

# Doodle Recognition for Early English Language Learning in Preschool Children

Dy Llen HOO

Faculty of Computer Science and Information Technology  
Universiti Malaysia Sarawak  
94300 Kota Samarahan, Sarawak, Malaysia  
dyllenhoo@gmail.com

Phei Chin LIM

Faculty of Computer Science and Information Technology  
Universiti Malaysia Sarawak  
94300 Kota Samarahan, Sarawak, Malaysia  
pclim@unimas.my

**Abstract**— This work presents the design and evaluation of a Doodle Recognition System aimed at improving English vocabulary retention in preschool children aged 3 to 6. The implemented interactive web application incorporates AI-based doodle recognition using the DoodleNet model to provide real-time feedback and support fine motor skill development. Implemented with Next.js, Tailwind CSS, and Supabase, the system includes a responsive drawing interface, pre- and post-assessment features, and progress tracking (<https://fyp-doodlenet-with-supabase.vercel.app/>). User testing with 28 children revealed measurable vocabulary improvements, particularly among 4- to 5-year-olds, with an overall post-test score increment of 11.3%. The findings indicated that integrating visual-motor activities with vocabulary learning enhances engagement and retention, suggesting the potential of doodle recognition systems to supplement early childhood language instruction.

**Keywords**-- *Computer-aided learning, Vocabulary memory, Artificial intelligence.*

## I. INTRODUCTION

Early English language learning is an essential component of early childhood education, contributing to cognitive development, academic achievement, and preparing children for participation in a globalized society. In Malaysia, English is taught as a second language (ESL) from preschool through secondary school [1], with preschool years widely recognized as the optimal period for language acquisition [2]. Vocabulary is a group of words that are divided into two groups: 1) lexical words that provide information and 2) functional words that serve grammatical purposes [3]. Vocabulary retention among young children is a significant concern, as many children enter school with limited vocabulary knowledge which can hinder their academic success [4].

Though research has shown that retrieval practice methods such as flashcards, low-stakes quizzes, and brain dumps can enhance long-term vocabulary retention [5], while fine motor skill development through play-based activities significantly predicts young children's vocabulary retention and broader language acquisition [6].

Drawing helps children improve their fine motor skills and hand-eye coordination because it requires children to hold and

manipulate writing utensils. It gives them opportunity to form connections between what they see and do. Drawing also gives immediate, visual feedback that allows children to improve their technique to get their desired results [7]. Doodle recognition is known to play a role in significantly influencing young children's fine motor skills and hand-eye coordination, which are critical for their future academic performance. Research demonstrating notable improvements in motor abilities through such interventions suggests that drawing and colouring can help with fine motor development [8].

## II. RELATED WORKS

Vocabulary retention is a key aspect of language learning for young children, especially those learning English as second language. One of the widely recognized strategies for improving vocabulary retention among young children is flashcards. Flashcards incorporate visual elements such as images, symbols, alphabets, and colours to attract children's attention and facilitate word recognition and memory retention. This method also enhances listening skills and verbal expression, which are crucial for early language development [9]. Studies conducted at Apple Tree Preschool and Little Elephant Kindergarten School revealed that young children showed significant improvement in vocabulary mastery after the introduction of themed, colourful, flashcards, with mean test scores increasing considerably [10]. However, some researchers have pointed out that the repetitive nature of flashcard-based learning can become monotonous over time, leading to reduced engagement and ultimately affecting vocabulary retention [11].

To address this, picture dictionaries have been introduced as another effective vocabulary learning strategy for preschoolers. Picture dictionaries leverage young children's natural preference in visual learning by presenting vocabulary words with corresponding images. The image-mnemonic associations provided by picture dictionaries help children recall new words more easily and make learning more enjoyable [12]. A study involving Malaysian kindergarten students, has shown that associating words with pictures not only improves vocabulary retention but also extends the duration over which children can recall those words [13]. Similar improvements in vocabulary mastery were reported in a study using picture-