



**Faculty of Information and Communication Technology**

**THE ENHANCEMENT OF GAMIFICATION LEADER BOARD  
MODEL BASED ON PLAYER TYPE TO INCREASE LEARNING  
ENGAGEMENT**

**Rafizah binti Daud**

**Master of Science in Information and Communication Technology**

**2019**



**THE ENHANCEMENT OF GAMIFICATION LEADER BOARD MODEL BASED  
ON PLAYER TYPE TO INCREASE LEARNING ENGAGEMENT**

**RAFIZAH BINTI DAUD**

**A thesis submitted  
in fulfilment of the requirements for the degree of Master of Science  
in Information and Communication Technology**

**Faculty of Information and Communication Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2019**

## DECLARATION

I declare that this thesis entitled “The Enhancement of Gamification Leader Board Model Based on Player Type to Increase Learning Engagement” is the result of my own research except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :.....

Name :RAFIZAH BINTI DAUD

Date :.....

## **APPROVAL**

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Science in Information and Communication Technology.

Signature :.....

Supervisor Name :PROF. TS. DR. SAZILAH BINTI SALAM

Date :.....

## **DEDICATION**

To my beloved husband

To my father and mother

To my beloved son and daughter

To my Supervisor, Professor Ts. Dr. Sazilah Binti Salam

To my Co-Supervisor, Dr. Siti Nurul Mahfuzah Binti Mohamad

For the full support, guidance and inspiration for me to fulfill the goals.

## ABSTRACT

Gamification is gaining energy as an educational innovation to engage students in their learning process. Education can benefit from gamification by improving learning environment to make it more enjoyable and engaging for students. Initial study indicated that leader board is one of the most popular gamification elements. However, the design of the leader board must be carefully balance since the lower position in the scoreboard can possibly affect engagement in a negative way. Some researches highlighted that some of the students enjoyed the competition and some of them did not. Hence, the aim of this study was to develop a gamification leader board model based on player type (GLeb) to engage students learning. This study involved both quantitative and qualitative methods. The quasi experiment three separate-sample pretest-posttest design was adopted to test the usability of GLeb prototype. The instruments used in this study were pre and post test, classroom observation rubric and perception of gamification leader board model based on player type. A total of 55 students from three Community Colleges in Melaka had involved in this study. The data were analyzed using descriptive, parametric and Partial Least Squares Structured Equation Model (PLS-SEM). The results show that the GLeb model contributes towards positive effect mediated by learning interaction in increasing learning engagement. The deployment of game mechanics produced greater learning engagement in quality of task, task completion time and task download time. The findings of this study are aligned with the Theory of Gamified Learning. Among key recommendations for future study are to refine the proposed model for affective engagement component and to further explore other potential elements of gamification to retain students' engagement. In conclusion, the formation of the GLeb could provide guidelines and conceptual model for Massive Open Online Courses (MOOC) Developers or other Learning Management Systems (LMS) to implement gamification design based on player type.

## **ABSTRAK**

*Gamifikasi semakin mendapat tempat sebagai satu inovasi pendidikan untuk mendekati para pelajar dalam proses pembelajaran. Pendidikan boleh mendapat manfaat daripada Gamifikasi dengan menambahbaik proses pembelajaran lebih menyeronokkan dan menarik untuk pelajar. Kajian awalan mendapati bahawa papan skor merupakan salah satu daripada elemen gamifikasi yang paling popular. Walau bagaimanapun, reka bentuk papan skor mestilah diseimbangkan dengan baik kerana kedudukan yang lebih rendah dalam papan skor menjejaskan motivasi dengan cara yang negatif. Sesetengah penyelidikan menekankan bahawa sesetengah pelajar menikmati persaingan dan sebahagian daripadanya tidak. Oleh itu, matlamat kajian ini adalah untuk membangunkan model papan skor berdasarkan profil pelajar (GLEb) untuk melibatkan pelajar di dalam pembelajaran. Kajian ini melibatkan kaedah kuantitatif dan kualitatif. Kajian ini menggunakan pendekatan metodologi rekabentuk sampel ujian pra dan pasca secara berasingan untuk menguji kegunaan prototaip GLEb. Instrumen-instrumen yang digunakan dalam kajian ini ialah ujian pra dan pasca, rubrik pemerhatian kelas dan persepsi terhadap model papan skor berdasarkan profil pelajar. Seramai 55 orang pelajar daripada tiga buah Kolej Komuniti di Melaka terlibat dalam kajian ini. Data dianalisis dengan menggunakan analisa deskriptif, parametrik dan permodelan persamaan struktur dengan kuasa dua terkecil separa (PLS-SEM). Hasil kajian menunjukkan bahawa GLEb telah menyumbang kepada kesan yang positif melalui interaksi pembelajaran dalam meningkatkan tahap penglibatan pelajar di dalam proses pembelajaran. Pelaksanaan mekanik permainan menghasilkan penglibatan pembelajaran yang lebih besar dalam kualiti tugas, masa penyelesaian tugas dan masa muat turun tugas. Penemuan kajian ini adalah selaras dengan Teori Pembelajaran Gamifikasi. Antara cadangan utama untuk kajian masa depan adalah untuk memperbaiki model yang dicadangkan bagi komponen penglibatan afektif dan untuk meneroka lagi unsur-unsur potensi yang lain untuk mengekalkan keterlibatan pelajar. Kesimpulannya, pembentukan GLEb dapat menyediakan garis panduan dan model konseptual untuk Massive Open Online Courses (MOOC) atau Sistem Pengurusan Pembelajaran Lain (LMS) untuk melaksanakan reka bentuk gamifikasi berdasarkan profil pelajar.*



## ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere appreciation to my supervisor Professor Ts. Dr. Sazilah Binti Salam for her essential supervision, advice, and support throughout my study journey. I would also like to thank to my co-supervisor Dr. Siti Nurul Mahfuzah Binti Mohamad for her encouragement and guidance towards the completion of this thesis. On top of that, I would like to express my deepest gratitude to the certificate students from Malaysia Community College who participated in this project as well as the lecturers for their cooperation, time and effort spent during experiment phase. My appreciation is also dedicated to Prof. Dato' Dr. Norazah Binti Nordin (UKM), Dr. Nurkhamimi Bin Zainuddin (USIM), Dr. Mohd Hafiz Bin Zakaria (UTeM) and Dr. Fam Soo Fen (UTeM) for all advice and suggestions during design and analysis process. Special thanks to Dr. Sharifah Nadiyah Binti Razali for her guidance in developing survey instruments. Finally, deepest appreciation dedicated to all my family members who helped to take care of my children Irfan Farihin and Nur Iris Farizza during this long journey.

## TABLE OF CONTENTS

	<b>PAGE</b>
<b>DECLARATION</b>	
<b>APPROVAL</b>	
<b>DEDICATION</b>	
<b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>ix</b>
<b>LIST OF FIGURES</b>	<b>xi</b>
<b>LIST OF APPENDICES</b>	<b>xv</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xvi</b>
<b>LIST OF PUBLICATIONS</b>	<b>xvii</b>
<b>CHAPTER</b>	
<b>1. INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem statement	2
1.3 Research objective	4
1.4 Research question	4
1.5 Research scope	5
1.6 Significant of the study	5
1.7 Limitation of the study	5
1.8 Research approach	6
1.9 Operational definition	8
1.9.1 Gamification	8
1.9.2 Gamification mechanics	8
1.9.3 Gamification element	8
1.9.4 Leader board	8
1.9.5 Rewards	9
1.9.6 Trophies-Badges	9
1.9.7 Points	9
1.9.8 Achiever	9
1.9.9 Socializer	9
1.9.10 Player	10
1.9.11 Learning engagement	10
1.9.12 Cognitive engagement	10
1.9.13 Behaviour engagement	10
1.9.14 Learner-learner interaction	10
1.9.15 Learner-content interaction	11

1.9.16 Learner-instructor interaction	11
1.10 Summary	11
<b>2. LITERATURE REVIEW</b>	<b>12</b>
2.1 Introduction	12
2.2 Gamification	12
2.2.1 Gamification elements	13
2.2.1.1 Point	14
2.2.1.2 Badge	16
2.2.1.3 Leader board	20
2.2.1.4 Leader board model	22
2.2.2 Issues on point, badge and leader board (PBL mechanic)	26
2.2.3 Implication to the study	27
2.3 Learning engagement	28
2.3.1 Cognitive engagement	28
2.3.2 Behavioural engagement	29
2.3.3 Emotional engagement	29
2.3.4 Learning engagement assessment	29
2.3.5 Gamification in learning engagement	31
2.3.6 Implication of learning engagement to the study	39
2.4 Learning interaction	40
2.4.1 Interaction in learning engagement	40
2.4.2 Implication of the learning interaction to the study	46
2.5 Player type model	47
2.5.1 Bartle player types	47
2.5.2 Marczewski's player types model	49
2.5.3 Implication of player type model to the study	52
2.6 Gamification theoretical framework for online learning	52
2.6.1 A taxonomy linking game attributes to learning	53
2.6.2 A theory of gamified learning	54
2.6.3 The mediating role of student interaction and student Engagement on learning outcome	60
2.6.4 Implication of theoretical framework to the study	62
2.7 Decision making with the analytic hierarchy process	63
2.7.1 Implication of AHP to the study	66
2.8 Summary	67
<b>3. METHODOLOGY</b>	<b>68</b>
3.1 Introduction	68
3.2 Research framework	68
3.3 Theoretical framework	70
3.3.1 Independent variables	71
3.3.1.1 Leader board types	71

3.3.1.2 Badge types	72
3.3.2 Dependent variables	73
3.3.3 Mediator variables	73
3.3.4 Gamification leader board model to increase learning engagement (GLeb)	74
3.4 Research design	76
3.4.1 Research question 1	77
3.4.1.1 Participant	77
3.4.1.2 Instrument	78
3.4.1.3 Research procedure	80
3.4.2 Research question 2a	82
3.4.2.1 Participants	82
3.4.2.2 Research procedure	83
3.4.3 Research question 2b	84
3.4.3.1 Participant	85
3.4.3.2 Instrument	85
3.4.3.3 Research procedure	85
3.4.4 Research question 3, 4 and 5	86
3.4.4.1 Participants for research question 3, 4 and 5	88
3.4.4.2 Instrument	90
3.4.4.3 Research procedure	92
3.4.4.4 Testing procedure for research objective 3	97
3.4.4.5 Data analysis guideline for PLS-SEM results (research question 5)	98
3.4.5 Summary	99
<b>4. DEVELOPMENT OF PROTOTYPE</b>	<b>100</b>
4.1 Introduction	100
4.2 Phase 1: Analysis	101
4.3 Phase 2: Design	102
4.3.1 Gamification mechanic design	103
4.3.2 Learning activity	107
4.3.3 Database	108
4.3.4 System architecture for website	108
4.4 Phase 3: Development	112
4.4.1 Software used	112
4.4.2 GLeb prototype interface	113
4.4.2.1 Admin module	114
4.4.2.2 Lecturer module	114
4.4.2.3 Student module	121
4.4.3 Testing	124
4.5 Phase 4: Implementation	124
4.5.1 Pilot test for GLeb system	125

4.5.2 Pilot test for instrument refinement	125
4.6 Phase 5: Evaluation	126
4.7 Summary	128
<b>5. DATA ANALYSIS</b>	<b>129</b>
5.1 Introduction	129
5.2 Demographic data	129
5.3 Data analysis results	132
5.3.1 Research question 1	133
5.3.1.1 Discussion on research question 1 finding	135
5.3.2 Research question 2a	136
5.3.3 Research question 2b	141
5.3.3.1 Discussion on research question 2 finding	144
5.3.4 Research question 3	145
5.3.4.1 Pre-test and post-test	145
5.3.4.2 Data analytic from GLeb system	153
5.3.4.3 Discussion on research question 3 finding	154
5.3.5 Research question 4	156
5.3.5.1 Data analytic from GLeb	156
5.3.5.2 Observation on student behaviour in class activity	160
5.3.5.3 Discussion on research question 4 finding	162
5.3.6 Research question 5	163
5.3.6.1 Data screening and measurement model	164
5.3.6.2 The construct, model and hypothesis	166
5.3.6.3 Results	167
5.3.6.4 Discussion on research question 5 finding	169
5.4 Summary	172
<b>6. CONCLUSION AND RECOMMENDATION</b>	<b>173</b>
6.1 Research contribution	173
6.2 Contribution to apply gamification theory in classroom	173
6.3 Contribution to design study	174
6.4 Contribution to research instrument	174
6.5 Research implication	174
6.5.1 Implications in teaching and learning process	174
6.5.2 Implications to the student	175
6.5.3 Implications to the institution	176
6.6 Research limitation	176
6.6.1 Type of gamification elements	176
6.6.2 Practical barrier	177
6.7 Future research	178
6.7.1 GLeb model refinement	178
6.7.2 Improvement on the GLeb system interface for website	179

6.7.3 Post contribution as cognitive engagement indicator	179
6.8 Summary	180
<b>REFERENCES</b>	<b>181</b>
<b>APPENDICES</b>	<b>200</b>

## LIST OF TABLES

<b>TABLE</b>	<b>TITLE</b>	<b>PAGE</b>
1.1	Summaries of RO, RQ, RH, RM and data analysis	6
2.1	The description of the badge functions	17
2.2	The example of badge implemented in education setting	19
2.3	Summary of leader board description and issues in current model	24
2.4	Examples of assessment indicators according to types of engagement	30
2.5	The summary of engagement indicators tested by previous study (2013-2018)	36
2.6	Research on interaction in learning engagement	42
2.7	Student course engagement questionnaire dimension (SECQ)	43
2.8	The classification of forty gamification elements by Chang (2016)	45
2.9	The description of Bartle Player types	48
2.10	Marczewski's expectation about player types	49
2.11	Incorporate player types in education research	51
2.12	The description on Theory of gamified learning by Landers (2014)	58
2.13	The AHP scale used in pairwise comparison	65
3.1	Independent variables	72
3.2	Summary of the IV, MV and DV variables	73
3.3	GLeb model description	75
3.4	AHP structure	79

3.5	Pairwise comparison scale	80
3.6	The implementation of online learning in Community Colleges	88
3.7	The selected Community College	89
3.8	Class observation approach	91
3.9	PLS -SEM data analysis guideline	98
4.1	Gamification engagement indicator explanation	107
5.1	The most frequently used mobile application by the respondents	131
5.2	Weight of the gamification instruction interaction dimension	133
5.3	The result of weight distribution	134
5.4	Type of leader board	137
5.5	Summary for leader board design issues	138
5.6	Leader board gamification mechanics preferences	139
5.7	Summary of panel comments	143
5.8	Student participation	145
5.9	The achievement of the pre-test and post-test for group $X_1$	147
5.10	The achievement of the pre-test and post-test for group $X_2$	148
5.11	The achievement of the pre-test and post-test for group $X_3$	149
5.12	The pre-test and post-test result summary	149
5.13	Result of Wilcoxon Signed Rank test on experiment group $X_1$	151
5.14	Result of Wilcoxon Signed Rank test on experiment group $X_2$	152
5.15	Result of Wilcoxon Signed Rank test on experiment group $X_3$	152
5.16	Measurement model	165
5.17	Results of hypothesis testing	168



## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Sub-type of point	15
2.2	Type of Leader board	22
2.3	Gamification-enhanced learning structure by Huang et. al, (2018)	33
2.4	The badge used in Huang et. al, (2018) study	33
2.5	Three types of interaction by Moore (1998)	40
2.6	The proposed gamification in interactivity framework by Chang (2016)	44
2.7	Marczewski's Taxonomy of player	49
2.8	Nine-teen different game categories name cluster tree in Bedwell taxonomy	53
2.9	Input-process-output model of serious game design	55
2.10	Theory of gamified learning by Landers (2014)	56
2.11	Mediating process of the theory of gamified learning tested in Landers (2014) study	59
2.12	The mediating role of student interaction and student engagement on learning outcome research framework	60
2.13	Online learning interaction model by Razali et al.(2015)	61
2.14	The decision hierarchy diagram in AHP methodology	64
2.15	The system interface for the pairwise comparison	65
2.16	The global priorities result	66

3.1	Research framework	69
3.2	Theoretical framework	70
3.3	GLeb model to increase learning engagement	74
3.4	Respondent for preliminary study	78
3.5	The example of AHP online survey	80
3.6	Testing procedure for research question 1	81
3.7	Respondents	82
3.8	Research design for research objective 3	87
3.9	The percentage of respondents	89
3.10	Separate sample pre-post-test design	92
3.11	Three separate sample pre-post-test design	92
3.12	Testing procedure for GLeb evaluation	94
3.13	Classroom setting for the observation data collection procedure	95
3.14	Classroom observation procedure	96
3.15	Testing procedure for research question 3 to 5	97
4.1	ADDIE model	101
4.2	Gamification Leader Board (GLeb) mechanic system	103
4.3	Leader board gamification mechanics	105
4.4	Conceptual design of GLeb system	106
4.5	System architecture for GLeb	109
4.6	Lecturer module for website platform	110
4.7	Student module for website platform	111
4.8	GLeb website homepage	113
4.9	Google play console	114

4.10	Add new lecturer	114
4.11	Student account administration	115
4.12	Task management interface: list of tasks available	115
4.13	View submitted task	116
4.14	Badges for quiz	116
4.15	List of quizzes	117
4.16	The forum thread	117
4.17	Overall leader board	118
4.18	Leader board for behaviour indicator	119
4.19	Leader board for cognitive indicator	119
4.20	Leader Board for behaviour indicator (post contribution)	120
4.21	Monitoring leader board display	120
4.22	Badge earned	121
4.23	Status of post contribution	122
4.24	Individual player type graph	122
4.25	Student module: overall leader board	123
4.26	Student module interface: leader board for cognitive	123
4.27	Phase 5: Evaluation	127
5.1	Age distribution	129
5.2	Type of smartphone operating system	130
5.3	Time spent for playing games	130
5.4	Percentage of students that agree to display their achievement	132
5.5	Percentage of students that feel distracted if their name at the bottom	132
5.6	Global priorities distribution for 12 gamification elements being studied	134

5.7	User type analysis tool for application	140
5.8	Proposed gamification leader board based on player profile	141
5.9	Testing model for research question 3	150
5.10	The finding for quality of task	154
5.11	The finding for task completion time	157
5.12	The finding for task download time	158
5.13	The finding for post contribution	159
5.14	Observation result for group X <sub>1</sub>	160
5.15	Observation result for group X <sub>2</sub>	161
5.16	Observation result for group X <sub>3</sub>	162
5.17	Measurement model PLS result	166
5.18	Research model	167
5.19	Indirect effect	168

## LIST OF APPENDICES

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
A	Survey questionnaire for preliminary analysis	200
B	Observation rubric form	215
C	Survey questionnaire for student perception on GLeb towards learning engagement	217
D	Validation form for proposed model	223
E	Expert list for survey questionnaire (preliminary analysis)	229
F	Expert list for model validation	230
G	Expert list for observation rubric and survey Questionnaire for Student Perception	231
H	Expert list for learning content	232
I	Expert list for PLS-SEM data analysis	233
J	Pre-test and Post-test	234
K	Pilot test report for GLeb prototype	239

## LIST OF ABBREVIATIONS

ADDIE	-	Analyze, Design, Develop, Implement, Evaluate
AHP	-	Analytical Hierarchy Process
DFD	-	Data Flow Diagram
DV	-	Dependant variable
GLeb	-	Gamification Leader Board Model Based on Player types
IV	-	Independent variable
KK	-	Kolej Komuniti
LE	-	Leaning Engagement
LI	-	Learning Interaction
MV	-	Mediator variable
SSK	-	Sijil Sistem Komputer Dan Rangkaian
URL	-	Uniform Resource Locator

## LIST OF PUBLICATIONS

Daud, R., Salam, S., Mohamad, S.N.M., Yusoff, A.M., 2018. "Gamification Leader Board Model Based on Player Type to Increase Student Engagement." *Proceedings of International University Carnival on E-Learning*, pp 552–555.

Daud, R., Salam, S., Mohamad, S.N.M., Yusoff, A.M., 2017. "Modeling a mobile gamification model to increase student engagement: An analysis using analytic hierarchy process," *Advance Science Letter*, 23 (9), pp. 8707–8712.

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Gamification as defined by Deterding et al. (2011) is the use of game design elements in non-game contexts. In recent five years, there has been an increasing interest in study works on the application of gamification to education which aims to shed light on the tendencies and emerging practices in this area. Malamed (2012) stated that gamification refers to the use of game-based elements such as mechanics, aesthetics, and game thinking in non-game contexts aimed at engaging people, motivating action, enhancing learning, and solving problems. Gamification has been used in a wide variety of industry classifications such as art, call centre, commerce, education, entertainment, environment, design, government, health, life, marketing, market research, mobile, social good, web sites and work. There has been a growing interest in applying gamification to education (Biggs, 2011).

As technology raises, faster wireless and mobile networks and more authoritative handheld devices are offered at lower cost. These technological improvements are generating the ideal environments for e-learning. As highlighted by Crescente and Lee (2011) there are several definitions of the term e-learning. A frequently accepted one can be found in which defined e-learning as any type of learning that happens when the student is not at a static, predetermined place, or learning that happens when the student takes advantage of the learning opportunities offered by internet technologies. This definition