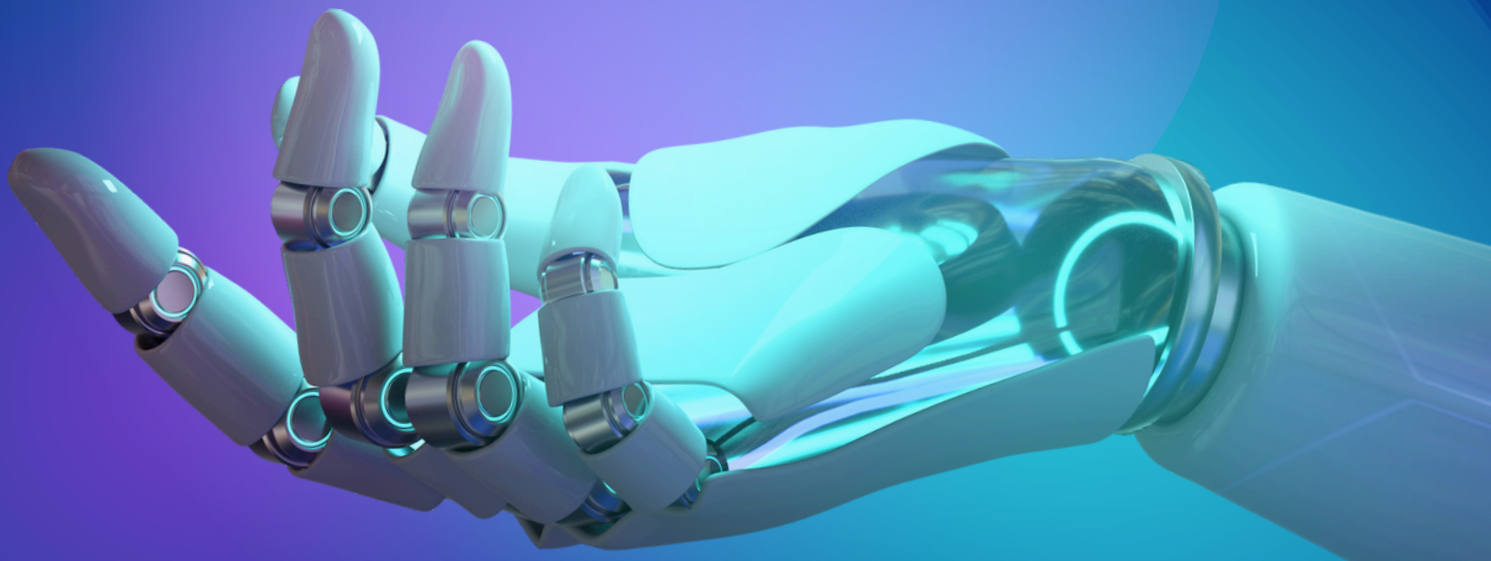
PROGRAMMING 3D
P.O.E PART 1

RESEARCH



PROG7314

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Introduction

This research document studies three established mobile memory training applications Match by Branded Brothers, MemoGames by Monkey Games Studios, and Remembery by Dreamy Dingo, to guide the development of Memory Match Madness. The purpose of this study is to identify effective design principles, innovative features, and common shortcomings in current cognitive training apps. Each application is examined in terms of user experience, gameplay mechanics, interface design, and technical implementation. Key aspects such as adaptive difficulty, multiplayer functionality, progress tracking, and gamification are evaluated to determine their contribution to user engagement and cognitive improvement. The research also explores how these applications manage performance, database integration, and platform optimization. Strengths and weaknesses are compared to highlight design practices that encourage long-term use while avoiding common pitfalls such as excessive advertisements and limited personalization. This evidence-based approach ensures that the insights drawn from the analysis directly inform the design and implementation of Memory Match Madness. Ultimately, this introduction establishes the framework for an informed evaluation that combines academic research with practical game development considerations.

Research on each app

App 1: Match – Branded Brothers

Overview of the app

"Match: Matching Game," also known as "Memo Game," is a classic memory card matching game developed by Branded Brothers that brings the traditional concentration game to mobile devices. Players flip cards to find matching pairs from various themed categories such as animals, logos, cartoons, and vehicles. It offers three main game modes: Quick Game for casual play, Quest mode with progressive difficulty levels, and a two-player mode for competitive gameplay. The application is designed as a brain training tool that claims to improve memory, concentration, and cognitive abilities for users of all ages. The game is accessible to a wide range of users. The app follows a freemium model where basic gameplay is free, but additional card categories and ad removal require in-app purchases. The developers have positioned this as both entertainment and educational software, particularly beneficial for seniors and individuals with attention difficulties. The game features colourful, intuitive graphics and simple touch controls that make it easy to navigate for users across different age groups. Overall, it represents a straightforward digital adaptation of a beloved classic game with modern mobile gaming conveniences (Branded Brothers, 2021).

Strengths and weaknesses of the app

- Strengths:

1. **Variety of Content and Levels:** The app includes many card categories such as animals, logos, and cartoons, which makes it appealing to both children and adults. Difficulty levels range from small grids to more complex layouts, ensuring it can be used by beginners as well as advanced players. This wide variety helps keep users engaged and makes the app suitable for both family and educational use (Branded Brothers, 2021).

2. **Cognitive Training Value:** The design of the game supports memory, attention, and concentration by requiring players to recall card positions and improve through increasing difficulty. The scoring system encourages accuracy and speed, helping players track progress. This makes the app useful not only for casual play but also for strengthening cognitive skills (Branded Brothers, 2021).

3. **Fair Monetization:** The game avoids aggressive pay-to-win mechanics. Ads are present but are reported to be manageable, and users can pay a reasonable fee to remove them. Additional content is affordable, allowing players to enjoy the game without being pressured into constant spending (Branded Brothers, 2021).
4. **Multiplayer Mode:** The two-player mode makes the game more engaging by turning an individual activity into a shared experience that encourages social interaction while still supporting memory training. This feature is especially useful for families, classrooms, and therapy sessions, as playing together can improve both learning and connection. The competitive aspect of multiplayer adds extra motivation and keeps users interested, while still supporting the app's focus on cognitive development. Allowing players to compare their results with others further encourages regular practice and ongoing skill improvement (Branded Brothers, 2021).

- Weaknesses:

1. **Inconsistent Scoring and Progress Tracking System:** Users report confusion with the scoring system, where more moves can sometimes lead to higher scores than fewer moves. The unclear timing system, often showing "time 0," adds further confusion. This lack of transparency makes it difficult for players to measure progress or understand how performance is evaluated. As a result, the app loses credibility as a training tool and reduces motivation for users seeking structured improvement (Branded Brothers, 2021).

2. **Technical Stability and User Interface Issues:** Many players experience recurring issues such as uneven card layouts, timers that do not reset, and buttons becoming unresponsive. These technical problems interrupt gameplay and frustrate users, reducing the benefits of memory training. The reliance on developer support for simple problems suggests weak quality assurance. Such instability is especially challenging for older or less tech-savvy users, who may represent a large part of the audience (Branded Brothers, 2021).

3. **Limited Offline Functionality and Connectivity Requirements:** The app requires internet access, limiting use in areas with poor coverage or for users with limited data. This is a significant problem since daily training should be available at all times. Offline restrictions make the app less useful for travelers, older users, or those in areas with unstable networks. Because internet access is not necessary for basic gameplay, this dependency reduces accessibility (Branded Brothers, 2021).

4. **Inadequate Category Organization and Visual Clarity:** Some categories, such as music, contain images that are unclear or difficult to recognize. Random category assignment in certain modes frustrates players who prefer specific themes. The lack of options to adjust card size, contrast, or visibility limits accessibility for users with visual or cognitive difficulties. These weaknesses reduce inclusivity and make the app less effective as a universal cognitive training tool (Branded Brothers, 2021).

Innovative Motivation for Features

The multiplayer functionality extends memory training beyond individual play into a shared social experience, promoting family interaction and peer motivation through competitive matches. Its scoring system with star ratings and achievement tracking introduces gamification, offering measurable indicators of progress that sustain user engagement. The inclusion of diverse categories such as animals, logos, and cartoons enhances educational value, supporting learning across multiple domains while strengthening visual association and memory formation (Branded Brothers, 2021).

App Implementation

The app was developed in Unity, but its structure can be examined through the lens of Android Studio development. The game logic relies on a centralized controller that manages menus, gameplay, and results, something that in Android Studio would typically be handled through Activities or Fragments, with lifecycle methods ensuring smooth transitions. The card-matching mechanics suggest the use of grid-based layouts, which in Android Studio

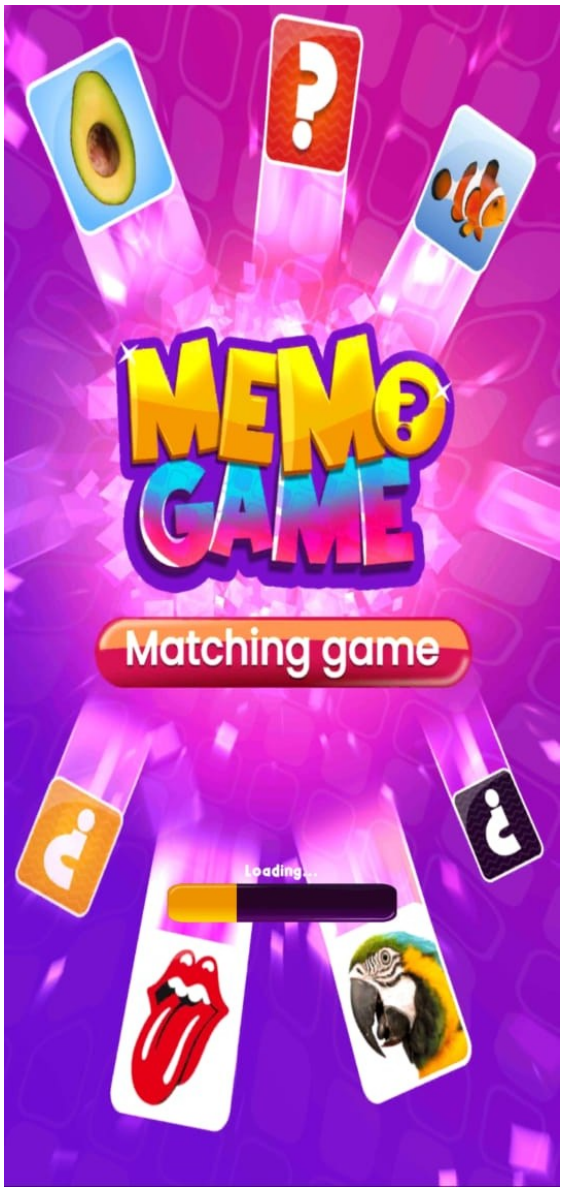
could be implemented with RecyclerView or GridLayout, while animations and drawable states would control card flipping and matching. Asset loading for themed categories appears to follow a modular system, comparable to Android's resource management or dynamic asset delivery approaches, ensuring efficient use of memory and storage (Branded Brothers, 2021;The IIE, 2020).

The multiplayer functionality points to real-time synchronization of game states. In a native Android Studio implementation, this would most likely be achieved through Firebase Realtime Database or WebSockets, while progress persistence could use SharedPreferences for lightweight storage or Room Database for structured data, with optional cloud synchronization. Monetization in the app is likely implemented using Unity's Advertisement SDK and Google Play Billing API, but in Android Studio it would align more seamlessly with the Google Play Billing Library. The technical challenges users reported, such as persistent timers and uneven card distribution, suggest asynchronous handling issues. In Android Studio, Kotlin coroutines would provide more reliable background task management, reducing these inconsistencies (Branded Brothers, 2021;The IIE, 2020).

From a performance perspective, Unity offers cross-platform deployment but carries a larger memory footprint. In Android Studio, profiling tools would allow for precise optimization of image-heavy assets, while features such as ConstraintLayout and vector drawables could enhance responsiveness across devices. Similarly, Kotlin's null-safety and structured concurrency could reduce crashes and memory leaks, delivering a smoother user experience. Animation frameworks, combined with efficient object pooling, would further improve transitions and gameplay flow (Branded Brothers, 2021;The IIE, 2020).

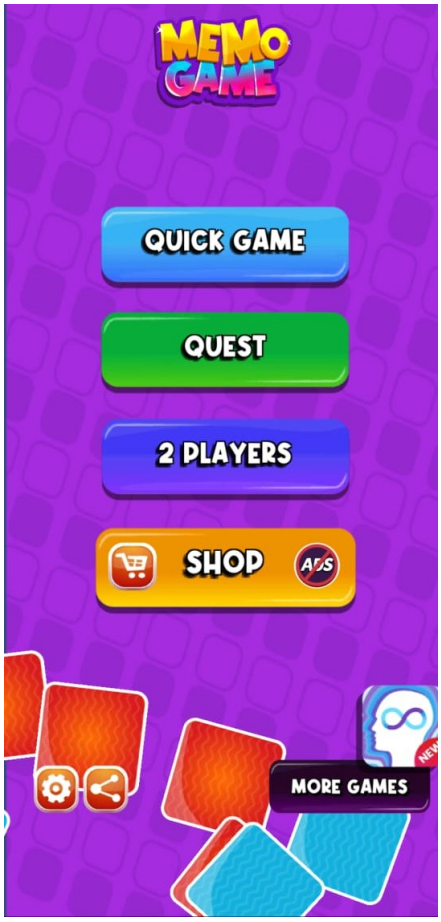
Overall, while Unity enables broader deployment, an Android Studio implementation with Kotlin would provide tighter lifecycle control, improved performance monitoring, and more stable handling of asynchronous logic. This would allow for more efficient memory management, better UI adaptability, and more reliable integration of in-app purchases ultimately supporting a more optimized and scalable version of the app tailored for Android users (Branded Brothers, 2021;The IIE, 2020).

Screenshots of the app



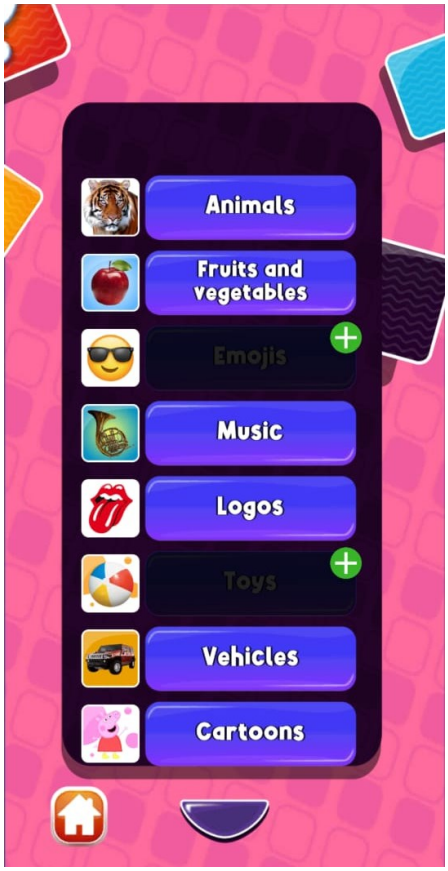
(Branded Brothers, 2021)

Figure 1 - App Startup, Loading Screen, and Branding: The splash screen showcases the "MEMO GAME" branding with dynamic 3D text effects and floating card animations that immediately establish the app's identity and purpose. The Unity engine's rendering capabilities are evident in the polished visual presentation, including particle effects and smooth transitions that enhance user engagement. The loading indicator and professional presentation reflect the developer's attention to first impressions and user experience design principles (Branded Brothers, 2021).



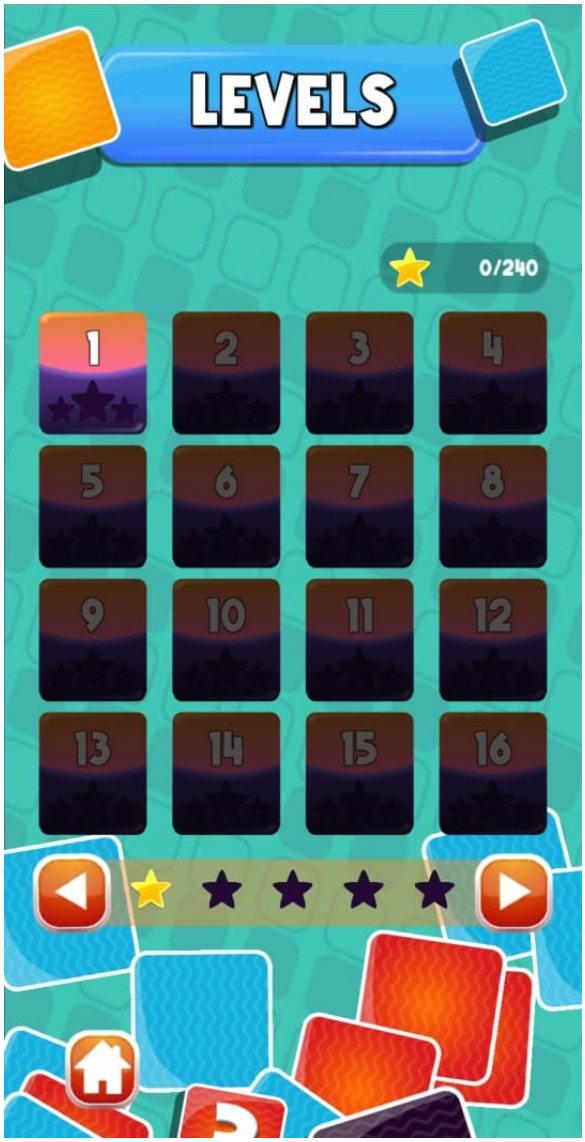
(Branded Brothers, 2021)

Figure 2 - Game Mode Selection: This interface presents the primary navigation options including Quick Game, Quest, 2 Players, and Shop, demonstrating the app's comprehensive feature set within a clean, hierarchical menu structure. The consistent visual design language with rounded buttons and clear iconography ensures intuitive navigation across different user demographics. The prominent placement of the Shop option indicates the importance of monetization within the app's business model while maintaining accessibility to core features (Branded Brothers, 2021)



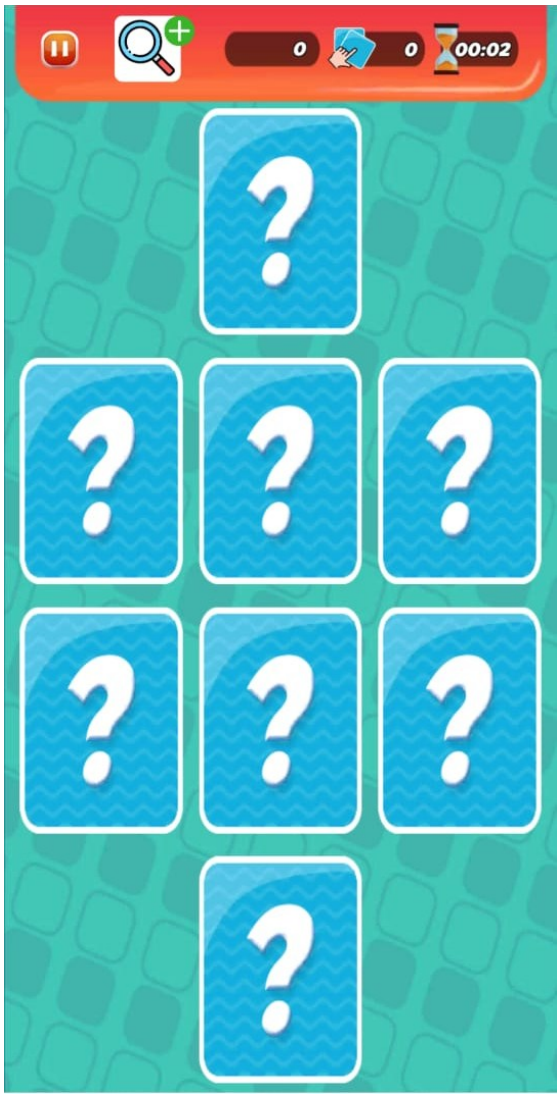
(Branded Brothers, 2021)

Figure 3 - Category Selection Interface: The initial screenshot demonstrates the app's main category selection screen, featuring a well-organized vertical list of themed content including Animals, Fruits and Vegetables, Music, Logos, Vehicles, and Cartoons. The interface design employs a vibrant purple background with colourful card elements scattered around the edges, creating an engaging and playful aesthetic that appeals to the app's broad age demographic. Each category is clearly represented with recognizable icons and bold, readable typography, facilitating easy navigation for users of varying technical proficiency levels. The presence of locked categories (indicated by plus signs) illustrates the freemium monetization model, where additional content can be unlocked through in-app purchases (Branded Brothers, 2021).



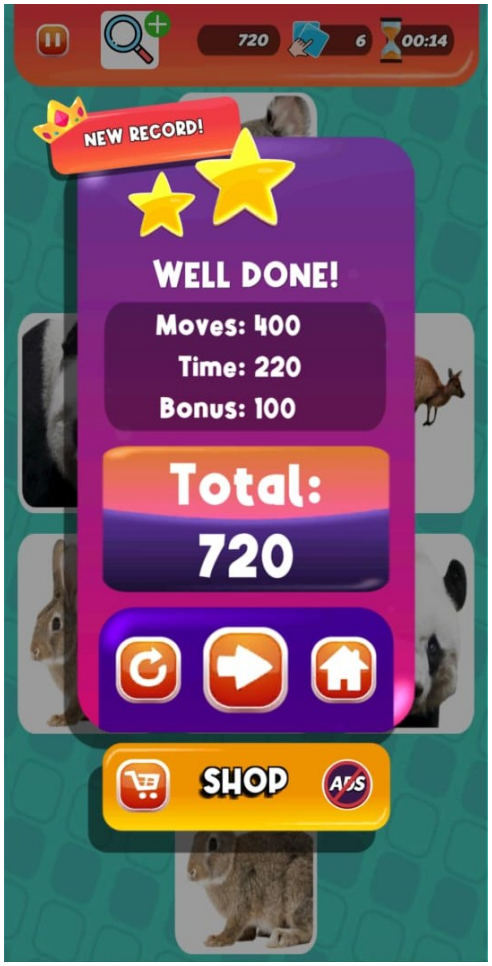
(Branded Brothers, 2021)

Figure 4 - Level Progression System: The Quest mode interface displays a structured progression system with numbered levels arranged in a grid format, incorporating star-based achievement tracking (0/240 visible) that gamifies the learning experience. The visual design maintains engagement through varied background colours and clear progress indicators, encouraging continued usage and skill development. This systematic approach to difficulty progression aligns with cognitive training best practices by providing measurable advancement milestones (Branded Brothers, 2021).



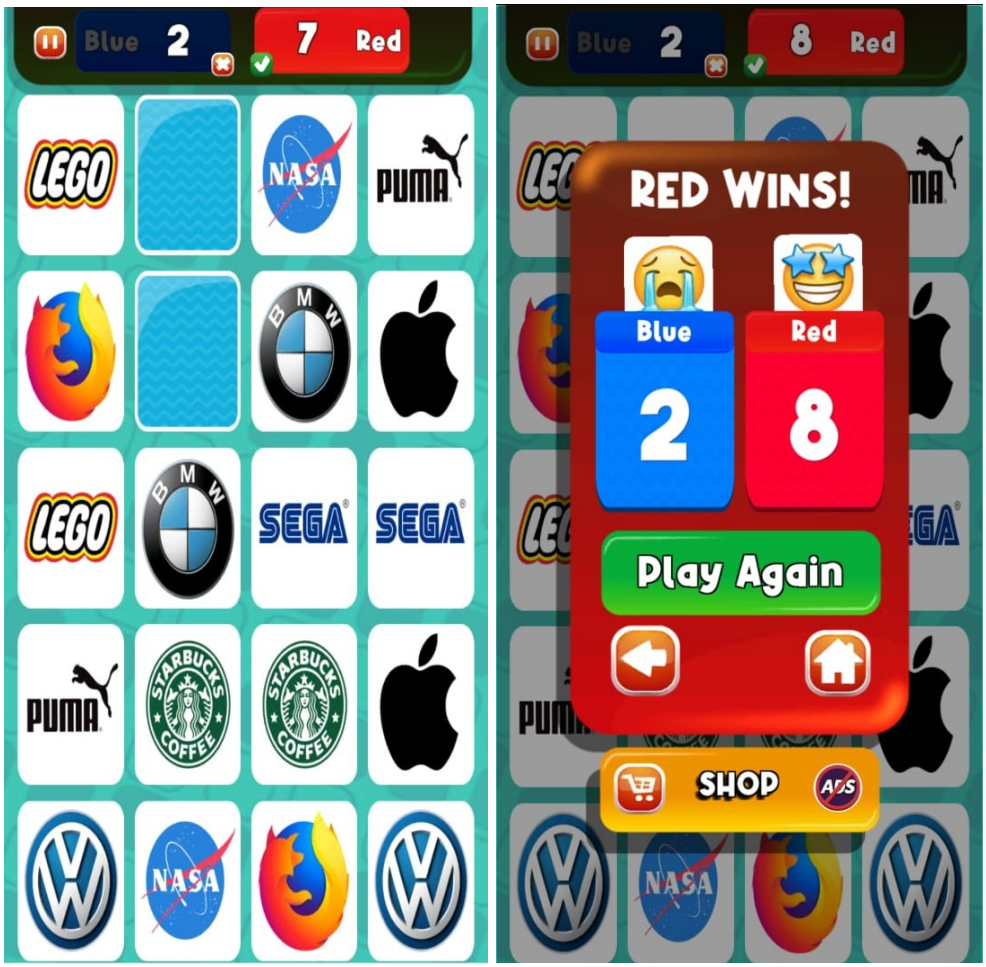
(Branded Brothers, 2021)

Figure 5 - Active Gameplay Interface: The core gameplay screen demonstrates the card grid layout with all cards in face-down position, showing question mark placeholders that maintain visual consistency while hiding the matching images. The top interface bar displays essential game information including scoring elements, card counters, and a timer, providing users with real-time feedback on their performance. The clean, uncluttered design focuses attention on the memory task while ensuring accessibility across different device sizes and user abilities (Branded Brothers, 2021).



(Branded Brothers, 2021)

Figure 6 - Performance Completion Screen: This results screen showcases the game's feedback system upon level completion, displaying a "WELL DONE!" message with performance metrics including moves taken (400), time spent (220), and bonus points earned (100). The two-star rating system provides immediate performance feedback, while the "NEW RECORD!" banner adds motivational elements that encourage repeated play and skill improvement. The colorful celebration interface with the final score display (720 points) demonstrates how the app gamifies the learning experience through positive reinforcement and clear achievement recognition (Branded Brothers, 2021).



(Branded Brothers, 2021) (Branded Brothers, 2021)

Figure 7 and 8 - Two-Player Multiplayer Interface The multiplayer mode screenshot reveals the competitive gameplay functionality, showing a split-screen interface with blue and red player sections displaying current scores (Blue: 2, Red: 8). The "RED WINS!" announcement screen demonstrates the head-to-head competition element, complete with emoji reactions that add personality to the competitive experience. This multiplayer implementation successfully transforms the traditionally solitary memory game into a social activity, supporting the app's broader appeal for family entertainment and educational group activities while maintaining the core cognitive training benefits (Branded Brothers, 2021).

App 2: MemoGames – Monkey Game Studios

Overview of the app

MemoGames: Memory Match is a cognitive training application developed by Monkey Games Studios that modernizes the classic card-matching game for mobile devices. The app includes over 180 levels designed to strengthen memory, focus, and concentration skills. It offers two main modes: Adventure mode with six gameplay variations (Classic, Time Attack, Mirror, Hidden Pairs, Limited Moves, Countdown) and Arcade mode with randomized levels for continuous play. The app is designed for a wide user base, from children to seniors, and is marketed as beneficial for individuals with dementia or cognitive challenges. It is available on both iOS and Android, requiring iOS 15.0 or later, and follows a freemium model where basic features are free, with in-app purchases for boosters, ad removal, and category unlocks. Progression is structured, starting with simple pair matching and advancing to trios and quartets with added constraints, providing gradual difficulty scaling. The interface supports multiple languages, improving accessibility for diverse users. Overall, MemoGames combines structured progression, accessibility, and therapeutic potential, representing a modern mobile adaptation of traditional memory games (Monkey Games Studios, 2024).

Strengths and weaknesses of the app

- Strengths

1. **Game Mode Diversity:** MemoGames offers two modes and six gameplay styles, ranging from Classic to more advanced modes like Mirror and Time Attack. The mix of pairs, trios, and quartets prevents monotony and supports different skill levels. This structured variety sustains engagement while systematically developing memory and attention (Monkey Games Studios, 2024).

2. **Strong Educational and Therapeutic Value:** The app applies evidence-based memory training principles across 180+ levels. Its progressive difficulty mirrors methods used in cognitive rehabilitation, making it suitable for dementia care, attention disorders, and general cognitive sharpness. By targeting domains such as working memory, visual-spatial processing, and executive attention, MemoGames provides a comprehensive cognitive training experience beyond entertainment (Monkey Games Studios, 2024).

3. **Accessibility and Inclusivity Design:** MemoGames promotes accessibility through multilingual support and age-friendly design. Its simple, clear interface allows use by different age groups and technical skill levels. With availability on iOS and Android and modest system requirements, the app ensures wide device compatibility. The freemium model further removes financial barriers, making cognitive training tools available to diverse socioeconomic groups (Monkey Games Studios, 2024).

4. **Structured Progressive Learning System:** The game builds skills through gradual progression, starting with basic pair matching and moving to quartets under time or movement limits. This natural learning curve supports continuous cognitive development. The level-based design provides measurable goals and achievement recognition, keeping users motivated and reinforcing consistent practice (Monkey Games Studios, 2024).

- Weaknesses

1. **Excessive Advertisement Disruption:** Frequent and intrusive advertisements interrupt gameplay, reducing the effectiveness of cognitive training. Sustained attention is critical for memory and focus exercises, but repeated ad interruptions break concentration. In many cases, ad viewing time exceeds actual playtime, creating frustration and reducing motivation. This is especially problematic for therapeutic users who require consistent and uninterrupted practice (Monkey Games Studios, 2024).

2. **Lack of Social and Multiplayer Features:** The lack of multiplayer, leaderboards, or social sharing features limits user engagement. Research shows that competition and collaboration enhance learning and motivation in training applications. Without social interaction, the app misses opportunities to improve retention, peer recognition, and long-term use. This gap reduces its potential impact compared to other educational or therapeutic platforms (Monkey Games Studios, 2024).

3. **Limited Customization and Personalization Options:** MemoGames does not provide adaptive difficulty systems or detailed personalization settings. Features such as progress-based adjustments, accessibility tools, or interface customization could improve training effectiveness. The absence of personalized feedback and recommendations limits its value as a long-term therapeutic tool. As a result, users with varying needs may not receive optimal cognitive benefits (Monkey Games Studios, 2024).

4. **Unclear Cognitive Assessment and Progress Metrics**: Although the app provides many levels, it lacks strong assessment tools to measure cognitive progress. Users only receive basic feedback and cannot track detailed improvement over time. Without integration with recognized cognitive assessment frameworks, the app's therapeutic value remains unclear. This limitation reduces its credibility for educators, therapists, and healthcare providers (Monkey Games Studios, 2024).

Innovative Motivation for Features

The dual-mode framework integrates structured Adventure progression with flexible Arcade play, catering to both therapeutic routines and casual sessions. With over 180 levels and six gameplay variations (Classic, Time Attack, Mirror, Hidden Pairs, Limited Moves, Countdown), the app provides comprehensive training that develops multiple cognitive skills. Features such as multilingual support and evidence-based difficulty scaling align with professional cognitive rehabilitation practices, positioning the app as a tool for both entertainment and therapeutic use (Monkey Games Studios, 2024).

App Implementation

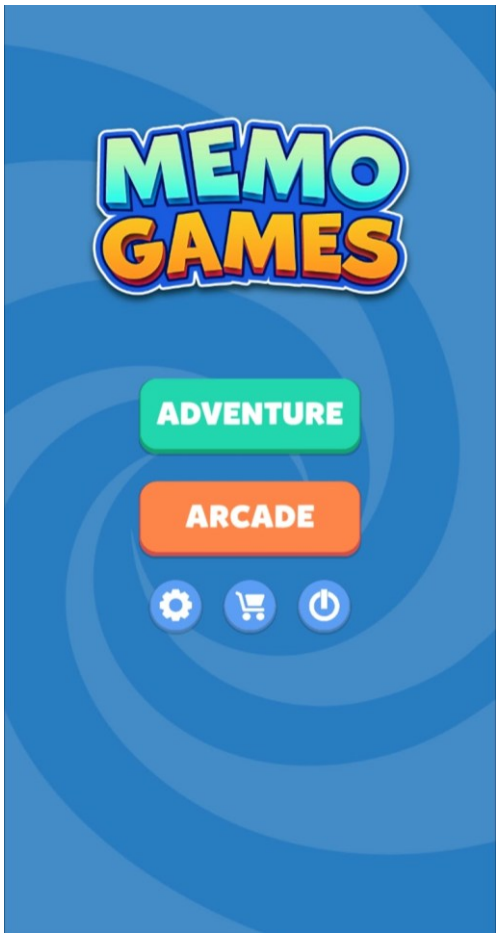
Based on the app's functionality and visual presentation, MemoGames likely employs a native Android development approach using Android Studio with Kotlin as the primary programming language. The clean, responsive interface suggests implementation using modern Android UI frameworks, particularly Jetpack Compose or traditional View-based layouts with ConstraintLayout for adaptive screen support across different device sizes. The card flipping animations and smooth transitions indicate effective use of Android's Animation API or Property Animation system, possibly incorporating Lottie animations for more complex visual effects. The app's state management for tracking card positions, user progress, and game modes would typically utilize Android Architecture Components, including ViewModel for UI-related data persistence and LiveData for reactive UI updates (The IIE, 2020). The 180+ level system suggests implementation of a robust data persistence layer, likely using Room database for local storage of user progress, achievements, and unlocked content, with potential cloud synchronization through Firebase for cross-device progress backup (Monkey Games Studios, 2024).

The multi-category content system and image loading functionality would benefit from Android Studio's efficient resource management and libraries such as Glide or Picasso for optimized image loading and caching. The freemium model implementation would integrate Google Play Billing API for in-app purchases, while advertisement integration likely utilizes Google AdMob SDK with careful lifecycle management to prevent memory leaks during ad loading and display cycles. The app's performance across various Android versions and device specifications suggests proper implementation of Android's backwards compatibility features and resource optimization techniques (The IIE, 2020). However, the reported advertisement disruption issues may indicate suboptimal ad integration that doesn't properly respect user experience principles, possibly due to inadequate implementation of ad frequency controls or poor timing of advertisement triggers relative to gameplay sessions (Monkey Games Studios, 2024).

The multilingual support and accessibility features suggest implementation of Android's internationalization framework with proper string externalization and locale-aware resource management. The various game modes and difficulty progressions would be managed through a well-structured game engine architecture, potentially utilizing Android's Fragment system for modular UI components and navigation between different game modes. The lack of multiplayer functionality indicates the app operates primarily in offline mode with minimal

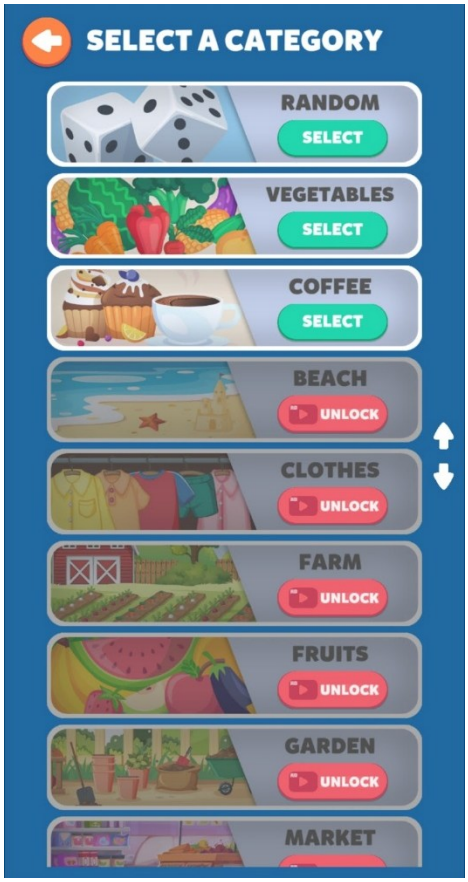
network dependencies, which simplifies architecture but limits social engagement features that could enhance user retention and therapeutic effectiveness (The IIE, 2020).

Screenshots of the app

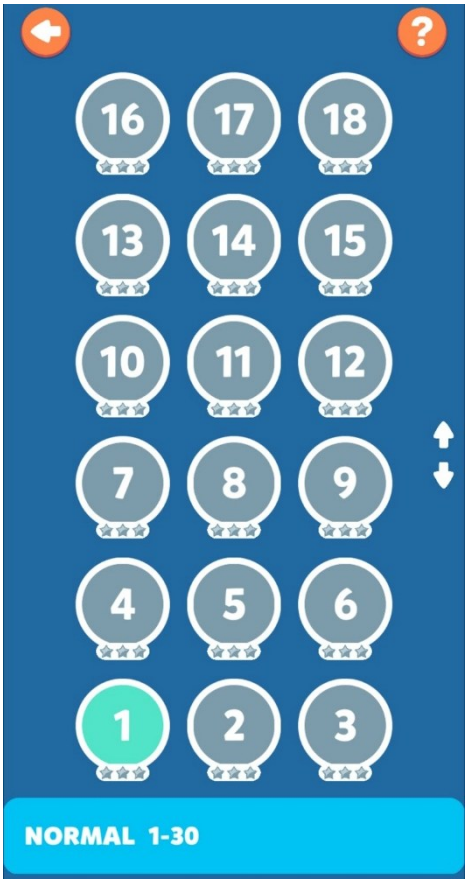


(Monkey Games Studios, 2024)

Figure 1 - Main Menu Interface The primary screenshot displays MemoGames' main navigation interface with prominent "ADVENTURE" and "ARCADE" mode buttons positioned centrally against a vibrant blue gradient background. The clean, minimalist design with rounded buttons and clear typography demonstrates the app's commitment to accessibility across different age groups. The bottom navigation icons for settings, shop, and power options indicate a comprehensive app ecosystem that supports customization and monetization features. This interface design aligns with the app's goal of providing intuitive navigation for users ranging from children to seniors, ensuring cognitive training accessibility without technical barriers (Monkey Games Studios, 2024).



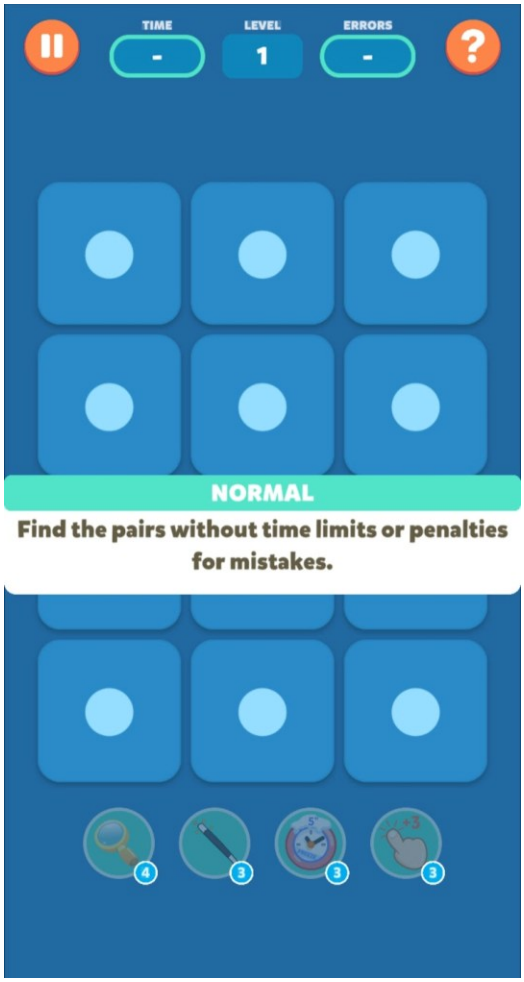
(Monkey Games Studios, 2024)



(Monkey Games Studios, 2024)

Figure 2 - Arcade Mode Category Selection Interface. When Arcade mode is selected, users encounter this category selection screen that showcases the app's content diversity through themed collections including Random, Vegetables, Coffee, Beach, Clothes, Farm, Fruits, Garden, and Market. The distinction between available categories (green "SELECT" buttons) and locked premium content (red "UNLOCK" buttons) clearly illustrates the freemium monetization strategy. This category-based approach in Arcade mode allows users to focus on specific themes that may resonate with their interests or therapeutic goals, enabling targeted cognitive training through familiar or preferred imagery that can enhance memory formation and engagement (Monkey Games Studios, 2024).

Figure 3 - Arcade Level Selection and Star Rating System. The Arcade mode level selection displays a structured progression from levels 1-18 with circular indicators showing completion status and achievement ratings. The highlighted level 1 in green indicates current progress, while star ratings beneath each level provide performance feedback that encourages replay for better scores. This systematic progression within Arcade mode differs from Adventure mode by allowing users to replay specific levels within chosen categories, supporting skill mastery and confidence building through familiar content themes before advancing to more challenging levels (Monkey Games Studios, 2024).



(Monkey Games Studios, 2024)

(Monkey Games Studios, 2024)

Figure 4 - Gameplay Instructions and Normal Mode Tutorial. This tutorial screen demonstrates the fundamental gameplay mechanics with a 3x3 grid layout, explaining the basic "find the pairs without limits or penalties for mistakes" objective that characterizes Normal mode difficulty. The clean instruction text and visual game board help users understand the core memory matching concept before progressing to more complex variations. The presence of booster icons at the bottom indicates additional gameplay assistance tools available throughout the experience, supporting users who may need extra help during cognitive training sessions (Monkey Games Studios, 2024).

Figure 5 - Arcade Level Gameplay with Coffee Category. This active gameplay screenshot shows Arcade mode in action with the Coffee category theme, displaying various coffee-related items including mugs, pastries, and beverages arranged in a 4x6 grid. The interface shows "Level 1" and "2 ERRORS" remaining, indicating Arcade mode's structured difficulty with specific error allowances. The colorful, themed imagery demonstrates how category selection enhances engagement through familiar objects that users can more easily memorize and associate, supporting the cognitive training effectiveness through meaningful visual content (Monkey Games Studios, 2024).

(Monkey Games Studios, 2024)

Figure 6 - Level Completion Feedback in Arcade Mode. The completion screen displays detailed performance metrics including time (0:18), movements (11), and star rating achievement, demonstrating Arcade mode's comprehensive feedback system. The "COMPLETED" banner with performance breakdown helps users track their cognitive improvement over time and provides motivation through achievement recognition. This detailed feedback mechanism supports the app's therapeutic positioning by giving users quantifiable measures of their memory and concentration performance, essential for monitoring cognitive training progress (Monkey Games Studios, 2024).

(Monkey Games Studios, 2024)

Figure 7 - Adventure Mode Gameplay - Random Category and Larger Grid. This screenshot reveals Adventure mode's key distinction from Arcade mode: random category selection and larger grid sizes that create more challenging cognitive demands. Unlike Arcade mode's user-controlled category selection, Adventure mode automatically presents various themes in larger grid configurations, requiring enhanced working memory and visual-spatial processing skills. The advanced level (46) with larger grid size and random Coffee category content demonstrates how Adventure mode provides unpredictable cognitive challenges that prevent users from developing category-specific strategies, ensuring broader cognitive skill development across diverse content themes (Monkey Games Studios, 2024).

App 3: Remembery – Dreamy Dingo

Overview of the App

Remembery - Memory game pairs is a brain training application developed by Dreamy Dingo that focuses on enhancing cognitive abilities through classic memory card matching gameplay. The app challenges players to flip cards and find matching pairs across various themed categories including cats, food, fruits, flags, and musical instruments. It offers five distinct game modes ranging from classic memory games to adventure modes with time constraints and limited moves, providing structured cognitive challenges for users of different skill levels. The application features 12 difficulty levels with different grid sizes, allowing progressive skill development and accommodating both beginners and advanced players. Multiple themed card packs add visual variety and maintain user engagement through familiar imagery across different categories. The app supports both single-player and multiplayer modes, enabling family and social gaming experiences that enhance motivation through competitive elements. Achievement systems and leaderboards provide gamification elements that encourage continued usage and skill improvement tracking. Three customizable themes (dark, light, custom) offer personalization options that cater to different user preferences and accessibility needs. The interface emphasizes simplicity and ease of use, making it accessible to users across different age groups and technical proficiency levels. Overall, Remembery positions itself as both entertainment and a cognitive training tool designed to improve memory, concentration, and logical thinking skills (Dreamy Dingo, 2016).

Strengths and weaknesses of the app

- Strengths

1. **Comprehensive Game Mode Variety:** The app offers five distinct modes, each targeting specific cognitive skills such as focus, memory retention, and pattern recognition. From classic matching to timed and limited-move challenges, this variety sustains engagement and prevents user fatigue. The structured difficulty progression supports gradual skill development while catering to diverse learning needs. Such variety enhances training effectiveness by providing both casual and advanced users with meaningful gameplay experiences (Dreamy Dingo, 2016). (Dreamy Dingo, 2016).

2. **Extensive Content and Difficulty Customization:** With 12 difficulty levels and themed card packs, the app provides scalable challenges for both children and adults. Grid sizes from 3x2 to 8x12 allow systematic difficulty growth, preventing frustration or boredom. Themed categories, such as animals and musical instruments, add educational value and improve memory through visual associations. This flexibility ensures suitability across demographics, supporting both casual play and structured cognitive goals (Dreamy Dingo, 2016).

3. **Strong Social and Competitive Features:** Multiplayer functionality transforms training into a shared experience, promoting peer motivation and family interaction. Leaderboards and achievements add gamification elements that encourage regular practice and measurable progress. These social features strengthen engagement while addressing the common issue of user drop-off in training apps. The ability to share challenges across generations fosters both retention and family bonding (Dreamy Dingo, 2016).

4. **User Experience and Accessibility Optimization:** The app's simple interface reduces navigation complexity while maintaining focus on training activities. Theme options (light, dark, custom) support accessibility needs, including visual sensitivities. Its small storage size ensures compatibility with low-spec devices, broadening accessibility. This design philosophy promotes inclusivity, making the app usable across age groups and technical skill levels while maximizing therapeutic potential (Dreamy Dingo, 2016).

- Weaknesses

1. **Excessive Advertisement Disruption:** Frequent ads interrupt gameplay and reduce concentration, undermining memory training effectiveness. Placement of 5-second ads at nearly every stage creates frustration and disrupts user flow. Without reasonable ad-removal options, users cannot customize their experience for uninterrupted training. Such interruptions negatively affect therapeutic use, especially for bedtime or clinical routines requiring consistency (Dreamy Dingo, 2016). (Dreamy Dingo, 2016).

2. **Visual Clarity and Accessibility Limitations:** Card images shrink with higher difficulty levels, reducing clarity and accessibility. Users with visual impairments face difficulty distinguishing icons, with no available size or contrast adjustments. Inadequate visual design hinders memory recognition and may discourage long-term use. These issues weaken the app's inclusivity and effectiveness as a training tool (Dreamy Dingo, 2016).

3. **Poor Timing Coordination and Interface Responsiveness:** Time-based modes often start before visual elements load, forcing random actions and breaking gameplay flow. This weak coordination undermines strategy, accuracy, and training value. Lack of interface responsiveness reduces satisfaction, especially in challenges that require precise timing. Such technical issues diminish the app's reliability as a cognitive training platform (Dreamy Dingo, 2016).

4. **Limited Personalization and Progress Tracking Features:** The app lacks adaptive algorithms to tailor training to individual cognitive needs. Progress tracking is minimal, preventing users from monitoring detailed improvement or identifying weaknesses. Without analytics or feedback, the app loses credibility as a serious training tool. This reduces long-term engagement and limits its value for therapeutic use (Dreamy Dingo, 2016).

Innovative Motivation for Features

The 12-level difficulty system, with grid sizes ranging from 3x2 to 8x12, ensures scalability suitable for children, adults, and seniors with cognitive challenges. Five distinct game modes target specific skills including focus, memory retention, and pattern recognition, providing variety while reducing user fatigue. A gamification framework with achievements, leaderboards, and social competition elements transforms individual training into an engaging and measurable experience, promoting consistency and long-term retention (Dreamy Dingo, 2016).

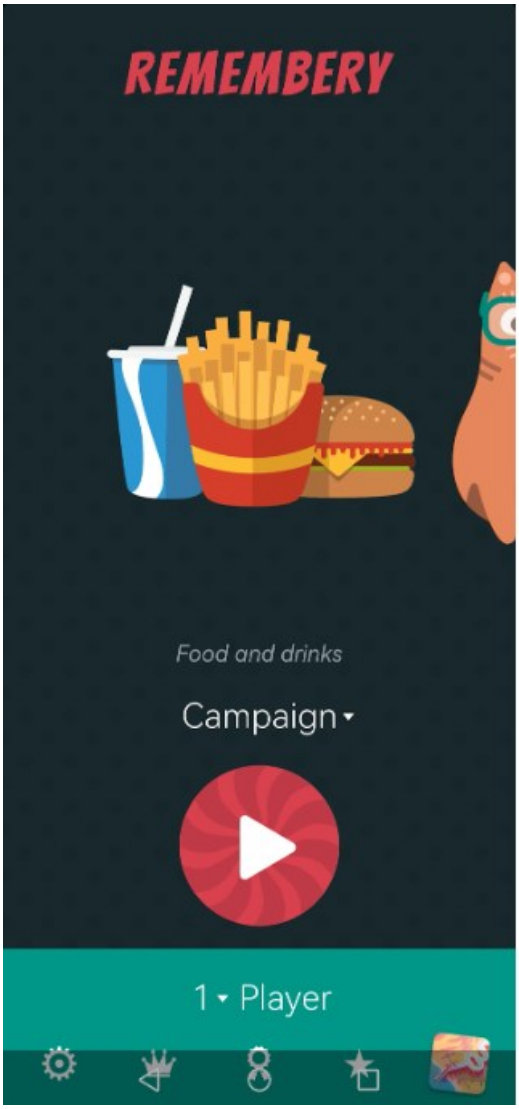
App Implementation

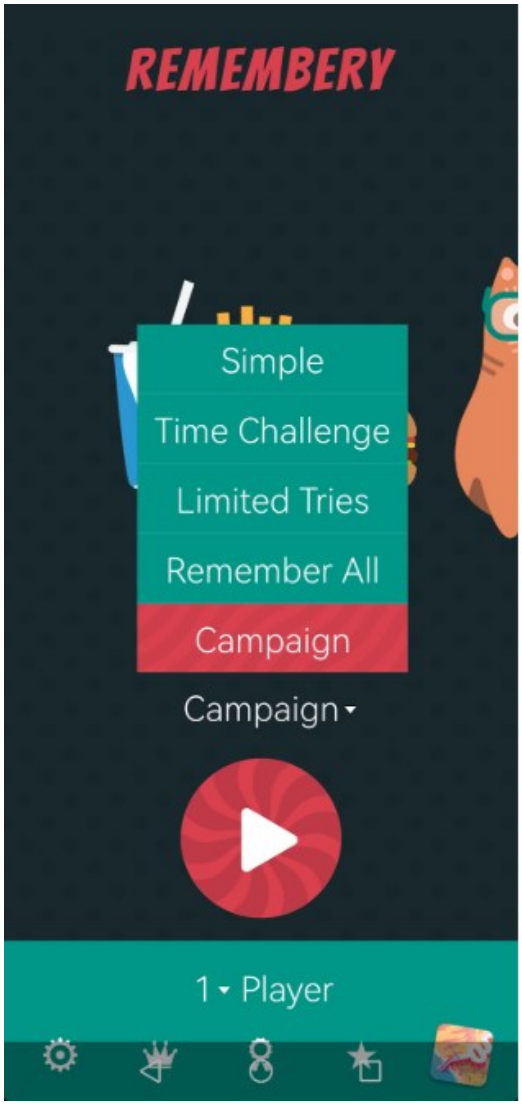
Based on its features and interface design, Remembery is most likely built using native Android development with Android Studio, where Kotlin serves as the main programming language. The card grid system suggests the use of RecyclerView with GridLayoutManager, enabling efficient memory handling and smooth scrolling across multiple devices and screen sizes. The presence of varied game modes and difficulty levels indicates a structured architecture that leverages Android Architecture Components such as ViewModel for UI data management and LiveData for reactive updates during configuration changes. Theme customization appears aligned with Material Design principles, implemented through custom styles and resource qualifiers. Meanwhile, achievement and leaderboard systems likely combine Room database for offline storage with cloud synchronization to support cross-device progress tracking (The IIE, 2020).

The multiplayer feature seems to rely on simple local networking or turn-based logic, ensuring state synchronization between players without requiring advanced real-time servers. Visual elements such as card flips and transitions are likely powered by the Property Animation API or ViewPropertyAnimator, creating smooth, engaging interactions that enhance gameplay. The themed content packs point to careful resource management, possibly through vector drawables and optimized image assets that maintain quality while keeping the app lightweight and compatible with older devices (Dreamy Dingo, 2016).

However, reported advertisement issues suggest limitations in the ad SDK integration, possibly through Google AdMob, where ad-loading events disrupt gameplay flow. Similarly, visual clarity problems at higher difficulty levels point to constraints in dynamic scaling algorithms, as card resizing does not fully support readability across complex grid layouts. These technical challenges highlight opportunities for refinement, such as improved lifecycle management for ads, better error handling, and more adaptive UI scaling. Addressing these concerns would significantly improve accessibility and ensure consistent cognitive training effectiveness (The IIE, 2020).

Screenshots of the app

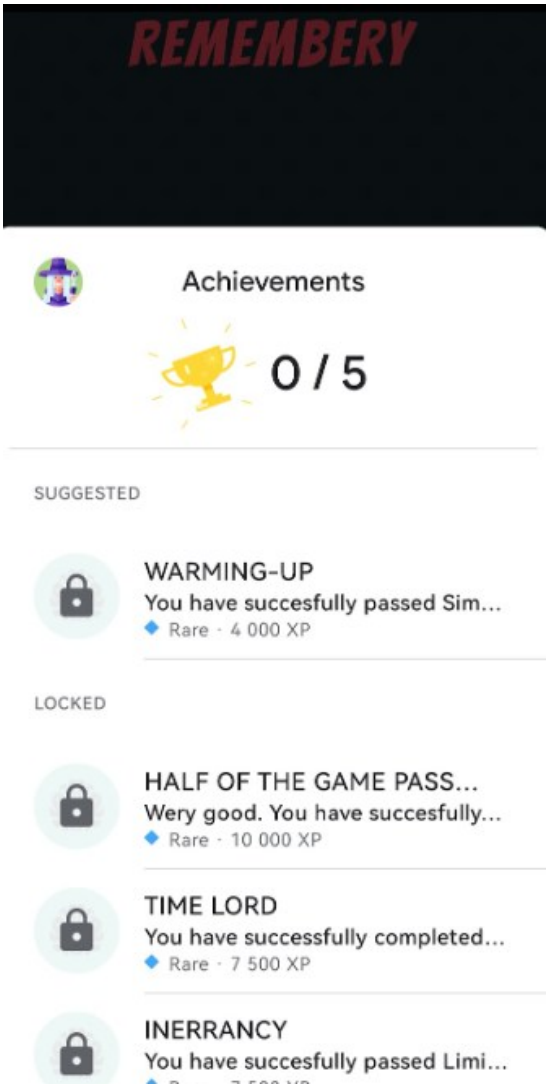




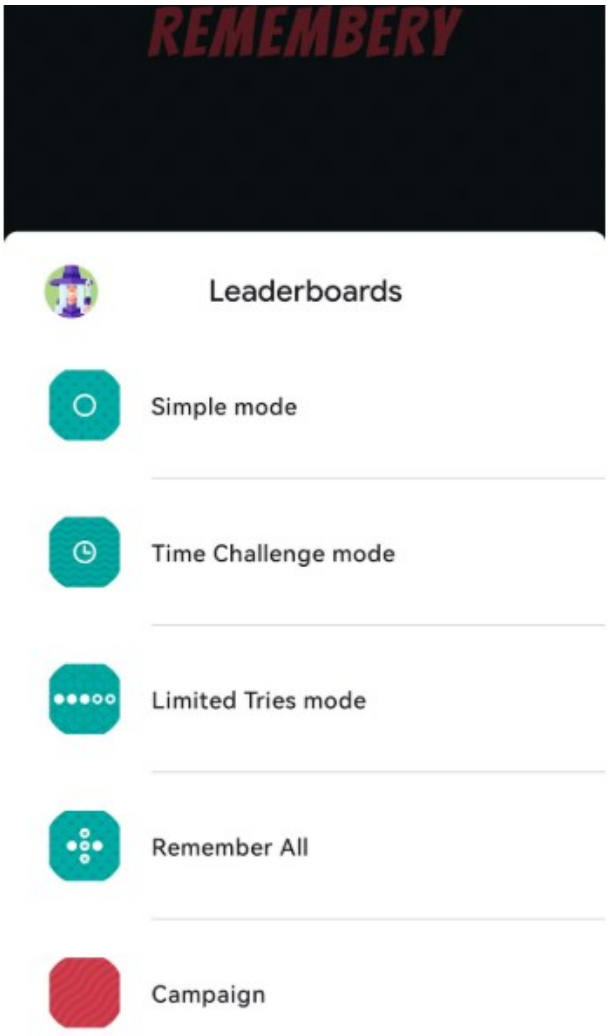
(Dreamy Dingo, 2016) (Dreamy Dingo, 2016)

Figure 1 - Homepage Interface.The main homepage displays Remembery's clean, minimalist design philosophy with the prominent red "REMEMBERY" branding against a dark background that creates visual focus and reduces eye strain during extended use. The central food-themed imagery featuring burger, fries, and drink icons immediately establishes the app's memory training concept while showcasing one of the available card themes. The "Food and drinks" campaign selection with a prominent play button demonstrates the app's organized approach to themed content categories that align with the comprehensive content variety described in the overview (Dreamy Dingo, 2016).

Figure 2 - Comprehensive Mode Selection Menu. The expanded mode selection interface reveals the full scope of cognitive training options including Simple, Time Challenge, Limited Tries, Remember All, and Campaign modes that target different cognitive skills and learning preferences. This comprehensive mode variety supports the app's positioning as a serious cognitive training tool rather than simple entertainment, providing structured progression paths that accommodate different training goals and user capabilities. The organized presentation with clear mode descriptions helps users select appropriate challenges that align with their cognitive training objectives and current skill levels (Dreamy Dingo, 2016).



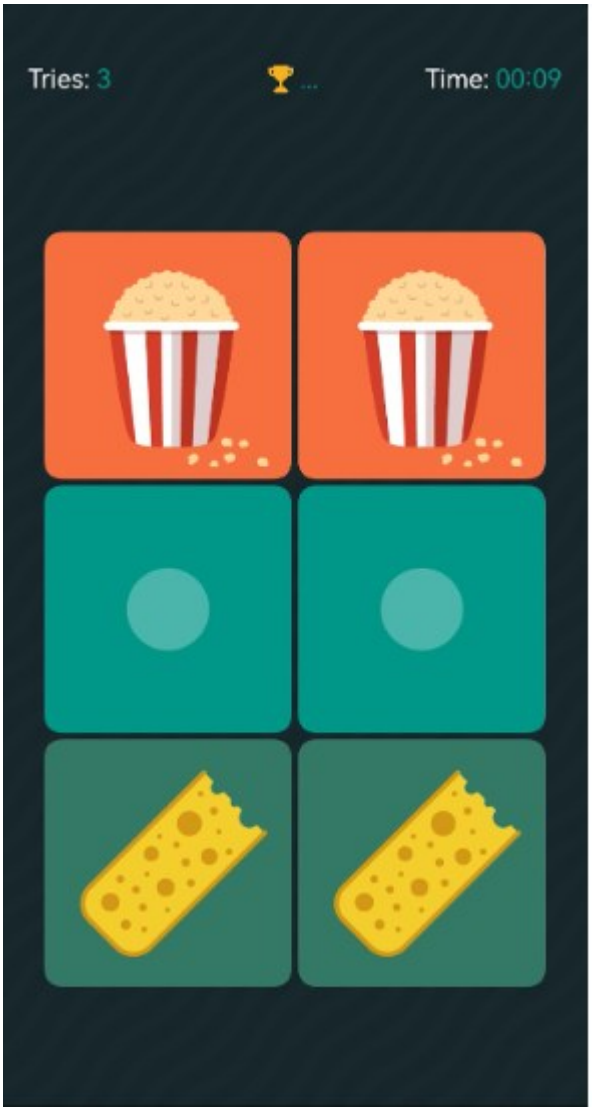
(Dreamy Dingo, 2016)



(Dreamy Dingo, 2016)

Figure 3 and 4 - Achievement and Leaderboard Systems. These screenshots reveal the app's gamification strategy through structured achievement tracking and competitive leaderboard functionality that motivates continued usage and skill development. The achievement system displays locked challenges with experience point rewards, creating clear progression goals that support the cognitive training objectives mentioned in the app overview. The leaderboard interface shows multiple game modes including Simple, Time

Challenge, Limited Tries, Remember All, and Campaign modes, demonstrating the comprehensive game mode variety that provides diverse cognitive challenges for different user preferences and skill levels (Dreamy Dingo, 2016).

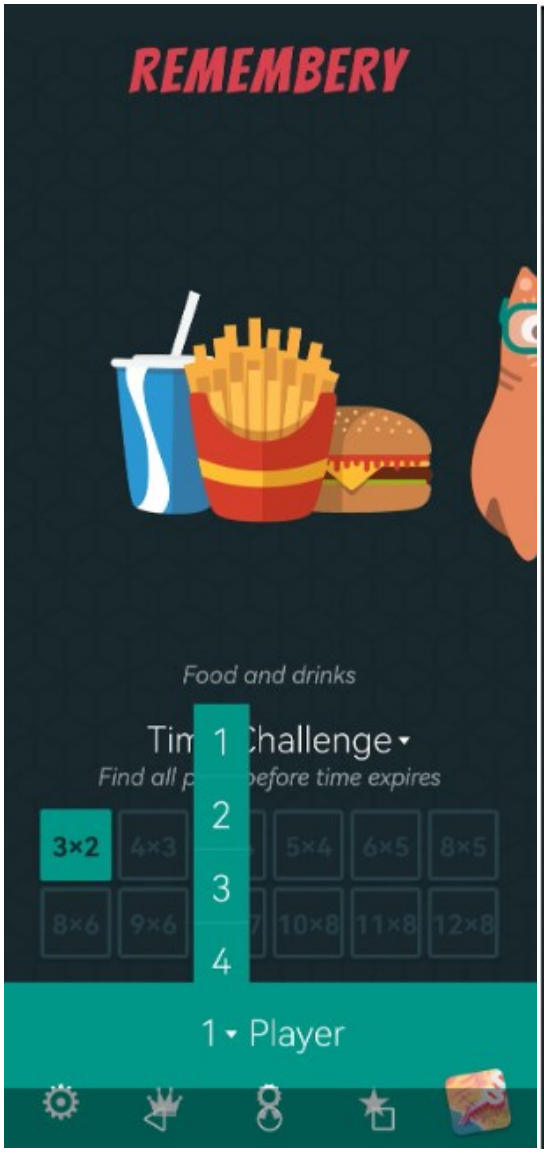


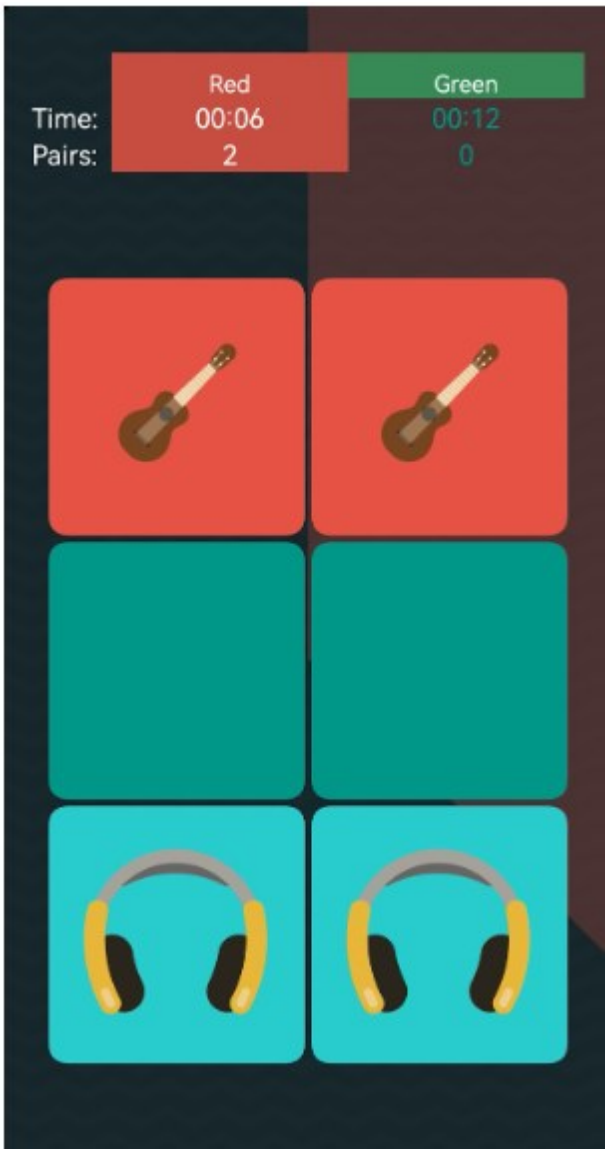
(Dreamy Dingo, 2016) (Dreamy Dingo, 2016)

Figure 5 - Mode and Difficulty Selection Interface. This configuration screen illustrates the extensive customization options that make Remembery accessible to users across different cognitive abilities and training goals. The "Simple" mode description "Take your time and find all pairs" with grid size options from 3x2 to larger configurations demonstrates the systematic difficulty progression that accommodates both beginners and advanced users. The visual grid size selector with numbered difficulty levels provides clear indication of challenge progression that supports the structured cognitive training approach outlined in the app overview (Dreamy Dingo, 2016).

Figure 6 - Active Gameplay Interface. The gameplay screen showcases the core memory training mechanics with a clean 2x3 grid layout featuring food-themed cards including popcorn and cheese imagery that create engaging visual associations for memory formation.

The interface displays essential game information including tries count, timer, and current matches, providing immediate feedback that supports cognitive training effectiveness. The simple, uncluttered design focuses attention on the memory task while maintaining the accessibility principles that make the app suitable for diverse user demographics (Dreamy Dingo, 2016).





(Dreamy Dingo, 2016) (Dreamy Dingo, 2016)

Figure 7 and 8 - Multiplayer Competition Interface. These screenshots demonstrate the social gaming features that transform individual cognitive training into competitive multiplayer experiences, showing red versus green player sections with real-time score tracking and timer displays. The split-screen competitive interface maintains the core memory training mechanics while adding social motivation elements that encourage family participation and peer engagement. The musical instrument theme (guitar and headphones) visible in the cards showcases another content category that provides educational variety and supports memory formation through familiar object recognition (Dreamy Dingo, 2016).

A COMPARISON OF
Existing Memory Matching Games

Similarities between the Apps

Cognitive Training Foundation: All apps use memory card mechanics to train memory, concentration, and attention. They combine entertainment with educational value for all ages.

Progressive Difficulty Systems: Each app adjusts challenge levels through larger grids, time limits, or matching rules, supporting sustained cognitive development.

Freemium Monetization Models: All apps provide free core features while monetizing via in-app purchases or ad removal, balancing accessibility with revenue needs.

Multi-Generational Accessibility: Simple interfaces, intuitive design, and clear visuals make them usable across age groups and technical skill levels.

Themed Content Categories: Apps use familiar themes (animals, food, objects) to aid memory retention and keep gameplay engaging.

(Branded Brothers, 2021; Dreamy Dingo, 2016; Monkey Games Studios, 2024).

Key Differences

	Match: Matching Game (Branded Brothers, 2021)	MemoGames: Memory Match (Monkey Games Studios, 2024).	Remembery – Memory game pairs (Dreamy Dingo, 2016)
Content Volume:	Match offers moderate content	MemoGames has the largest library (180+ levels)	Remembery provides balanced modes and difficulty levels
Technical Implementation:	Match uses Unity with stronger visuals	MemoGames uses Kotlin for smooth offline play	Remembery focuses on efficiency and small size
Social Features:	Match includes strong two-player modes	MemoGames lacks social functions	Remembery supports leaderboards and multiplayer
Advertisement Integration:	Match balances ads	MemoGames suffers from frequent ad disruptions	Remembery experiences immersion-breaking ads
Progress Tracking:	Match has basic metrics	MemoGames has limited analytics	Remembery includes achievements but no detailed cognitive assessment.

Best features of all the apps

1. **Dynamic Difficulty Adaptation System:** This feature automatically adjusts card grid size, complexity, and time limits based on player performance (for example: accuracy, speed, and mistakes). It prevents frustration from excessive difficulty and boredom from overly simple levels, keeping players motivated. By creating personalized difficulty curves, it ensures steady improvement for different learning styles and abilities. This makes the game engaging for casual players while still offering measurable cognitive training benefits (Branded Brothers, 2021; Dreamy Dingo, 2016; Monkey Games Studios, 2024).

2. **Multi-Categorical Educational Content Library:** This feature introduces diverse content categories such as Animals, Fruit, Pokémon, Flags, F1 Logos, and Harry Potter, turning simple matching into themed educational experiences. Each theme promotes different learning outcomes, from geography and biology to cultural awareness and memory of popular icons. The interface allows players to select categories aligned with their interests, ensuring personalization and reducing monotony. Teachers, parents, and therapists can use these categories for targeted learning, therapy, or family engagement. The variety of content appeals to multiple age groups and learning styles, making the game versatile in both entertainment and education. By combining fun with academic enrichment, the library sustains engagement while supporting cross-curricular learning (Branded Brothers, 2021).

3. **Enhanced Social Multiplayer Integration Framework:** This system supports local and online multiplayer modes, from family challenges to classroom tournaments. Features like leaderboards, replays, and community events make the game more interactive and socially engaging. By encouraging friendly competition and collaboration, it enhances motivation and keeps players returning. This addresses the solitary nature of traditional memory games, proving that social interaction significantly boosts both learning outcomes and user retention (Branded Brothers, 2021; Dreamy Dingo, 2016).

4. **Dual Game Mode Framework**: This feature offers two distinct modes: Adventure Mode for structured progression and Arcade Mode for casual, endless play. Adventure Mode gradually increases difficulty, building cognitive skills through planned challenges and achievement recognition. Arcade Mode provides spontaneous sessions with randomized levels, suitable for quick training or casual relaxation. Together, the modes balance formal skill development with flexible play, appealing to both serious users and casual gamers. This design accommodates therapeutic programs, educational use, and personal entertainment alike. By offering structured and unstructured options, the game avoids routine fatigue and supports long-term use. The dual framework makes the app adaptable to different goals, time commitments, and user preferences (Branded Brothers, 2021; Digitag Studio, 2018).

Conclusion

The analysis of the three memory training applications demonstrates both the potential and limitations of current approaches to cognitive training through mobile games. While Match excels in social interaction and monetization, MemoGames offers therapeutic value, and Remembery provides strong customization features, all three reveal recurring weaknesses such as intrusive advertising, weak progress tracking, and limited adaptability. The findings indicate that future development should focus on four key innovations: dynamic difficulty adjustment, diverse educational content libraries, enriched multiplayer integration, and dual game modes for structured and casual play. Technical evaluation shows that native Android development in Kotlin ensures stability, performance, and seamless integration with modern APIs, supporting reliable gameplay and synchronization. This research confirms that successful memory training applications must balance entertainment with measurable cognitive benefits while maintaining accessibility for a wide audience. The results form a foundation for the planning and design of Memory Match Madness, ensuring the app leverages proven strategies while addressing current market gaps. In doing so, the project moves toward creating a cognitive training platform that is engaging, adaptable, and grounded in research-driven design.

REFERENCES

Branded Brothers, 2021. Match: Matching game [Mobile app]. Version 1.25. Avaliable at: <https://play.google.com/store/apps/details?id=com.brandedbrothers.memogame&pcampaignid=web_share> [Accessed 29 July 2025].

Dreamy Dingo, 2016. Remembery – Memory game pairs [Mobile app]. Version 1.1.4-b58. Available at: <https://play.google.com/store/apps/details?id=ua.krou.remembery&pcampaignid=web_share> [Accessed 29 July 2025].

Monkey Games Studios, 2024. MemoGames: memory match games [Mobile app]. Version 1.2.34. Avaliable at: <https://play.google.com/store/apps/details?id=com.monkeygames.memorygames&pcampaignid=web_share> [Accessed 29 July 2025].

The Independent Institute of Education, 2020. PROGRAMMING 3C/ Open-Source Coding [PROG7313; OPSC6311; OPSC7311]. nt. [online via internal VLE] The Independent Institute of Education. Available at: <PROG7313MM.docx> [Accessed 29 July 2025].

Unity Technologies, 2025. Programming and scripting with Unity. [online]. Available at: <https://unity.com/solutions/programming> [Accessed 3 August 2025].

Annexure: Disclosure of AI Usage in my Assessment

1. Section(s) within the assessment in which generative AI was used
    - Section(s) within the assessment in which generative AI was used, PoE PART 1 - Research
2. Name of AI tool(s) used
    - QuillBot Paraphrasing Tool
3. Purpose/intention behind use
    - Paraphrasing, correcting grammar and spelling;
4. Date(s) in which generative AI was used
    - From 29 July 2025 – 25 August 2025.
5. Link QuilBot paraphrasing tool
    - https://quillbot.com/paraphrasing-tool