

Research Article

CAPIDS (Capable Kids): An Interactive Game-based Application for Early Mental Disorders Identification in Children

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Abstract: Children with mental disorders represent a significant and growing global health concern. According to the World Health Organization (WHO), 317 million people were affected in 2019. This impacts their motoric and cognitive development. To enhance awareness of children's mental disorder an interactive Android game-based application was developed using Kodular. It offers two modes: a child mode, access is limited to the animated tasks, and parent mode provides systematic reports to analyse children's behaviour. This dual-structure supports early identification of mental disorder symptoms and the feasibility of assistive agents for children with special needs in daily social interactions.



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1. INTRODUCTION

Mental health disorder is a condition in the human mental state which can be caused by an abnormal genetic structure or by psychological and physical stress. The national healthcare quality and disparities report (2022) indicates that millions of children worldwide experience mental health disorders each year. The prevalence of mental health disorders reaches 24.6% among children aged 0–17 years, with 104 per 1,000 children aged 4–16 years experiencing emotional disorders (WHO, 2022). In the South Asia region, the availability of data on mental disorders remains limited, with coverage estimated at only 4.47% (Erskine et al., 2017). In Indonesia, the prevalence of emotional mental disorders among individuals aged 15 years and older increased to 9.8%, compared to 6.0% in 2013 (Yuliasuti, 2022). This relatively low detection rate is likely attributable to inadequate identification and reporting within health services rather than a low occurrence of mental disorders.

Mental disorders at a young age significantly affect children's growth and development. These behavioural differences can make it difficult for them to establish social relationships with peers and adults. Recognizing the behavioural patterns and characteristics of a child with a mental disorder is crucial to reduce further behavioural changes. Recognition and approaching a specialist must be undertaken as quickly as possible. Obstacles in the field such as a lack of experts or limited access to identify a child with a mental disorder, also significantly impact proper management of the condition. Recognizing these challenges, we created an application for early mental disorder identification. This app can analyse the behavioural patterns of children aged 3-6 years to identify whether they have a mental disorder through interactive games, making the process engaging for children while providing systematic reports for parents.

2. LITERATURE REVIEW

We implemented several expert testing systems that we converted into a game to appeal to children. According to the internal clinical standards, there are several expert methods for detecting mental illness in children:

- Strengths and difficulties questionnaire (SDQ/KMME): Questionnaire method is characterized by a brief assessment of five behavioural domains, including emotional problems and hyperactivity, based on reports from parents or teachers.
- Clinical interview methods (K-SADS): The K-SADS interview method is characterized by the use of semi-structured interview techniques to evaluate the child's psychopathological history in depth.
- Diagnostic criteria methods (DSM-5/PPDGJ-III): The DSM-5 and PPDGJ-III criteria are characterized as standard classification guidelines used by professionals to accurately diagnose mental disorders.
- Routine examination methods (KKME/GPPH in SDIDTK Program): the KMME and GPPH methods in the SDIDTK program are characterized by routine examinations every 6 months to detect emotional mental disorders and ADHD symptoms in preschool children.

The results will be presented in both graphic and numeric format, followed with statements about the child's mental state. Final outputs are classified by the type of disorders, and divided into several stages that indicate the compatibility percentage and the urgency for further treatment.

This application helps children to increase their motor and cognitive skills. According to David I. Gallahue, there are four stages of motoric development in children:

1. The reflexive movement stage (birth to 1 year): It is characterized by involuntary or reflex movements in response to stimuli for survival.
2. The rudimentary movement stage (birth to 2 years): Is characterized by the emergence of the first voluntary movements such as learning to control the head, sitting, and crawling.
3. The fundamental movement stage (2 to 7 years): It is characterized by the mastery of basic skills such as running, jumping, throwing, and catching with better coordination.
4. The specialized movement stage (7 years and above): It is characterized by the refinement and application of motor skills into more complex activities such as sports or art.

According to Piaget in Yudiasmini, Agung, & Ujianti, 2014, there are 4 stages of cognitive development in children:

1. The sensorimotor stage (0-2 years): The sensorimotor stage is marked by children's actions based on what is in their minds.
2. The preoperational stage (2-7 years): The preoperational stage involves recognizing and using symbols to represent an object or thought, particularly the use of language.
3. The concrete operational stage (8-11 years): The concrete operational stage is characterized by logical reasoning.
4. The formal operational stage (11 years and above): the formal operational stage is characterized by abstract thinking, hypotheses, deductive reasoning, and inductive reasoning (Yudiasmini et al., 2014).

3. METHODOLOGY

3.1 Time and Place Study

This study was conducted for approximately two months, started on December 5, 2025. Authors began by identifying worldwide environmental issues. In December 25, 2025, the application design phase took place, followed by testing and evaluation with community and professionals feedback by the second week of December 2025. The research was carried out at SMA Angkasa 1 Jakarta, SMAN 61 Jakarta, National Brain Centre Hospital (RSPON) Prof. Dr. dr. Mahar Mardjono Jakarta.

3.2 Tools and Materials

3.2.1 Laptop

A laptop is used for application development; Huawei MateBook D15 in 15.6-inch Full HD (1920x1080) 8GB/16GB RAM, and SSD storage (256GB/512GB), USB-C (charging), USB-A, HDMI, fingerprint sensor, and a hidden pop-up webcam. The laptop is used for the whole processes, starting from application design until script compilation.

3.2.2 Kodular: Development Platform Android Drag- and-Drop App

Kodular is a web-based platform that provides users with environment for developing Android applications using block programming, originally derived from MIT App Inventor. This approach eliminates the need for manual coding, making it accessible for beginners to start programming and designing Android Applications from scratch. In terms of simplicity, Kodular utilize a drag-and-drop interface, allowing users to build applications without writing or periodically editing scripts.

Key features of Kodular:

1. Visual block programming – Kodular uses a block-based coding system, making app development as intuitive as assembling blocks in a visual compiler or scratchpad. This eliminates the need for writing complex code, making it easier for beginners and non-programmers to create functional applications.

2. Wide range of components – the platform offers various built-in components, such as buttons, labels, images, and input fields, enabling the creation of dynamic and responsive user interfaces.
3. Real-time preview and testing – Kodular provide a real-time preview feature, allowing users to test their applications instantly without needing to export or install them separately. This streamlines the development process and enhances efficiency.

3.2.3 Firebase Realtime Database: Core User Data Repository

Firebase Realtime Database is a cloud-based data management that enables applications to store data as JSON, retrieve, and synchronize data in real-time. Within the Kodular ecosystem, Firebase used as the primary data repository. Its NoSQL structure provides flexibility and scalability for organizing data from small prototypes to enterprise-level systems application.

Key features of Firebase Realtime Database:

1. Real-time synchronization: data updates are shown immediately across all connected devices, ensuring consistency without manual refresh.
2. Reliable cloud security: data is securely hosted on Google’s servers, guaranteeing global accessibility.
3. Adaptive scalability: accommodates handling applications with millions of users, adapting seamlessly to increasing demand.
4. Kodular integration: Kodular provides a dedicated firebase component, allowing developers to configure database connections through a drag-and-drop interface without extensive coding and complex setup.

3.2.4 PHP: Hypertext preprocessor

PHP is a general-purpose scripting language that is fundamental for web development. Its ability to be embedded directly within HTML, enabling developers to integrate programmatic logic effortlessly into markup structure. PHP code is interpreted and executed on the server to be generated in the form of standardized HTML. This ensures user to interacts only with the rendered content, while the underlying logic remains concealed to enhance both security and efficiency.

3.2.5 1001 Fonts: Typography Resource Website for User Interface

1001 Fonts is a website providing free thousands of typefaces. It serves as a creative toolkit for web development, allowing users to search, preview, and download fonts to refine the textual presentation within user interfaces. Beyond its decorative function, it influences in readability and user cognitive engagement.

Key features of 1001 Fonts:

1. Immense Catalogue: decorative and playful font style
2. Easy integration: downloaded fonts can be imported immediately into Kodular projects to enhance visual identity.

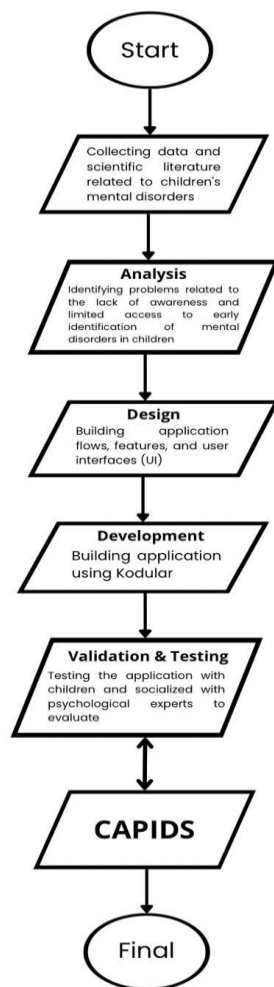
3.2.6 Google Material Icons: Interface Display

Google Material Icons is Google’s official library of vector-based icons designed according to Material Design framework. These icons provide visual language, ensuring user to interact and navigate the app more easily. This contains resources to create user-friendly interface.

Key feature of Google Material Icons:

1. Comprehensive guidelines: it offers principles for typography, colour schemes, and motion design to improve user experience.
2. Cross-platform consistency: ensures consistent user experience across devices, reinforcing familiarity, and ease of use.

3.3 Research Flow



3.4 Application Development Stages

3.4.1 Literature Study

We start by searching for a source or journal about mental disorders on the internet, using some platform (Google, IEEE Xplore, et al.). We took data about cognitive skills, motor skills, and the clinical screening method (SDQ, KMME, DSM-5) to identify mental disorders in children. The source

that we got from the internet reference will be filtered before we use it as a socialization reference. We also do socialization about our idea with experts to improve the quality of the product and make sure that our research will have a massive impact for society and special needs community.

3.4.2 Requirement Analysis

Lack of awareness and difficulty in gaining access to identify mental disorder on children creates difficulties in handling kids with mental disorder. The purpose of this application is to develop an easier way to do early identification of mental disorders in children.

3.4.3 Design

This stage involved creating the storyboard for the interactive games and architectural design of the application. We mapped out how the game-tasks correspond to the SDQ and KMME screening domains. We also use a variation of colour, shape, and animation to make it easier for children to understand the pattern of the game.

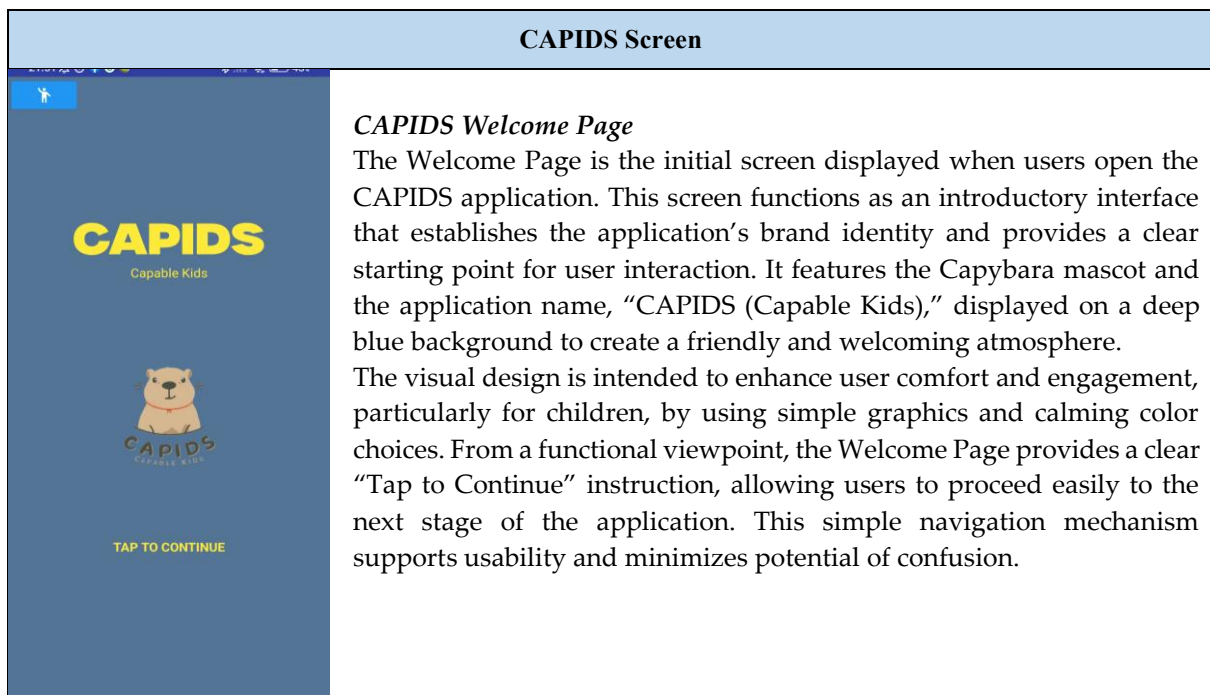
3.4.4 Development

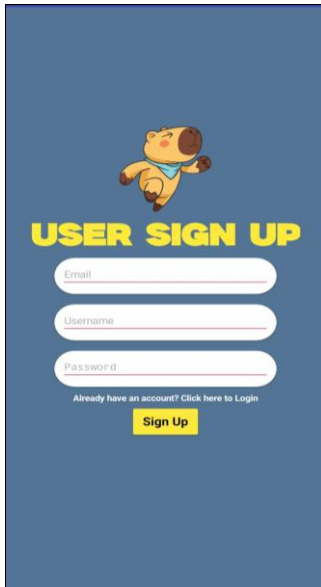
The actual building of the app using Kodular. We implemented the visual block programming to create game mechanics and integrated a database to store and calculate the results for parent reports.

3.4.5 Validation & Testing

We have tested the application for some kids from preschools. We also socialized our application to an extraordinary school and with psychologist. The result shows that the application is helpful to identify mental disorder in children, but our application cannot be the main evidence to identify a certain type of mental disorder in children.

4. RESULTS & DISCUSSION





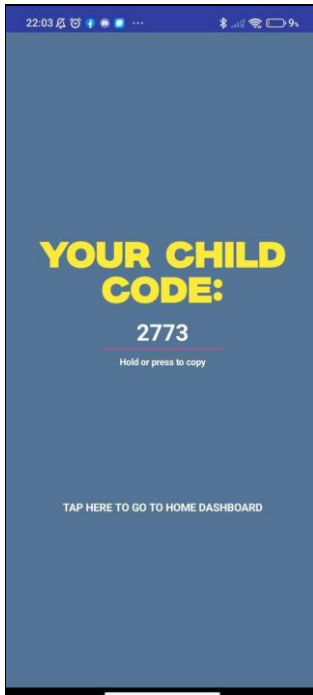
Account Registration Screen

The User Sign Up screen is the first registration page where new users create an account before accessing the game. To protect their account, users must enter a valid email address, select a unique username, and generate a secure password. After filling out all of the fields, users can register by tapping the “Sign Up” button. If user already have an account, user can immediately to the login screen by selecting the "Click here to Login" option.



Child Data Screen

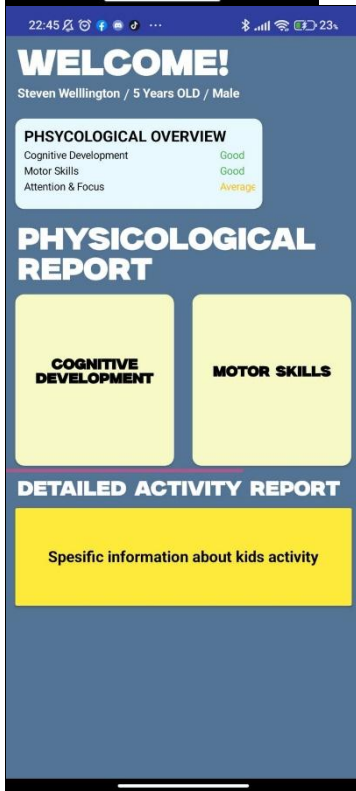
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Child Code Screen

Once the profile is created, the system automatically generates a unique code. Each child receives a unique and permanent access code generated by the application. This code is only accessible in the parent section of the app. The code stays unchanged and will be utilized for future access to parent mode.

To access parent mode, user needs to enter the child's access code. This security feature ensures that only parents or guardians can access the parent mode. Parent mode allows parents to check their child's progress, performance reports, and game activity.



Parent Dashboard

This screen serves as the primary interface for the Parental Mode, functioning as a central hub from which users can navigate to various sub-modules. The interface is structured into three primary components:

1. Summary Card: this component provides a high-level overview of the child's developmental progress. It evaluates three core domains: cognitive development, motor skills, and attention and focus. Performance within these domains is categorized using three distinct qualitative indicators: "Good," "Average," and "Need Improvement."
2. Psychological Report: this section offers an analytical breakdown of the three domains mentioned in the Summary Card through Specialized Data cards. Upon interaction, each card directs the user to a detailed screen that provides a clinical interpretation of the specific indicators assigned to each developmental category.
3. Detailed Report: activated by a dedicated card, this section navigates to a comprehensive data visualization screen containing granular information regarding the child's activities. This includes category-specific performance metrics, longitudinal data on total gameplay duration, and the average response latency (time-per-task) for each exercise.

<p>welcome to</p> <h2>SHAPE MATCH</h2> <p>Shape Match Game!</p> <p>Hai, 123456! Pilih bentuk yang sesuai!</p> <p>Soal 1 dari 10</p> <p>Bentuk apa ini?</p>   <p>Kembali</p>	<p>Shape Match Game</p> <p>The Shape Match page focuses on developing children’s ability to identify and distinguish geometric shapes. A shape will appear in the middle of the screen, and the child asked to select the matching option from several choices displayed below. Shapes may vary in form and colour, such as a red triangle, black circle, or green square, requires children to notice the shape and colour.</p> <p>The purpose of this game is to strengthen children visual-spatial skills and concentration. The design ensures children to compare, analyze, and make proper decision, which supports early analytical thinking. Shape Match transforms abstract concepts into interactive challenges, making the gamified shape learning concepts.</p>
<p>welcome to</p> <h2>COLOR BUDDY</h2> <p>Color Match Game!</p> <p>Hai, 123456! Pilih warna yang sesuai!</p> <p>Soal 1 dari 10</p> <p>Warna apa ini?</p>   <p>Kembali</p>	<p>Color Buddy</p> <p>The “Color Buddy” game is designed to strengthen children’s ability to recognize and name colors in an animated interactive game-task. At the center of the screen, a color block will be displayed clearly, while several options appear below to let children determine the correct answer. The task requires the child to select the option that matches the displayed block, encouraging careful observation and accurate identification.</p> <p>This activity helps children connect visual perception with language, reinforcing their understanding of color vocabulary. It also nurtures focus and decision-making, as they must pay attention to subtle color differences to choose proper answer. By presenting colors in a gamified format, “Color Buddy” creates an engaging environment where children learn to recognize colors, fostering resilience.</p>

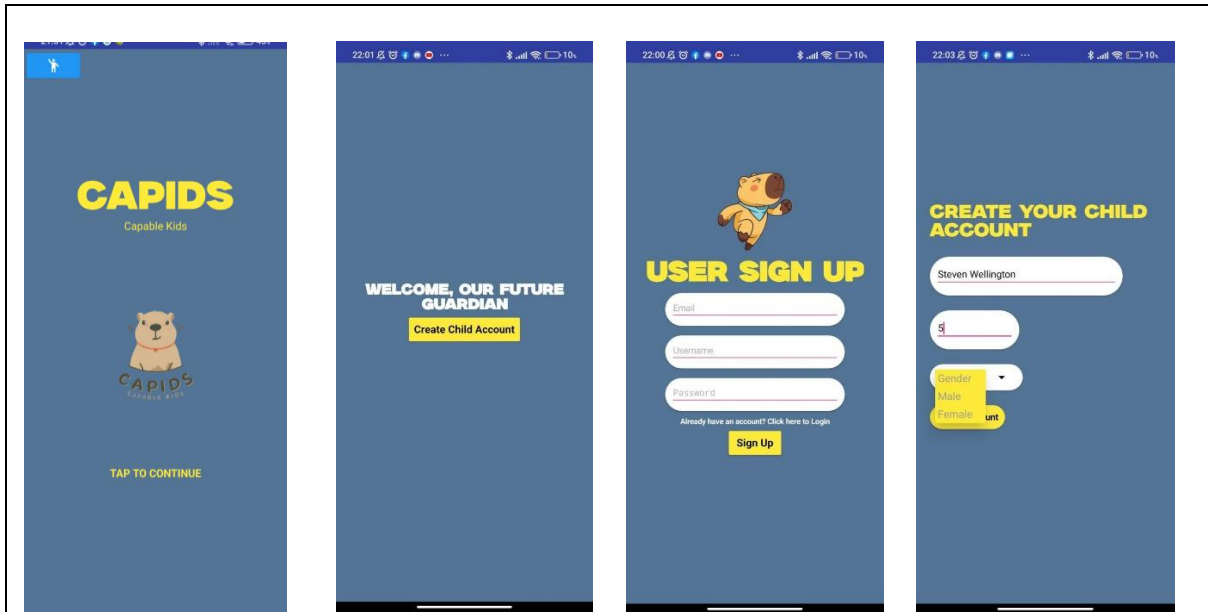
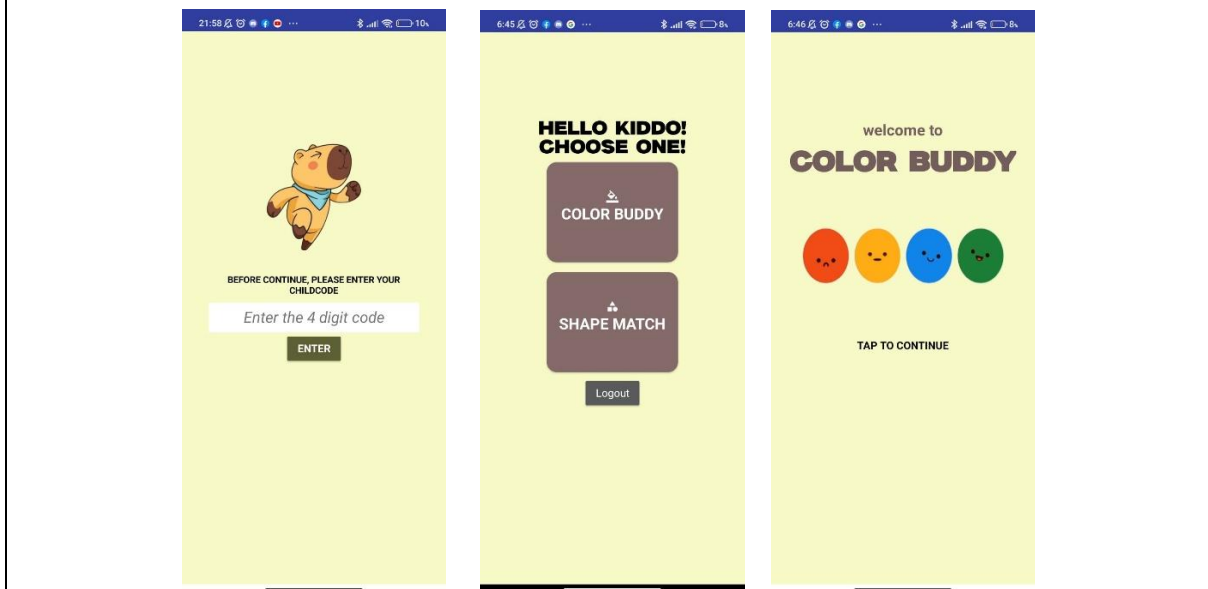


Figure 1. Home Screen



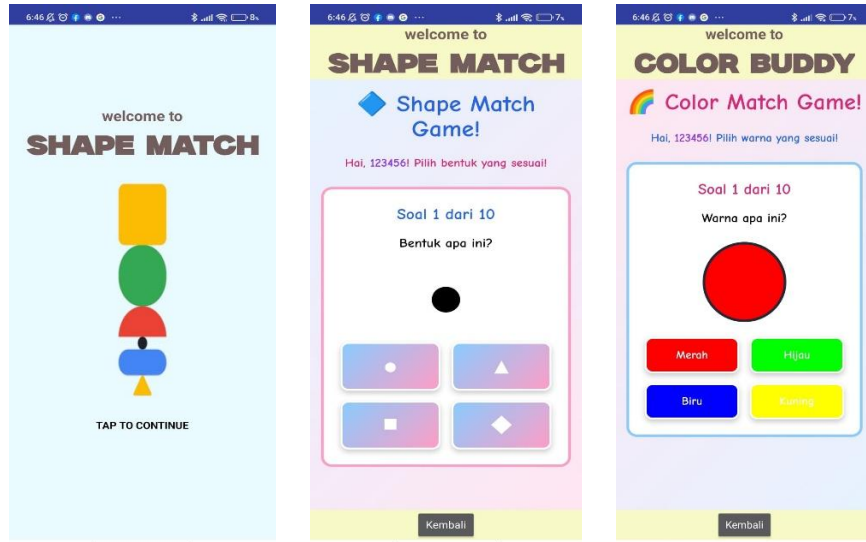
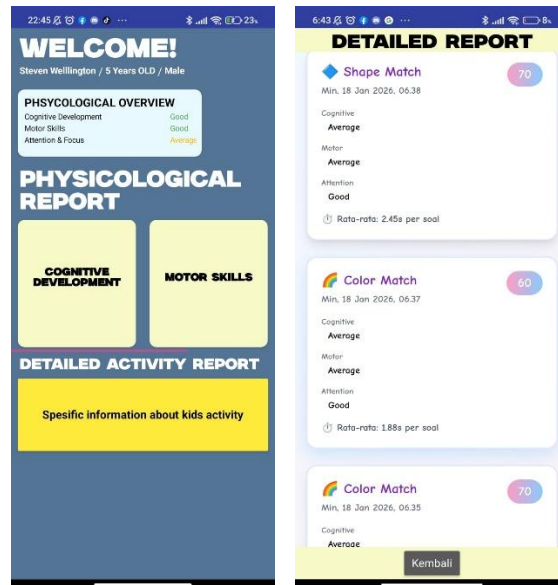


Figure 2. Children Screen



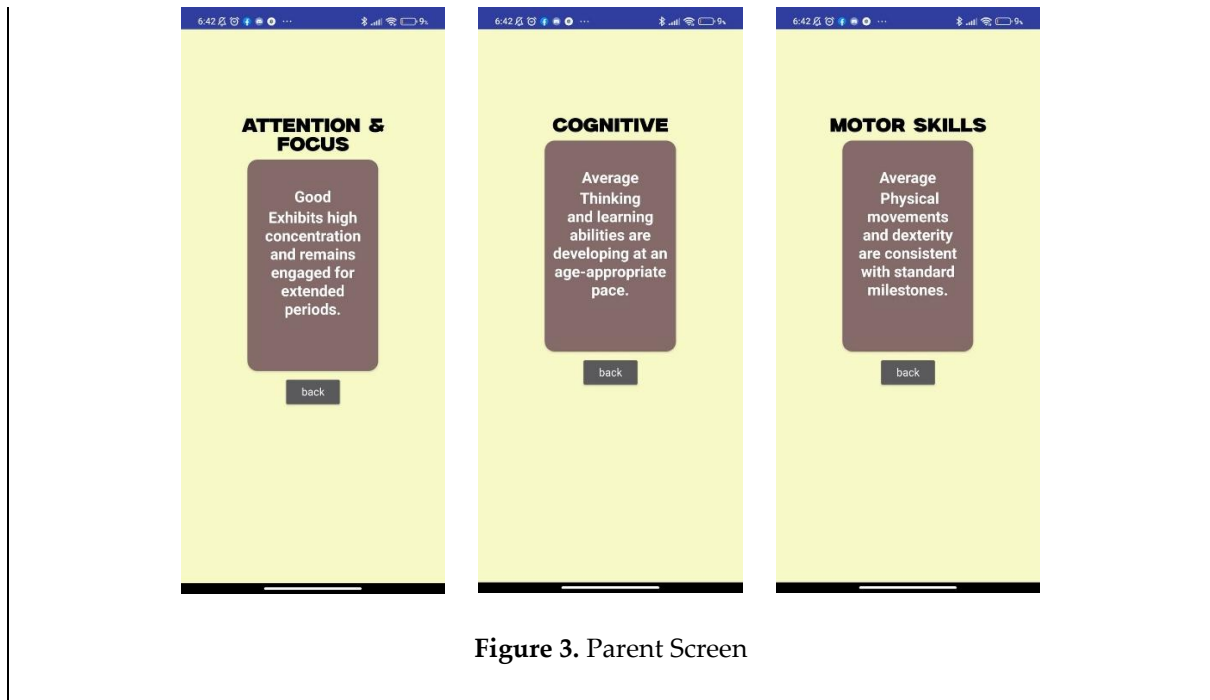


Figure 3. Parent Screen

4.2 Meaning of the Results

The identification system in this application has 35% - 45% of accuracy level. The identification rate of 35–45% indicates that this puzzle-based drag-and-drop application provide an initial picture of a child’s behavioural patterns, particularly in how children focus their attention, attempt to solve problems, and respond to mistakes. This percentage shows that the application is sufficiently sensitive to detect early risk signals, but it is not intended to deliver medical or psychological valid diagnoses.

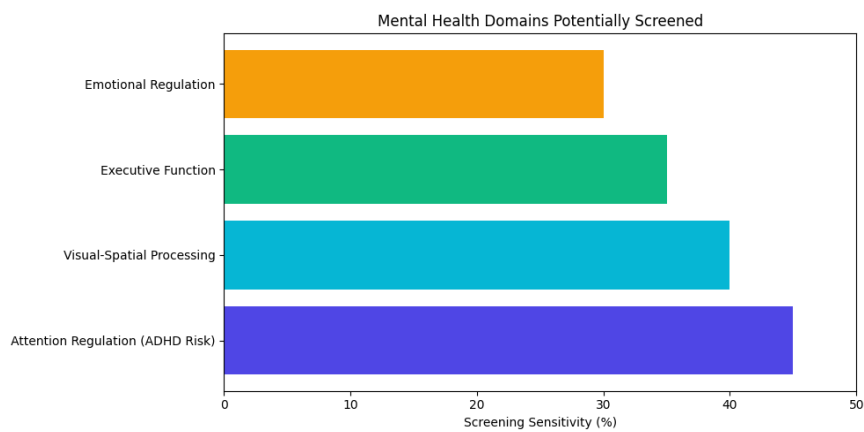


Figure 1. This is a figure.

For parents and general users, these results should be understood as early indicators, not as definitive conclusions about a child’s condition. The application helps to identify patterns of behaviour, rather than to label a specific mental disorder.

4.3 What the Application Observes

During gameplay, the application records naturally occurring behaviours, such as:

- a) how often the child makes errors,
- b) whether the same mistakes are repeated,
- c) how the child adjusts strategies when facing difficulty,
- d) and how the child reacts when tasks become challenging.

These behavioural patterns are broadly consistent with indicators commonly considered in early clinical screening, particularly those related to attention, cognitive flexibility, and response regulation. However, because a child's behaviour can be influenced by many factors, such as mood, fatigue, or motivation. The results should not be interpreted as a comprehensive Clinical Outcome Assessments (COA).

4.4 Boundaries and Clinical Caution

Although the application is designed with structured tasks and systematic behavioural data collection, it does not replace professional evaluation. In clinical practice, assessments of children's mental health and development rely on multiple sources of information, including direct observation, standardised tests, clinical interviews, and reports from parents or teachers.

Therefore, the results generated by this application should be used as a starting point for reflection and monitoring. If consistent patterns of difficulty are observed over time, these findings may reasonably encourage parents to seek further guidance from mental health professionals.

4.5 Position of the Application within Child Health Frameworks

Overall, the application functions as a game-based early screening support tool, designed to

- a) raise parental awareness of children's behavioural patterns,
- b) support early recognition of potential developmental risks,
- c) and guide appropriate follow-up actions when needed.

The application follows clinical caution principles by avoiding diagnostic labels and single-point conclusions. Its role is to support parents understanding and awareness, not to replace professional judgment.

5. CONCLUSION

The CAPIDS application serves as an interactive tool to assist in the early identification of mental health risks in children in toddler. By converting expert screening methods into a game-based format, the app monitors behavioural patterns such as attention regulation, executive function, and motoric coordination. The system achieves an initial identification accuracy rate between 35% and 45%, providing a systematic analytical report that highlight the potential developmental concerns for parents.

While the application provides valuable insights into behavioural patterns, it functions as a screening support tool instead of a clinical diagnostic service. Future development aims to increase accuracy by integrating advanced technologies such as artificial intelligence or Internet of Things devices. Collaborations with professional psychologists could also expand the platform into a comprehensive resource for mental health management. Ultimately, CAPIDS bridges the gap in mental health access by raising public awareness and supporting the social development of children with special needs.

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