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CS 141- Hack Society: Projects from the Public Sector

September 7, 2025

Reader's Aide: A Chrome Extension to Aid with Low Literacy

The Problem Explanation and Motivation

Despite being one of the world's most developed nations, the United States faces significant adult literacy challenges. According to the most recent Program for the International Assessment of Adult Competencies (PIAAC) study, 28% of U.S. adults read at or below the lowest proficiency level, which was an increase from previous years. This statistic represents real people facing daily challenges. Consider a mom, who wants to help her third-grader with homework but keeps mixing up the word "environment" or "experiment." This is frustrating for both the mom and child. Consider a 65-year-old seeking government services, like Medicare, who encounters unfamiliar terminology like "eligibility criteria" or "documentation" and abandons the process altogether, missing out on essential services he qualifies for. These situations represent a vulnerable population caught between the need to navigate an increasingly text-based and digital world and whatever prevents them from seeking help through traditional literacy programs. Sometimes the stigma associated with low literacy creates a cruel paradox where those who need assistance are often least likely to seek it publicly. Other times, the demands of life, like work or childcare, make it difficult for adults to find time to focus on themselves.

Reader's Aide is a Chrome extension to assist adults in the Los Angeles area with literacy challenges by providing immediate reading support directly in their browser. The extension offers word definitions, pronunciation assistance, and connections to the Los Angeles Public Library's literacy resources. Adults living in the LA area have very comprehensive literacy programs catered to their needs and skills. Reader's Aide doesn't want to replace this offering. It encourages them to take advantage of them. Instead, Reader's Aide addresses the need for non-stigmatizing, immediately accessible read assistance that meets users, who may have their own reasoning for not committing to a formal program, where they are: browsing the web.

Solution Architecture

1. Background Service Worker: Central coordination hub that manages API communications, handles context menu interactions, coordinates permission management, and maintains extension state.
2. Side Panel UI: Primary user interface featuring word input and definition display, pronunciation controls, practice functionality, and the LAPL resource link.

3. Content Scripts: Bridge between web pages and extensions capture text selections, inject UI elements when prompted, and facilitate communication between web pages and the extension.
4. Permission Management System: Handles microphone access with a dedicated permission request page, clear explanation of permission needs, and a fallback when permission denied

Key Features & Implementation

1. Word Lookup and Definition: The extension integrates with the Merriam-Webster Dictionary API to provide concise definitions. Given the target audience, the chosen dictionaries were the elementary (grades 3-5) and intermediate (grades 6-8). Definitions are presented with clear part-of-speech labels and simplified definitions to overwhelming users.
2. Text-to-Speech (TTS) Functionality: The implementation uses Chrome's built-in TTS engine for consistent performance across devices, and the voice is slowed for clarity.
3. Speech Recognition for Practice: The Web Speech API provides pronunciation feedback. The system compares user pronunciation with the target word and provides encouraging feedback.
4. Context Menu Integration: Users can highlight text on any webpage and access Reader's Aide through the context menu. This makes reading comprehension easier since there is a more streamlined way to use Reader's Aide.

The user interface and code design were also deliberate. This extension was coded without CSS frameworks. The extension uses a purple color palette that is inviting, but still professional. The high contrast between text and background, focus indicators and clear instructions were intentional accessibility choices. The layout has a clear visual hierarchy with consistent spacing. It also has large, labelled, and easily tappable buttons for touch interfaces. Minimalist design was used to reduce cognitive load. This was outlined in the PIAAC study. It was shown that adults with low literacy rates struggle with reading comprehension when there are distracting points in the writing itself or on the platform hosting the writing. Therefore, this implementation focuses on a simple, distraction free interface.

Evaluation

Reader's Aide successfully addresses the concrete literacy challenges identified in the problem statement through its features. When the mom tries to help with her child's online modules, she can simply highlight the text and select "Search '-' on Reader's Aide" from the context menu. Within seconds, she receives a clear definition and can hear the pronunciation, transforming a moment of frustration into a learning opportunity. For the 65-year-old struggling with applying for government benefits, the extension provides immediate clarification of terms like"eligibility criteria," complete with a

definition and pronunciation help. The ability to hear the word pronounced correctly builds his confidence in discussing insurance options.

The system performs efficiently, with API responses typically returning in under half a second and the interface responding instantly to user interactions. The speech recognition system works most of the time with some difficulty with homophones. However, there are some major limitations. Due to the target audience of the extension, dictionary APIs with simplified definitions were prioritized. In this implementation, the Merriam Webster Elementary (grades 3-5) and Intermediate (grades 6-8) APIs were used. There is a chance of censorship appropriate for children, although not seen during personal and user testing, which is not ideal for adult users. I'm not in community with people who struggle with reading comprehension, so I asked my aunt who has an intermediate understanding of English to test the extension. She could successfully look up word definitions without assistance and found the pronunciation feature especially valuable. She said it was really easy to use the tool while online.

Conclusion

Reader's Aide represents a successful attempt at creating a tool that genuinely addresses the literacy challenges faced by many adults. The extension delivers on its core promise of providing immediate, private reading assistance exactly when and where users need it most. The static side panel interface successfully eliminates any social or situational barrier to seeking help, while the thoughtful implementation of features like context menu integration, pronunciation practice, and easy access to LAPL literacy resources creates a better user experience. Looking forward, I hope to implement features that allow choosing between medical and general dictionaries, multilingual support and maybe more formal partnerships with formal literacy programs. Reader's Aide shows the potential of technology to create inclusive, empowering tools that meet people where they are and help them move forward with confidence.

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