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1. Problem Context and Background

Reading is the foundation of all learning. A child who struggles to read in the early grades will likely struggle in every subject that follows. In the Philippines, this issue has become increasingly visible. Results from the Programme for International Student Assessment (PISA) consistently show that Filipino learners perform below global averages in reading comprehension. At the national level, the Department of Education (DepEd) has acknowledged that many students reach upper elementary grades without mastering foundational reading skills.

The problem goes deeper than comprehension alone. Many struggling readers lack strong decoding skills, the ability to connect letters (graphemes) to their corresponding sounds (phonemes). Instead of understanding how reading works, some students rely on memorizing familiar words or guessing based on context. While they may appear to read fluently in controlled situations, their understanding remains fragile.

Classroom realities make this issue more complex. Public school teachers often handle large class sizes, limiting their ability to provide individualized phonics correction. Although initiatives such as Catch-up Fridays and curriculum reforms aim to address learning gaps, teachers still lack detailed diagnostic tools that identify specific sound-level weaknesses. Without knowing whether a child struggles with short vowels, consonant blends, or digraphs, remediation becomes generalized rather than precise.

As students move to higher grade levels without resolving these foundational gaps, reading difficulties compound. What begins as a phonics issue in Grade 1 can become a comprehension crisis by Grade 6. Addressing this early decoding gap is therefore essential to preventing long-term academic failure.

2. Refined Problem Statement

Early-grade students in the Philippines struggle with reading because of weak phoneme-level decoding skills, limited individualized phonics intervention, and the absence of scalable diagnostic tools in classrooms. Existing reading programs focus on general fluency or word recognition rather than identifying specific sound-level weaknesses.

Teachers need a structured and data-driven way to diagnose, monitor, and remediate decoding gaps. Without phoneme-level feedback and analytics, literacy interventions remain broad and inefficient, allowing foundational weaknesses to persist.

3. Stakeholder Analysis

Early-grade Students

The primary stakeholders in this issue are early-grade students, particularly those in Kindergarten to Grade 3 who are still developing foundational reading skills. For these learners, reading is not automatic; it requires guided practice and correction.

When students repeatedly mispronounce words or struggle to decode unfamiliar text, they often experience frustration and loss of confidence. Over time, struggling readers may avoid participation, internalize failure, or fall significantly behind peers. Early intervention can dramatically alter their academic trajectory, making this group the most directly affected by the literacy gap.

Teachers

Teachers represent another crucial stakeholder group. In Philippine public schools, educators frequently manage large class sizes and tight curriculum schedules. Providing individualized phonics correction for each struggling reader is extremely challenging. Teachers often rely on observational assessments, which may not precisely identify which phonetic components a child finds difficult. Without structured diagnostic data, remediation becomes generalized rather than targeted. This increases workload, contributes to burnout, and reduces intervention efficiency.

Parent and Guardians

Parents and guardians are also deeply impacted. When a child struggles to read, families often feel anxiety and uncertainty. Some parents attempt to seek private tutoring, creating financial strain. Others may lack the technical knowledge to provide structured phonics instruction at home. Without clear insights into specific reading weaknesses, parents are left with limited direction on how to help their child effectively.

School Administrators

School administrators serve as institutional stakeholders responsible for literacy outcomes and resource allocation. They require measurable progress indicators to evaluate intervention effectiveness. Persistent low reading performance affects school reputation and performance metrics. Administrators need scalable, cost-effective solutions that can demonstrate impact through data-driven reporting.

National Policymakers

At a broader level, the Department of Education and national policymakers are responsible for addressing systemic literacy challenges. Foundational reading gaps influence long-term workforce readiness and economic productivity. Continued underperformance in reading assessments reflects structural weaknesses that require scalable, evidence-based intervention strategies.

These stakeholders are interconnected. A child's reading difficulty influences teacher workload, family stress, school performance indicators, and national development goals. Addressing the decoding gap has cascading benefits across multiple levels of society.

4. Initial List of Existing / Competing Solutions

Duolingo is a widely used language-learning app that includes speech recognition features for pronunciation practice. It gamifies learning through short exercises and rewards, making it engaging for children. While it checks pronunciation at the word or sentence level, it is designed for language acquisition rather than foundational literacy intervention. However, Duolingo does not break words into grapheme-phoneme components for structured decoding. It does not provide phoneme-level diagnostics or identify specific sound-level weaknesses in early readers.

Raz-Kids provides leveled reading materials and comprehension quizzes for elementary students. Teachers can assign books based on reading level, and students can record themselves reading aloud. Although it tracks fluency and comprehension, it does not analyze pronunciation at the phoneme level. It focuses more on reading volume and comprehension performance rather than decoding diagnostics.

ABCmouse is an early learning platform that includes phonics lessons, reading activities, and interactive games for young children. It introduces letter sounds and basic blending. While it teaches phonics concepts, it does not use advanced phoneme-level speech recognition to validate individual sounds in real time. Feedback is often activity-based rather than diagnostic-driven.

Hooked on Phonics is a structured phonics-based reading program that has been widely used for early literacy instruction. It focuses heavily on sound-letter relationships and blending. The program primarily relies on guided practice and

workbook-style reinforcement. It does not integrate AI-driven phoneme-level speech validation or automated performance analytics.

Google Read Along (formerly Bolo) app listens to children read aloud and provides encouragement and basic pronunciation feedback. It is free and accessible on mobile devices. While it uses speech recognition, its feedback is generally word-level rather than phoneme-specific. It does not generate detailed phoneme confusion reports or targeted remediation suggestions.

Whisper is a powerful automatic speech recognition (ASR) model capable of highly accurate transcription across languages and accents. Whisper is a general-purpose transcription system. It does not provide phonics instruction, grapheme-to-phoneme mapping, or structured literacy feedback designed for early-grade learners.

Wav2Vec 2.0 is a deep learning model used for speech recognition and phoneme modeling in research applications. Although capable of phoneme-level modeling with fine-tuning, it is not an educational product. It does not provide built-in instructional guidance, classroom dashboards, or literacy analytics.

Khan Academy Khan Academy Kids offers early literacy activities including phonics games, storytelling, and vocabulary building. It provides engaging phonics exposure but lacks real-time phoneme-level pronunciation validation and detailed diagnostic reporting for teachers.

5. Problem Significance

Early literacy is one of the strongest predictors of long-term educational success. Students who fail to master reading in the early grades are more likely to experience academic difficulty, disengagement, and dropout. Poor literacy skills limit access to higher education and reduce employment opportunities later in life.

At a national level, weak foundational reading skills contribute to reduced workforce readiness and slower economic growth. Addressing the phoneme-level decoding gap is not only an educational priority but also a socioeconomic imperative.

With ongoing curriculum reforms and advances in AI-driven speech technology, there is a timely opportunity to introduce scalable, data-driven solutions that address the root cause of reading difficulties. Without targeted intervention at the decoding level, learning poverty will continue to widen, affecting millions of Filipino learners and the nation's long-term development.