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Picture Exchange Communication System (PECS) Malay Application for Global Development Delay (GDD) and Autisme Spectrum Delay (ASD)

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Abstract

Most of the Global Development Delay (GDD) and Autism Spectrum Disorder (ASD) kids are facing speech delay problem and cannot communicate well around with people. With the help of Picture Exchange Communication (PECS) and mobile application approach, this method will help the caregivers and therapist to assist the special need kids in understanding and learning the surrounding objects and verbs. PECS Malay Application focuses on teaching and facilitating communication in Malay Language from GDD and ASD children. This project is developed using PHP MySQL for the whole web system and Kodular for the Android application. The apps also integrate with the database to record the childrens' progress, which can be helpful for tracking and monitoring their development over time. Based on the result obtained from the apps testing and verification conducted in Pusat Pemulihan Dalam Komuniti (PPDK) Parit Raja and Program Pendidikan Khas Integrasi Sekolah Kebangsaan Parit Raja, it indicates that this account for approximately 85.71% of the candidates successfully achieved the highest score in the exercise/activity. This is shown that PECS Malay App was effective in supporting their leaning and this app can provide valuable assistance in improving their communication skills and understanding of objects and actions. Additionally, the survey conducted among user's representative of this PECS Malay App provide valuable insights and feedback which helps in improving the features, functionality and overall user experience of the app. By incorporating suggested improvements ad addressing specific requests, this can ensure that the app becomes a more comprehensive and satisfying communications and therapy tools for children with special needs.

1. Introduction

A Global Development Delay (GDD) refers to children under five failing to meet expected developmental milestones [1]. GDD often involves difficulties in intellectual functioning and social adjustment [2]. Early diagnosis and intervention are crucial for treating developmental delays [3]. GDD is strongly associated with Autism Spectrum Disorder (ASD), a neurological condition characterized by social communication limitations and repetitive behaviors [4]. ASD is influenced by genetic and environmental factors [5]. ASD affects individuals of all backgrounds and is more common in boys [5]. The Picture Exchange Communication System (PECS) allows non-

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verbal individuals to communicate through images [6]. PECS consists of six phases, teaching skills from basic communication to sentence structure, they will learn on How to Communicate (Phase I), Distance and Persistence (Phase II), Picture Discrimination (Phase III), Sentences Structure (Phase IV), Answering Question (Phase V), and Commenting (Phase VI) [7]. This project will be implemented based on PECS in the form of an application in Malay Language. [7]. An application in Malay Language will be developed based on the PECS approach [7].

Most GDD and ASD children experience speech delay and struggle to communicate effectively. A customized PECS app in Malay is needed to support communication and language development. Existing PECS apps in the Malay language are scarce, creating a need for a user-friendly solution. The app should incorporate photos, symbols, and culturally relevant tools. The opportunity arises to teach communication through gadgets and assess progress effectively. The project aims to achieve three main objectives. Firstly, to design an appealing application that incorporates attractive elements for an engaging user experience. Secondly, to develop a PECS-based system in the Malay Language that assists GDD and ASD children in social communication and understanding their environment. Lastly, to assess the effectiveness of the app system in tracking and monitoring the progress of GDD and ASD children who utilize it.

The scope of this project focuses on utilizing software to create a mobile application that caters to the needs of GDD and ASD children. The application will provide a learning experience in the Malay communication language specifically designed for these children, incorporating two main learning tasks Objects and Verbs ('Objek' and 'Perbuatan') based on the PECS methodology. The mobile application will serve as an educational tool for GDD and ASD children, offering an alternative medium for their learning and development. The project will be developed using PHP MySQL as the system backend and Kodular as the platform for creating the Android application. Prioritizing the project and ensuring the achievement of its objectives is of utmost importance.

2. Materials and Methods

The project involves utilizing software development tools such as (a) XAMPP, (b) Notepad++, (c) Kodular and PHP MySQL for the development of a mobile application. XAMPP serves as the server environment, while Notepad++ is used for code editing. PHP MySQL is employed for server-side scripting and database management, and Kodular functions as a visual app development platform.

2.1 Application Development

The server component of the project utilizes XAMPP for local testing and development purposes, with Apache and MySQL servers running to enable web application development and testing. The database component stores and manages structured data required for the application's functionality, including tables for users, admins, and candies. Notepad++ is utilized for coding and development, with various script files created for assets, databases, and specific functions within the application. These files play essential roles in providing instructions and managing various aspects of the application. Once the interface design and coding are completed, the files are saved and uploaded to a web host. The URL generated by the hosted website is then inserted into Kodular blocks, allowing the app to launch the device's default web browser and open the provided URL. Alternatively, the app can incorporate web content using Kodular's Web Viewer component.

2.2 Application Design

In this section, the workflow of the PECSs Malay Apps will be explained. Before the users can start doing the activity, it is necessary for them to login or if they do not have an account yet, they need to register their name and age for the records but with the help of their parents, caregivers, or therapist. After they successfully have logged into their account, they can choose their name to start the activity. The user is supposed to learn the object and verb first before they begin to do the exercise. Fig. 1 shows the hierarchical navigation for the overall process in PECS Apps.

2.3 Database Design

A database is used in this project to store and manage structured data that is necessary for the functionality and operation of the application for three main entities: Admin, User and Candy. Admin table is used to store admin information, the User table is used for registered user information and Candy is used for storing the user's performance on the exercises on Object or Verb. Fig. 2 illustrates the physical data model that defines the entities and their attributes, as well as the relationships between them.

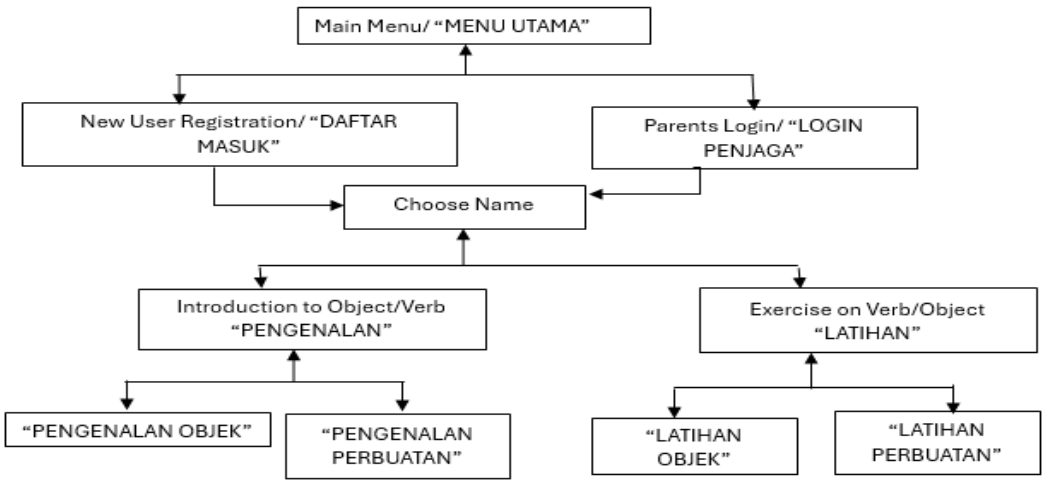

Fig. 1 *Hirarchical Navigation for PECS Malay App.*

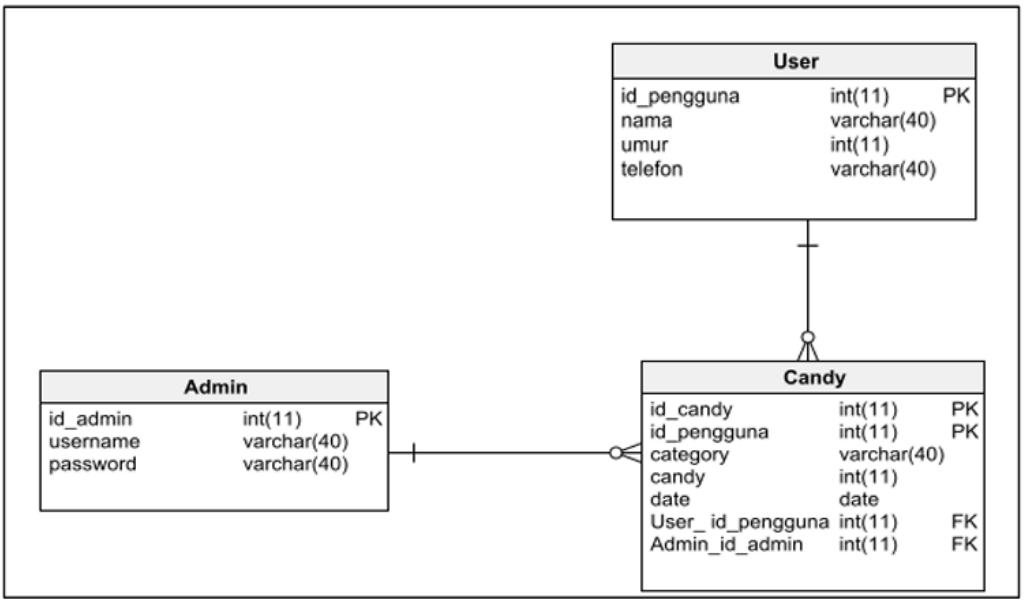

Fig. 2 *Physical Data Model for Database.*

2.4 Feedback Method

Feedback from users is collected through a survey, aimed at gathering information about user experiences, satisfaction levels, and suggestions for improvement. The survey is distributed to targeted individuals such as parents, caregivers, educators, or therapists who have used the app. Data analysis is performed to identify trends and patterns, enabling recommendations for app improvements.

3. Result and Discussion

The results and discussion section presents the application layout, data and analysis of the study. PECS Malay app allows users to store data with the assistance of parents, caregivers, educators, and therapists. The app includes two main categories: introduction and exercise. The introduction section provides pictures and pronunciation for displayed images. In the exercise category, users answer five questions by selecting the correct image from a choice of two. The chapter also includes an analysis of the survey feedback from parents, caregivers, educators, and therapists.

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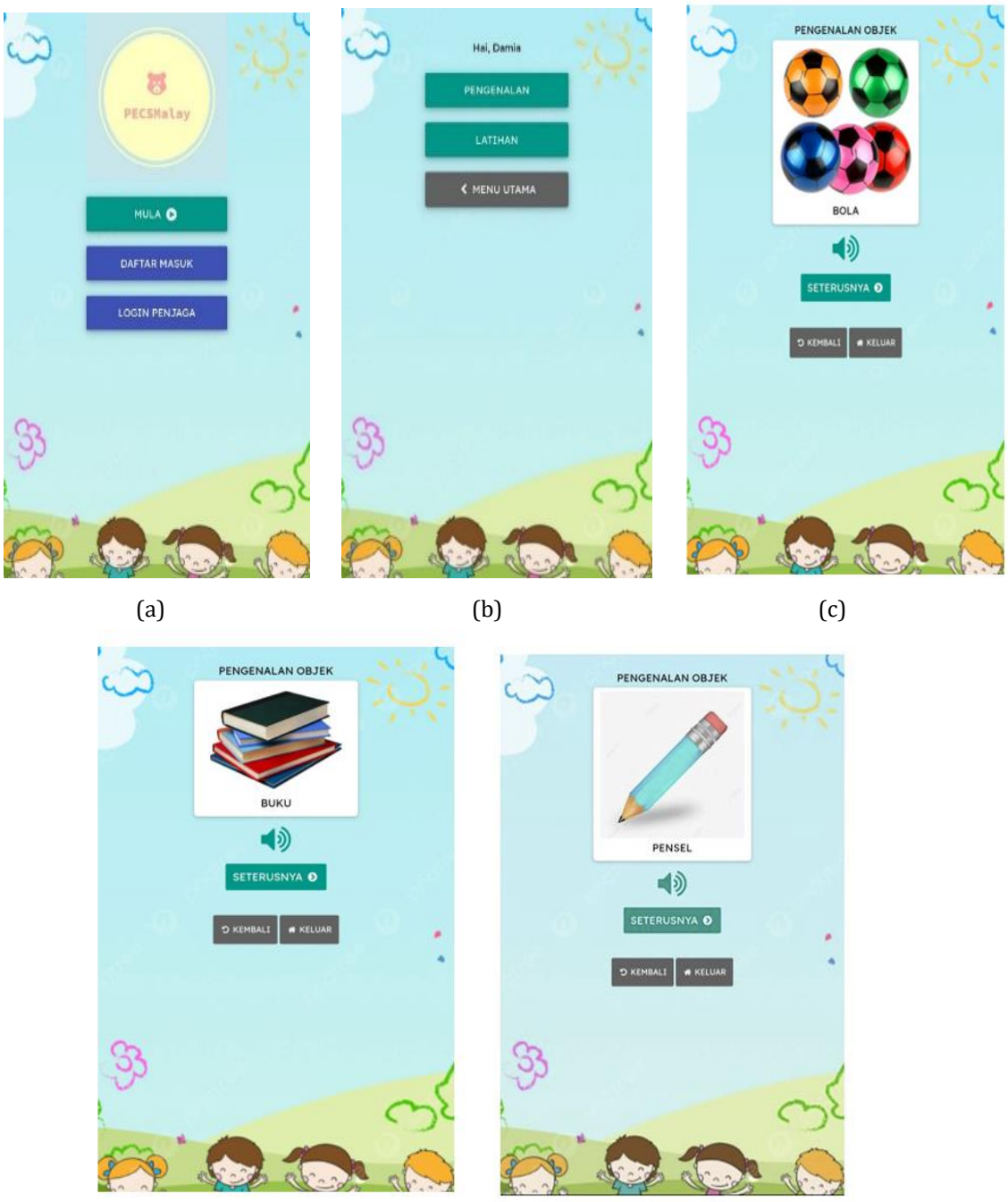
3.1 Application Layout

Fig. 3(a) to (e) depicts the flow of the PECS application in the Malay version, specifically focusing on the "PENGENALAN OBJEK". Users will experience the same flow for "PENGENALAN PERBUATAN" activity. Users need to log in or register before starting the activity. They learn to recognize objects and verbs, with audio pronunciation support. Navigation options such as "KEMBALI" (back), "KELUAR" (exit), and "SETERUSNYA" (next) allow users to progress through the exercise. Next, Fig. A1 in Appendix A depicts the PECS Malay app flow for the exercise section consisting of five questions displayed in random sequence. User can select either 'LATIHAN OBJEK' and 'LATIHAN PERBUATAN' options and candy as a score. In the exercise part, if they select the correct answer, the candy score is incremented. If the kids select the wrong answer, they can either try again or move on to the next question.



(a) (b) (c)

(d) (e)

Fig. 3 *Application Layout for PECs Malay App*

3.2 Testing and Application

The PECS Malay app was tested and verified at Pusat Pemulihan Dalam Komuniti (PPDK) Parit Raja and Program Pendidikan Khas Integrasi (PPKI) SK Parit Raja. PPDK is a center managed by the Department of Development of Persons with Disabilities (JPOKU), Department of Social Welfare (JKM) whereas PPKI is managed by Ministry of Education Malaysia. Both entities aim to provide rehabilitation, training, education, equal opportunities, and social integration for people with disabilities (OKU). The testing evaluated the app's impact on language learning, engagement, and communication skills. A comparison was made between the app and manual teaching aids, using the same images representing objects and verbs. The activities with these two centers are illustrated in Appendix B.

3.3 Tables of Overall Score Analysis

Based on the analysis in Table 1, it can be concluded that out of the 14 candidates, 12 of them scored higher when using the PECS Malay app. This accounts for approximately 85.71% of the candidates calculated as Formula (1). The higher scores achieved by these 12 candidates indicate that the PECS Malay app was effective in supporting their learning. It suggests that the application provided valuable assistance in improving their communication skills and understanding of objects and verbs.

Table 1 *Overall Score Summary*

	Manual Teaching Aid			Using PECS Malay App				
Candidates	Objects	Verbs	Total Score	Objects	Verbs	Total Score	Analysis	Note
1	5	15	20	25	20	45	25	Better using app
2	25	20	45	25	25	50	5	Better using app
3	20	25	45	25	25	50	5	Better using app
4	5	5	10	15	20	35	25	Better using app
5	5	10	15	10	20	30	15	Better using app
6	5	15	20	15	20	35	15	Better using app
7	20	10	30	20	10	30	0	Same performance
8	25	25	50	25	25	50	0	Same performance
9	5	10	15	15	15	30	15	Better using app
10	5	10	15	10	15	25	10	Better using app
11	25	20	45	25	25	50	5	Better using app
12	15	20	35	20	25	45	10	Better using app
13	15	5	20	25	20	45	25	Better using app
14	5	15	20	15	25	40	20	Better using app

$$\text{Number of candidates better using app} = x$$

$$\textit{Total of overall candidates} = y$$

$$\textit{Percentage of efficiency using app} = \frac{x}{y}\ x\ 100\% \tag{1}$$

$$\frac{12}{14}\ \ x\ 100\% = 85.71\%$$

However, it is worth noting that the remaining 2 candidates did not show a significant improvement in scores after using the app. This could be due to various factors such as individual learning styles, preferences, or other factors not captured in the data provided. Overall, the majority of the candidates benefited from using the PECS Malay app, highlighting its potential as an effective tool for supporting children with Global Developmental Delay (GDD) and Autism Spectrum Disorder (ASD) in their learning and communication development.

3.4 Feedback from Users' Representative

Table 2 shows that it indicates a high level of agreement among the respondents regarding the suitability of the app's contents for assisting special kids in their communication needs. The majority strongly agreed that the contents effectively cater to the unique requirements of the target audience. This suggests that the app's contents are engaging, relevant, and aligned with the communication challenges faced by special kids.

Table 2 *Survey on overall design and contents of app as teaching aid for special kids.*

The entire content of the application is suitable as a therapy aid for special students.	Percentage
Strongly disagree	0%
Disagree	0%
Neutral	18.20%
Agree	18.20%
Strongly agree	63.60%

4. Conclusion

In conclusion, the PECS Malay application was developed to assist children with Global Development Delay and Autism Disorder. The app utilizes picture cards and interactive exercises to enhance communication and language development. It features user login, introduction, and exercises. Developed using php MySQL and Kodular, the app aims to improve children's understanding of Malay words and communication skills. It enables parents and caregivers to track their children's progress and actively participate in their learning journey. The PECS Malay app can be used as a valuable tool in supporting language and speech development for children with special needs.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Noor Syafawati;* ***data collection:*** *Noor Syafawati;* ***analysis and interpretation of results:*** *Noor Syafawati, Nor 'aisah;* ***draft manuscript preparation:*** *Noor Syafawati, Nor 'aisah . All authors reviewed the results and approved the final version of the manuscript.*

Appendix A:

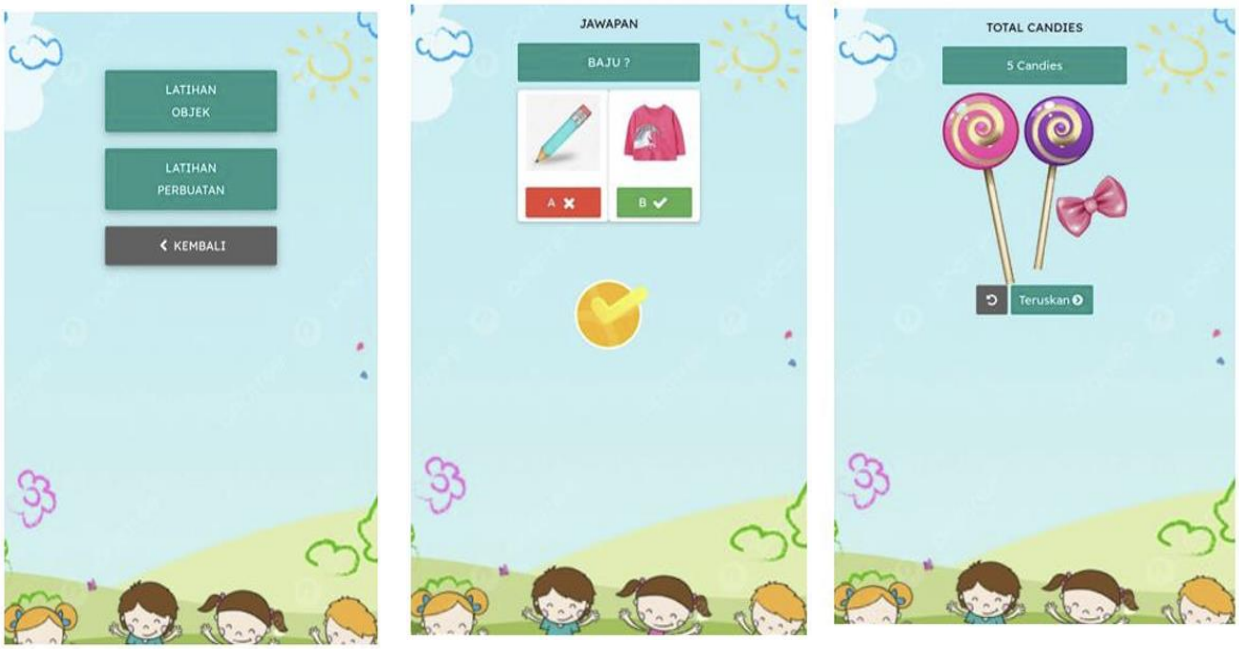

Fig. A1 *Exercise on Object , "LATIHAN OBJEK".*

Appendix B: PPDK and PPKI

Fig. B1 *Activity at Pusat Pemulihan Dalam Komuniti, Parit Raja.*

Fig. B2 *Activity at Program Pendidikan Khas Integrasi, SK Parit Raja.*

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