

Technology-based Tools for Teaching Early Literacy Skills

A Multimethod Approach with Learning Simulations and Intervention

Beth A. O'Brien, Chee Soon Tan and Luca Onnis

KEY IMPLICATIONS

- Learning to read in English is most efficient when input is focused at a small unit size (i.e., letters and phonemes) and uses words that are consistent regarding spelling.
- Implications for how to select and organize teaching materials for early literacy are aligned with support for use of decodable texts with more regularly spelled words.
- Phoneme-level intervention yields better word decoding, but those with better phonological awareness showed better support for word reading fluency with word-level intervention.

BACKGROUND

Learning grapheme-phoneme correspondences (GPC) is foundational to learning to read alphabetic languages, and is a core problem for struggling readers. Acquiring GPCs, especially in irregular writing systems like English, requires learners to pick-up many of the quasi-regular spelling patterns implicitly, through experience. A key educational question is how to select and organize the best input experiences for learning. Two variables known to affect GPC acquisition are examined in this project: grain size (the units of spellings that correspond to units of sound) and consistency (the reliability of the spelling-sound mapping of a word).

This issue is even more important for struggling readers, because they lack wide experience with print. Therefore, increasing print exposure *and* maximizing the effectiveness of these experiences allows for a better chance of effective learning. Effective ways to increase exposure use technology-based formats with engaging activities. Technology-based interventions are used in this study with struggling learners to examine effects of focusing at different grain sizes.

FOCUS OF STUDY

The objective of this project is to examine and identify the types of input that yield effective learning of English sound-symbol correspondence (GPC). This objective is met with two multiple methods studies: a machine learning approach using an artificial neural network (ANN), and a randomized-controlled behavioural intervention study. The research questions address the types of input (i.e., grain size, consistency) that yield the most efficient learning for early literacy, and possible moderating effects for intervention outcomes.

KEY FINDINGS

The ANN study's learning simulations showed that an initial focus on consistent words led to more efficient learning, even though this also

led to less robust learning of inconsistent words. Both the ANN and intervention studies showed that optimal input experience for English literacy development is focused at a small grain size initially. The intervention study revealed that learners' phonological awareness (PA) moderated treatment effects, where those with better PA responded best to a word-level intervention.

SIGNIFICANCE OF FINDINGS

Implications for practice

Supplemental, technology-based apps are a promising way to engage Learning Support Programme (LSP) students and to give them the additional practice required to learn GPCs. Tablet-rendered games could reinforce explicit instruction in LSP.

Implications for policy and research

Experience with print is best focused at a small grain size (e.g., letter-phoneme level), implying that initial use of decodable texts with more consistent words may be best for learning to read.

Learning gains (for studies involving intervention)

Individual differences, such as in phonological awareness, may moderate response to interventions focused at different grain sizes.

PARTICIPANTS

A total of 148 children from seven primary schools across Singapore participated in Study 2.

RESEARCH DESIGN

Study 1

An ANN was built and presented with printed word input, from which it had to implicitly learn orthography-to-phonology mappings. Learning was tracked over training as word and pseudoword decoding accuracy, and different simulations were compared for order of training effects in terms of grain size and consistency.

Study 2

A randomized-controlled design intervention was conducted. LSP students engaged daily with touch-screen apps, where apps focused on learning orthography-to-phonology mappings in conditions in which intervention focused at the phoneme-, rime-, or word-level. Progress was assessed four times.

About the authors

Beth A. O'BRIEN and Chee Soon TAN are with the National Institute of Education, Singapore.

Luca ONNIS is with the University of Genoa, Italy.

Contact Beth A. O'Brien at beth.obrien@nie.edu.sg for more information about the project.

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