

The Wordification® Project

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The Wordification® Project is developing a web-based game system aimed at providing a language-based (as opposed to memory based) tool for English spelling instruction, and one that does not rely on teacher training. The application will be engineered so as to provide individuated instruction that can accommodate a full spectrum of learners. As a resource that can deliver as much or as little spelling instruction as any given student may need, it will provide students who have decoding deficits (e.g. dyslexia) a path to enhanced literacy that would otherwise be missing from their education. The goal of this project is to provide a universally accessible, low-cost intervention nation-wide, and thereby to have a substantial positive impact on literacy (and hence national economic welfare) in every educational jurisdiction in which it is utilized.

The practical importance of this project cannot be overstated.

- **The educational and societal cost of illiteracy is enormous.**

Adults with low levels of literacy are less likely to graduate high school, attend college, and be employed full-time, as well as more likely to live in poverty, be incarcerated, and report poorer overall health. Low literacy has a substantial impact on national economic welfare. If literacy skills of the US labor force increased by merely $\frac{1}{4}$ of a standard deviation, the GDP would increase by over 40 trillion dollars by 2090.

- **Literacy failure in the US is epidemic.**

The most recent National Assessment of Educational Progress (NAEP) reports reveals that only 35% of 4th graders and 34% of 8th graders read at a proficient or higher level, and students' reading performance was lower in 2019 than 2017, suggesting that current methods are not working. Writing outcomes are even worse than reading outcomes. Only 27% of 8th and 12th graders write at a proficient or higher level. Likewise, teachers report that almost 30% of their students experience difficulty with spelling.

- **Inadequate knowledge of the English spelling interferes with higher-level literacy.**

The ability to derive meaning from text depends on being able to *recognize words* and to *comprehend the language of the text*, and this must happen *fluently* for optimal performance. Inadequate knowledge of English spelling has a direct negative impact on word recognition and reading fluency, and an indirect negative impact on reading comprehension. Therefore, spelling instruction is vital for students' literacy and subsequent occupational success.

Inadequacy of Current Typical Practice

Many teachers lack in-depth understanding of the English spelling system and report low confidence in their ability to teach English spelling effectively. As a result, typical classroom instruction of English spelling fails to meet the literacy needs of all students. Preliminary data suggests that the majority of teachers themselves believe that spelling is not adequately addressed in their own classrooms. There are three reasons for this:

- **Issue 1: Spelling is a linguistic skill, but spelling instruction is memory-based.**

The most common instructional approach used by teachers is word memorization. In this approach, words are learned several at a time (e.g. through the weekly spelling list). However, research has confirmed that students' actual learning of spelling best occurs via an understanding of words' linguistic features, and not through memorization. Weiser and Mathes (2011) reported significant positive effects of linguistic-based instruction on spelling outcomes. Yet, despite strong theoretical and empirical support for this approach, little to no instructional time is spent developing and applying linguistic skills.

- **Issue 2: Teachers have insufficient training in linguistic spelling principles.**

Most primary school teachers have virtually no linguistic training. They have difficulty with such things as counting the number of sounds in words, in counting the number of morphemes, and in understanding the rules that map sounds to letters and letters to sounds. Their own lack of training typically results in their students having lower spelling skills. And teachers self-report frustration with both their students' poor spelling abilities and with their own limited ability to provide effective spelling instruction. Preliminary data indicates that 73% of teachers believe their training programs did not prepare them to provide high-quality spelling instruction.

- **Issue 3: Teachers do not employ adaptations for struggling and/or gifted learners.**

Adapting instruction to each student's unique needs is a primary characteristic of effective spelling instruction. Despite this, almost half of teachers make virtually no adjustments in their implementation of spelling instruction to accommodate the skill levels of individual students.

There is thus a great unmet need for an efficient means of teaching children the linguistic principles of the English spelling system and individualizing classroom spelling instruction to student skill levels, one which current resources and teaching methods do not allow.

Computerized Spelling Instruction: A Solution

Computerized spelling instruction can provide a solution for these problems. In computerized spelling instruction, relevant linguistic principles can be embedded within the application. The result is the provision of accurate, evidence-based instruction, even when teachers lack explicit knowledge of the linguistic system. Additionally, computerized spelling instruction can be programmed to adapt to an individual student's spelling skill level. Accordingly, Wordification® implements individualized spelling instruction through internal assessment algorithms that determine a student's appropriate instructional level and particular spelling needs. The application's database includes relevant phonological, orthographic, morphological, and semantic properties of individual words (and groups of words), and the application's code uniquely incorporates, hidden to the user, theoretical approaches to spelling acquisition and data-based spelling instructional strategies. Words and word features all have associated audio files, enabling students to learn through both speech-to-text and text-to-speech exercises.