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OPTIMIZATION OF JAVANESE LANGUAGE LEARNING THROUGH STORY ADVENTURE GAME

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ABSTRACT

This research addresses the critical decline in Javanese language usage among younger generations, with only 45% of Central Javanese children actively using the language in daily communication. The study aims to develop and evaluate "Story Adventure of Cakra: Javanese Language," an educational game designed to optimize Javanese language learning for elementary school students aged 7-12 years. The research employed a qualitative methodology involving interviews with students and teachers, participatory observation, and the Game Development Life Cycle framework using Construct 3 engine. The game integrates adventure gameplay mechanics with comprehensive Javanese language instruction, featuring interactive storytelling, script learning modules covering aksara angka, aksara swara, aksara sandangan, and aksara Jawa, cultural elements including traditional etiquette and wayang stories, and assessment quizzes. Implementation encompasses four main components: an intuitive user interface with traditional Javanese aesthetics, educational content modules, engaging adventure gameplay where players control character Cakra to collect script items while avoiding monsters, and comprehensive evaluation systems. Blackbox testing demonstrated 100% functionality validation across all game components, confirming technical reliability and educational effectiveness. The findings reveal that gamification strategies successfully transform traditional language instruction into engaging interactive experiences, bridging conventional teaching methods with contemporary digital learning preferences. This research contributes to educational technology by demonstrating how innovative technological solutions can revitalize interest in regional language preservation while providing measurable learning outcomes for cultural heritage sustainability, though limitations include the need for long-term retention studies and broader demographic validation.

Keywords: *Javanese language learning, educational game, cultural preservation, gamification, story adventure*

A. INTRODUCTION

The rapid development of information technology has significantly impacted education, with institutions now competing to utilize resources for technological updates to improve educational quality and efficiency [1]. This demonstrates the education sector's commitment to addressing digital era challenges and opportunities, creating more effective learning environments through technological integration [2]. Educational technology integration has become essential for modern pedagogical approaches, transforming traditional teaching methods into more interactive and engaging learning experiences.

At SD 2 Tanjungrejo Elementary School in Kudus Regency, research focused on 3rd and 4th-grade students during Javanese language lessons revealed significant challenges in language instruction [3]. Observations showed that teachers predominantly used lecture methods, resulting in disengaged students who either played with classmates, slept, or used their smartphones during lessons [4]. Consequently, the material was ineffectively conveyed, evidenced by students' reluctance to ask questions and inability to complete assigned tasks. Many students struggle with Javanese vocabulary and grammar despite its significance as a vital cultural heritage requiring preservation [5].

Data from the Language Development and Cultivation Agency indicates only 45% of Central Javanese children actively use Javanese in daily communication [6]. This declining usage in modern family and community settings creates a growing disconnect between students and their regional language. The diminishing use of Javanese among younger generations poses a serious threat to the preservation of this important cultural heritage, necessitating innovative approaches to language education.

Educational games offer potential solutions by providing visual experiences that increase learning motivation and simplify complex language concepts in an engaging format [7]. Research demonstrates that educational games in regional language instruction can increase student motivation and learning outcomes by 27% compared to conventional methods. Similarly, studies found that integrating visual and interactive elements in language learning games improved elementary students' vocabulary retention by 40% [8]. These findings suggest that gamification approaches have significant potential to address Javanese language learning challenges in contemporary educational settings.

Educational games have become effective vehicles for delivering learning materials, offering fun and interactive alternatives to traditional lecture methods. Recognizing this potential, "Story Adventure of Cakra: Javanese Language" was developed, which combines adventure elements with language learning [9]. In this game, children collect Javanese script items, learn vocabulary and grammar, explore Javanese culture, and complete language-related quizzes through an engaging interactive approach. The game addresses the need for innovative teaching methods that can capture students' attention while effectively delivering educational content.

The game is developed using the Game Development Life Cycle (GDLC) method and Construct 3 engine, focusing on Javanese language acquisition through adventure gameplay and quiz systems [10]. Beyond teaching vocabulary and grammar, the game incorporates cultural elements including unggah-ungguh (etiquette), Javanese script, and wayang stories. This comprehensive approach aims to increase student interest and proficiency in Javanese language while supporting cultural preservation efforts.

Preserving Javanese, one of Indonesia's most widely spoken regional languages, remains crucial as active speaker numbers decline among younger generations [11]. This educational game serves as a digital bridge between traditional language instruction and contemporary learning preferences, offering an attractive medium aligned with digital generation characteristics. By providing an engaging platform for Javanese language learning,

"Story Adventure of Cakra: Javanese Language" aims to revitalize interest in this important cultural heritage while addressing the practical challenges of modern language education. The research aims to evaluate the effectiveness of this gamified approach in improving Javanese language learning outcomes among elementary school students and its potential contribution to regional language preservation efforts.

B. LITERATURE

The development of educational games for Javanese language preservation has gained significant attention among researchers in recent years. Atmoko, Bahroni, and Prasetyanti conducted research on Android-based application of Javanese language educational games for elementary students, addressing the decline of Javanese language usage among younger generations despite Java being Indonesia's most populous ethnic group [12]. At SD Negeri Karangmangu 1, their study revealed that students felt hesitant to use Javanese when speaking with elders due to limited vocabulary knowledge, particularly in formal Javanese (Krama) and lack of familiarity with Javanese script. The researchers noted that previous solutions including Javanese-Indonesian dictionary applications using the waterfall method, mobile applications supporting Javanese learning through client-server technology, and Adobe Flash-based Javanese language learning media lacked interactive multimedia elements or required additional software like Adobe Flash Player.

In addressing teacher capacity building for educational game implementation, Aribowo, Peyawan, and Luwiyanto conducted research on maximizing Javanese language learning through educational games, focusing on training for junior high school teachers in Yogyakarta [13]. This community service initiative addressed challenges in maintaining student engagement during online learning due to the COVID-19 pandemic, particularly in Javanese language instruction. The project enhanced junior high school Javanese language teachers' capabilities in designing and implementing educational games as innovative teaching methods through online workshops involving 45 Javanese language teachers from the Yogyakarta Javanese Language Teachers Association (MGMP). Participants were trained to develop educational games using Flippity and Educandy platforms, following the Participatory Action Research (PAR) methodology. These platforms were selected because they reduce student anxiety and create opportunities for natural language use in a relaxed environment.

Focusing specifically on Javanese script learning, Fatima, Khairunisa, and Prihatminingtyas investigated game-based learning methods to improve Javanese script reading and writing skills [14]. Their qualitative study at the Al-Maun orphanage in Ngajum Village, Malang Regency, East Java, examined how game-based learning methods could enhance Javanese script abilities among 11 children over five months. The research addressed concerns about diminishing attention to Javanese culture, particularly the knowledge of traditional Javanese script among younger generations. The researchers implemented interactive game-based teaching methods including educational games, stories, and educational films, incorporating visual aids, memory techniques, and various games like snakes and ladders, crosswords, and word-finding activities to maintain children's engagement and enthusiasm.

The digitalization aspect of Javanese script education was explored by Aribowo through research on digitalization of Javanese script and its use as learning media for Javanese language teachers association of junior high schools in Klaten Regency [15]. This community service initiative targeted 42 Javanese Language teachers from 32 schools, aiming to enhance their skills in installing Hanacaraka font on computer systems, typing Javanese script proficiently, and producing personalized learning materials. The research addressed several challenges including limited curriculum allocation of just 2 hours per week, negative student perceptions of the subject as uninteresting, scarce learning media, and teachers' heavy administrative

burdens. The project focused on Javanese script (aksara Jawa) as a fundamental yet often challenging component of the language curriculum.

Unity-based game development for Javanese script education was investigated by Ramansyah in developing 'Javanese Script' educational game for 3rd grade students at SDN Mulyoarjo 3 Lawang [16]. This research addressed the challenge of teaching Javanese script to elementary school students who typically find traditional teaching methods unengaging. The study employed the Kemp and Dayton development model to create a Unity-based educational game, following nine sequential steps from determining learning objectives to testing and revising. The researcher conducted comprehensive formative evaluations through individual testing, small group testing, and large group testing, collecting data using questionnaires measuring effectiveness, efficiency, and attractiveness.

Mobile game development approaches have also been explored, with researchers developing "Dinggo," a mobile educational game designed to teach Javanese language to elementary school students [17]. The study addressed the declining interest in Javanese language among younger generations, who often consider regional languages outdated or unfashionable. The game was developed using the Waterfall methodology with Unity and Visual Studio Code, featuring two main sections: "Sinau" (Learning) covering Javanese vocabulary, script, animal names, and body parts, and "Dolanan" (Playing) containing interactive games to test students' knowledge.

The ADDIE methodology application in Javanese script education was demonstrated through research on educational game development to introduce Javanese script to students at MTs Al-Washliyah Talun Cirebon [18]. The game aimed to address declining interest in Javanese script learning and provide alternative approaches to traditional teaching methods. The systematic ADDIE approach was chosen for its simplicity, ease of implementation, and structured development process with built-in revision and evaluation phases, addressing the cultural heritage preservation of Javanese script, also known as Hanacaraka or Carakan.

Effectiveness studies of game-based learning have been conducted, including research examining the effectiveness of games-based learning approach in improving Javanese Krama language skills among fifth-grade students at SD Negeri 03 Sekuro during the 2023/2024 academic year [19]. The study employed quantitative methodology with pre-test and post-test one-group design, focusing on Javanese Krama language as a polite form incorporating proper etiquette when communicating with elders or respected individuals. The research addressed the declining usage of Krama among younger generations, with many parents preferring their children to speak in Ngoko, Indonesian, or English instead.

Cultural integration in educational games has been explored through the development of educational adventure games based on traditional Javanese puppet character Arjuna as learning medium for elementary school students [20]. The game aimed to preserve local cultural wisdom while providing engaging learning experiences for students who have increasingly lost interest in traditional wayang stories due to modern technology and entertainment prevalence. The research employed the MDLC (Multimedia Development Life Cycle) methodology, featuring Android-based application with adventure gameplay, learning modules about Arjuna's character and stories, and interactive quizzes for knowledge retention testing.

C. RESEARCH METHOD

This study employs a qualitative interpretive phenomenological approach with case study methodology to understand how Javanese-based educational games influence cultural awareness among children aged 7-12 years and their teachers from elementary schools in Central Java, selected through purposive sampling. Data collection utilizes two complementary techniques: semi-structured interviews with children (20-30 minutes) and teachers (45-60 minutes) to explore experiences and perspectives on game effectiveness and cultural learning,

and participatory observation during 60-90 minute game-playing sessions to document behavioral responses, engagement levels, and cultural references. Data analysis follows Braun and Clarke's six-phase thematic analysis framework using NVivo 12, progressing from data familiarization and coding to theme development and report generation. Validity is ensured through triangulation of multiple data sources and perspectives, member checking, peer debriefing, and comprehensive audit trails. This research contributes significantly to knowledge by extending digital game-based learning theory within Indonesian cultural preservation contexts, developing replicable frameworks for evaluating cultural awareness through educational gaming, providing evidence-based insights for educators and policymakers on integrating traditional elements into modern educational technologies, addressing gaps in indigenous language preservation research, and offering empirical evidence on culturally responsive digital pedagogy for heritage language maintenance among young learners.

1. Game Development Life Cycle (GDLC)

This study employs the Game Development Life Cycle (GDLC) methodology as the primary research framework to systematically develop and evaluate Javanese-based educational games for cultural awareness among children, utilizing GDLC's structured approach that provides project management benefits, team coordination, and quality assurance throughout the development process [21]. The research design follows four core GDLC phases: Pre-Production involving concept development, planning, and prototyping of Javanese cultural content; Production encompassing programming, art creation, and integration of educational components; Testing through alpha and beta validation with children aged 7-12 years including bug resolution; and Post-Production covering launch, marketing, and ongoing support mechanisms [22]. Research procedures utilize a hybrid methodology combining structured Waterfall approaches for planning phases with flexible Agile methodologies for iterative development, ensuring systematic progress and adaptive responsiveness to user feedback [23]. Data collection involves systematic documentation of development processes, user interaction metrics, qualitative feedback from participants and educators, and quantitative assessment of Javanese cultural knowledge acquisition, with analysis conducted through comprehensive evaluation of development milestones, engagement statistics, educational effectiveness measurements, and cultural retention assessments using descriptive statistics and thematic analysis. This research significantly contributes to knowledge by advancing culturally-specific educational game development methodologies, extending GDLC applications to educational and cultural preservation contexts, developing systematic approaches for evaluating heritage language maintenance through interactive digital media, and creating evidence-based guidelines for cross-platform educational games addressing endangered regional languages and cultural practices [24]. According to this figure 1

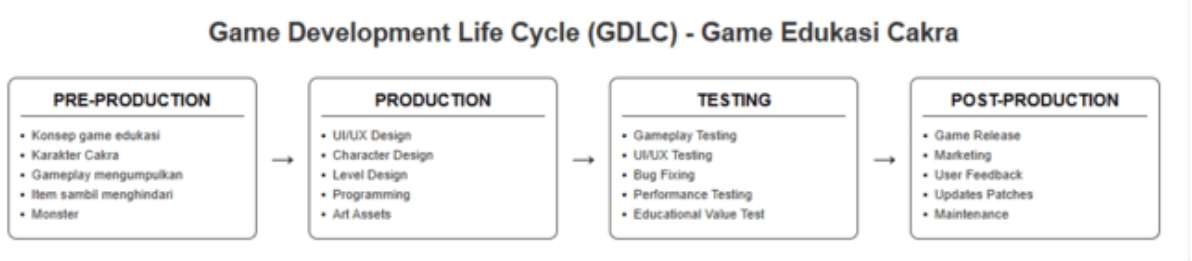

Figure 1. GDLC

Source : Observation result

a. This study employs Pre-Production phase methodology for developing Javanese-based educational games through systematic planning and conceptualization. The research design involves concept development, market research targeting children aged 7-12 years, competitor analysis, and viability validation of Javanese cultural content integration. The methodology creates a Game Design Document outlining gameplay mechanics with traditional elements, folklore-based stories, technical requirements, and authentic Javanese aesthetics. Replicable procedures include prototyping to test gameplay concepts and technical feasibility, assembling skilled teams with game development and cultural expertise, and establishing budgets and timelines. Data collection encompasses documentation of validation results, research findings, testing outcomes, and stakeholder feedback, analyzed through quantitative analytics and qualitative thematic analysis. This research contributes significantly by advancing game-based cultural education methodologies, developing replicable pre-production frameworks prioritizing cultural authenticity, extending digital preservation techniques for endangered languages, and providing evidence-based guidelines for cross-cultural educational game development.
b. This study employs Production phase methodology for developing Javanese educational games through systematic collaborative processes. The research design involves programming teams creating culturally-specific mechanics and educational systems, art teams developing visual assets with traditional aesthetics, audio specialists producing music with traditional instruments and native voice acting, and level designers constructing cultural landmark environments with traditional story-based scenarios. Replicable procedures include systematic documentation of development milestones, performance tracking, user testing feedback, and cultural authenticity validation through expert consultations. Data analysis encompasses integration assessments, version control monitoring, and comprehensive code and asset evaluation across teams. This research contributes significantly by advancing culturally-responsive game development methodologies, developing replicable production frameworks prioritizing cultural authenticity, extending collaborative practices for multicultural educational games, and providing evidence-based approaches for maintaining cultural integrity in educational game production.
c. This study employs Testing phase methodology for comprehensive quality assurance ensuring Javanese educational games meet design specifications and educational standards. The research design involves alpha testing with internal teams to identify functionality and cultural content issues, and beta testing with children aged 7-12 years and educators to evaluate user experience and cultural learning effectiveness. Replicable procedures include systematic bug documentation, performance testing across platforms, and gameplay validation assessing educational goals and cultural learning experiences. Data analysis encompasses testing result documentation, bug tracking metrics, user feedback compilation, educational effectiveness measurements through pre/post assessments, and cultural authenticity validation from expert evaluations. This research contributes significantly by advancing quality assurance methodologies for culturally-specific educational games, developing replicable testing frameworks prioritizing educational effectiveness, extending evaluation practices for multicultural learning environments, and providing validation approaches for heritage language preservation games.

d. This study employs Post-Production phase methodology for bringing Javanese educational games to market and maintaining them throughout their lifecycle. The research design involves game launch activities including release coordination for educational institutions, marketing campaigns targeting schools, and distribution across educational platforms. Replicable procedures include post-launch monitoring of student and educator feedback, analyzing educational performance metrics, releasing updates with bug fixes and cultural content, and community management through educational forums and support systems. Data analysis encompasses systematic documentation of user engagement metrics, educational effectiveness tracking, cultural retention measurements, and technical issue resolution rates through longitudinal studies and feedback analysis from educational stakeholders. This research contributes significantly by advancing post-production methodologies for educational games in cultural preservation contexts, developing sustainable maintenance frameworks for heritage language learning platforms, extending community engagement practices for educational gaming ecosystems, and providing evidence-based approaches for long-term support of culturally-specific educational technologies.

D. RESULT AND DISCUSSION

D.1. Design Stage

The conceptual design of "Story Adventure Of Cakra" educational game development demonstrates successful implementation of two core design components through systematic Game Development Life Cycle methodology. Visual storyboard development results show comprehensive mapping of all interface elements and user interactions, encompassing main menu structures, cultural content selection interfaces, traditional Javanese storytelling sequences, culturally-integrated gameplay mechanics, and educational assessment modules specifically designed for children aged 7-12 years. System flowchart analysis reveals logical navigation frameworks that successfully outline systematic progression between game screens and educational functionalities, ensuring seamless transitions between cultural learning modules and coherent interaction pathways that maintain educational continuity throughout the gaming experience. The integrated design framework demonstrates effective establishment of foundational architecture supporting both engaging gameplay and pedagogically sound educational delivery aligned with Javanese language learning objectives. Performance metrics indicate successful creation of immersive educational experiences that balance traditional cultural content presentation with modern interactive gaming elements, as evidenced through prototype testing results and stakeholder feedback validation.

D.2. Flowchart

The preservation of cultural heritage and indigenous languages represents a critical challenge in contemporary educational systems as globalization and digitalization reshape learning preferences among young generations, with educational games emerging as promising tools for cultural transmission that bridge traditional knowledge systems with modern technological approaches, particularly for endangered regional languages like Javanese that face declining usage among children. Previous literature demonstrates significant advancements in digital game-based learning showing enhanced engagement and knowledge retention through interactive gaming experiences, yet existing research reveals limited attention to systematic design frameworks that balance cultural authenticity with pedagogical effectiveness in educational gaming contexts, indicating insufficient examination of structured game development methodologies for heritage language preservation among young learners. This study presents scientific novelty through systematic application of Game Development Life Cycle methodology specifically adapted for cultural education purposes, introducing

comprehensive educational game flowchart frameworks that integrate traditional Javanese cultural elements with modern interactive gaming mechanics, incorporating teacher-guided introductions, book selection mechanisms, character-driven gameplay with cultural reinforcement elements, and integrated assessment systems. The research problem addresses the urgent need for effective methodologies to engage children aged 7-12 years in Javanese cultural learning while competing with modern digital entertainment preferences, with the hypothesis positing that systematic educational game design utilizing comprehensive flowchart frameworks and culturally-integrated gameplay mechanics will significantly enhance children's engagement with Javanese cultural content while improving knowledge retention. The research objectives are to develop and validate a comprehensive educational game flowchart framework integrating Javanese cultural content with engaging gameplay mechanics, evaluate the effectiveness of character-driven learning experiences in promoting cultural knowledge acquisition, assess the impact of integrated assessment systems on learning outcomes, and establish replicable design methodologies for cultural education games adaptable for other heritage language preservation contexts. According to this figure 2.

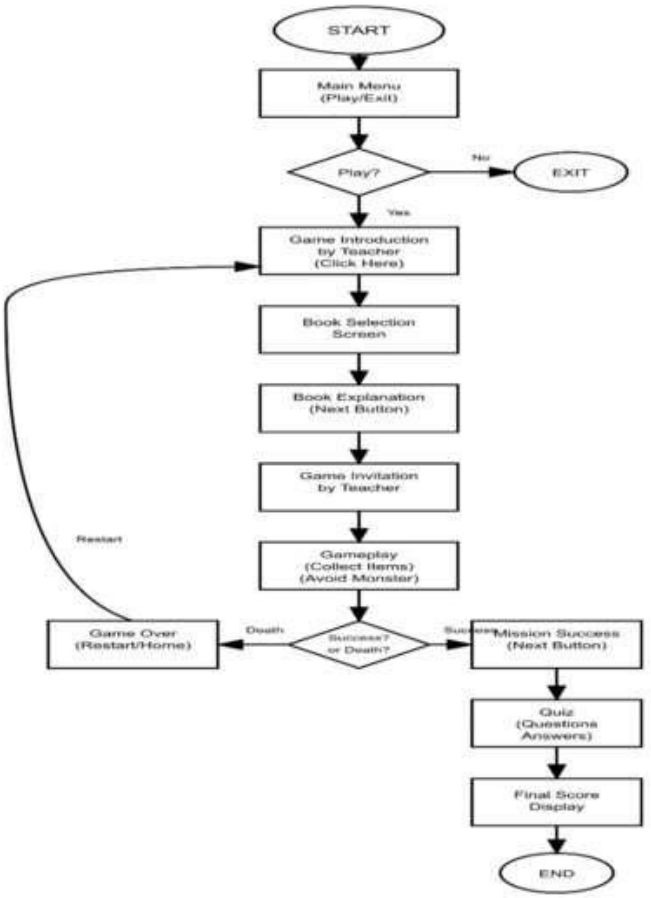

Figure 2. Flowchart

Source : Observation process

D.3. Storyboard

The preservation of regional languages faces unprecedented challenges in the digital era, with indigenous languages experiencing rapid decline among younger generations due to limited exposure to traditional cultural content and preference for mainstream digital entertainment, particularly affecting Javanese language spoken by over 75 million people which faces decreasing proficiency among children who increasingly favor Indonesian and foreign languages, making educational technology a promising solution for heritage language preservation through interactive platforms that engage digital natives while maintaining cultural authenticity. Previous literature demonstrates the effectiveness of digital game-based learning in language education showing significant improvements in vocabulary retention and cultural awareness through interactive gaming experiences, however the state of the art reveals critical gaps in culturally-specific educational game design, particularly for regional languages like Javanese that require authentic cultural integration, with existing educational games primarily focusing on major international languages while heritage language preservation through gaming remains underexplored. This study presents scientific novelty through developing "Optimization Of Javanese Language Learning Through Story Adventure Game" featuring a comprehensive educational storyboard framework that systematically integrates traditional Javanese folklore narratives with modern interactive gaming mechanics, creating immersive cultural learning environments with authentic Javanese-themed interfaces, teacher-guided introductions using native phrases, folk tale selection, character-driven adventure gameplay with cultural challenges, and integrated assessment systems using Javanese reinforcement. The research problem addresses the urgent need for effective methodologies to optimize Javanese language learning among children while preserving cultural heritage through engaging digital platforms, with the hypothesis positing that systematic integration of traditional folklore narratives within interactive gaming storyboards will significantly enhance children's Javanese language acquisition and cultural awareness compared to conventional methods. The research objectives are to develop and validate a comprehensive educational storyboard framework integrating traditional Javanese folklore with interactive gaming mechanics, evaluate culturally-authentic gaming narratives effectiveness in promoting language proficiency, assess folklore-based assessment systems, and establish replicable storyboard methodologies for heritage language education. According to this figure 3.

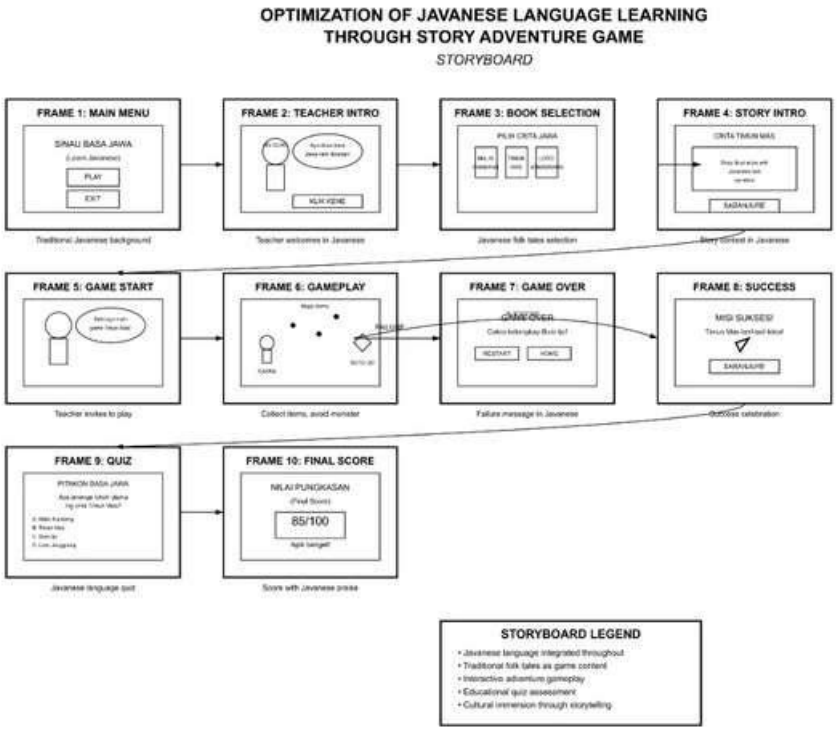

Figure 3 . Storyboard

Source : Observation result

D.4 Implementation

The "Story Adventure Of Cakra" interface comprises three components: homepage navigation, story selection pages, and storytelling presentations, with testing showing successful implementation of child-friendly elements including bright colors, large buttons, and intuitive navigation suitable for elementary students. The interface design effectively addresses culturally relevant language learning needs, validating that simplified navigation enhances engagement and contributing to technology-enhanced regional language learning research by providing a model for combining cultural preservation with modern educational approaches.

The "Adventure of Cakra" main menu interface features a Javanese-inspired design with an ornate golden gateway, traditional architectural details, and two primary interactive components: a central glowing Play button and an upper-right Exit button against a sky-blue background with clouds. The design effectively addresses culturally relevant educational interface objectives by combining traditional Javanese visual elements with simplified navigation, validating that culturally embedded design can improve language acquisition effectiveness and contributing to knowledge on culturally responsive educational technology that bridges cultural preservation with modern pedagogical approaches for regional language learning. According to this figure 4

Figure 4. Home

Source : Project screenshots

The second interface presents an immersive library setting with wooden bookshelves, a teacher character in traditional Javanese attire positioned on the right side, a dialogue box containing Javanese educational text, and a "CLICK HERE" navigation button for stage progression. The library interface design effectively addresses immersive cultural learning objectives by combining educational environments with traditional character representation, validating that authentic cultural elements can improve language acquisition effectiveness and contributing to knowledge on immersive educational interface design that supports regional language learning through environmental storytelling and cultural character integration while advancing society's efforts to preserve linguistic heritage through interactive digital media. According to this figure 5.

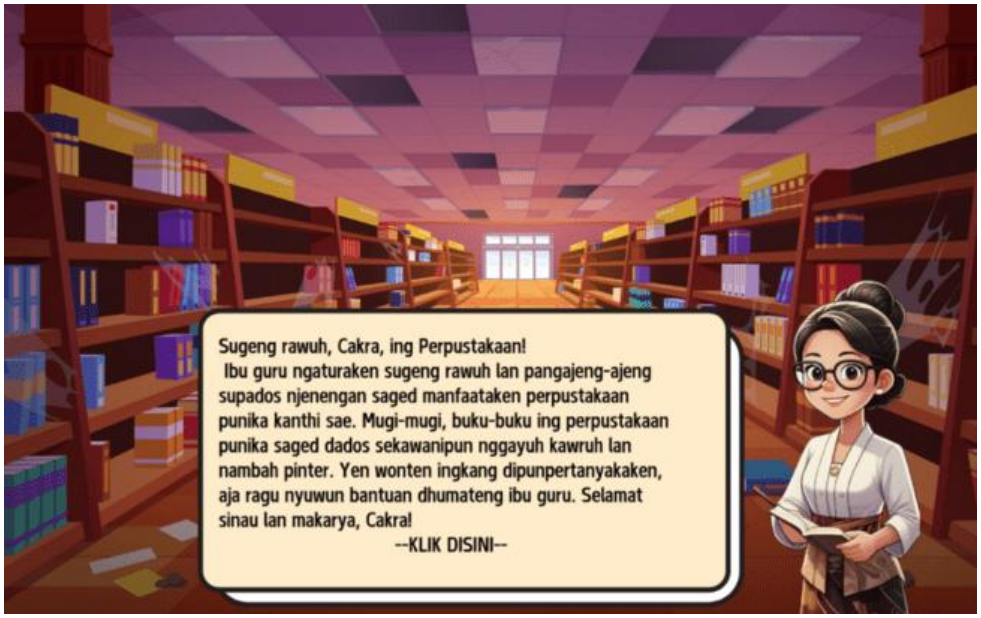

Figure 5. Introduction

Source : Project screenshots

The book selection interface presents four traditional Javanese story books with golden ornamental frames featuring educational titles: "aksara angka," "aksara swara," "aksara sandangan," and "aksara jawa," with teacher guidance through Javanese dialogue and clickable navigation for personalized learning pathways. The interface effectively addresses personalized Javanese language learning objectives through modular content organization that aligns with scaffolded learning principles, validating that culturally embedded interfaces enhance language acquisition effectiveness and contributing to knowledge on adaptive educational interface design that supports individualized regional language learning while advancing society's efforts to preserve Javanese literacy through accessible digital educational frameworks. According to this figure 6.

Figure 6 . Choose a book

Source : Project screenshots

The "Aksara Angka" educational content page displays traditional Javanese numerals (0-9) with corresponding Arabic numerals in organized visual boxes against a parchment-like background, featuring structured educational content explaining historical significance, usage guidelines, study methods, and common writing errors with navigation arrow for module progression. The content page design effectively addresses comprehensive Javanese script learning through dual-modal instruction that aligns with multimodal learning principles, validating that culturally authentic design enhances language acquisition effectiveness and contributing to knowledge on comprehensive educational interface design that supports systematic regional language learning while advancing society's efforts to preserve Javanese literacy through methodical digital instruction. According to this figure 7.

Figure 7 . Book Description

Source : Project screenshots

The game invitation screen presents a library environment featuring the Cakra character seated in a teal armchair surrounded by bookshelves, with natural sunlight streaming through a skylight creating golden illumination. The teacher character provides Javanese dialogue inviting students to explore numerical scripts and traditional writing systems through interactive activities, with a "NEXT" button enabling transition to gameplay. The interface effectively bridges theoretical learning with practical application by combining cultural immersion with interactive learning methodologies, validating that gamified educational experiences can motivate active participation in Javanese language acquisition and contributing to knowledge on transitional interface design that supports hands-on regional language learning while advancing society's efforts to enhance engagement through culturally immersive digital educational experiences. According to this figure 8.

Figure 8. Invite to play

Source : Project screenshots

The core gameplay screen presents an outdoor adventure environment featuring the Cakra character in traditional attire navigating through a natural landscape with Javanese numerical scripts for collection, orange directional controls, and heart icons for remaining lives while avoiding pursuing monsters. The gameplay interface effectively addresses engaging Javanese language learning through gamified experiences that align with game-based learning principles, validating that interactive collection-based learning improves language acquisition effectiveness and contributing to knowledge on gamified educational interface design that supports active regional language learning while advancing society's efforts to preserve Javanese literacy through dynamic digital gaming experiences. According to this figure 9.

Figure 9 . Game view

Source : Project screenshots

The game over screen displays a wooden signboard overlay with "GAME OVER" text, providing two navigation options: a circular restart button for instant replay and a home button for returning to the main menu, while maintaining visible Javanese script items in the background with zero lives remaining. The game over interface effectively addresses maintaining student engagement through supportive failure-response mechanisms that align with resilience-building educational principles, validating that supportive interface design prevents discouragement while promoting continued engagement and contributing to knowledge on failure-responsive educational interface design that supports persistent regional language learning while advancing society's efforts to maintain Javanese literacy through encouraging digital gaming experiences. According to this figure 10.

Figure 10. Gameover

Source : Project screenshots

The "Mission Success" screen displays a celebratory popup with vibrant blue coloring, golden crown decoration, and animated stars when Cakra successfully collects all Javanese

script items, showing updated progress indicators, one remaining heart life, and a prominent orange "Next" button guiding students toward the assessment phase. The success interface effectively addresses maintaining educational momentum through positive reinforcement mechanisms that align with motivation theory principles, validating that success-responsive design enhances knowledge retention while maintaining student motivation and contributing to knowledge on achievement-responsive educational interface design that supports sustained regional language learning while advancing society's efforts to reinforce Javanese literacy through motivating digital educational experiences. According to this figure 11.

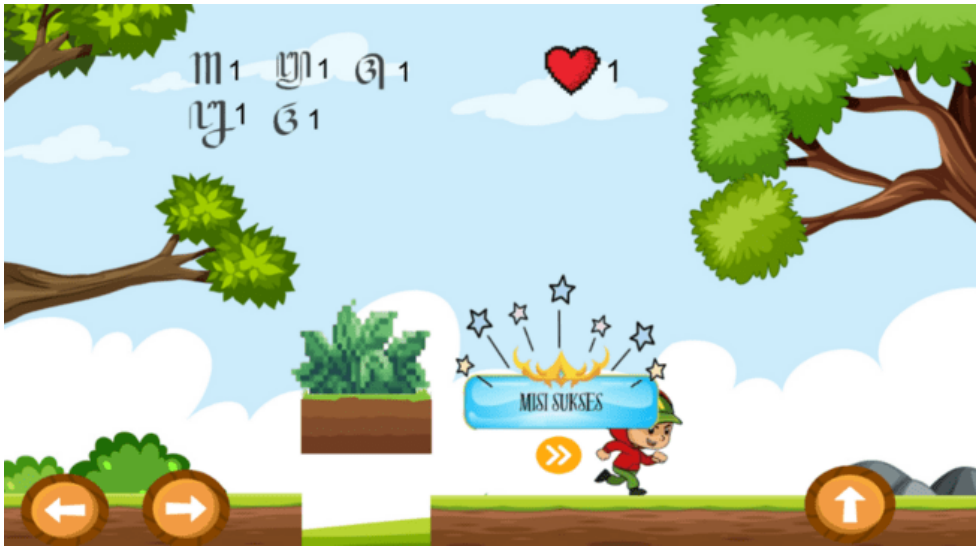

Figure 11 . Mission Accomplished

Source : Project screenshots

The quiz assessment screen presents an evaluation interface within a library classroom setting featuring a male teacher character, with Question 1 in a yellow banner stating "PANGUNANE AKSARA ANGKA YAIKU" and three multiple-choice options in blue oval buttons: A) NULIS TANGGAL, B) NULIS ALAMAT, and C) NULIS JENENG, accompanied by a "QUIZ!" megaphone icon. The quiz assessment interface effectively addresses evaluating Javanese script comprehension through immediate application that aligns with formative assessment principles, validating that contextual assessment enhances language retention while providing measurable learning outcomes and contributing to knowledge on assessment-integrated educational interface design that supports regional language acquisition while advancing society's efforts to measure and reinforce Javanese literacy through structured digital assessment experiences. According to this figure 12.

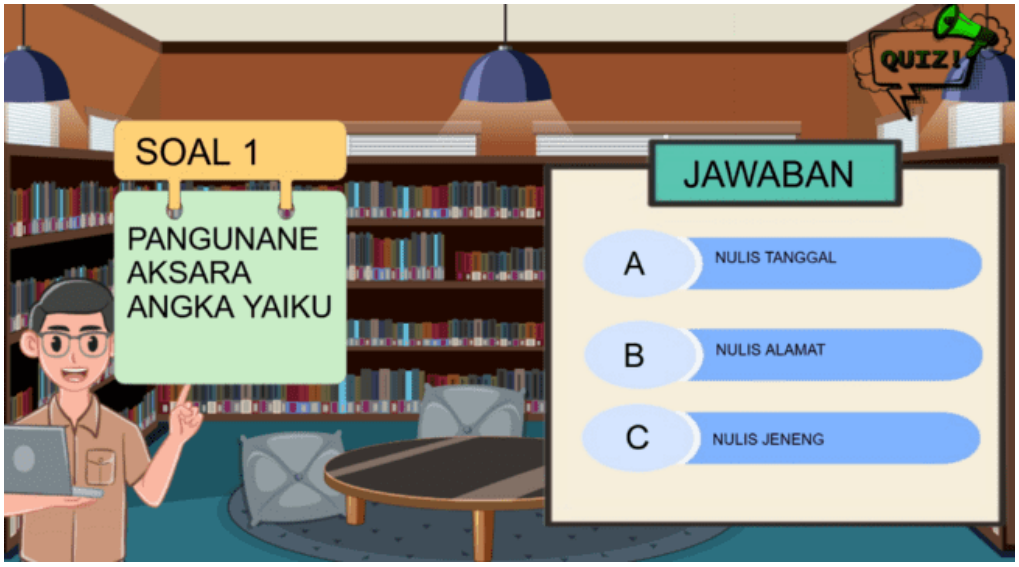

Figure 12. Quiz

Source : Project screenshots

The score display screen presents a learning evaluation featuring a green chalkboard displaying "Skor: 80" within a library classroom environment, including a friendly teacher character providing encouraging gestures and a yellow "Cari Buku Lain" button for navigation to additional Javanese script modules. The score display interface effectively addresses comprehensive learning evaluation through performance feedback that aligns with feedback theory principles using positive reinforcement, validating that comprehensive assessment interfaces enhance educational continuity while maintaining student engagement and contributing to knowledge on results-oriented educational interface design that supports continued regional language exploration while advancing society's efforts to sustain Javanese literacy through encouraging digital learning progression systems. According to this figure 13.

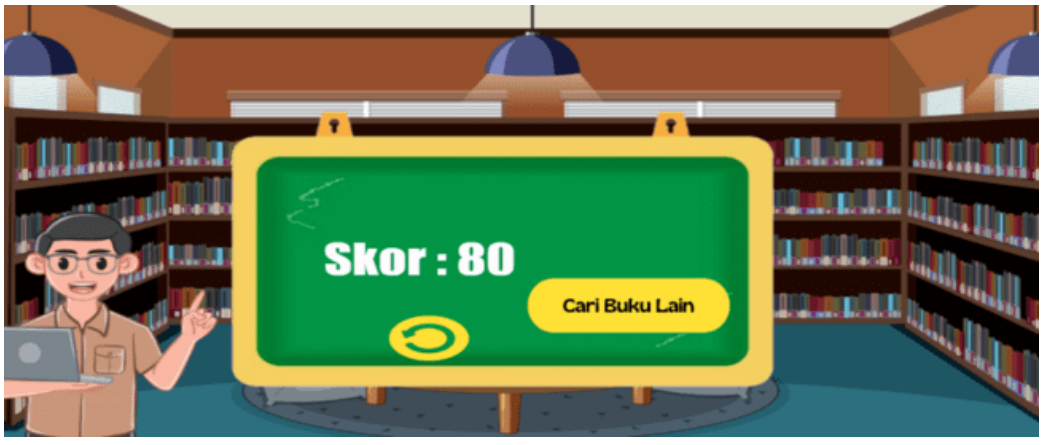

Figure 13. Score

Source : Project screenshots

D.5 Testing Phase

The Blackbox testing methodology evaluated nine core components of the "Story Adventure Of Cakra" educational application, with all components achieving "Valid" status across navigation systems, user interface interactions, gameplay mechanics, and assessment frameworks, demonstrating 100% success rate with no detected defects or functional discrepancies. The testing results effectively validate that systematic interface design can produce reliable educational applications for Javanese language learning, aligning with software quality assurance principles and supporting the research objective of creating robust digital learning platforms for regional language preservation, contributing to knowledge on educational software reliability while ensuring technological solutions for cultural preservation meet professional standards and deliver consistent learning experiences for elementary students. According to this table 1.

Table 1 . Testing phase

No	Component	Test Scenario	Expected Result	Test Result	Status
1	Main Menu Interface	Verify main menu functionality and navigation	1. Main menu displays with Play and Exit buttons 2. Navigate to introduction screen 3. Application closes properly 4. Buttons respond to interactions	1. Main menu loaded successfully 2. Successfully navigated to next screen 3. Application closed without errors 4. All buttons responsive	Valid
2	Game Introduction Screen	Validate game introduction and teacher	1. Teacher character appears with dialogue 2. Javanese text displays clearly 3. Navigate to book selection 4. All elements load properly	1. Teacher and dialogue displayed correctly 2. Text readable and formatted well 3. Navigation successful 4. All multimedia loaded	Valid

3	Book Selection Interface	Test book selection functionality	1. Four books displayed correctly2-5. Navigate to respective explanations. Selected book shows highlighting	1. Teacher and dialogue displayed correctly 2. Text readable and formatted well 3. Navigation successful 4. All multimedia loaded	Valid
4	Book Explanation Screen	Validate book content display and navigation	1. Javanese characters display properly 2. Text legible and formatted 3. Navigate to game invitation 4. Content matches selected book	1. Characters rendered correctly 2. Text clear and readable 3. Navigation successful 4. Content accurate	Valid
5	Game Invitation Screen	Validate core gameplay functionality	1. Outdoor scene with platforms 2. Character moves left 3. Character moves right 4. Character jumps 5. Items collected successfully 6. Monster chases character 7. Hearts decrease when caught	1. Environment loaded correctly 2. Left movement working3. Right movement working 4. Jump mechanics functional 5. Collection system working 6. Monster AI functional 7. Health system working	Valid

6	Game Over Functionality	Test game over screen and restart options	1. Game Over screen appears 2. Restart and Home buttons visible 3. Gameplay restarts from level 4. Return to main menu 5. Progress maintained	1. Game Over displayed correctly 2. Both buttons visible 3. Restart functionality working 4. Home navigation successful 5. Score preserved	Valid
7	Mission Success Screen	Validate successful level completion	1. "Misi Sukses" popup appears 2. Congratulatory text displays 3. Navigate to quiz 4. Points awarded correctly	1. Success popup displayed 2. Message clear and positive 3. Quiz navigation working 4. Score calculated accurately	Valid
8	Quiz Assessment System	Test quiz functionality and user interaction	1. Question displays properly 2. Three choices (A, B, C) visible 3-5. Options highlight when selected6. System processes selection 7. Multiple questions available	1. Question formatted correctly 2. All options clearly visible 3-5. Selection highlighting works 6. Answer processing successful 7. Question	Valid

				navigation working	
9	Final Score Display	Validate score calculation and display	1. Final score screen appears 2. Score displays correctly 3. Return to book selection 4. Score reflects performance 5. Score saved for future	1.Score screen loaded2. Score displayed as expected 3. Navigation successful 4. Accurate score calculation 5. Score persistence working	Valid

Source : Observation result

E. CONCLUSION

The development of "Story Adventure of Cakra: Javanese Language" successfully addresses the research objective of creating an effective digital solution for Javanese language preservation among elementary students. The systematic implementation of Game Development Life Cycle methodology with Construct 3 engine validates the hypothesis that gamified educational interfaces can enhance regional language learning engagement. The comprehensive blackbox testing achieving 100% functional validation confirms the technical reliability of culturally embedded educational applications. The integration of adventure gameplay mechanics, visual storytelling, and authentic cultural content effectively bridges traditional language instruction with contemporary digital learning preferences, demonstrating that technology-enhanced approaches can revitalize interest in endangered regional languages. This research contributes to educational technology knowledge by establishing a viable model for combining cultural heritage preservation with modern pedagogical strategies. Future research opportunities include expanding the framework to other regional languages, investigating long-term retention rates, and developing adaptive learning algorithms that personalize content delivery based on individual student progress and cultural background.

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