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Fact Sheet 43

Research basis for Lucid CoPS

Singleton (1987) outlined a cognitive model for the early diagnosis of dyslexia, based upon an assessment of underlying strengths and weaknesses in abilities that are known to underpin the learning process, especially in phonology and memory. He also criticised the conventional assessment and diagnostic procedures for dyslexia, which, in essence, rely on waiting for the child to fail and often come too late in the child's education (Singleton, 1988).

The criteria on which conventional procedures are typically based (i.e. intelligence–attainment discrepancy and exclusion of social disadvantaging factors) biases identification towards relatively bright, middle-class children. Dyslexic children of lower ability and/or from less advantaged home backgrounds may be overlooked. Singleton (1994) argued that early identification can be established by reference to cognitive precursors, such as phonological awareness and memory.

Over the period 1990–96, researchers in the Department of Psychology, University of Hull, UK, carried out a longitudinal study of a representative sample of almost 400 children from 24 schools. At the beginning of the study these children were all 4 or 5 years of age. 27 different computer tests were created in order to assess a wide range of cognitive abilities that are especially important in the early stages of literacy development, and that are believed to be valid indicators of dyslexia. These tests, which are in the form of games with colourful graphics, animation and high-quality digitised speech, included measures of visual and verbal memory, sequencing, phonological awareness, naming speed, auditory discrimination, and visual-perceptual analysis.

All the children in the sample were administered these computer tasks, and subsequently their literacy, numeracy and intellectual development was followed up over the next four years, using a variety of standardised psychological measures. The follow-up data were then used to determine which of the computer tests were most effective predictors of dyslexia and other difficulties in literacy. The eight computerised tests which gave the most satisfactory results were selected and these were consolidated in a software package incorporating a pupil-registration system and facility for on-screen graphical profiling and print-out of results (in both centile and z-score formats); the whole suite was given the name CoPS Cognitive Profiling System. The system was subsequently standardised on a new sample of over 800 children in the UK. The components of CoPS are shown in Table 1.

The results of the longitudinal study showed that the selected computer tests gave a highly satisfactory prediction of children who later were found to be experiencing literacy difficulties and dyslexia. Correlational, regression and discriminant function analyses were carried out on the data when the children were aged eight years. The highest correlations between the computerised tests at five years and reading ability at age eight were in auditory sequential working memory (Races test; r = 0.56), phonological awareness (Rhymes test; r = 0.52), auditory discrimination (Wock test; r = 0.44) and visual sequential memory (Zoid's Friends test; r = 0.39).

Phonic skills at age eight also correlated significantly with these measures, with the highest correlation coefficient being 0.73 for the computerised test of auditory discrimination (Wock test). Stepwise multiple regression analyses showed that the Rhymes and Races tests

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administered at age 5 together accounted for 48% of the variance in reading ability at age 8 (compared with only 23% of the variance being attributable to verbal intelligence.

Table 1. Components of Lucid CoPS

Test	Principal cognitive mode	Principal processing skills being assessed
Zoid's Friends	Visual †	Sequential memory (colours)
Rabbits	Visual	Sequential memory (spatial + temporal)
Toybox	Visual †	Associative memory (shape + colour)
Zoid's Letters	Visual †	Sequential memory (symbols)
Zoid's Letter Names	Auditory/verbal	Associative memory (symbols + names)
Races	Auditory/verbal	Sequential memory (names)
Rhymes	Auditory/verbal	Phonological awareness (rhyming)
Wock	Auditory/verbal	Auditory discrimination
Clown	Visual	Colour discrimination (supplementary test)

† indicates that a verbal encoding strategy may augment visual strategies.

Discriminant function analysis also produced encouraging results. Two groups were composed: those children who attained scores less than 1 standard deviation below the mean, and those above this score on the British Ability Scales Word Recognition Test at age 8.

The overall prediction rate of CoPS tests delivered at age 5 was found to be 96%, with a false negative rate of 16.7% and a false positive rate of only 2.3%, both of which are within acceptable limits. By contrast, a simple word recognition test given at age 6 was not found to predict reading at age 8 nearly so well – although this generated a false positive rate of only 3.3%, it resulted in a massive false negative rate of 82.1%!

In other words, early reading progress does not always guarantee later success. This is particularly pertinent in cases of those dyslexic children who are able to apply visual strategies for whole-word recognition in the early stages of learning to read, but who then fall behind as they get older because weaknesses in phonological processing and/or auditory memory hinder the acquisition of effective phonic reading skills. Comparison with other early screening devices widely used in the UK also showed that CoPS performed very favourably. For example, investigations of the Aston Index have revealed 47% false positives and 21% false negatives.

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Please note that the information contained in this document is believed to be correct at time of going to press.

