Authors' objectives
To carry out a meta-analysis of instructional research with samples of children and adolescents with learning disabilities (LD) in the domains of word recognition and reading comprehension.

Searching
PsycINFO, MEDLINE and ERIC were searched from 1963 to 1997 (July 1 1997 for studies reported in the English language, using the following terms: 'learning' 'disabled (disabilities)', 'reading disabled (disabilities)', 'dyslexic', 'educationally handicapped', and 'slow learners'. These were paired with variations of: 'intervention', 'treatment', 'training', 'remediation', or 'instruction'. The following journals were also handsearched: Journal of Learning Disabilities, Journal of Educational Psychology, Learning Disability Quarterly, Reading and Writing, Learning Disabilities Research and Practice, Exceptional Children, and the Journal of Special Education.

In addition, researchers were contacted for copies of unpublished and/or ongoing intervention studies, and every state department (and director) of education was contacted for technical reports on intervention studies of children and adolescents with LD.

Study selection
Study designs of evaluations included in the review
Studies were included if they had at least one between-instructions comparison condition (i.e. control condition) or within-design control condition (e.g. repeated measures design) that included participants with LD.

Specific interventions included in the review
Treatment to enhance academic performance. Studies were included if participants with LD received treatment that was above and beyond what they would have received during their typical classroom experience.

Participants included in the review
Children and adolescents with LD. Studies were included if the recipients of the intervention were children or adults of average intelligence, who were experiencing problems in a particular academic, social, or related behaviour domain. The cut-off score for inclusion in the synthesis was a reported mean standardised IQ score of greater than 84.

Outcomes assessed in the review
Dependent measures were coded into one of the following general categories:

the 'word recognition' domain, which included all measures of real-word recognition; or

the 'reading comprehension', which included all measures related to silent or oral reading comprehension.

The authors also coded measures of the following:

'word skills', including all component measures of word recognition, such as phonics and nonword (pseudoword) recognition; and

'meta-cognitive' skills, including self-monitoring, speed of processing, problem-solving processes, synthesis, problem-solving strategies, and awareness of strategy use.

How were decisions on the relevance of primary studies made?
More than one reviewer selected the papers for the review, with inter-rater agreement exceeding 90%; however, it is unclear exactly how many of the reviewers performed the selection.
Assessment of study quality
The internal validity was rated, based on a scale which took the following into consideration: participant mortality; Hawthorne effects and selection bias; comparable exposure between the treatment and control groups in terms of materials; comparable instruction time between the treatment and control groups; comparable (same) teachers between the treatment and control groups; procedural validity checks; practice effects on the dependent measure; floor and ceiling effects; inter-rater reliability; regression to the mean ruled out as an alternative explanation of findings; and homogeneity of variance between the groups.

An abbreviated form (items 1,2,4,8) and a complete form (items 1 to 11) were used to rate the studies. A score of 1 to 3 was assigned to each of the 11 items; a score of 1 reflected internal validity control, 2 reflected no validity control, and 3 reflected no validity information. The scores ranged from 11 to 33. The validity assessment was undertaken as part of the coding of the included papers. Four doctoral students served as independent raters.

Data extraction
Four doctoral students served as independent raters on the coding of each report. The categories of data coded were: sample characteristics; demographics; quality of research methodology; components and parameters of instruction; generalisation/transfer; and conditions of treatment.

Methods of synthesis
How were the studies combined?
A weighted Cohen's d statistic was the primary index of the effect size (ES). Each ES was weighted by the reciprocal of the sampling variance. The weighted mean ESs were tabulated for the word recognition and reading comprehension measures.

How were differences between studies investigated?
Homogeneity was calculated using the Q statistic. When significant heterogeneity was found, the finding was further explored in an analysis of the study features.

Results of the review
Ninety-two studies were selected for the analyses: 54 included measures of word recognition (159 effect sizes) and 58 included measures of reading comprehension (175 effect sizes); 20 studies included both word recognition and reading comprehension measures.

The mean scores of internal validity for the word recognition studies were 22.56 (standard deviation, SD=2.43) and 7.63 (SD=1.79) when using the full and abbreviated scales, respectively. The corresponding values for the reading and comprehension studies were 21.77 (SD=2.67) and 7.14 (SD = 1.76). The overall ratings of internal validity were higher for the word recognition studies than the reading comprehension studies.

The results of the synthesis showed that a prototypical intervention study had an ES of 0.59 for word recognition and 0.72 for reading comprehension. Four important findings emerged from the synthesis.

1. The ESs for measures of comprehension were higher when the studies included derivatives of both cognitive and direct instruction, whereas the ESs were higher for word recognition when the studies included direct instruction.
2. The ESs related to reading comprehension were more susceptible to methodological variation than those for word recognition.
3. The magnitude of ES for word recognition studies was significantly related to samples defined by cut-off scores (IQ greater than 85, and reading less than the 25th percentile). The magnitude of the ES for reading comprehension studies was sensitive to discrepancies between IQ and reading when compared with competing definitional criteria.

4. Instructional components related to word segmentation did not enter significantly into a weighted least-squares
hierarchical regression analysis for predicting ES estimates of word recognition beyond an instructional core model. However, small-group interactive instruction and strategy cueing contributed significant variance beyond a core model to ES estimates of reading comprehension.

Authors' conclusions
The results from the meta-analysis were consistent with the literature. These indicated that a combined instructional model, which includes components of both strategy and direct instruction, positively influences reading comprehension performance and that direct instruction improves word recognition. Aptitude variables, such as intellectual range and severity of reading deficiency, played an important role in predicting the treatment outcomes.

CRD commentary
This was a reasonably well-conducted review. The papers were selected for the review by more than one reviewer, using appropriate inclusion criteria that related to the types of study design, intervention, participants and outcomes. The literature search was thorough: three databases were searched, key journals were handsearched and attempts were made to identify unpublished research. However, limiting the search to English language papers may have meant that relevant papers were missed. The validity was appropriately assessed, although it is unclear whether the tool used to obtain the validity ratings had itself been shown to be valid and reliable. The outcome data were tabulated, but details regarding the participants or specific interventions included in each study were not given.

The included studies were appropriately synthesised and the author's conclusions appear to follow from the evidence presented. However, due to the theoretical approach taken by the author, and the lack of information on the specific interventions included in the review, these conclusions may be of limited value in making decisions regarding practice.

Implications of the review for practice and research
The author did not state any implications for further research and practice.

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