

**EVALUATING AND ENHANCING USABILITY AND
GAMIFICATION IN SKULING BASED ON ISO 9241-
11: A DESIGN THINKING APPROACH WITH
USABILITY TESTING AND GAMEX**

SKRIPSI



**OLEH:
I KETUT VEDA SUPUTRA
2215091023**

**PROGRAM STUDI SISTEM INFORMASI (SI) (S1)
JURUSAN TEKNIK INFORMATIKA
FAKULTAS TEKNIK DAN KEJURUAN
UNIVERSITAS PENDIDIKAN GANESHA**



SKRIPSI

DIAJUKAN UNTUK MELENGKAPI TUGAS DAN MEMENUHI SYARAT-SYARAT UNTUK MENCAPAI GELAR SARJANA KOMPUTER



Pembimbing I	Ir. Putu Yudia Pratiwi, S.Pd., M.Eng. NIP.199308042020122008
Pembimbing II	Ir. I Made Ardwi Pradnyana, S.T., M.T. NIP.198611182015041001

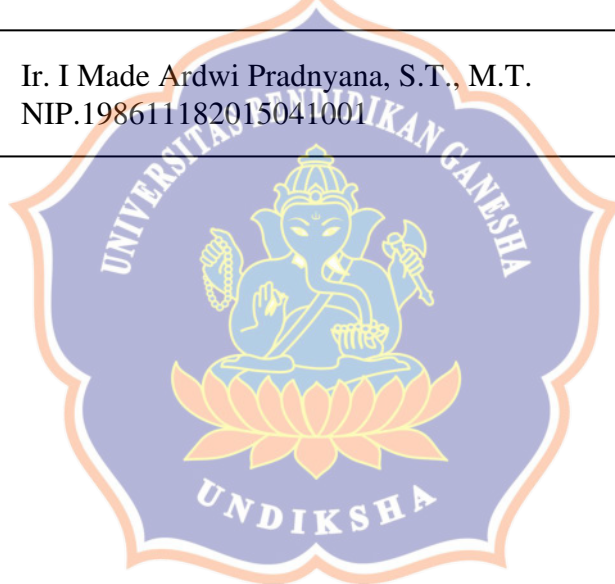


- UU ITE No. 11 Tahun 2008 Pasal 5 Ayat 1 "Informasi Elektronik dan/atau hasil cetaknya merupakan alat bukti hukum yang sah"
- Dokumen ini telah ditandatangani secara elektronik menggunakan sertifikat elektronik yang diterbitkan BSrE - BSSN, validitas dokumen elektronik ini bisa dicek menggunakan aplikasi mobile VeryDS oleh BSrE
- Cetakan dokumen ini merupakan salinan dari file dokumen bertandatangan elektronik yang keabsahannya dapat diakses melalui scan QRCode yang terdapat pada sertifikat ini.

Skripsi oleh I Ketut Veda Suputra ini
telah dipertahankan di depan dewan penguji
Pada tanggal 06 Agustus 2026

Dewan Penguji

Ketua	Putu Dhanu Driya, M.A. NIP.200002132025061007
Anggota	Luh Putu Eka Damayanthi, S.Pd., M.Pd. NIP.198603132024212001
Anggota	Ir. Putu Yudia Pratiwi, S.Pd., M.Eng. NIP.199308042020122008
Anggota	Ir. I Made Ardwi Pradnyana, S.T., M.T. NIP.198611182015041001



- UU ITE No. 11 Tahun 2008 Pasal 5 Ayat 1 "Informasi Elektronik dan/atau hasil cetaknya merupakan alat bukti hukum yang sah"
- Dokumen ini telah ditandatangani secara elektronik menggunakan sertifikat elektronik yang diterbitkan BSrE - BSSN, validitas dokumen elektronik ini bisa dicek menggunakan aplikasi mobile VeryDS oleh BSrE
- Cetakan dokumen ini merupakan salinan dari file dokumen bertandatangan elektronik yang keabsahannya dapat diakses melalui scan QRCode yang terdapat pada sertifikat ini.



**Balai Besar
Sertifikasi
Elektronik**

Diterima oleh Panitia Ujian Fakultas Teknik dan Kejuruan
Universitas Pendidikan Ganesha
guna memenuhi syarat-syarat untuk mencapai gelar Sarjana Komputer

Menyetujui

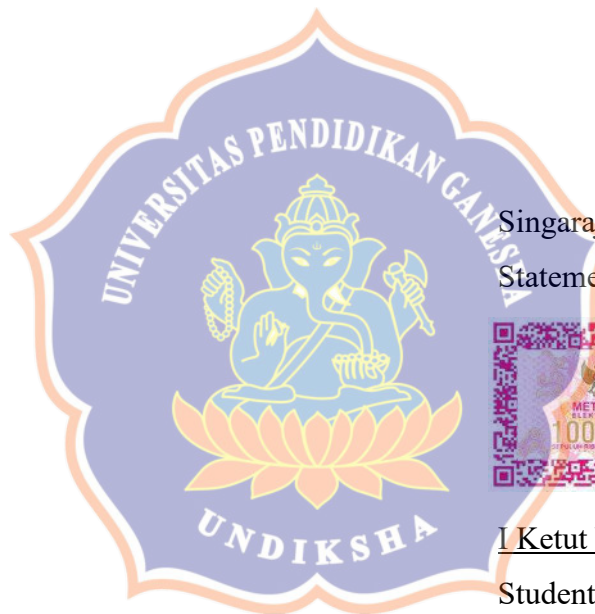
Ketua Ujian	Ir. Made Windu Antara Kesiman, S.T., M.Sc., Ph.D. NIP.198211112008121001
Sekretaris Ujian	Ir. I Made Dendi Maysanjaya, S.Pd., M.Eng. NIP.199005152019031008



- UU ITE No. 11 Tahun 2008 Pasal 5 Ayat 1 "Informasi Elektronik dan/atau hasil cetaknya merupakan alat bukti hukum yang sah"
- Dokumen ini telah ditandatangani secara elektronik menggunakan sertifikat elektronik yang diterbitkan BSrE - BSSN, validitas dokumen elektronik ini bisa dicek menggunakan aplikasi mobile VeryDS oleh BSrE
- Cetakan dokumen ini merupakan salinan dari file dokumen bertandatangan elektronik yang keabsahannya dapat diakses melalui scan QRCode yang terdapat pada sertifikat ini.

STATEMENT OF AUTHENTICITY

I hereby declare that the academic work entitled "Evaluating and Enhancing Usability and Gamification in Skuling Based on ISO 9241-11: A Design Thinking Approach with Usability Testing and GAMEX" together with all of its contents, is genuinely my own work, and that I have not engaged in plagiarism or cited sources in any manner inconsistent with prevailing academic ethics. I am prepared to accept any risk or sanction imposed on me should violations of academic ethics be found in this work, or should any claims arise contesting its authenticity.



Singaraja, 8 August 2026

Statement made by



I Ketut Veda Suputra

Student ID. 2215091023

MOTTO



You'll fail. Might as well try.
The only way out is through, after all.

PREFACE

The thesis “Evaluating and Enhancing Usability and Gamification in Skuling Based on ISO 9241-11: A Design Thinking Approach with Usability Testing and GAMEX,” which is submitted to fulfill part of the requirements of obtaining a bachelor’s degree in Universitas Pendidikan Ganesha’s Information Systems major, would not have been possible without the support, guidance, and encouragement from several parties, such as:

Mr. Ir. I Made Dendi Maysanjaya, S.Pd., M.Eng., serving as the coordinator of the Information Systems study program, for the grace, accommodations, and assistance extended throughout the entire thesis creation process; the behaviors exhibited will remain a standard to hold onto going forward.

Ms. Ir. Putu Yudia Pratiwi, S.Pd., M.Eng., and Mr. Ir. I Made Ardwi Pradnyana, S.T., M.T., serving as the first and second thesis advisors respectively, for the patience and understanding shown throughout the creation of this thesis despite countless shortcomings along the way; the invaluable knowledge given in each guidance session will continue to shape the approach taken toward problems long after this thesis is complete.

Mr. Putu Dhanu Driya, M.A., and Ms. Luh Putu Eka Damayanthi, S.Pd., M.Pd., serving as the first and second thesis examiners respectively, for the rigor and care shown in reviewing this work; the questions and criticisms raised during examination pushed this thesis beyond what it was initially capable of, making it sharper and more thorough as a result.

Mr. Ir. Gede Surya Mahendra, S.Pd., M.Kom., serving as the academic advisor, for the steady presence maintained throughout the past four years, well beyond the scope of this thesis; the gentle reassurance and constant encouragement provided carried through times that would have otherwise been difficult to navigate alone, and the tireless dedication shown toward students will remain an example to carry forward.

Mr. Geraeldo Sinaga, serving as the Chief Operating Officer of Skuling, along with the rest of Skuling's staff, for granting permission to conduct this

research; the assistance extended made it possible to understand the inner workings of the application well enough to carry out this study.

Cherished parents, siblings, and nephews, for the unwavering love and support that made this entire journey possible; their presence, even from a distance, remained a constant reminder that there will always be people offering unconditional support, a truth that steadied every uncertain step taken throughout this process.

The author's beloved friends: Ayu Krisna, Wisaka, Qieqie, Nadia, Diyan, Salwa, William, Shakila, Syaila, all of IKI SIFORS'22 & MCUT 25's Indonesian batch, and everyone else that is unable to be spelled out one by one, for the laughter, company, and quiet solidarity that made the stretches of these past four years truly bearable; this journey simply wouldn't have felt the same without them.

And lastly, to "Dorothy" by Sulli and "Snow Irony" by Maison book girl, two songs played on loop more times than could be counted; they offered not a way out, but instead the calm of quiet understanding—enough on the hardest nights when the stress culminates, when everything was too much to bear.

The author recognises that this thesis is far from perfect, with much room for improvement; as such, constructive criticism and suggestions from any parties are sincerely welcomed. Nevertheless, the author hopes that this thesis will prove to be beneficial for the readers.

Singaraja, 8 August 2026

Author

TABLE OF CONTENT

STATEMENT OF AUTHENTICITY	iv
MOTTO	v
PREFACE	vi
TABLE OF CONTENT	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF EQUATIONS	xv
LIST OF ATTACHMENTS	xvi
ABSTRACT	xix
CHAPTER I INTRODUCTION	1
1.1 Background	1
1.2 Problem Statements	8
1.3 Research Questions	9
1.4 Research Objectives	9
1.5 Research Scope	9
1.6 Research Benefits	10
CHAPTER II THEORETICAL STUDY	11
2.1 State of the Art	11
2.1.1 Prior Research	11
2.1.2 Research Contributions	19
2.2 Skuling	20
2.3 Theory Basis	22
2.3.1 Usability and User Experience	22
2.3.2 ISO 9241-11	24
2.3.3 Usability Testing	24

2.3.4	Gamification	28
2.3.5	Gameful Experience Scale (GAMEX)	28
2.3.6	Design Thinking	33
CHAPTER III RESEARCH METHODOLOGY		38
3.1	Preparations.....	38
3.1.1	Prior Observation & Interview with Skuling's Co-Founder	38
3.1.2	Problem Identification & Literature Study	39
3.1.3	Determining Methodologies & Respondent Amount.....	39
3.2	Design Thinking.....	41
3.2.1	Baseline Testing	42
3.2.2	Empathize	46
3.2.3	Define	46
3.2.4	Ideate	47
3.2.5	Prototype.....	48
3.2.6	Post-Redesign Testing	49
CHAPTER IV RESULTS AND DISCUSSION		51
4.1	Baseline Testing.....	51
4.1.1	Performance Measurement	51
4.1.2	GAMEX Questionnaire Results	54
4.1.3	Retrospective Think-Aloud Results.....	55
4.1.4	Usability Evaluation Based on ISO 9241-11	65
4.2	Empathize.....	68
4.3	Define.....	69
4.3.1	Affinity Diagram	69
4.3.2	User Persona	73
4.3.3	Pain Points	74

4.3.4	Problem Statements	76
4.3.5	How Might We	77
4.4	Ideate	78
4.4.1	User Flow of Task 1 (Registration)	78
4.4.2	User Flow of Task 2 (Xplain).....	79
4.4.3	User Flow of Task 3 (Daily Missions)	80
4.4.4	User Flow of Task 4 (Battle)	81
4.4.5	User Flow of Task 5 (Leaderboard)	82
4.4.6	User Flow of Task 6 (SkulWorld)	83
4.4.7	User Flow of Task 7 (Chat)	84
4.4.8	User Flow of Task 8 (Friends).....	84
4.4.9	Prioritised Solutions through Eisenhower Matrix	85
4.5	Prototype	86
4.5.1	Task 1: Registration	87
4.5.2	Task 2: Xplain	92
4.5.3	Task 3: Daily Missions	94
4.5.4	Task 4: Battle	97
4.5.5	Task 5: Leaderboard, Ranks, and Badges.....	102
4.5.6	Task 6: SkulWorld.....	104
4.5.7	Task 7: Chat.....	108
4.5.8	Task 8: Friends	110
4.6	Post-Redesign Testing.....	112
4.6.1	Performance Measurement	113
4.6.2	GAMEX Questionnaire	118
4.6.3	Retrospective Think-Aloud	121
4.6.4	Usability Evaluation Based on ISO 9241-11	128

4.7 Limitations	131
CHAPTER 5 CONCLUSIONS.....	134
5.1 Conclusion	134
5.2 Recommendations	136
REFERENCES.....	137
ATTACHMENTS	156



LIST OF TABLES

Table 2.1 Prior Research	11
Table 2.2 Ministry of Home Affairs R&D effectiveness standards	26
Table 2.3 Original GAMEX Questionnaire	30
Table 2.4 Translated GAMEX Questionnaire.....	31
Table 3.1 Summary of Design Thinking Process.....	41
Table 3.2 Predefined Baseline Testing Retrospective Think-Aloud Questions....	44
Table 3.3 Summary of the Testing Process.....	45
Table 3.4 Predefined Post-Redesign Retrospective Think-Aloud Questions	49
Table 4.1 Baseline Testing Performance Metrics of the Participants	51
Table 4.2 Baseline Testing Effectiveness Metrics: Success Rate	52
Table 4.3 Baseline Testing Effectiveness Metrics: Error Rate	53
Table 4.4 Baseline Testing Efficiency Metrics	54
Table 4.5 Baseline Testing GAMEX Dimension Averages.....	54
Table 4.6 Themes of Baseline Testing RTA Analysis.....	56
Table 4.7 Validation of Initial Problems.....	66
Table 4.8 Pain Points	75
Table 4.9 Problem Statements	76
Table 4.10 How Might We	77
Table 4.11 Post-Redesign Testing Performance Metrics of the Participants.....	113
Table 4.12 Post-Redesign Effectiveness Metrics: Success Rate.....	114
Table 4.13 Post-Redesign Effectiveness Metrics: Error Rate	115
Table 4.14 Post-Redesign Efficiency Metrics.....	116
Table 4.15 Post-Redesign Testing GAMEX Dimension Averages	118
Table 4.16 Themes of Post-Redesign Testing RTA Analysis.....	122
Table 4.17 Resolution Status of Baseline Usability Themes	129

LIST OF FIGURES

Figure 2.1 Skuling's Features on the App Store	21
Figure 3.1 Research Steps	38
Figure 4.1 Theme #1: Obscure Daily Missions Feature	57
Figure 4.2 Theme #1: Obscure Friends List Feature.....	57
Figure 4.3 Theme #2: Non-Functional Search on Friends List.....	58
Figure 4.4 Theme #3: Badges Lacking Clickable Affordance.....	59
Figure 4.5 Theme #3: Lack of Power-Up Label	59
Figure 4.6 Theme #4: Unclear Error Message in E-mail Form	60
Figure 4.7 Theme #4: Unclear Rank Description	60
Figure 4.8 Theme #5: Sudden Quiz in Registration Process	61
Figure 4.9 Theme #5: Sudden SmartEnergy Pop-Ups	62
Figure 4.10 Theme #6: Illustration and Summary Box in Xplain	63
Figure 4.11 Empathy Map.....	69
Figure 4.12 Affinity Diagram #1: Features in Unexpected Locations.....	70
Figure 4.13 Affinity Diagram #2: Non-Functional Search	71
Figure 4.14 Affinity Diagram #3: Ambiguous Affordances.....	71
Figure 4.15 Affinity Diagram #4: Unclear System Feedback.....	72
Figure 4.16 Affinity Diagram #5: Lack of Proper Onboarding	72
Figure 4.17 Affinity Diagram #6: Xplain's Divided Reception	73
Figure 4.18 User Persona	74
Figure 4.19 User Flow of Task 1 (Registration)	79
Figure 4.20 User Flow of Task 2 (Xplain).....	80
Figure 4.21 User Flow of Task 3 (Daily Missions)	81
Figure 4.22 User Flow of Task 4 (Battle)	81
Figure 4.23 User Flow of Task 5 (Leaderboard).....	82
Figure 4.24 User Flow of Task 6 (SkulWorld)	83
Figure 4.25 User Flow of Task 7 (Chat)	84
Figure 4.26 User Flow of Task 8 (Friends).....	84
Figure 4.27 Prioritised Solutions through Eisenhower Matrix	85
Figure 4.28 Task 1 (Registration): Wireframe	87
Figure 4.29 Task 1 (Registration): Form Fields and "Misi Besar"	88

Figure 4.30 Task 1 (Registration): University Selection	89
Figure 4.31 Task 1 (Registration): Diagnostic Quiz Pop-Up.....	90
Figure 4.32 Task 1 (Registration): Diagnostic Quiz and Features.....	91
Figure 4.33 Task 2 (Xplain): Wireframe.....	92
Figure 4.34 Task 2 (Xplain): Home and Material Selection.....	93
Figure 4.35 Task 2 (Xplain): Material and Study Results	94
Figure 4.36 Task 3 (Daily Missions): Wireframe	95
Figure 4.37 Task 3 (Daily Missions): Mission Claim Flow	96
Figure 4.38 Task 4 (Battle): Wireframe	97
Figure 4.39 Task 4 (Battle): Battle Preparation Process	98
Figure 4.40 Task 4 (Battle): Continue Confirmation Pop-Up.....	99
Figure 4.41 Task 4 (Battle): Battle Results Screen	100
Figure 4.42 Task 4 (Battle): Insights and Battle Discussion Page.....	101
Figure 4.43 Task 5 (Leaderboard): Wireframe	102
Figure 4.44 Task 5 (Leaderboard): Profile Page and All Ranks.....	102
Figure 4.45 Task 5 (Leaderboard): All Badges and Badge Pop-Up	103
Figure 4.46 Task 6 (SkulWorld): Wireframe.....	104
Figure 4.47 Task 6 (SkulWorld): Welcome Screen	105
Figure 4.48 Task 6 (SkulWorld): SkulBoard and MySquad.....	106
Figure 4.49 Task 6 (SkulWorld): Squad Page and Post View	107
Figure 4.50 Task 7 (Chat): Wireframe	108
Figure 4.51 Task 7 (Chat): Blank State and Search Interface.....	108
Figure 4.52 Task 7 (Chat): Chatroom Interface	109
Figure 4.53 Task 8 (Friends): Wireframe	110
Figure 4.54 Task 8 (Friends): Profile Page and Friend Search	111
Figure 4.55 Improved Interface of Battle's Minimize Mechanic	126

LIST OF EQUATIONS

Equation 2.1 Success Rate	26
Equation 2.2 Error Rate.....	26
Equation 2.3 Time-based Efficiency	27
Equation 2.4 Time on Task	27



LIST OF ATTACHMENTS

Attachment 1 Review Examples on Skuling’s Play Store & App Store Pages ..	156
Attachment 2 Spreading the Pre-Research Survey through X (Twitter).....	157
Attachment 3 Pre-Research Survey	158
Attachment 4 Documentation of the User Interview Process	162
Attachment 5 Summarized Transcript of User Interview: Respondent #1	166
Attachment 6 Summarized Transcript of User Interview: Respondent #2	168
Attachment 7 Summarized Transcript of User Interview: Respondent #3	170
Attachment 8 Summarized Transcript of User Interview: Respondent #4	172
Attachment 9 Summarized Transcript of User Interview: Respondent #5	173
Attachment 10 Summarized Transcript of User Interview: Respondent #6	174
Attachment 11 Summarized Transcript of User Interview: Respondent #7	176
Attachment 12 Summarized Transcript of User Interview: Respondent #8	178
Attachment 13 Summarized Transcript of User Interview: Respondent #9	179
Attachment 14 Summarized Transcript of User Interview: Respondent #10	181
Attachment 15 Summarized Transcript of User Interview: Respondent #11	183
Attachment 16 Summarized Transcript of User Interview: Respondent #12	185
Attachment 17 Summarized Transcript of User Interview: Respondent #13	186
Attachment 18 Summarized Transcript of User Interview: Respondent #14	188
Attachment 19 Summarized Transcript of User Interview: Respondent #15	190
Attachment 20 Summarized Transcript of User Interview: Respondent #16	192
Attachment 21 Validation of GAMEX Translation with Expert 1	194
Attachment 22 Validation of GAMEX Translation with Expert 2	200
Attachment 23 Validation of Pre-Revised GAMEX Translation with CVI	206
Attachment 24 Validation of Revised GAMEX Translation with CVI	208
Attachment 25 Baseline & Post-Redesign Testing Task Scenario	210
Attachment 26 Baseline Interface Flow: Task 1 (Registration).....	217
Attachment 27 Baseline Interface Flow: Task 2 (Xplain)	220
Attachment 28 Baseline Interface Flow: Task 3 (Daily Missions)	222
Attachment 29 Baseline Interface Flow: Task 4 (Battle).....	223
Attachment 30 Baseline Interface Flow: Task 5 (Leaderboard)	226
Attachment 31 Baseline Interface Flow: Task 6 (SkulWorld).....	227

Attachment 32 Baseline Interface Flow: Task 7 (Chat).....	229
Attachment 33 Baseline Interface Flow: Task 8 (Friends)	230
Attachment 34 Documentation of the Baseline Testing Process	231
Attachment 35 Baseline Testing Records: Respondent #1	239
Attachment 36 Baseline Testing Records: Respondent #2	240
Attachment 37 Baseline Testing Records: Respondent #3	242
Attachment 38 Baseline Testing Records: Respondent #4	243
Attachment 39 Baseline Testing Records: Respondent #5	245
Attachment 40 Baseline Testing Records: Respondent #6	246
Attachment 41 Baseline Testing Records: Respondent #7	247
Attachment 42 Baseline Testing Records: Respondent #8	248
Attachment 43 Baseline Testing Records: Respondent #9	249
Attachment 44 Baseline Testing Records: Respondent #10	250
Attachment 45 Baseline Testing Records: Respondent #11	251
Attachment 46 Baseline Testing Records: Respondent #12	253
Attachment 47 Baseline Testing Records: Respondent #13	254
Attachment 48 Baseline Testing Records: Respondent #14	255
Attachment 49 Baseline Testing Records: Respondent #15	256
Attachment 50 Baseline Testing Records: Respondent #16	257
Attachment 51 Baseline Testing GAMEX Questionnaire Results	258
Attachment 52 Baseline Testing Thematic Analysis: Task 1 (Registration)	260
Attachment 53 Baseline Testing Thematic Analysis: Task 2 (Xplain).....	269
Attachment 54 Baseline Testing Thematic Analysis: Task 3 (Daily Missions) .	277
Attachment 55 Baseline Testing Thematic Analysis: Task 4 (Battle)	284
Attachment 56 Baseline Testing Thematic Analysis: Task 5 (Leaderboard)	294
Attachment 57 Baseline Testing Thematic Analysis: Task 6 (SkulWorld)	300
Attachment 58 Baseline Testing Thematic Analysis: Task 7 (Chat)	304
Attachment 59 Baseline Testing Thematic Analysis: Task 8 (Friends).....	308
Attachment 60 Baseline Testing Thematic Analysis: GAMEX	311
Attachment 61 Baseline Testing Thematic Analysis: Final Thoughts.....	322
Attachment 62 Source Code of the Front-End Redesign	327
Attachment 63 Documentation of the Post-Redesign Testing Process	328

Attachment 64 Post-Redesign Records: Responden #2	331
Attachment 65 Post-Redesign Records: Responden #3	332
Attachment 66 Post-Redesign Records: Responden #4	333
Attachment 67 Post-Redesign Records: Responden #5	334
Attachment 68 Post-Redesign Records: Respondent #6	335
Attachment 69 Post-Redesign Records: Respondent #13	336
Attachment 70 Post-Redesign GAMEX Questionnaire Results	337
Attachment 71 Post-Redesign Thematic Analysis: Task 1 (Registration).....	338
Attachment 72 Post-Redesign Thematic Analysis: Task 2 (Xplain)	342
Attachment 73 Post-Redesign Thematic Analysis: Task 3 (Daily Missions)	346
Attachment 74 Post-Redesign Thematic Analysis: Task 4 (Battle).....	348
Attachment 75 Post-Redesign Thematic Analysis: Task 5 (Leaderboard)	352
Attachment 76 Post-Redesign Thematic Analysis: Task 6 (SkulWorld).....	355
Attachment 77 Post-Redesign Thematic Analysis: Task 7 (Chat).....	357
Attachment 78 Post-Redesign Thematic Analysis: Task 8 (Friends)	359
Attachment 79 Post-Redesign Thematic Analysis: GAMEX	360
Attachment 80 Post-Redesign Thematic Analysis: Final Thoughts	365

