New Developments in Information Technology for Dyslexia

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Information technology

Information technology provides tools and techniques for:

- delivering educational **content** (text, graphics, sound)
- in an **interactive and stimulating way**
- and recording **responses**

Advantages of information technology in the classroom

- Provides a multi-sensory environment for active learning and adaptive assessment.
- Can deliver individualised instruction that has been differentiated for each child.
- Flexible learning tools for giving practice — essential for overcoming memory weaknesses found in dyslexia.
- Enjoyable activities for children — helps to maintain their interest and boost motivation.
- Beneficial for busy teachers — labour-saving and time-saving.

Information technology and dyslexia

Information technology can be used to help children and adults with dyslexia in three main ways:

1. **Training**
2. **Supporting learning**
3. **Screening and assessment**

1. Training

- Most dyslexic children have difficulties processing and remember phonological information.
- This means that many aspects of learning in school are hard for them, e.g. reading, spelling, writing, arithmetic.
- Computers can provide additional practice and training to overcome the limitations created by poor memory.

Computer Assisted Learning and reading - a brief history

- Roth and Beck (1987) - pioneered use of digitised speech in CAL to support reading
- Reitsma (1988) - showed that optional speech feedback was particularly effective
- Wise et al (1989) - found that segmented speech feedback was best
- Olson and Wise (1992) - did not replicate this finding
- Wood (1998) - evaluations of Integrated Learning Systems in the UK
- Underwood (2000) - studies of talking books

Leescircus

(Van Daal and Reitsma, 2000)

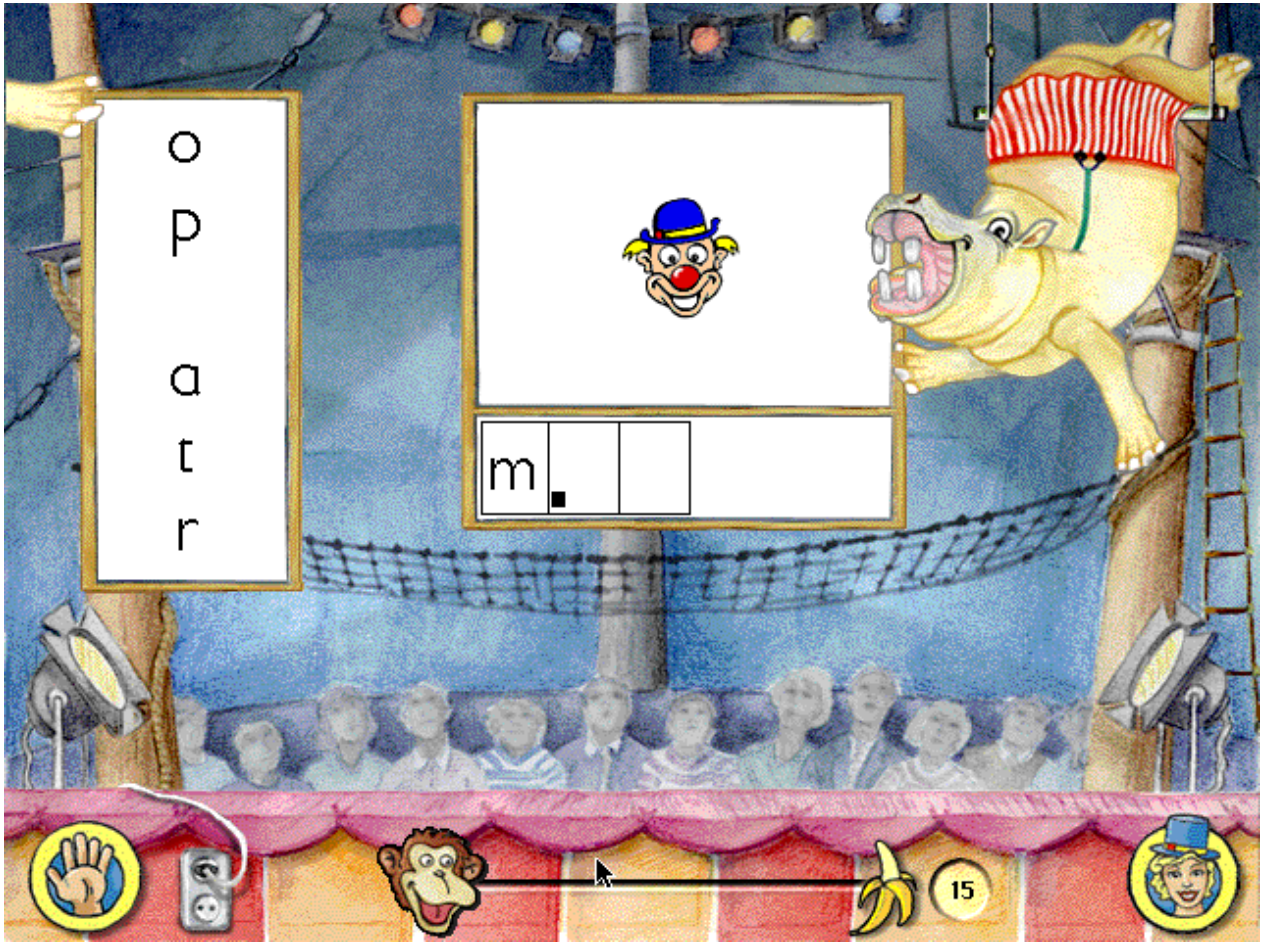
Leescircus is an interactive CAL program for Dutch children with colourful graphics and sound devised by PI Research Amsterdam, incorporating 9 different exercises designed to:

- draw attention to the phonological structure of words
- teach letter-sound correspondences
- develop automaticity in word reading and spelling.

[Van Daal & Reitsma, *Journal of Research in Reading*, 2000, 23, 181-193]

Leescircus
phonological awareness example

Leescircus
word building example



Van Daal and Reitsma (2000)

Study 1

- Sample of normal kindergarten children, mean age 6.5 years.
- Expl (n=9) used *Leescircus* over a 4 month period*;* control group (n=13) had normal kindergarten activities
- In post-tests, expl group significantly outperformed control group on word and nonword reading.
- Gains made in 1.5 – 6 hrs using the program were equivalent to that normally attained after 3 months of formal reading instruction.

Van Daal and Reitsma (2000)
Study 2

- The sample comprised 14 dyslexic children (mean age 10.7 yrs) with serious spelling difficulties and motivational problems.
- Used *Leescircus* for at least 5 minutes a day, 3 times a week for about 26 weeks.
- Made significant improvements in spelling.
- The children displayed more positive behaviours when working with the computer compared with normal classroom activities.

Examples of commercial CAL programs for dyslexia

- ***Wordshark3*** *- most widely used program of its kind in the UK*
- ***Lexia Reading System*** *- extensively used in USA and elsewhere in the world*
- *StarSpell 2000*
- Talking Books
- Integrated Learning Systems [ILS]
- *Numbershark*

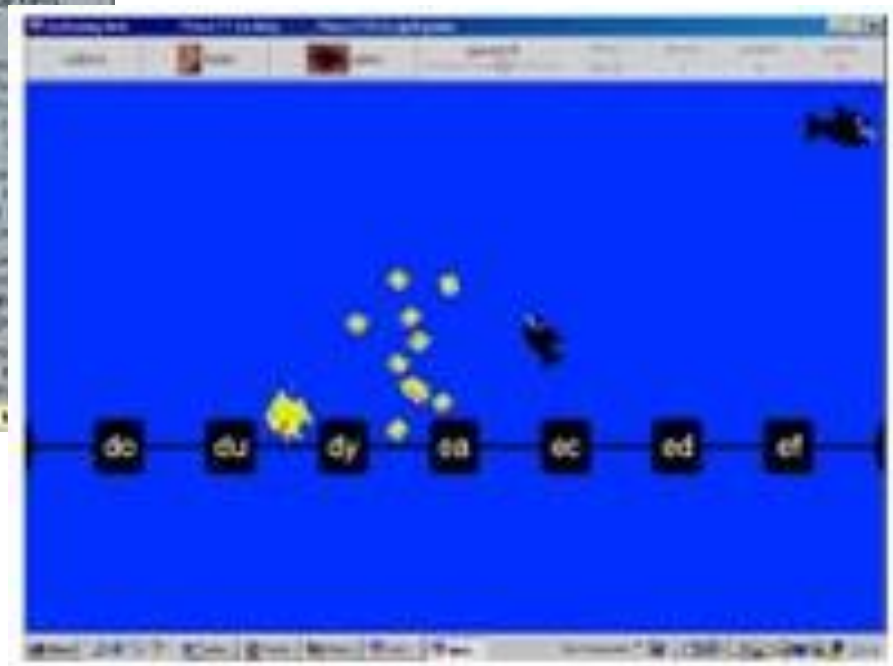
Wordshark3

- By Savery and Burton; first released in 1995.
- Largest selling CAL program for literacy in the UK (10-20% of schools).
- Comprises 36 reading and spelling games,m suitable for ages 7 - 15.
- Contains word lists from 'Alpha to Omega' (Hornsby and Shear, 1976) and the UK National Literacy Strategy (Wordshark 2L, 1998).
- Designed primarily to enable dyslexic students to practice word recognition and phonic skills.
- Current (2003) version is Wordshark3.

Wordshark3 word lists

- Phonics
- Onset and Rhyme
- Homophones
- Spelling rules
- Common letter patterns
- Visual and auditory patterns
- Prefixes and Suffixes
- Roots
- Word division
- High frequency words
- Use of words in context
- Alphabet and dictionary skills

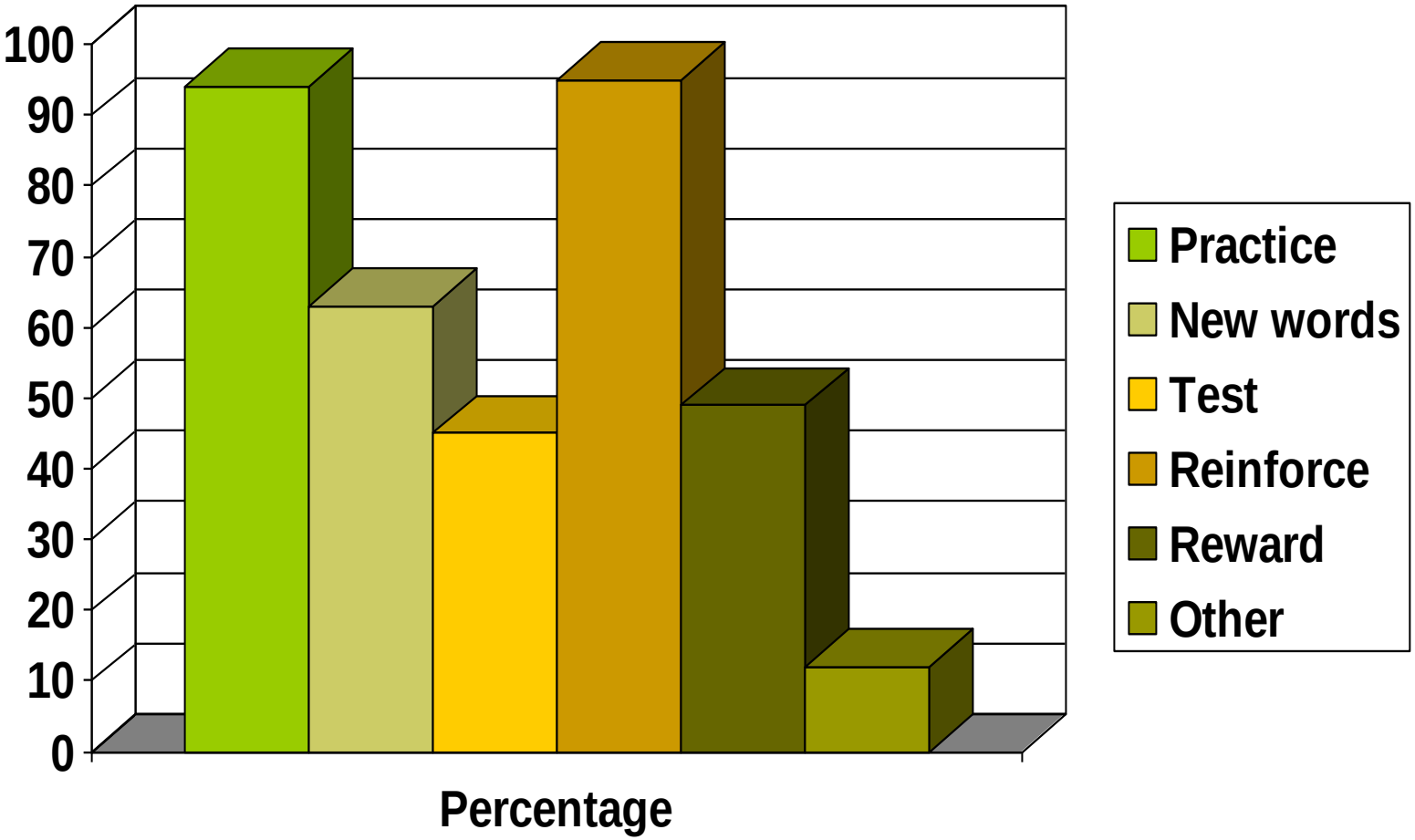
Wordshark3 - example games



Wordshark evaluation study
(Singleton and Simmons, 2001)

- Questionnaire sent to 1312 schools that had purchased Wordshark
- 403 responses
- 31% response rate
- 52% primary/middle schools
- 39% secondary schools
- 9% special schools
- Most schools were using Wordshark in the 7-15 age range for SEN pupils.

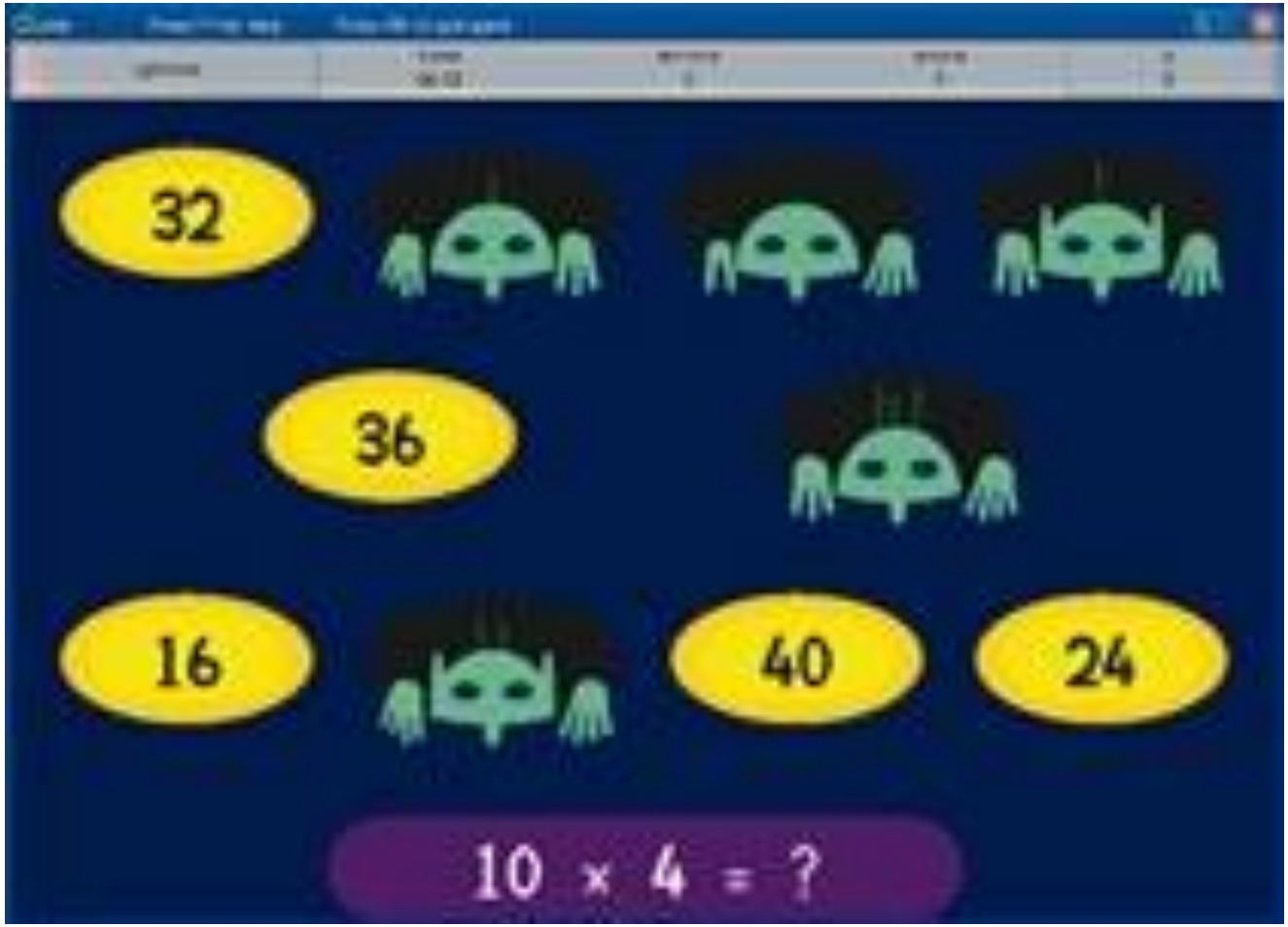
Types of Wordshark use



Wordshark — Conclusions

- Singleton, C. H. and Simmons, F.R. (2001) An evaluation of Wordshark in the classroom. *British Journal of Educational Technology,* 32 (3), 1-14.
- Similar findings have been reported for benefits to numeracy skills in a study of 188 schools using Numbershark, a CAL program designed to improve arithmetical concepts and procedures (Singleton & Laws, submitted).

Numbershark



Talking Books

- The commercial development of Talking Books since the early 1990s built on the pioneering work by researchers such as Reitsma and Van Daal (The Netherlands), Olson and Wise (USA), and Moseley, Terrell and Davidson (UK).
- The Broderbund series (e.g. 'Arthur's Teacher Trouble'; 'Grandma and Me') were the first commercial successes in the field, but these were criticised for being 'gimmicky'.
- Now there is a wide range of Talking Books in English, published in the UK and USA.

Research on Talking Books

- Designed to facilitate reading development by providing practice (repeated reading), supporting word recognition (speech feedback) and boosting confidence.
- Many studies using commercially available Talking Books have demonstrated educational benefits for beginning readers.
- Underwood (2000) found that the way that Talking Books were used in the classroom made a difference to outcome.
- Lewin (2000) found that less able readers made more gains in word recognition as a result of working with Talking Books.

Issues with Talking Books

- Concerns that the child may become reliant on the computer for decoding unknown words
- Most talking books only provide whole-word (rather than segmented) feedback.
- No mechanism for detecting and correcting errors if help is not requested.
- Some children are prone to ‘over-accessing’ or ‘under-accessing’ help.
- No studies to date have specifically addressed benefits for dyslexic readers.

Integrated Learning Systems (ILS)

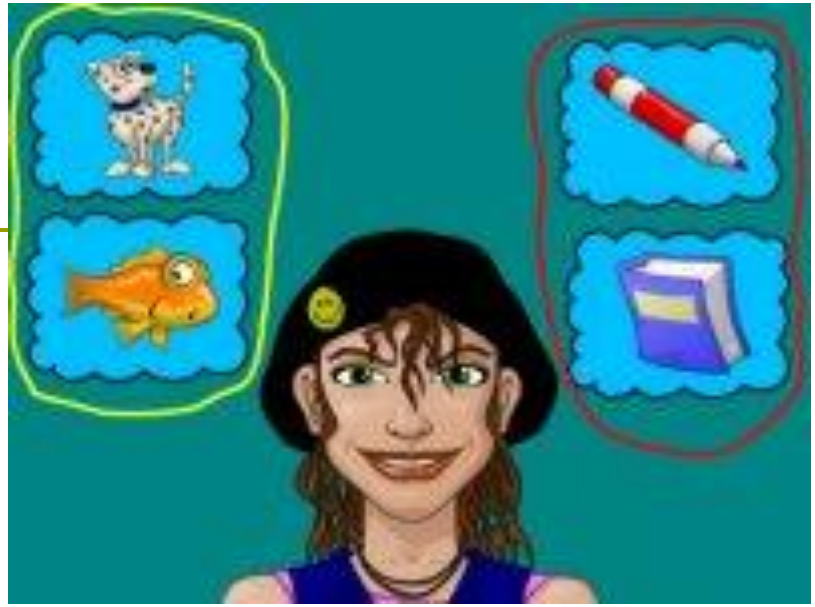
- Networked programs that provide CAL activities to groups of students on an individualised basis (e.g. *SuccessMaker*).
- Widely used in the US; UK evaluations have been not so positive (e.g. Wood, 1998; Wood et al, 1999).
- Underwood (2000) — benefits of ILS are a largely function of organisational factors.
- Miller et al (2000) — ILS works if it is embedded within the school curriculum and general ethos of the school.
- No studies to date have specifically addressed benefits of ILS for dyslexic readers.

2. Supporting learning

Computers can enable dyslexic students to be <u>independent learners</u> by helping with:

- Organising life and time
- Developing memory strategies
- Researching topics
- Reading books using text-to-speech
- Making and organising notes
- Planning and writing essays
- Checking and correcting work
- Revising for examinations

Memory BOOSTER



- Adventure game for 4 – 11+
- Teaches memory strategies
  - Rehearsal
  - Concept grouping
  - Imagery
  - Story construction
- Gives practice in applying memory strategies
- Does not need teacher supervision
- Suitable for use at school and home
- Print-out certificates of achievement

Organising life and time

Computers can help the dyslexic by:

- Keeping files and work tidy and accessible
- Making it easy to alter plans, notes and other work without messy crossings out
- Making copies of work (disk and printed) for security and convenience
- Producing planners and timetables

Researching topics

- Conventional sources of information tend to be:
  - Text heavy
  - Organised alphabetically
  - Difficult to navigate
- Websites and encyclopaedias on CD Rom:
  - Non-alphabetical
  - Less text
  - Use of graphics and sound
  - Hyperlinks make navigation easier

Writing

- Writing is probably the most challenging activity for dyslexic students.
- Many cognitive processes need to be carried out in parallel.
- Heavy demands on working memory.
- Poorly automatised processes (e.g. spelling, grammar, punctuation) reduce capacity for executive monitoring.
- Poor reading skills result in writing mistakes being overlooked.

Word processing

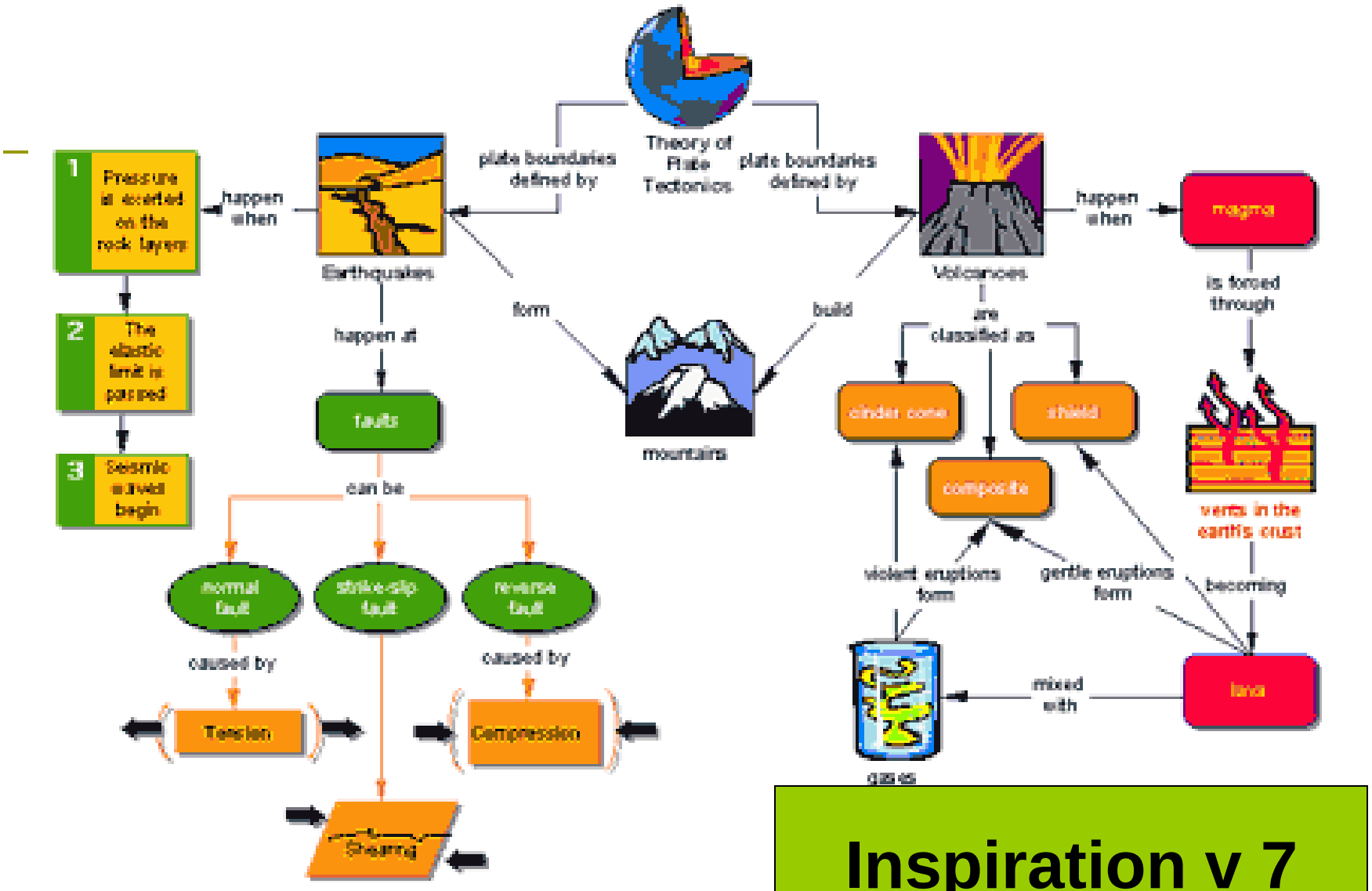
- Enables the normally simultaneous cognitive processes in writing to be separated out.
- Standard word processing enables dyslexic students to:
  - organise their work better
  - see and correct their mistakes more easily
  - extend their vocabulary with a thesaurus
  - use basic spell checking
  - produce neater, more legible work

Enhanced word processing

- **Word prediction** – the computer guesses the words as you type
- **Text reading** – the computer reads back text that you have written or scanned in
- **Enhanced spell checking** – picks up 'dyslexic' spelling errors
  - Examples include:
    Co-Writer/Write:Outloud;
    Penfriend;
    textHELP! Type and Talk.

Mind mapping software

- Provides structure and encourages organisation
- Assists planning of work and activities
- Promotes ordered thinking
- Helps recall of information through visualisation
- Can be used for:
  - Creating notes
  - Essay plans and outlines
  - Learning, revision and self testing
- Examples: Inspiration, Kidspiration, Mind Genius
- See www.dyslexic.com for reviews



Inspiration v 7

Switch between Graphical view and outline view

Vertebrates
Vertebrates are animals with a backbone.

- **I. Mammals**
  - **A. Characteristics**
    Mammals have larger brains than other vertebrates. Mammals are divided into carnivores who eat only meat, herbivores who eat only plants, and omnivores who eat both plants and meat.
    1. **have hair**
       Hair is unique to mammals and is for warmth. Some marine mammals such as whales do not have much hair, but have a layer of fat to protect them from cold.
    2. **give birth to live young; feed milk to babies**
       Mammals are the only group of vertebrates that lactate - produce milk for their babies.
    3. **warmblooded**
       Mammals can regulate their body temperature.
- **II. Birds**
  - **A. Characteristics**
    1. **warmblooded**
       Birds can regulate their body temperature.
    2. **have feathers for flying and insulation**
    3. **hollow bones**
       Birds have hollow bones making them lighter
- **III. Reptiles**
  - **A. Characteristics**
    1. **lay eggs**
    2. **breathe air**
       Even though some reptiles live in the water, lik
       sea snakes, they always breathe air.
    3. **coldblooded**
       Reptiles body temperature changes with their
    4. **dry, scaly skin**
       Reptiles have water-resistant skin.
- **IV. Fish**
  - **A. Classes**
    1. **Osteichthyes**
       a. **bony**
       Osteichthyes are the largest class of fish. T
       skeletons and swim bladders to help then
    2. **Agnatha**
       a. **jawless**
       Agnatha do not have jaws.
    3. **Chondrichthyes**
       a. **cartilaginous**
       Chondrichthyes, such as sharks, have ske
       made of cartilage.
  - **B. Characteristics**
    All fish have fins and live in the water.
- **V. Amphibians**
  - **A. Characteristics**
    Amphibians are coldblooded - their body tempera
    with the environment.
    1. **live part of life on land and part in water**
       Amphibians must live in a moist environment
       skin from drying out.
    2. **have gills as babies and lungs as adults**
       Amphibians go through metamorphosis from
       to air-breathing.

CREATED BY:
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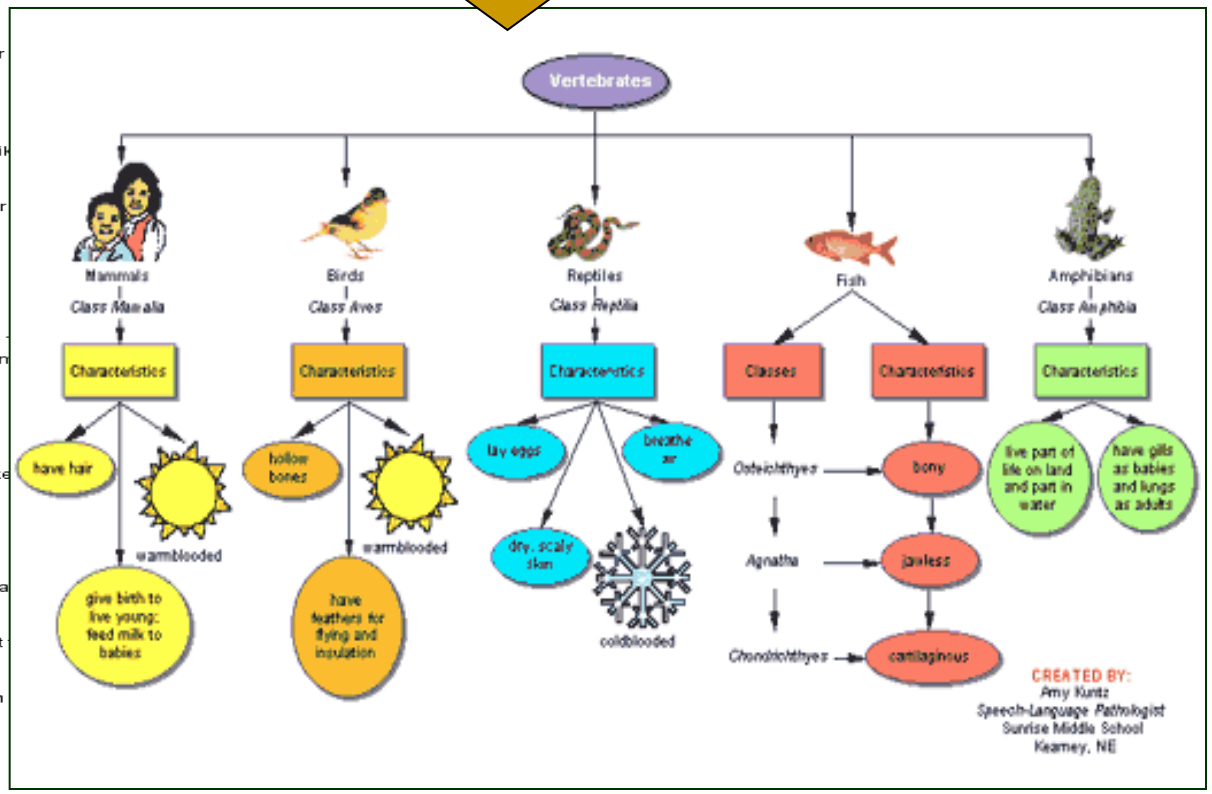


Inspiration v7

3. Screening and assessment

Computers have advantages over conventional methods of screening and assessment:

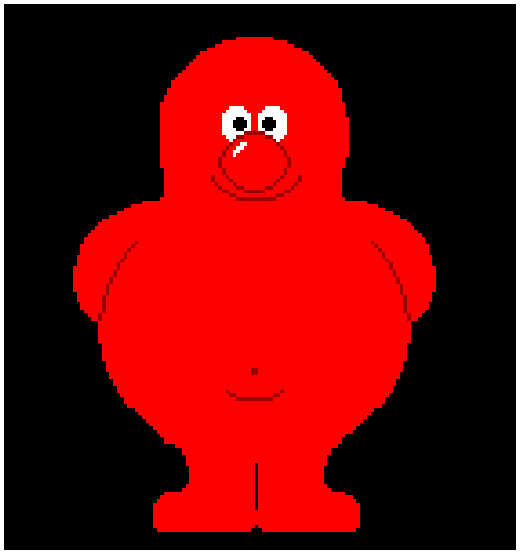
- Standardised presentation
- Improved accuracy of measurement
- Speedier administration (especially with adaptive tests)
- Less training of administrators needed
- Labour (and cost) saving
- Results available instantly
- Enjoyable for children
- Confidential for adult self-assessment

Computer-based systems for dyslexia screening and assessment

- **Lucid CoPS Cognitive Profiling System** (Singleton, Thomas and Leedale, 1996)
- **StudyScan and QuickScan** (Zdzienski, 1997)
- **LASS Secondary** (Horne, Singleton and Thomas, 1999)
- **LASS Junior** (Thomas, Singleton and Horne, 2001)
- **LADS** (Singleton, Horne and Thomas, 2002)
- **Lucid Rapid Dyslexia Screening** (Singleton, Thomas and Horne, 2003)

Lucid CoPS
Cognitive Profiling System

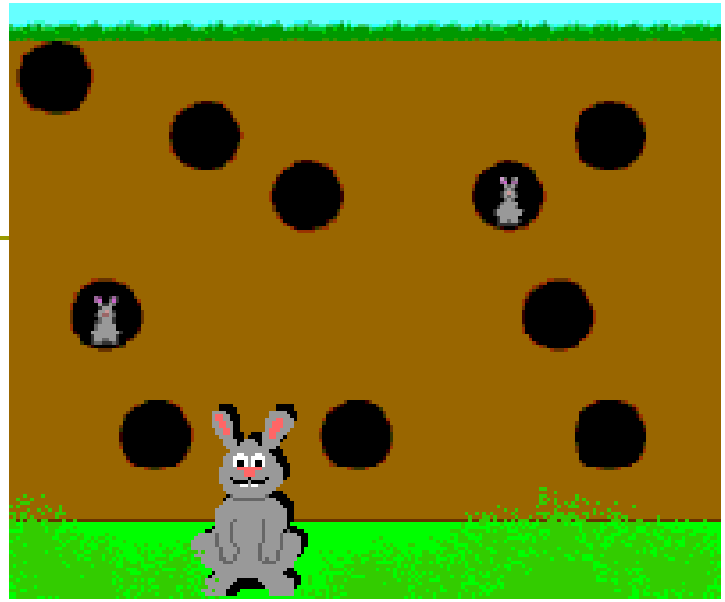
- Age 4 – 8 years
- Takes about 45 minutes
- Provides a profile of cognitive skills that underpin learning
- Uses attractive and engaging games to assess cognitive skills
- Can be used to identify dyslexia and other learning problems, but does not label children
- Used in over 5,000 schools in UK
- Three foreign language versions developed

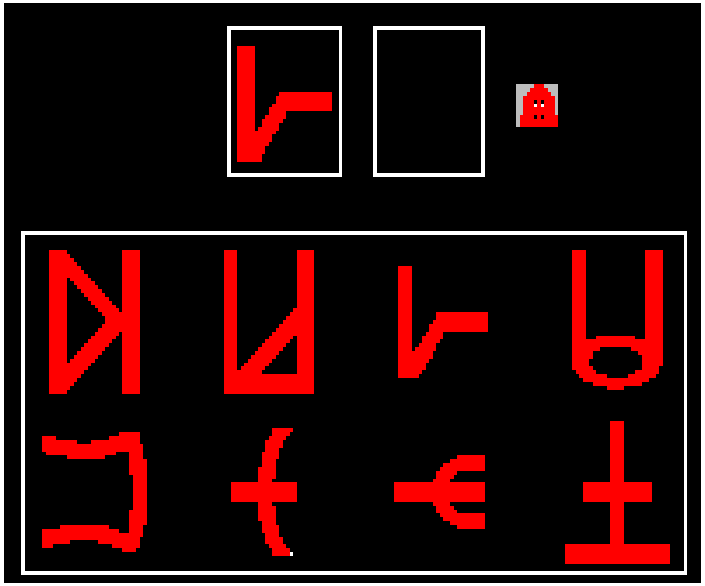


The visual memory tests in

Lucid CoPS

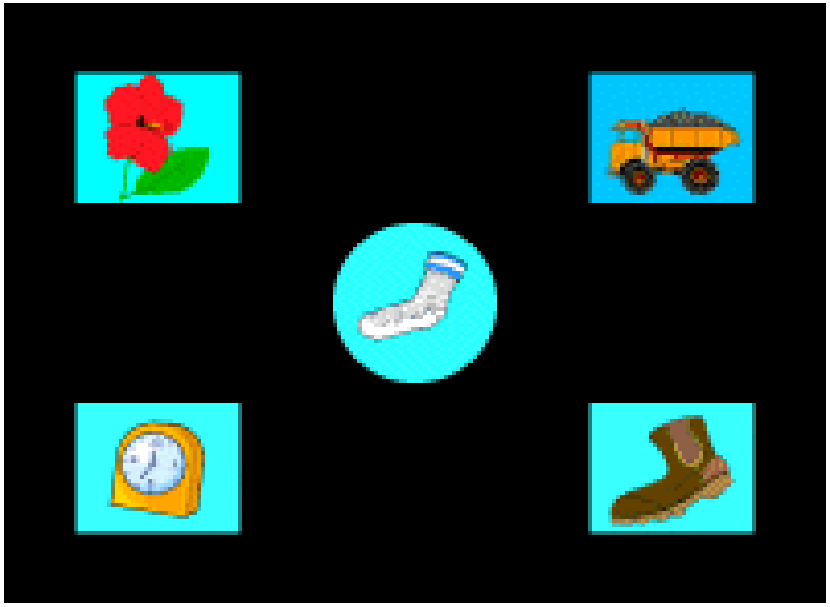
- Zoid's Friends
  (Sequential colour)
- Rabbits
  (Sequential position)
- Toybox *(Associative)*
- Zoid's Letters
  (Sequential symbols)





The auditory verbal tests in

Lucid CoPS



- Zoid's Letter Names (*Associative Memory)*
- Races *(Sequential Memory)*
- Rhymes *(Phonological Awareness)*
- Wock (*Phoneme Discrimination)*

LASS Junior

- Age 8 - 11
- Takes about 45 minutes
- Comprises 8 tests:
  - 4 diagnostic tests
  - 4 attainment/ability tests
- Generates a graphical profile of strengths and weaknesses in learning
- Can be used to identify dyslexia but does not label children
- Used in over 2,500 schools in UK

Diagnostic tests in

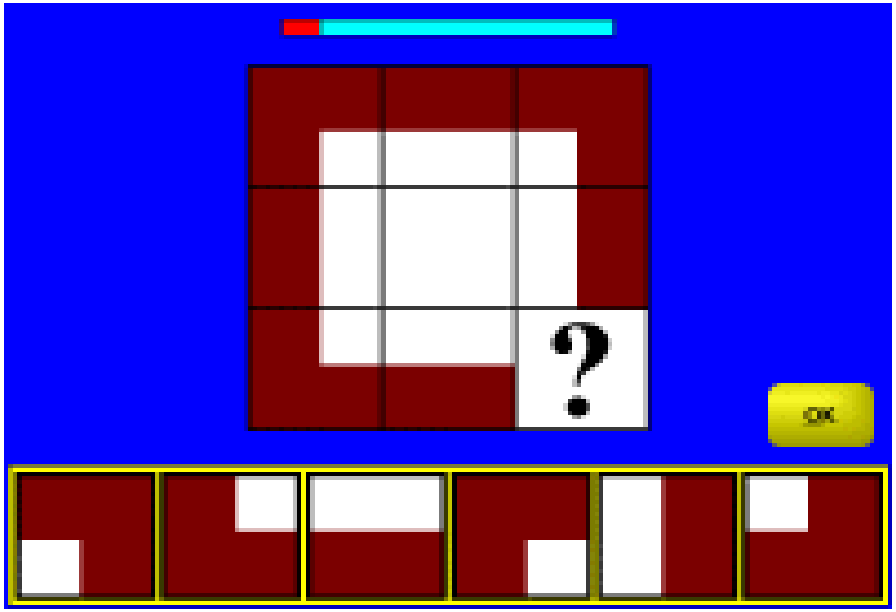
LASS Junior

- ‘Haunted Cave’ (Visual memory)
- ‘Mobile Phone’ (Auditory sequential memory)
- ‘Word Chopping’ (Phonological processing)
- ‘Funny Words (Phonic skills)

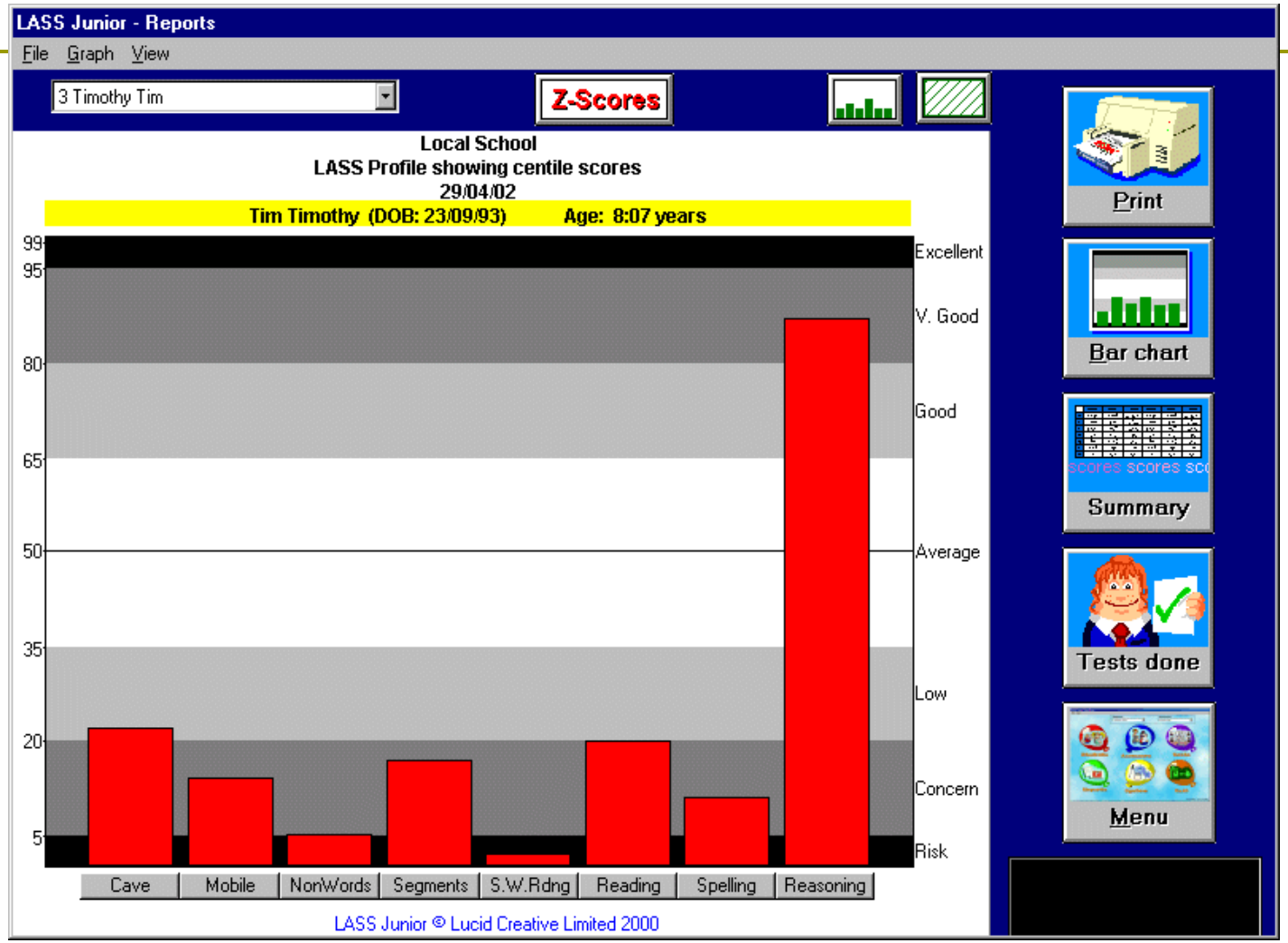
Attainment and ability tests in

LASS Junior

- **Word reading**
  (Single word recognition)
- **Sentence reading**
  (Reading comprehension)
- **Spelling**
- **Nonverbal reasoning**
  (Matrix reasoning)



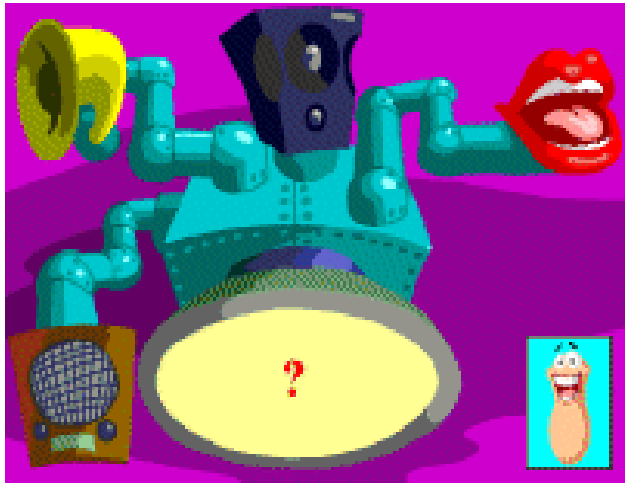
Example reports screen



LASS Secondary

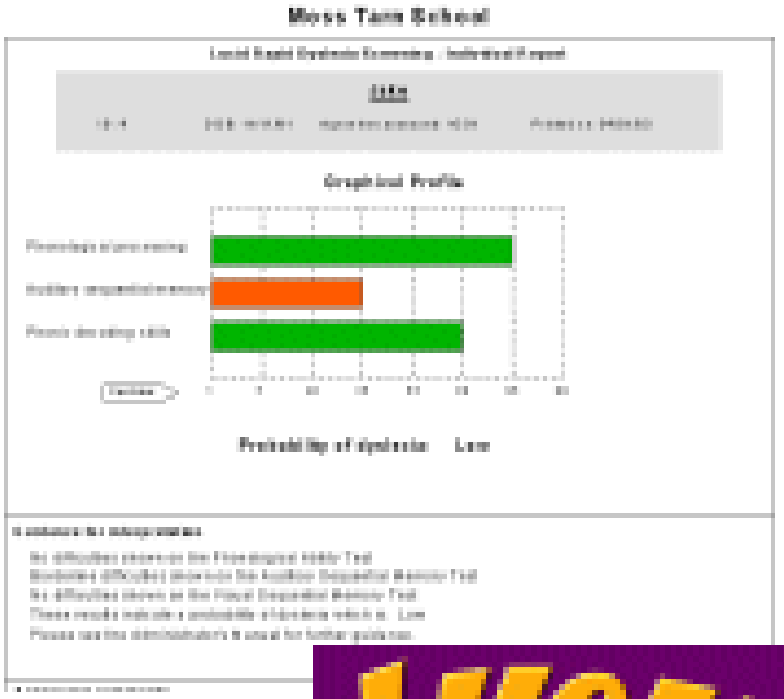
LASS Secondary

- Similar to LASS Junior, but designed for 11-15 year olds
- 4 diagnostic tests
- 4 attainment/ability tests
- Used in over 1,500 schools
- Can be used on a school network



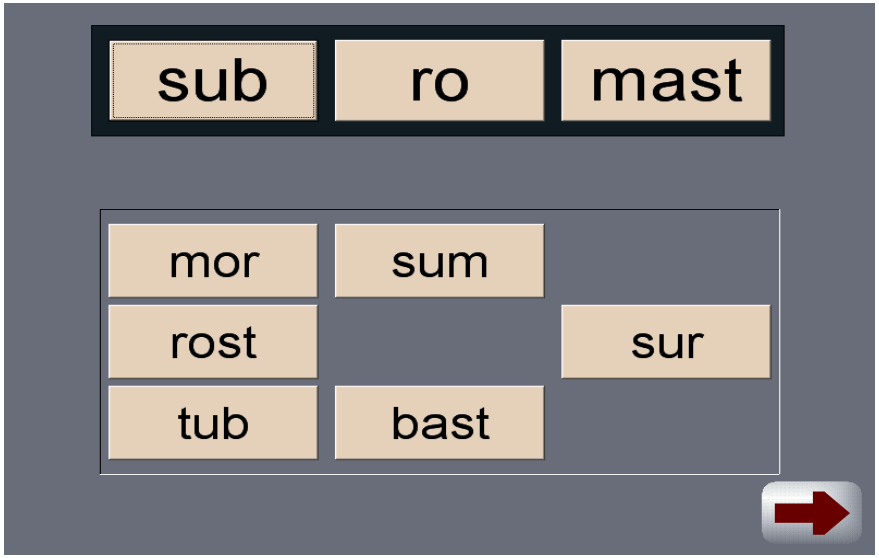
Lucid Rapid Dyslexia Screening

- Age 4 – 15 years
- Takes 15 minutes
- Contains three tests
  - **Phonological processing**
  - **Auditory working memory**
  - **Phonic decoding skills**
- Provides automatically interpreted reports
- Results can be incorporated into Lucid CoPS, LASS Junior and LASS Secondary



Lucid Adult Dyslexia Screening

- Adaptive screening test for adults aged 16 +
- Comprises four measures; takes about 20 mins
- Based on phonological deficit model of dyslexia
- Easy to use – does not need specialist expertise to administer
- Graphical profile of results available immediately
- Automatic interpretation



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