System
UUM	Universiti Utara Malaysia
VCD	Video Compact Disk

LIST OF PUBLICATIONS

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- Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**. (2010). Mobile Games Based Learning (mGBL) with Local Content and Appealing Characters, *Int. Journal of Mobile Learning and Organization*, 4(1), pp. 55-82. USA.
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LIST OF AWARDS AND RECOGNITIONS

- Award: **Gold Medal** at the Seoul International Invention Fair 2009 (SIIF2009), Korea.
 - Project Title: *1M'sia Mobile Game*.
 - Project Members: Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**.
- Award: **Gold Medal** at the International Exposition of Research and Invention of Institutions of Higher Learning 2009 (PECIPTA2009), Kuala Lumpur.
 - Project Title: *1Malaysia through Local Content*.
 - Project Members: Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**.
- Award: **Bronze Medal** at the Malaysian Technology Expo 2009 (MTE2009), Kuala Lumpur.
 - Project Title: *MY Road Traffic Signs mGame*.
 - Project Members: Norshuhada Shiratuddin, **Syamsul Bahrin Zaibon** & Ayman Srour.

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 - Authors: Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**.

CHAPTER 1

Background of Study

1.1 Introduction

This introductory chapter deliberates on the motivation aspects of the study; the advances of mobile learning (m-learning), the statement of the problem; objectives and significances of the study; and lastly, definition of the terms that are used throughout the study.

1.2 Research Motivations

A few aspects have been brought towards the proposed title of this study. Therefore, this section summarizes some aspects which motivate the study to be conducted.

1.2.1 Current State of Mobile Phone Subscriptions in Malaysia

The ownership of mobile phone is exponentially increasing all around the world. The International Telecommunication Union (ITU) Telecommunication/ Information Technology and Communication (ICT) Indicators Report (ITU, 2008) found indication that ICTs, broadband, and mobile phone uptake advance growth and development in Asia Pacific region. This is due to the fact that mobile technology is naturally portable, flexible to anywhere, possible to connect users to variety of information sources and enable communication everywhere (Smith et al., 1999; Naismith et al.,

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