



UNDERGRADUATE THESIS

DEVELOPMENT OF ROBLOX-BASED QUARTET CARD EDUCATIONAL GAME TO INCREASE THE MOTIVATION AND UNDERSTANDING OF IPAS FOR ELEMENTARY SCHOOL STUDENTS

RAHMA ADISTY MUFFID AZZAHRA
NPM 22081010135

THESIS ADVISORS

Yisti Vita Via, S.ST. M.Kom.

Andreas Nugroho Sihananto, S.Kom., M.Kom.

**MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS PEMBANGUNAN NASIONAL VETERAN JAWA TIMUR
FACULTY OF COMPUTER SCIENCE
INFORMATICS STUDY PROGRAM
SURABAYA
2026**



UNDERGRADUATE THESIS

DEVELOPMENT OF ROBLOX-BASED QUARTET CARD EDUCATIONAL GAME TO INCREASE THE MOTIVATION AND UNDERSTANDING OF IPAS FOR ELEMENTARY SCHOOL STUDENTS

RAHMA ADISTY MUFFID AZZAHRA
NPM 22081010135

THESIS ADVISORS

Yisti Vita Via, S.ST. M.Kom
Andreas Nugroho Sihananto, S.Kom., M.Kom.

**MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS PEMBANGUNAN NASIONAL VETERAN JAWA TIMUR
FACULTY OF COMPUTER SCIENCE
INFORMATICS STUDY PROGRAM
SURABAYA
2026**

APPROVAL SHEET

DEVELOPMENT OF ROBLOX-BASED QUARTET CARD EDUCATIONAL GAME TO INCREASE THE MOTIVATION AND UNDERSTANDING OF IPAS FOR ELEMENTARY SCHOOL STUDENTS

By:

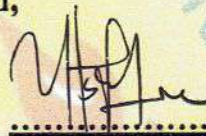
RAHMA ADISTY MUFFID AZZAHRA
NPM. 22081010135

Has been defended before, and accepted by, the Board of Assessors of the Thesis Examination of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jawa Timur, on July 10, 2026:

Approved,

Yisti Vita Via, S.ST., M.Kom.

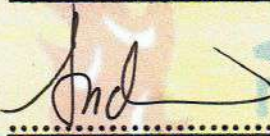
NIP. 19860425 2021212 001



(Advisor I)

Andreas Nugroho Sihananto, S.Kom., M.Kom.

NIP. 1990041 22024061 003



(Advisor II)

Dr. Intan Yuniar Purbasari, S.Kom., M.Sc

NIP. 19800602 202521 2 029



(Head Assessor)

Budi Mukhamad Mulvo, S.Kom., MT.

NIP. 19891118 202406 1 003



(Assessor I)

Acknowledge by,

Dean of the Faculty of Computer Science


Prof. Dr. Ir. Novirina Hendrasarie, MT.
NIP. 19681126 199403 2 001

APPROVAL SHEET

DEVELOPMENT OF ROBLOX-BASED QUARTET CARD EDUCATIONAL GAME TO INCREASE THE MOTIVATION AND UNDERSTANDING OF IPAS FOR ELEMENTARY SCHOOL STUDENTS

By:

RAHMA ADISTY MUFFID AZZAHRA
NPM. 22081010135

Approved to proceed to the Thesis Examination



Approved by,

Coordinator of Informatics Study Program
Faculty of Computer Science

Dr. Intan Yuniar Purbasari, S.Kom. MSc.
NIP. 19800602 202521 2 029

STATEMENT OF ORIGINALITY

I am the undersigned:

Student Name : Rahma Adisty Muffid Azzahra
NPM : 22081010135
Degree Program : Bachelor (S1)
Study Program : Informatics
Faculty : Faculty of Computer Science

Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

And I declare that this scientific document is free from elements of plagiarism. If in the future indications of plagiarism are found in this Thesis, I am willing to accept sanctions in accordance with the applicable laws and regulations.

Thus, I made this statement without any coercion from anyone and to be used as it should.

Surabaya, July 14, 2026
Declarant,



RAHMA ADISTY MUFFID AZZAHRA
NPM. 22081010135

ABSTRACT

Nama Mahasiswa/ NPM : Rahma Adisty Muffid Azzahra / 22081010135

Judul Skripsi : Development of Roblox-Based Quartet Card Educational Game to Increase The Motivation and Understanding Of IPAS for Elementary School Students

Dosen Pembimbing : 1. Yisti Vita Via, S.ST. M.Kom
2. Andreas Nugroho Sihananto, S.Kom., M.Kom

This study developed a Roblox Studio-based quartet card educational game to support IPAS learning for elementary school students and evaluate its influence on learning motivation and conceptual understanding. Social studies learning is still largely dominated by conventional methods, making it less engaging and limiting active student involvement. Development followed the ADDIE model (analysis, design, development, implementation, and evaluation). The game was built using Roblox Studio with the Luau programming language and designed as a multiplayer quartet card game that emphasizes concept grouping activities based on unistructural and multistructural levels in the SOLO Taxonomy. The implemented IPAS content covers several topics aligned with the curriculum. The evaluation involved 30 sixth-grade students. Conceptual understanding was measured with pretest and posttest analyzed using Normalized Gain (N-Gain), while learning motivation was measured using the Intrinsic Motivation Inventory (IMI), covering interest/enjoyment, perceived competence, effort/importance, and value/usefulness. The results show that the educational game was successfully implemented and generated positive motivational responses from students. Therefore, the Roblox-based quartet card educational game has strong potential as an engaging and interactive digital learning medium for IPAS instruction in elementary schools.

Keywords: Educational Game, Quartet Card, Roblox Studio, IPAS, Learning Motivation, N-Gain

ACKNOWLEDGEMENTS

Praise be to the presence of Allah SWT for His abundant grace, guidance, and grace so that the author can complete his thesis with the title "Development of Roblox-Based Quartet Card Educational Games to Increase Motivation and Understanding of IPAS of Elementary School Students" well. The preparation of this thesis is one of the requirements to obtain a Bachelor's degree in Computer Science at the Informatics Study Program, Faculty of Computer Science, National Development University "Veteran" East Java.

In the process of preparing this thesis, the author received a lot of help, support, and prayers from various parties, both morally and materially. On this occasion, the author expresses his deepest gratitude to:

1. Mrs. Prof. Dr. Ir. Novirina Hendrasarie, MT as the Dean of the Faculty of Computer Science, National Development University "Veteran" East Java.
2. Mrs. Dr. Intan Yuniar Purbasari, S.Kom., M.Sc. as the Head of the Informatics Study Program, Faculty of Computer Science, National Development University "Veteran" East Java.
3. Mrs. Yisti Vita Via, S.ST. M.Kom., and Mrs. Andreas Nugroho Sihananto, S.Kom., M.Kom., as Supervisors who patiently provided direction, guidance, input, and motivation during the process of preparing this thesis.
4. All lecturers and academic staff of the Informatics Study Program, Faculty of Computer Science, National Development University "Veterans" East Java who have provided knowledge and assistance during the lecture period.
5. SD Islam Insan Kamil Tuban and the ranks of teachers and students who have been willing to become respondents and support the data collection process in this study.
6. The author's beloved family, my mom, my dad, and my three younger siblings, whose endless love, unwavering prayers, and constant support, both emotionally and materially, have been the greatest source of strength throughout this journey. Thank you for always believing in me, standing by my side through every challenge, and reminding me that I was never alone. This thesis would not have been possible without your love, patience, and sacrifices.
7. My closest friends in the Informatics Study Program, Gevanno, Gredy, and especially Indri, for their friendship, encouragement, and the countless

moments of discussion and support throughout the lecture period and the preparation of this thesis.

8. My online friends, Remi, Markus, Anna, Cinna, Maia, Harshul, and Edgar, thank you for the togetherness, support, and enthusiasm that you gave during the lecture period until the process of preparing this thesis. Despite being separated by distance and only meeting virtually, your attention and concern have always been an encouragement to the writer.
9. All fellow students of the 2022 Informatics Study Program cohort, as well as every other individual who contributed in ways too numerous to list, for their part in supporting the completion of this thesis.

The author acknowledges that this thesis is still far from perfect, both in its content and presentation. Therefore, constructive criticism and suggestions are sincerely welcomed for future improvement. It is the author's hope that this thesis can be beneficial and serve as a meaningful reference for readers, particularly in the fields of educational game development and the use of Roblox Studio to support IPAS learning for elementary school students.

Surabaya, July 14, 2026

Rahma Adisty Muffid Azzahra

TABLE OF CONTENTS

APPROVAL SHEET	iii
APPROVAL SHEET	v
STATEMENT OF ORIGINALITY	vii
ABSTRACT	ix
ACKNOWLEDGEMENTS.....	xi
TABLE OF CONTENTS.....	xiii
LIST OF FIGURES	xvii
LIST OF TABLES	xix
LIST OF CODES	xxi
LIST OF APPENDICES	xxiii
CHAPTER I INTRODUCTION.....	1
1.1. Background.....	1
1.2. Problem Formulation	2
1.3. Research Objectives.....	3
1.4. Research Benefits	3
1.5. Research Limitations	3
CHAPTER II LITERATURE REVIEW	5
2.1. Previous Research.....	5
2.2. Learning Concepts and Characteristics of Elementary School Students	9
2.3. Digital Learning Media.....	10
2.4. Learning Outcomes of IPAS Subjects	11
2.5. Game-Based Learning (GBL).....	14
2.6. Card-Based Learning	14
2.7. Quartet Card-Based Educational Games	15
2.8. Roblox and Roblox Studio platforms	16
2.9. Lua (Luau) Scripting in Roblox Game Development.....	17

2.10.	Multiplayer Interaction in Educational Games	19
2.11.	ADDIE Development Model	19
2.12.	Use Case Diagram.....	21
2.13.	Activity Diagram	21
2.14.	Black Box Testing.....	22
2.15.	Game User Experience Satisfaction Scale (GUESS-18)	22
2.16.	Learning Motivation	26
2.17.	Intrinsic Motivation Inventory (IMI)	26
2.18.	Concept Understanding and Pretest-Posttest	29
CHAPTER III SYSTEM DESIGN AND IMPLEMENTATION.....		31
3.1	Research Stages	31
3.2	Identify the Concept of the Game	32
3.3	IPAS Material Mapping on Game Cards	32
3.4	Game Component Planning	40
3.4.1	Game Card Design.....	40
3.4.2	Game Layout Design	41
3.4.3	Gamer Design	42
3.5	Game Mechanic Planning	43
3.5.1	Large Groove	44
3.5.2	Small Grooves.....	45
3.6	Game System Planning	49
3.6.1	<i>Use Case Diagram</i>	49
3.6.2	<i>Activity Diagram</i>	50
3.7	Game Interface Design.....	52
3.7.1	Main Menu.....	52
3.7.2	Playing Procedure	53
3.7.3	<i>Lobby</i> and Game Room	53

3.7.4	Game Screen	54
3.7.5	Game Results and <i>Feedback Panel</i>	55
3.8	Game Development	56
3.9	Functional Testing (<i>Black Box</i>)	58
3.9.1	Main Menu Navigation System Testing	58
3.9.2	How to Play Page System Testing.....	59
3.9.3	Testing of Lobby and <i>Game Room</i> Systems	59
3.9.4	Card Initialization and Distribution System Testing	60
3.9.5	Card Request System Testing	61
3.9.6	Testing of Set and Score Formation Systems	61
3.9.7	Game Termination System Testing	62
3.10	Implementation	62
3.11	Evaluation	64
CHAPTER IV RESULTS AND DISCUSSION		71
4.1	Game Feature Implementation Results.....	71
4.1.1	Lobby and <i>Game Room</i> Features.....	71
4.1.2	Card Initialization and Distribution Features.....	75
4.1.3	Player Turn Features	78
4.1.4	Card Request Features	81
4.1.4	Quartet Set Formation Detection Feature	85
4.1.5	Score Features.....	87
4.1.6	Game Termination Features.....	89
4.2	Game Interface Implementation Results.....	91
4.2.1	Quartet Card Interface	92
4.2.2	Main Menu Interface	93
4.2.3	How to Play Page Interface	94
4.2.4	Game <i>Lobby</i> Interface.....	94

4.2.5	Game Page Interface	95
4.2.6	Game Outcome Interface and Output Result	96
4.3	System Functional Test Results (<i>Black Box</i>)	98
4.3.1	Main Menu Navigation System Testing	98
4.3.2	How to Play Page System Testing	99
4.3.3	Testing of Lobby and Game Room Systems.....	100
4.3.4	Card Initialization and Distribution System Testing	102
4.3.5	Card Request System Testing	104
4.3.6	Testing of Set and Score Formation Systems	106
4.3.7	Game Termination System Testing	107
4.3.8	Test Results Recapitulation.....	108
4.4	Results of Concept Understanding Evaluation (<i>Pretest – Posttest</i>)....	109
4.5	Results of Learning Motivation Evaluation (IMI)	110
4.6	User Experience Evaluation Results (GUESS-18)	113
CHAPTER V CONCLUSIONS AND SUGGESTIONS.....		117
5.1	Conclusion	117
5.2	Suggestions	118
BIBLIOGRAPHY		121
APPENDIX		124

LIST OF FIGURES

Figure 2.1 SOLO Taxonomy	12
Figure 2.2 Quartet Card Example	15
Figure 2.3 Roblox Platform Interface Display	16
Figure 2.4 Development Environment Roblox Studio Interface	17
Figure 2.5 Example of Implementation of Luau Script in Roblox Studio	18
Figure 2.6 ADDIE Development Model	20
Figure 3.1 Research Stages	31
Figure 3.2 Mapping of IPAS Phase C material on a quartet card game	33
Figure 3.3 Front quartet card design	41
Figure 3.4 Back quartet card design	41
Figure 3.5 Game Area Layout Design	42
Figure 3.6 Quartet card gameplay	44
Figure 3.7 Card request mechanism	46
Figure 3.8 Illustration of the card request mechanism	47
Figure 3.9 Mechanism of formation of quartet sets	47
Figure 3.10 Illustration of the mechanism of the set formed	48
Figure 3.11 Use Case Diagram Quartet Card Educational Game	50
Figure 3.12 Activity Diagram Quartet Card Educational Game	51
Figure 3.13 Main Menu screen interface design	52
Figure 3.14 Screen interface design Rules of Play	53
Figure 3.15 Interface design <i>Lobby</i> game	54
Figure 3.16 Game screen interface design	55
Figure 3.17 Game Finish screen interface design	55
Figure 3.18 Feedback panel	56
Figure 3.19 Stages of Game Development	57

Figure 3.20 Implementation Stages.....	62
Figure 4.1 Difference in Game Room Appearance.....	72
Figure 4.2 Button Display in Unfilled and Full Spaces	73
Figure 4.3 Differences of the "Login" Button.....	74
Figure 4.6 Active Player Turn View	78
Figure 4.7 Turn Shift Display of Player Interfaces 1 and 2	79
Figure 4.8 Local Player Turn Indicator	80
Figure 4.9 Other Players' Turn Indicators	81
Figure 4.10 View When Players Select Items.....	82
Figure 4.11 Card Move Display	83
Figure 4.12 Display of Card Addition from Deck	84
Figure 4.13 Quartet Set Formation Display on Player's Hand	86
Figure 4.14 Notification Display Set Formed	87
Figure 4.15 Score Update and Set Number Display	88
Figure 4.16 Player Points and Wins Panel Update Display	89
Figure 4.17 Display of the Final Game	91
Figure 4.18 Front Side View of Quartet Cards	92
Figure 4.19 Back Side View of Quartet Cards.....	93
Figure 4.20 Main Menu Interface	93
Figure 4.21 How to Play Page Interface	94
Figure 4.22 Game Lobby Interface	95
Figure 4.23 Game Page Interface.....	96
Figure 4.24 Game Results Interface	97
Figure 4.25 Feedback Panel	97

LIST OF TABLES

Table 2.1 Review of Some Previous Studies	5
Table 2.2 Mapping of IPAS Learning Outcomes.....	13
Table 2.3 GUESS-18 Rating Scale	23
Table 2.4 GUESS-18 Instrument in Research.....	23
Table 2.5 Category of GUESS-18 result improvement	25
Table 2.6 Statement Details on the IMI Subscale	27
Table 2.7 IMI Rating Scale	28
Table 2.8 IMI Yield Improvement Category	29
Table 2.9 N-Gain yield enhancement category.....	30
Table 3.1 Game Concept Summary	32
Table 3.2 Details of System and Body Health Category Mapping.....	34
Table 3.3 Details of Ecosystem Category Mapping	34
Table 3.4 Water Cycle Category Mapping Details	35
Table 3.5 Energy Category Mapping Details.....	36
Table 3.6 Details of Solar System Category Mapping.....	37
Table 3.7 Details of Mapping the Indonesian Geography Category.....	37
Table 3.8 Details of Mapping Sound and Light Categories.....	38
Table 3.9 Details of Mapping History and Heroes Categories	39
Table 3.10 Quartet Card Design Components	40
Table 3.11 Components on a Playground Board	42
Table 3.12 Player Design	43
Table 3.13 Basic Rules of Quartet Play	43
Table 3.14 Score Calculation System	49
Table 3.15 Main Menu Navigation System Testing	59
Table 3.16 How to Play Page System Testing	59
Table 3.17 Testing of Lobby <i>and Game Room</i> Systems.....	60

Table 3.18 Card Initialization and Distribution System Testing.....	60
Table 3.19 Card Request System Testing	61
Table 3.20 Card Set and Score System Testing	61
Table 3.21 Game Termination System Testing.....	62
Table 3.22 Implementation Details	63
Table 3.23 Segment Game Implementations	63
Table 3.24 Example of User Experience Evaluation Results.....	65
Table 3.25 Examples of <i>Pretest</i> and <i>Posttest Results</i> for the Ecosystem Category..	66
Table 3.26 Example of Pretest and Posttest Result Calculation	67
Table 3.27 Example of Motivation Test Results.....	68
Table 4.1 Main Menu Page System Testing	98
Table 4.2 How to Play Page System Testing	99
Table 4.3 Testing of Lobby and Game Room Systems.....	101
Table 4.4 Testing of Card Initialization and Distribution Systems.....	103
Table 4.5 Card Request System Testing	104
Table 4.6 Testing of Set and Score Formation Systems	106
Table 4.7 Testing the Game Termination System.....	107
Table 4.8 Recapitulation of Test Results	108
Table 4.9 Pretest, Posttest, and N-Gain Results of IPAS Concept Understanding ..	109
Table 4.10 Learning Motivation Measurement (IMI) Results per Respondent	111
Table 4.11 Summary of IMI Learning Motivation Scores by Subscale.....	112
Table 4.12 User Experience Evaluation Results (GUESS-18) Per Respondent	114
Table 4.13 Recapitulation of GUESS-18 User Experience Scores by Dimension ..	115

LIST OF CODES

Code 4.1 Adding players to a specific space.....	72
Code 4.2 Switch switches based on space capacity	73
Code 4.3 Starting countdown and game	74
Code 4.4 Card data.....	75
Code 4.5 Card <i>deck</i> distribution.....	76
Code 4.6 Card shuffling and division	77
Code 4.7 Player turn randomization.....	78
Code 4.8 Player turn switching function.....	79
Code 4.9 Turn indicator	80
Code 4.10 Card <i>item</i> requests.....	81
Code 4.11 Card transfer	82
Code 4.12 Grab a new card from the <i>deck</i>	84
Code 4.13 Detection of quartet set formation	85
Code 4.14 Notification set formed	86
Code 4.15 Score addition	87
Code 4.16 Storage of accumulated points and win amounts	88
Code 4.17 Game check completed.....	89
Code 4.18 Compilation of player score data.....	90
Code 4.19 Displaying the final result screen	90

LIST OF APPENDICES

Appendix 1. Letter of Certification of Plagiarism Check Results	125
Appendix 2. Instrument Concept Comprehension Test Questions	126
Appendix 3. Pretest and Posttest Score Data Per Question Item	140
Appendix 4. IMI Learning Motivation Results per Item	144
Appendix 5. GUESS-18 User Experience Results per Item	145