ASCILITE 2026

The Future is Connection:

Collaboration, Creativity and Compassion in a Digital Society

An assistive Braille proofreading system for empowering lay volunteers

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Braille literature serves as a critical conduit for individuals with visual impairments to access information, deepen learning, and achieve professional self-actualization (Ryles, 1996). However, transcribing Chinese texts into Taiwanese Braille poses unique and formidable challenges. Unlike alphabetic languages, Chinese is a logographic language consisting of thousands of distinct characters. Crucially, Taiwanese Braille does not directly map onto Chinese characters but is instead intrinsically bound to their phonetic values via the Zhuyin system (Hung, 2008). Consequently, a single character can carry entirely different pronunciations and Braille representations depending on its semantic context, rendering polyphonic characters the primary bottleneck in automated transcription. Beyond Taiwanese Braille, Japanese Braille confronts analogous hurdles in homonym confusion (Seto et al., 2023)—the inverse of the polyphonic challenge—reflecting a persistent dilemma across character-based Asian orthographies. To correct errors induced by polyphonic ambiguities, Braille literature must undergo rigorous proofreading prior to publication. Traditional proofreading relies heavily on cumbersome manual workflows, typically executed via two approaches: a collaborative dyad of a visually impaired reader and a sighted volunteer, or an individual expert proficient in both Chinese characters and Braille. This acute dependency on specialized human resources severely delays Braille literature production, stifling the timely supply of accessible learning materials and thereby impeding digital equity.

To alleviate this persistent societal dilemma and promote inclusive learning design, this study developed a web-based assistive platform, Braille Reviser (B-Reviser). Bridging human empathy and algorithmic efficiency, B-Reviser empowers lay volunteers to independently correct Braille errors simply by modifying familiar Zhuyin (phonetic) symbols. Developed on a LAMP architecture, B-Reviser integrates the CNS11643 Full Character Library from Taiwan's Government Open Data Platform to construct a robust character-to-phonetic baseline. To resolve the most intractable contextual ambiguities of polyphonic characters, B-Reviser leverages the Gemini Large Language Model for deep semantic analysis, substantially reducing transcription errors prior to human verification. Within the user interface, each Chinese character is rendered alongside its corresponding Zhuyin and Braille representations, with polyphonic characters visually highlighted to guide user attention. For any displayed character, clicking its Zhuyin displays all alternative pronunciations (as illustrated in Figure 1 below), while clicking the character itself links directly to an online Chinese dictionary for real-time reference.

This workflow effectively dismantles the expertise barrier inherent in traditional proofreading, enabling lay volunteers to achieve precise correction autonomously. Ultimately, this human-centered proofreading platform addresses long-standing goals in assistive technology (Bhowmick & Hazarika, 2017). Preliminary evaluations demonstrate that B-Reviser significantly reduces technical thresholds, operational complexity, and task duration for volunteers. Centered on digital inclusion, this system exemplifies human-centric crowdsourcing design as a form of compassionate technology. Through human-artificial intelligence collaboration, B-Reviser empowers lay volunteers to accelerate the production of Braille literature, thereby promoting accessible learning and digital inclusion for individuals with visual impairments (Hersh & Johnson, 2008).

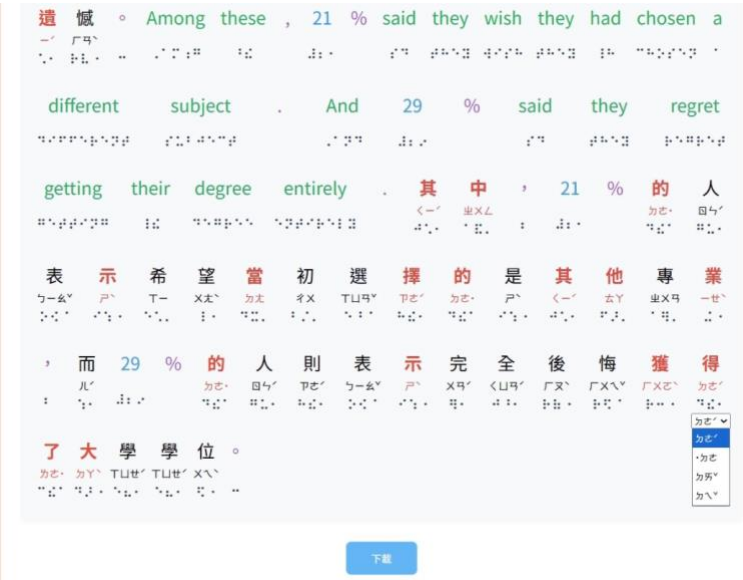


Figure 1. The B-Reviser user interface displaying each Chinese character rendered alongside its corresponding Zhuyin and Braille representations. Polyphonic characters are highlighted in red to guide user attention; clicking a Zhuyin representation triggers a dropdown menu with alternative pronunciations for real-time correction

Keywords: Assistive technology, inclusive learning design, Braille proofreading, compassionate technology, visual impairment education

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Lee, H. P. & Sheu, T. (2026, Nov 29 – Dec 2). An assistive Braille proofreading system for empowering lay volunteers **[**Poster]. In Cochrane, T., Narayan, V., Poole, T., Lai, P., Lake, P., Moore, O., & Li, L. (Eds.), *The Future is Connection: Collaboration, Creativity and Compassion in a Digital Society*. Proceedings ASCILITE 2026. Brisbane (pp. 42–43). https://doi.org/10.65106/apubs.2026.3159

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