



Effects of educational technology applications on reading outcomes for struggling readers: A best-evidence synthesis

Educator's summary

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This review examines the effectiveness of educational technology applications in improving the reading achievement of struggling readers in primary schools.

We conducted a literature search of all articles written between 1980 and 2012, and applied consistent inclusion standards to focus on studies that met high methodological standards. A total of 20 studies based on about 7,000 primary school pupils were included in the final analysis.

Four major categories of education technology are reviewed:

1. **Small-group integrated applications**, such as *Lindamood Phoneme Sequence Program* and *Read, Write, and Type*. These tutorial educational technology applications use small-group interaction tightly integrated with reading curriculum.
2. **Comprehensive models**, including *READ 180* and *Read About*. These programmes use computer-assisted instruction (CAI) along with non-computer activities as pupils' core reading approach.
3. **Supplemental technology**, such as *Destination Reading*, *Plato Focus*, *Waterford*, and *WICAT*. These programmes provide additional instruction at pupils' assessed levels of need to supplement traditional classroom teaching.
4. **The Fast ForWord programme**. This programme supplements traditional CAI with software designed to retrain the brain to process information more effectively through a set of computer games that slow and magnify the acoustic changes in normal speech.

The full report (which this review summarises) is available at www.bestevidence.org.uk

Key findings

Researchers examined the relationship between education technology effectiveness for struggling readers and three key study variables: type of intervention, year level, and programme intensity.

Key findings were as follows:

Type of intervention Outcomes varied substantially according to the type of intervention. Four studies of small-group integrated applications, *Failure Free Reading*; *Read, Write and Type*; and *Lindamood Phoneme Sequence Program*, produced the largest effect sizes (ES=+0.32). Twelve studies of supplemental programmes, such as *Jostens* and *Lexia*, generated an effect size of +0.18. The mean effect size from two qualifying studies of comprehensive models, represented by *READ 180* and *Read About*, was +0.04. For the *Fast ForWord* programme, two qualifying studies had an average effect size of +0.06.



Year level Studies were organised into two year levels: lower primary (Years 1 to 4) and upper primary (Years 5 to 7). Two of the studies examined outcomes across both year levels but did not provide disaggregated data. Our findings indicate that the mean effect size for lower primary (ES=+0.36) was much larger than upper primary (ES=+0.07). The mean effect size for the two mixed-year level studies was +0.25.

Programme intensity Programme intensity was grouped into two categories: low intensity (the use of technology interventions, including any associated off-line activities, less than 75 minutes a week) and high intensity (more than 75 minutes a week). The effect sizes for low- and high-intensity programs were +0.08 and +0.19, respectively, but the difference was not statistically significant due to low power (QB=1.20, $p < 0.27$).

Conclusions

Findings of this review indicate that educational technology applications produced a positive but modest effect on the reading skills of struggling readers (overall weighted mean effect size=+0.14) in comparison to traditional methods. Among the four types of educational technology applications reviewed, small-group integrated applications such as *Lindamood Phoneme Sequence Program* and *Read, Write, and Type* produced the largest effect sizes, but these were mostly small studies, which tend to overstate programme impacts. Supplementary models, such as *Jostens*, had a larger number of studies and a more modest effect size. Comprehensive models and the *Fast ForWord* programme did not produce meaningful positive effect sizes. However, the results of these two categories of programmes should be interpreted with extreme caution due to the small number of studies involved.

The eight qualifying studies that took place in the lower primary years had an overall effect size of +0.36 whereas the 10 studies carried out in the upper primary years produced an effect size near zero (ES=+0.07). This finding provides some evidence that early intervention is essential for struggling readers. In addition, it appears that high-intensity programmes had a bigger impact on struggling readers than low-intensity programmes.

One of the most important practical implications of this review is that there is a limited evidence base for the use of technology applications to enhance the reading performance of struggling readers in elementary schools. Only 20 studies met the inclusion standards, and many of these were small experiments. The evidence to date shows promise for some types of technology applications, but much more remains to be done both in research and in development of more effective solutions. The problems of reading failure in elementary schools are important and they justify continued efforts to create and validate reliably effective approaches combining the best efforts of teachers and technology.



Review methods

A literature search of articles written between 1980 and 2012 was carried out to find studies that met the following inclusion criteria:

- The studies evaluated applications incorporating any type of educational technology, including computers, multimedia, interactive whiteboards, and other technology.
- The studies involved primary school pupils who were having difficulties learning to read. These are defined as children with reading disabilities, pupils in the lowest 33 per cent (or lower) of their classes, or any pupil receiving tutoring, special education, or other intensive services to prevent or remediate serious reading problems.
- The studies compared pupils taught in classes using a given technology-assisted reading programme to those in control classes using an alternative or standard method.
- Studies could have taken place in any country, but the report had to be available in English.
- Random assignment or matching with appropriate adjustments for any pretest differences had to be used.
- Pretest data had to be provided, unless studies used random assignment of at least 30 units (individuals, classes, or schools) and there were no indications of initial inequality.
- The dependent measures included quantitative measures of reading performance, such as standardised reading measures. Experimenter-made measures were accepted if they were comprehensive measures of reading, which would be fair to the control groups, but measures of reading objectives inherent to the programme (but unlikely to be emphasised in control groups) were excluded.
- A minimum study duration of 12 weeks was required.
- Studies had to have at least two teachers in each treatment group.
- Studied programmes had to be replicable in realistic school settings. Studies providing experimental classes with extraordinary amounts of assistance (eg, additional staff in each classroom to ensure proper implementation) that could not be provided in ordinary applications were excluded.



The full report

Cheung A, Slavin RE (2012, June). *Effects of Educational Technology Applications on Reading Outcomes for Struggling Readers: A Best Evidence Synthesis*. Baltimore, MD: Johns Hopkins University, Center for Research and Reform in Education.

The full report can be downloaded at www.bestevidence.org.uk

