LASS 11-15

Lucid Assessment System for Schools

FOR AGES 11 TO 15 YEARS

Teacher's Manual

Fourth Edition
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Lucid

LASS 11-15 Teacher's Manual

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1 Introduction

1.1 What is LASS 11-15?

LASS 11-15 is a fully computerised multifunctional assessment system for use with students in the age range 11 years 0 months to 15 years 11 months.[1] ('LASS' stands for 'Lucid Assessment System for Schools').

LASS 11-15 has six broad applications:

routine screening on entry to secondary education
screening of all students in the age range for literacy problems
assessment of special needs in literacy
identification of specific learning difficulties and dyslexia
regular monitoring of progress in literacy
assessment of general ability

LASS 11-15 is very easy to administer: the computer delivers the assessment tasks to the student in the form of games, without the need for individual supervision, and scores the results immediately. The tasks, which are challenging and enjoyable, have been created specifically for students in this age range, with colourful cartoon-style graphics and high-quality digitised sound.

LASS 11-15 comprises the following eight assessment modules that can be used individually or in combination:

single word reading
sentence reading
spelling
reasoning
auditory memory ('Mobile')
visual memory ('Cave')
phonic skills ('Nonwords')
phonological processing ('Segments')

The full suite of eight computerised modules takes about 45 minutes, on average, to administer, but teachers may choose to administer only some of the tests if they wish. Most of the modules are adaptive tests — that is, the computer automatically adjusts the difficulty of the items to suit the ability level of the student. This means that assessment is faster and more efficient, and also prevents students becoming bored by items which are too easy or frustrated by items that are too difficult.

LASS 11-15 enables teachers to:

- obtain a reasonable estimate of the student's intelligence
- assess the student's attainments in reading and spelling and identify students who are under-performing in these areas
- measure discrepancies between actual literacy attainment and expected literacy attainment based on intelligence

[1] *LASS 11-15* can be used outside this stipulated age range, but considerable caution should be exercised when doing so (see Section 2.3.15 for further information).

- identify underlying problems in memory or phonological processing skills that could be the cause of under-performance in literacy
- identify students with dyslexia (specific learning difficulty)
- monitor development in reading and spelling on a regular basis
- assess improvements in memory, phonological and phonic decoding skills brought about by appropriate training or intervention

1.2 How LASS 11-15 was developed

LASS 11-15 was created by Lucid in conjunction with the same research team from Hull University that collaborated in the development and validation of the assessment programs *CoPS Cognitive Profiling System* (Singleton, Thomas and Leedale, 1996, 1997; see also Singleton, Thomas and Horne, 2000) and *CoPS Baseline Assessment* (Singleton, Thomas and Horne, 1998; see also Singleton, Horne and Thomas, 1999). The first version of *LASS 11-15* was known by this name, but in 2001 its name was changed to *LASS Secondary* because in that year Lucid released a version of the software for younger children, called *'LASS Junior'* (Thomas, Singleton and Horne, 2001), covering the age range 8 years 0 months to 11 years 11 months. *LASS Junior* was renamed *LASS 8-11* in 2009 at the same time that *LASS Secondary* reverted to its original title *LASS 11-15*.
LASS 8-11 comprises the same tests as *LASS 11-15*, but these were redesigned specifically for the younger age group, with easier items, age-appropriate graphics, and were standardised using a representative sample of pupils in the 8–11 age range. For further information about *LASS 8-11* and the other Lucid computerised assessment systems, please contact Lucid or consult the Lucid website (www.lucid-research.com).

The initial research to develop *LASS 11-15* was carried out over the period 1997 to 1999, using a total of 2,366 students aged 11 years 0 months to 15 years 11 months (mean 13 years 3 months, standard deviation of the sample 14.0 months) attending 28 different secondary schools in the UK. There were 1,302 boys and 1,064 girls. Pilot versions of the eight tests in the suite were trialled with these students, and feedback was obtained from the teachers administering the system. The data obtained from these trials were subjected to item analysis, including determination of difficulty levels for each item (pass rates), which were then incorporated into the adaptive algorithm in the adaptive tests in the suite. In addition, timings, progression rules and discontinuation rules were calibrated. The tests were then subjected to a standardisation process to obtain norms for each year group (see Section 1.2.1). Subsequent studies examined the validity and reliability of LASS 11-15 (see Section 1.2.2), whether it is subject to any gender bias (see Section 1.2.4) and whether students preferred LASS 11-15 to being assessed with comparable conventional tests (see Section 1.2.5).

At the time of publication of this fourth edition of the Teacher's Manual, *LASS 11-15* is in use in several thousand schools in the UK, and in many English-speaking schools across the world. In the years since its first release it has become an indispensible assessment tool for many teachers, but it is also widely used in many other settings, including **prisons**, **youth offender centres**, **careers guidance centres**, **community support centres**, and by national and local **voluntary associations** that serve the needs of students with dyslexia and other learning problems. Feedback from users indicates that the fact that students tend to prefer this method of assessment over conventional forms of assessment (see Section 1.2.5) is an important factor in the decision by many teachers to use *LASS 11-15*. However, the ease of use of the program, the flexibility of the system, and the value of the results in informing educational decisions also play a very significant part in decision-making.

Like all Lucid products, *LASS 11-15* conforms to the British Psychological Society's guidelines for the development and use of computer-based assessments (British Psychological Society, 1999a).

1.2.1 Standardisation

The eight tests in LASS 11-15 have been standardised so teachers using the system can establish where any given student falls on any of the components of the suite, in relation to the population norms. This means that direct and meaningful comparisons can be made between the individual tests that a single student takes. In addition, direct and meaningful comparisons can be made between students as well as between the student and national norms. The initial standardisation of LASS 11-15 was carried out in 1998, using a representative sample of 505 students (300 boys and 205 girls) attending 14 schools in different parts of the UK. The age range was 11 years 0 months to 15 years 11 months. The mean age was 13 years 2 months (standard deviation 14.3 months). For full details of the standardisation process, see Horne (2002).

1.2.2 Validity

Validity of new psychological and educational tests is usually established by comparing them with equivalent established tests. This is usually called 'concurrent validity'. Some difficulties may arise in the case of computer-based tests, where the modes of response (typically using a mouse) are different to those used in conventional tests (typically either oral or written responses). Inevitably, this tends to result in somewhat lower correlation coefficients that those obtained when comparing two similar conventional tests (for a discussion of these issues, see Singleton, 2001).

Bearing this limitation in mind, Horne (2002) carried out a concurrent validity study of *LASS 11-15* using 75 students (47 boys and 28 girls), age range 11 years 6 months to 15 years 11 months (mean age 13 years 6 months; standard deviation 17.0 months). This sample had been randomly selected from Year 7 to Year 11 registers in five different secondary schools in different regions of England and Scotland, the schools having been chosen so that pupils from a broad range of socioeconomic backgrounds were adequately represented. (These were not the same schools in which the reliability study had been carried out.) The students were tested on *LASS 11-15* (all modules except the Single Word Reading Test) and also tested within four weeks using well-known published conventional tests of skills that, as far as possible were equivalent or similar to those in *LASS 11-15*. The order of test administration was counter-balanced to control for order effects. The results, which are shown in Table 1, indicate significant correlations between the *LASS 11-15* tests and the comparison measures, with the highest correlation coefficients being obtained for the literacy measures (where there is the closest correspondence in the tasks involved). The somewhat lower correlation coefficients for the cognitive measures may be explained by differences in the modes of response (oral or motor in the conventional tests, via mouse input in LASS 11-15) and requirements of the tasks (e.g. in WMS-III spatial span, no semantic elements are included, whereas in the LASS 11-15 Cave test the student has to remember the object as well as its spatial position). Despite these inevitable limitations when comparing computer-based tests with conventional tests, it may be concluded that the results provide satisfactory concurrent validation for the tests in *LASS 11-15*. This study has been submitted for publication (see Horne Singleton and Thomas, 2003a).

Table 1. Correlation coefficients obtained between LASS 11-15 tests and equivalent or similar conventional tests (n=75).

LASS 11-15 test	Comparison test	**Correlation**

		coefficient (r)*
Sentence reading	NFER Sentence Completion Test	0.75
Spelling	British Spelling Test Series 3	0.88
Reasoning	Matrix Analogies Test	0.52
Cave (Visual memory)	Wechsler Memory Scales (WMS-III) Spatial Span (total score)	0.37
Mobile (Auditory memory)	Wechsler Memory Scales (WMS-III) Digit Span (total score)	0.55
Nonwords (Nonword reading)	Phonological Assessment Battery (PhAB) Nonword Reading	0.43
Segments (Syllable segmentation)	Phonological Assessment Battery (PhAB) Spoonerisms	0.45

** All correlations except Cave are significant at p<0.001 or better; the correlation for Cave was significant at the p<0.01 level.*

Validity of assessment instruments may also be established by another method, in which the instrument is used to predict which individuals do, and which do not, fall into a given category. This is usually called 'predictive validity'. In the case of *LASS 11-15* the most obvious test of this would be to see how effective it was in identifying dyslexia in a group of students that contained by known dyslexic and known non-dyslexic individuals. Horne (2002) carried such a study using 176 students (102 boys and 74 girls), age range 11 years 6 months to 15 years 11 months (mean age 13 years 7 months; standard deviation 17.4 months). This sample had been randomly selected from Year 7 to Year 11 registers in five different secondary schools in different regions of England and Scotland, the schools having been chosen so that pupils from a broad range of socioeconomic backgrounds were adequately represented. The sample was broken down into a group of 30 students (21 boys and 9 girls) who had been diagnosed by educational psychologists as having dyslexia, 17 students (11 boys and 6 girls) with other special educational needs ('other SEN group'), and 129 students (76 boys and 59 girls) without special educational needs ('non-SEN group'). The dyslexic group scored significantly lower than the non-SEN group on five of the seven *LASS 11-15* tests (sentence reading, spelling, auditory memory, nonword reading and syllable segmentation). There were no significant differences between the dyslexic group and the non-SEN group on *LASS 11-15* reasoning or visual memory. However, the other SEN group scored significantly lower than the non-SEN group on all seven of the *LASS 11-15* tests used in the study. Comparable results were found when the same groups were compared on several conventional tests (the tests used are listed in the column headed 'Comparison tests' in Table 1). These findings fit well with established views about dyslexia – i.e. that dyslexic students are comparatively poor on measures of literacy, phonological skills and auditory memory and these weaknesses are not due to low intelligence (see Snowling, 2000) – and provide validation for the use of *LASS 11-15* in the identification of dyslexia. When the overall profile of scores was examined, *LASS 11-15* was found to have correctly identified 79% of the dyslexic students as having dyslexia, compared with 63% success rate for the equivalent conventional tests and only 59% using the phonological measures alone. These results provide convincing predictive validity for the use of *LASS 11-15*, which had rather greater accuracy than a mixture of conventional tests. This study has been submitted for publication (see Horne Singleton and Thomas, 2003b).

1.2.3 Reliability

The term ‘reliability’, when applied to a psychometric test, usually refers to the extent to which it can be expected to yield similar results when administered to the same individual on different occasions. This is sometimes referred to as ‘test-retest reliability’.

Horne (2002) investigated the test-retest reliability of *LASS 11-15* using 101 students (55 boys and 46 girls) aged between 11 years 6 months and 15 years 11 months (mean age 13 years 8 months; standard deviation 16.5 months). This sample had been randomly selected from Year 7 to Year 11 registers in seven different secondary schools in different regions of England and Scotland, the schools having been chosen so that pupils from a broad range of socioeconomic backgrounds were adequately represented. The students were tested on *LASS 11-15* (all modules except the Single Word Reading Test) and then retested four weeks later. The results (see Table 2) show that in all cases, significant test-retest correlation were obtained, indicating satisfactory test-restest reliability. Higher correlations were found for the literacy measures than for the cognitive measures. It appears most likely that the somewhat lower (but nevertheless significant) correlations for the memory measures is due to greater susceptibility of these task to practice effects arising from enhanced motivation and application of strategic thinking at the retest. This study has been submitted for publication (see Horne Singleton and Thomas, 2003a).

Table 2. Test-retest correlation coefficients for LASS 11-15 tests over a four week period (n=101).

LASS 11-15 test	**Correlation coefficient (r)***
Sentence reading	0.85
Spelling	0.93
Reasoning	0.51
Cave (Visual memory)	0.53
Mobile (Auditory memory)	0.58
Nonwords (Nonword reading)	0.77
Segments (Syllable segmentation)	0.74

** All correlations are significant at p<0.001 or better.*

1.2.4 Gender differences

Studies of gender differences in education typically find that girls out-perform boys in school attainment (see Fergusson & Horwood, 1997) and that boys are more likely to be referred for educational difficulties (see Vardill, 1996). Nevertheless, it is generally held that psychological and educational tests should, as far as possible, be free of gender bias, so that when decisions about children’s progress are being made (especially where special support may be required) this can be based on information derived from sources that favour neither girls nor boys. On the other hand, it has sometimes been suggested that computer-based tests may favour boys because of their supposed greater interest in computers (see Crook, 1996). If this is the case, it could distort results obtained using a computer-based assessment such as *LASS 11-15*.

Horne (2002) carried out a study to investigate possible gender bias in *LASS 11-15*, using 176 students (102 boys and 74 girls), age range 11 years 6 months to 15 years 11 months (mean age 13 years 7 months; standard deviation 16.7 months). This sample had been randomly selected from Year 7 to Year 11 registers in twelve different secondary schools in different regions of England and Scotland, the schools having been chosen so that pupils from a broad range of socioeconomic backgrounds were adequately represented. The results (see showed that although girls scored consistently higher than boys in all except the Cave test (Visual memory), in no cases were these differences found to be statistically significant. When the same sample was examined for possible gender bias on equivalent conventional tests (the tests used are listed in the column headed ‘Comparison tests’ in Table 1) the only significant difference to be found between boys and girls was on the British Spelling Test Series 3, where girls outperformed boys. With this one exception, therefore, there was no evidence that either the conventional or the *LASS 11-15* computer-based tests are biased in favour of boys or girls. This study has been submitted for publication (see Horne Singleton and Thomas, 2003c).

Table 3. Gender comparisons on LASS 11-15 tests (mean z scores).

LASS 11-15 test	Female	**Male**
Sentence reading	0.87	0.71
Spelling	0.79	0.64
Reasoning	0.62	0.54
Cave (Visual memory)	0.27	0.33
Mobile (Auditory memory)	0.66	0.40
Nonwords (Nonword reading)	0.78	0.51
Segments (Syllable segmentation)	0.56	0.47

1.2.5 Student preferences

It is a fairly well-established finding that most students prefer computer-based tests to conventional tests (see Singleton, 1997, 2001, 2003). In the validity study carried out by Horne (2002) (see Section 1.2.2), the students were asked whether they preferred the computer-based tests or the conventional tests. The results were that 54 of the 75 pupils (72%) preferred the computer-based tests while only 17 preferred the conventional tests (23%). There were no significant gender differences in this preference pattern. These findings have implications for assessment, especially where disaffected pupils are concerned. If students enjoy doing computer-based tests, they are likely to be more motivated and stay on-task. This helps to produce results that teachers can be confident about.

1.3 Getting started with LASS 11-15

1.3.1 Correct time, date and date format used by your computer

Before you install the *LASS 11-15* program it is important that your computer is configured to use dates correctly. *LASS* has to calculate students’ ages using their date of birth and the computer system date. Ensure that the computer’s system date is accurate (in *Windows* ® you can check the date and time using the digital clock/calendar at the extreme right of the Task Bar). For users in the UK, Eire and many other English-speaking countries you should use the computer’s *Regional Settings* (see *Windows* ® *Control Panel*) to check that the *Short Date style* used by the computer is in the format *dd/mm/yy*.
If you are in North America you should be using the American version of *LASS 11-15*, which is called ***LASS Senior***. You should then use the appropriate date format *mm/dd/yy*.
If your computer is brand new please check that the *Regional Settings*, including the *Short Date style* are configured appropriately.

1.3.2 Installing LASS 11-15

Installation of *LASS* is straightforward.
To view the start-up menu screen put the *LASS* CD in the CD-drive.
On the Windows desktop select **Start** and then **Run** and enter the command line:

D:\SETUP

where D is your CD drive letter. The start-up menu has options to install the software (and database components if you are using the networked version) and to view the user manuals in *Adobe Acrobat* ®.
You can obtain a free copy of the *Acrobat* ® *Reader* ® from www.adobe.com.

1.3.3 Running LASS 11-15 — Serial Number and password

After installation you should launch the *LASS 11-15* program from its Desktop icon. If this is the first time you have used LASS you will be required to register your software by entering details for the licensee, school or institution and serial number. The serial number will be found in the inside of the DVD case in which the CD was delivered.

Whenever you run *LASS 11-15* you will need to enter the administrator password.
Your password is initially set to **lucid** (all letters lower case)
You can alter this password at any time should you wish to.

For information on registering new students, deleting students, archiving, security settings and passwords, please consult the **LASS 11-15 Software Guide,** which can be found on the *LASS* CD as an *Adobe* ® *PDF* file, or can be viewed from within the LASS program as a web page.

1.3.4 Using the tests in LASS 11-15

Before administering any test in *LASS* please read Chapters 2 and 3. Together, these provide detailed guidance on how to select *LASS* tests and administer them. Although *LASS 11-15* is mostly used in schools, it may also be used in other settings, and by professionals other than teachers. Nevertheless, for convenience throughout this manual, the term 'teacher' is typically used to refer to the person supervising the test administration. Where appropriate, the terms 'test administrator' or 'supervisor' may be substituted for 'teacher'.

1.3.5 Interpreting LASS 11-15 results

Before attempting to interpret *LASS 11-15* results, and especially when drawing up an Individual Education Plan (IEP) or considering educational provision for any student in detail, teachers are strongly advised to consult Chapters 4 and 5. Chapter 7 provides case studies in interpreting *LASS* results, which teachers will find very helpful.

Results obtained from *LASS* are analysed in relation to norms in 12-month age bands, and are shown as centile scores (or standard deviations) on a graphical profile that can be printed out. In addition, detailed results from every item delivered to the student are accessible to the teacher. The system is maintained under password security, so that the teacher is in complete control of what tests the students are permitted to do, and only the teacher has access to results.

Interpretation of results obtained from *LASS* is straightforward. It is easy to spot students who are under-performing in literacy in relation to their age and/or intellectual potential. It is also straightforward to verify if any difficulties are likely to be of a dyslexic nature — i.e. caused by underlying cognitive problems in phonology and/or memory. All this information can be used in formulating Individual Education Plans (IEPs) and is valuable when deliberating whether or not to request a formal assessment by an Educational Psychologist. *LASS 11-15* can also be used on a regular basis (e.g. every term) to monitor progress in reading and spelling, or check development in phonic skills.

1.3.6 Teaching activities and resources

Chapter 6 provides guidelines and suggestions regarding teaching activities and resources that may be adopted in cases where *LASS* results indicate a problem or potential problem in the student's learning. This is supplemented by further information and resources on the Lucid website (www.lucid-research.com), which is updated from time-to-time. In particular, since going to press, educational software that is recommended in this manual may have been withdrawn from sale, superseded or augmented by new programs. The case studies in Chapter 7 also include suggestions on learning and teaching, and in Chapter 8 Anita Keates describes how *LASS 11-15* and *LASS 8-11* have been implemented in two different schools.

Use of *LASS* does not imply any obligation to follow a particular line of teaching, and teachers, as professionals, will naturally wish to use their own judgement regarding what is, and is not, suitable for any given student. Nevertheless, it is strongly recommended that teachers read the teaching advice provided in this manual, as it is likely that they will find ideas and strategies that they had not previously considered. This is especially likely if the teacher is not very experienced in working with students who have specific learning difficulties.

To keep up to date with software developments and other teaching resources, teachers should consult the Lucid website (www.lucid-research.com). In addition, the British Dyslexia Association publishes information on recommended software and teaching materials (www.bdadyslexia.org.uk).

1.3.7 Training courses

Training courses in the use and interpretation of *LASS* may be available through Lucid-approved third party organisations, usually within the UK.
For further information please contact Lucid, or visit the website (www.lucid-research.com).

1.3.8 Troubleshooting

Problems in running Lucid assessment software are rare; those that do occur are usually related to installation or connection problems on school or college networks, User Account restrictions, computer date and time inaccuracies and incorrect Regional settings on computers.
Lucid's technical support team can usually resolve these types of issues fairly quickly - please contact us if you need help. It is often quicker and more efficient to use email, as an initial exchange of information may be required to diagnose and resolve an issue. Initial information which will be required by Lucid includes (1) Software title (2) Software version number (3) Software serial number (4) Software licence details.
The technical support email address is technical@lucid-research.com.

You can also contact Lucid by telephone during office hours 9-5 Monday to Friday (GMT). See our website www.lucid-research.com for contact details.

2 Administering LASS 11-15 tests

2.1 Composition of the LASS 11-15 suite

2.1.1 Outline of tests

The LASS 11-15 suite comprises three **attainment** tests (single word reading, sentence reading and spelling), one **ability** test (reasoning) and four **diagnostic** tests (auditory memory, visual memory, phonic skills and phonological processing). An outline of each test is given in Table 4. Three of the eight tests (***Sentence Reading, Spelling*** and ***Reasoning***) are *adaptive*, i.e. they are based on statistical item response theory (IRT), whereby each test item is selected from a large bank of items, each of which is of known difficulty for students of that age group. The remaining tests are *progressive* in format, i.e. they utilise a graded series of items of increasing difficulty for students of that age group. In some of the tests there is a discontinuation algorithm built in, whereby the test will automatically cease once the student's current attainment or ability level has been exceeded beyond reasonable statistical error; otherwise, the student must attempt all items in the test.

For each test, instructions are spoken by the computer, and practice items are given to familiarise the student with the test requirements. When the student has completed the practice items, the test phase begins.

2.1.2 Adaptive assessment

The term 'adaptive testing' refers to any technique that modifies the nature of the test in response to the performance of the test-taker. Paper-based tests are *static* instruments, fixed in their item content, item order, and duration. By contrast, computer-based assessment can be *dynamic*. Since the computer can score performance at the same time as item presentation, it can modify the test accordingly, tailoring it to the capabilities of the individual taking the test much more effectively than has ever been possible before.

Conventional tests can be very crude instruments in which, much of the time, the individual's abilities are not being assessed with great precision because the items are either too difficult or too easy. In an adaptive test the individual can be moved swiftly to that zone of the test that will most efficiently discriminate his or her capabilities, thus making assessment shorter, more reliable, more efficient, and often more acceptable to the person being tested. The savings in testing time are distinctive and can far outweigh any disadvantages of transferring from conventional methods to computer-based methods. For example, Olsen (1990) compared paper-based and computer-administered school achievement and assessment tests with computerised adaptive tests. The computer-based non-adaptive version took 50–75% of the time taken to administer the conventional version, while the testing time for the adaptive version was only 25% of the time taken for the paper-based version.

Table 4. Composition of the LASS 11-15 suite of tests

TEST	CATEGORY	TYPE	**DESCRIPTION**
Sentence Reading	Attainment	Adaptive	Cloze reading — completing sentences by identifying the missing

TEST	CATEGORY	TYPE	**DESCRIPTION**
			word from a choice of five alternatives. No spoken assistance is given.
Single Word Reading	Attainment	Progressive	Reading individual words out of context — identifying from a choice of five alternatives the printed word that corresponds to a spoken word.
Spelling	Attainment	Adaptive	Spelling individual real words that are spoken by the computer.
Reasoning	Ability	Adaptive	Non-verbal intelligence — analogical reasoning where the correct item from a choice of six alternatives has to be selected in order to complete a spatial matrix.
Mobile	Diagnostic	Progressive	Auditory sequential memory (digit span) — recall of between two and nine digits in correct (forwards) sequential order.
Cave	Diagnostic	Progressive	Visual memory — immediate recall of objects and their spatial positions, beginning with two items and progressing to seven items.
Nonwords	Diagnostic	Progressive	Reading individual nonwords — a pure measure of phonic decoding skills. For each nonword there is a choice from four spoken alternatives.
Segments	Diagnostic	Progressive	Phonological processing ability — segmentation and deletion of syllables and phonemes in real words. For each item there is a choice from four spoken alternatives.

In each of the three adaptive tests in *LASS*, the program first gives the student a series of 'probe' items to determine the range of optimal item sensitivity for that student. These are followed by a series of test items starting in the range of optimal item sensitivity and increasing in difficulty until the student's current attainment or ability level has been exceeded beyond reasonable statistical error, whereupon the test ceases. The program incorporates a facility to regress to easier items should it transpire that, by chance, the result of the probe items has overestimated the student's approximate ability or current attainment level.

2.2 Summary details of each test

2.2.1 Sentence Reading

Sentence Reading is an adaptive test that involves finding the missing word in a sentence. Students are presented with a sentence that has one word missing and a picture to go with the sentence. Students select the correct word from five words at the bottom of the screen by clicking on it and then clicking on the OK button to move on. The student starts by attempting some 'probe' items to determine the level at which they should start the test. Their progress through the test depends on their performance and the test is discontinued when the student fails a certain number of items within one level.

2.2.2 Single Word Reading

Students are presented with a picture of an object on the screen and hear the word spoken by the computer. Students select the correct word from five words at the bottom of the screen and then click on the OK button to move on. This test is not adaptive and the student must attempt all of the items.

Single Word Reading is the only test in the *LASS* suite for which scores are not distributed in a normal curve. In fact, there is a significant negative skew, indicating that most students will achieve a maximum or near-maximum performance (in statistical terms this is sometimes referred to as a *'ceiling effect'*). The ***Single Word Reading*** test does not have sufficient sensitivity to discriminate amongst students within the average range, and so its use should be confined to students who are *significantly behind* in reading development, either to determine their attainment level or evaluate progress.

2.2.3 Spelling

Spelling is an adaptive test that involves spelling single words. Students are presented with a picture on the screen and hear a word and a sentence putting the word into context. Students spell the word using keyboard entry and then click on the *Enter* key or *OK* button to move on. The student starts by attempting some 'probe' items to determine the level at which they should start the test. Their progress through the test depends on their performance and the test is discontinued when the student fails a certain number of items out of the last few attempted.

2.2.4 Reasoning

Reasoning is an adaptive test involving matrix puzzles that can be solved by a careful application of logical reasoning, using both visual and verbal strategies. Students are shown a 3 × 3 matrix with the bottom right hand square empty. Students choose which of six squares at the bottom of the screen complete the pattern. They then click on the OK button to move on. The student starts by attempting some 'probe' items to determine the level at which they should start the test. Their progress through the test depends on their performance and the test is discontinued when the student fails a certain number of items out of the last few attempted.

2.2.5 Cave

Cave is a visual spatial memory test set in a cave with eight hollows in the wall. Different pictures, called 'phantoms', appear in different hollows one at a time and then disappear. The student must remember which phantom went in which hollow. After the phantoms have disappeared they are shown on the bottom of the screen along with two distractors. The student must select the phantoms that were presented, by clicking the mouse on them, dragging them to the correct hollow and dropping it. The student can put the phantoms back in any order as this is not a test of sequential memory. Each item has a (fairly generous) time limit in order to increase the challenge of the task: the instructions are that the phantoms must be put in their correct positions 'before the candle burns out'.

All students start with a presentation of two phantoms and complete twelve trials in total. When a student has correctly placed two phantoms they move on to three phantoms and so on until the twelve trials have been completed. The maximum number of phantoms that can be presented is eight. The number of distractors also increases as the test progresses, so increasing the overall difficulty of the task.

2.2.6 Mobile

This test is a measure of auditory sequential memory involving digit span. The student is given a telephone number to remember which they then enter onto a mobile phone using the mouse. The student then clicks on the green phone button when s/he has finished. Students must get both practice items (three digit numbers) correct before moving on to the test items. All students start with two trials of three digit numbers and if they answer one or both correctly then they move on to two trials of four digit numbers and so on up to nine digits. If a student fails both trials on a level then the test is automatically discontinued.

2.2.7 Nonwords

Nonwords is a test of phonic decoding skills, comprising 25 items, presented in order of difficulty. A nonword is presented visually on the screen, the sound system represented on screen will then play four different versions of the word. The student can hear these different versions as many times as they want to by hovering the mouse over the loudspeakers. When they hear the version of the word that they think is correct they click on that loudspeaker and then on the red button to move on to the next item. Students must attempt all 25 items in the test.

2.2.8 Segments

Segments is a test of syllable and phoneme deletion that identifies poor phonological processing ability. The test comprises 32 items, presented in order of difficulty. Students are presented with real words and asked what each word would sound like if part of the word was removed. Students can hear the instructions for each item as many times as they want by clicking the question mark on the sound system represented on screen. The sound system plays four different answers which the student can hear as many times as they want to by hovering the mouse over the loudspeakers. When they hear the answer that they think is correct they click on that loudspeaker and then on the red button to move on. The student must attempt all the items in the test.

2.3 Guidelines for administering LASS 11-15 tests

2.3.1 Is the teacher familiar with the test being administered?

Assessing students with *LASS* is straightforward, but before you begin to test students you should first run through the complete suite of tests to familiarise yourself with them. To do this you should register yourself as a 'student'. If you wish to exit any test and return to the *tests menu* before the end, then press F4. This quick exit from a test is also useful when demonstrating the program to other teachers or for use in training sessions. However, they should not be used when testing a student unless absolutely necessary — see Section 2.3.12.

2.3.2 Is the testing environment satisfactory?

The ideal testing environment is one that is reasonably quiet, with minimal distractions. This could be a separate room, but *LASS* has been designed to use in the ordinary classroom, where distractions are often unavoidable. Visual and auditory distraction (both to the student being tested and to other students in the class) should be minimised. It is recommended that the computer and the student are positioned in such a way that the student is not looking directly at the rest of the class, nor should the rest of the class easily be able to see the monitor screen. The best position for this is usually in the corner of the room. To minimise auditory distraction, headphones are recommended. Inexpensive lightweight headphones of the type used for portable audio equipment will be adequate (but not the type that are inserted into the ear).

The student should be sitting comfortably at a suitable level in front of the computer screen (not too high or low, in order for them to see the screen and use the mouse satisfactorily). It is not recommended that students attempt the tests standing up, as they are more likely to move about and alter the angle at which the screen is viewed – this can lead to failure to see everything that is happening on the monitor, and can also disrupt mouse control. The supervisor should check for reflections on the monitor from windows and lights that could impair the student's perception. To do this the supervisor should check by viewing the screen from the same position that the student will adopt.

It is not recommended that students attempt the tests when other students are standing or sitting in a position in which they can become involved in the task or act as a distraction. It will be hard for other students to inhibit their responses and their behaviour may influence the decisions of the student being tested.

It is usually not necessary for students of this age to be closely supervised while attempting the tests, unless the teacher has a particular reason to do so. The tests in *LASS* have been designed to be interesting and stimulating for students in this age group and the vast majority of students are highly motivated to do their best. Once the teacher is satisfied that the student understands the requirements of a test, has completed the practice items and has moved on to the test items, the teacher may leave the student to complete that test. However, where the teacher suspects that a student may not be well motivated to complete the test, or may be easily distracted, closer supervision is advisable. In particular, disaffected students, or those with very low ability, may need closer supervision in order to provide encouragement and ensure they remain on task.

2.3.3 Is the equipment functioning correctly?

The teacher or supervisor should check that (a) the monitor display is clear and its colours correct, (b) the sound system (speakers or headphones) is audible (not too loud or to soft, and without interference), and (c) the mouse is functioning correctly (it may need cleaning) and is positioned in front of the student on a suitable surface so that its movements are unimpeded.

2.3.4 Is the student prepared for the task?

It is important that the student *understands* the *nature* of the task, *how* to indicate responses to the computer using the mouse, and *when* to respond (essentially when the tests will allow them to respond). Students should not be allowed to take the tests if they are unwell, as results are likely to be unreliable. In general, students will experience no difficulty in understanding the instructions spoken by the computer and in following the practice tasks. This should enable them to progress to the test phase without special attention from the teacher. However, if the student does not understand any instructions the supervisor may re–express them in a more suitable manner. Explaining and re-expressing the task requirements to the student may continue into the demonstration and practice stages of each test. This is particularly useful for any student who is experiencing problems in understanding the true nature of the task. It is often easier for the student to comprehend the task requirements by experience of the practice stages, than by more abstract oral explanation. Once the test items commence, there should be no further aid given to the student.

2.3.5 Choosing which tests to administer

LASS 11-15 is a *suite* of eight tests, each of which has a different function. Teachers can choose to give *all* or *some* of the tests. *LASS* is a complex assessment package and a great deal of research and careful thought has gone into its development — each and every test component is there for a specific purpose, and each test can give the teacher valuable information about the student.

Much will depend on the purposes of the assessment and the teacher's knowledge of the student's difficulties. If nothing is known about a student, it is strongly recommended that all of the tests should be administered except ***Single Word Reading***, thereby accessing the fullest information. (However, if the ***Sentence Reading*** result is low, then it would be appropriate to administer ***Single Word Reading*** also.) On average, this should take between 30 and 45 minutes to complete, in total. If the teacher already has useful information (e.g. about reading and spelling attainment) it should be adequate to concentrate on the other assessment components of the program.

Although it is desirable to give the full suite of tests to each student, it is not absolutely *essential.* If time is short, it is acceptable to administer a subset of the tests instead of the full suite, in which case the issue of choice of tests arises. In this situation, it is helpful to think of *LASS* as a *kit of tools*, with the teacher choosing one or more of those tools for specific purposes. There are instances in which a teacher requires information about a student's abilities in a particular aspect of attainment (e.g. reading or spelling) or particular cognitive domain (e.g. memory or phonological processing). In such circumstances it is perfectly acceptable for the teacher to carry out *only* the most appropriate *LASS* tests rather than administering all of them.

In order to make sensible choices about which tests to administer and which to leave out, teachers first need to understand what each of the tests is for. To develop an understanding of the tests, teachers are advised to study Chapters 4, 5 and 7. It should be noted that the ***Single Word Reading*** test is the only one in the *LASS* suite for which scores are not distributed in a normal curve. In fact, there is a significant negative skew, indicating that most students will achieve a maximum or near-maximum performance (in statistical terms this is sometimes referred to as a '*ceiling effect*'). The ***Single Word Reading*** test does not have sufficient sensitivity to discriminate amongst students within the average range, and so its use should be confined to students who are *significantly behind* in reading development, either to determine their attainment level or evaluate progress.

Whichever strategy teachers adopt for selecting *LASS* tests for administration to any given student, it is strongly recommended that first they should familiarise themselves thoroughly with *all* the tests, how they are delivered and what cognitive abilities they measure. In other words, to make the most effective use of *LASS*, teachers need to know about *all* the 'tools' in the *LASS* 'kit', what they are for and how they are used. This will require trying out the tests as well as consulting the relevant sections of this manual. Only then can teachers make an informed professional decision about how best to use *LASS* to meet their particular assessment needs.

2.3.6 Order in which tests are administered

The *order* in which *LASS* tests are attempted is not particularly important. As teachers become more experienced with the program, they will find that they develop their own views about what tests are most useful to begin with, or to use in certain cases.

2.3.7 Number of tests to be administered per session

It should be obvious that a satisfactory test result cannot be obtained if students are not attending to the tasks and attempting to do their best. However, the *LASS* tests are mentally demanding and students can easily become mentally fatigued after a few tests. The effort that they apply can diminish significantly, although they may still enjoy the activity. Consequently, even though students may express a desire to continue it is recommended that the teacher or supervisor should use his or her discretion in deciding whether or not to administer more tests in the current session. Many teachers find that *three or four tests* per student are sufficient in any one continuous session. However, this may vary according to the concentration level of the student and other factors. Some students in this age range are quite capable of completing all tests in a single session.

2.3.8 Switching the cartoons on/off

Each test in *LASS* (in the stand-alone version only) can be preceded by (and closed) with a humorous animated cartoon. These cartoons have been designed with students of this age in mind and each last about one minute or less. They provide additional stimulation and interest as well as helping to engage students who might otherwise be difficult to assess. The cartoons setting is normally off, though they can be turned on for one or multiple students by altering the *'Show cartoons'* setting on the 'Security' menu in the *Reports and Administration* section of the *LASS* software.

Note: This option has been discontinued in the networked edition of *LASS 11-15*.

2.3.9 Is the assessment being conducted fairly?

In order for the assessment to be 'fair' (i.e. to give a reasonably accurate representation of the student's abilities) it is essential for the supervisor to ensure that during the test:

- the student is paying attention, is 'on task' and is not distracted
- the student does not become unduly fatigued
- there is no teaching or helping with the task during the test items (whether from the supervisor or other students)

- there is no 'cheating' — this may take the form of the student placing his or her hands on the computer screen to circumvent the memory element of the test (e.g. in ***Cave***).
- feedback from the supervisor is minimised and encouragement consistent

2.3.10 Giving encouragement, prompts and feedback

As much as possible, *the supervisor should avoid giving specific feedback to students during a test*, because this may influence their behaviour in an undesirable fashion. There is a risk of feedback differentially affecting students, so that some are encouraged and others discouraged. *LASS* itself provides limited feedback (e.g. 'good') where appropriate. Nevertheless, some students will try to elicit additional feedback from the supervisor about their performance. This may take the form of both verbal and non-verbal behaviours. For example, the student may ask directly if they were correct. Many students will look for the supervisor's facial and bodily reactions to their responses. Some students may even try to evaluate the supervisor's reaction by observing the supervisor's reflection in the monitor screen. For these reasons it is usually preferable that the supervisor sits to the side and slightly behind the student to minimise any feedback to the students which may bias the results.

Rather than specific feedback, *general encouragement* should be given to the student. This encouragement should be referenced to task completion rather than task accuracy and ideally should be delivered equitably to all students. However, it is inevitable that some students will require more encouragement than others, and where this is the case the teacher should be mindful of the possibility of influencing results unduly. Differential encouragement between students is likely to have an influence on the results obtained, and therefore should be avoided where possible. Some key phrases and general incentive prompts which may be used to aid the administration of the tests include: "well done"; "you were good at that game (or level), now try the next one"; "you will like this game"; "now concentrate on this"; "try hard"; "listen very carefully"; "have a go at these ones"; "have a try"; "just do your best".

Unless it is felt absolutely necessary, *prompting during the actual test items should be kept to a minimum.* For the most part any necessary prompting should occur during the pauses between test levels and the tests themselves. However, these prompts must be used with careful consideration. It is very important that any prompting should not significantly affect the students' performances differentially. Ideally these prompts should be given to every student equally and be utilised as general encouragement in order to maintain concentration. They should not be related to students' specific accuracy performances, which is likely to lead to students receiving differential encouragement due to the fact that some students will inevitably perform better than others.

2.3.11 Keeping a Comments Record

It is recommended that the teacher keeps a brief written record of the student's behaviour at each time of *LASS* testing, particularly noting such factors as health, tiredness, attention, concentration, distractions, and general motivation. A template **Comments Sheet** is provided in the Appendices of this manual (see Section 9.3, page 101). This may be photocopied or printed freely and used for recording any observations during testing. This record can then be referred to when interpreting the student's *LASS* profile. The teacher should particularly be on the lookout for colds and coughs, which not only disturb concentration but which can also affect hearing.

The following are examples of suggestions regarding completion of the *LASS* Comments Sheet:

Testing Room: e.g. 'quiet room', 'classroom — noisy' (also mention any uncomfortable conditions)

Health: e.g. 'good', 'had bad cold', 'coughing' (also mention any other health factors)

Attention: e.g. 'good', 'fair', 'distracted', 'tired'

Other comments: e.g. 'over-confident', 'responded very quickly', 'nervous at first', 'did not understand instructions', 'could not hear computer properly', 'unconfident — kept asking "Is that right?"'

2.3.12 Abandoning a test prematurely

Very occasionally, an administrator will want to abandon a test before the student has completed it. This necessity may arise as a result of some unforeseen circumstances, which may interfere with the smooth progress of the assessment. You can quit from a test prematurely by waiting until the mouse pointer is visible and then press the **F4** key **once**. It may take a few seconds to respond before you are returned to the menu screen. The student cannot restart the test where they left off (a consequence of this would be to invalidate the results). It may be necessary for the student to attempt the test at a later date depending on the reason for premature abandonment. Premature exiting from a test is generally used for demonstration purposes rather than in real testing situations. **Students should NOT be instructed or allowed to use the F4 key, which should only be used in extreme circumstances because all of the data for that partial attempt will be lost.**

2.3.13 Re-testing with LASS 11-15

Teachers often ask 'How soon can a student be re-tested with *LASS 11-15*?' The answer depends on why re-testing is being considered. If the teacher has good reason to believe that a given result is not truly indicative of a student's ability because of some hindrance factor, then re-testing can be as soon as is convenient (see Section 7.11 for an illustration of this). For example, this would be the case if a student had a cold and could not hear the words, was unwell and not able to concentrate, was excessively nervous, or because there were unexpected distractions in the room. Obviously efforts should be made to ensure that those hindrance factors have been resolved before re-testing. To retest, either re-register the student with an amended name (e.g. *Williams2* if the original surname was *Williams*) or use the *'Fine Tuning'* menu in *Reports and Administration* to wipe the test(s) from the original testing session. See the **LASS Software Guide**.

If the teacher wishes to see if the student has improved as a result of some intervention then a sensible interval should be allowed before re-testing. In general, three months would be recommended as the minimum interval, but this could be less if the teacher had good reason for doing so. Repeated re-testing at short intervals is not advisable, because under those circumstances any ability or attainment test is likely to show spurious improvements in performance by virtue of practice effects.

2.3.14 Problems of time-shortage for testing

In cases where teachers wish to administer all the tests in the *LASS* suite, but are prevented from doing so because of lack of time, useful strategies for solving time-shortage problems include:

- Ensuring that administration of *LASS* is part of *school policy* and that appropriate staff time is *allocated* for it on the timetable, rather than expecting teachers somehow to *create* the time on top of their other responsibilities. Giving *LASS* to students does take time, but all teachers in the school should accept that it is time well spent, because the information gained is valuable in their education.

- Encouraging staff to recognise that *LASS* is a useful educational activity *in its own right*. The tests are mentally stimulating and involve use of concepts and skills which are vitally important in learning. Hence time spent by teachers and students on the tests has a wider educational value.
- Only minimal supervision is necessary, once a student is clear about what any given *LASS* test requires. It is not essential for the teacher to observe the whole test administration, and the student's performance can be inspected later via the Data Tables — see Section 2.4.3.
- Training non-teaching personnel to administer *LASS*. Although it is essential that interpretation of *LASS* results is carried out by an experienced teacher or other suitably qualified professional, administration of the tests can be done by any adult who understands the essentials of what the task involves. In particular, that they are *tests*, so the student needs to *understand* what is required, but the tester is not permitted to coach the student or give hints to the answers. In many schools *LASS* tests are being successfully and efficiently delivered by various non-teaching personnel, such as classroom assistants, parents, volunteers or school governors. However, it is not advisable to use older students to supervise testing.
- Registering all students in a block is more time-efficient than registering students singly at the time of testing. *LASS* can therefore import cohorts of new students using a comma-separated text file which may have originated as output from a schools management system.
- Giving all students in the class the same *LASS* test, before moving on to another test. That way, the tester can get into a 'rhythm' and does not have to re-adjust the delivery of each different test.
- Organising activities in order to use available time most effectively. Using breaks or lunchtime can work in some cases. Amalgamating classes for some activities can free up one teacher who can use that time to administer *LASS*.
- Operating an efficient 'queuing' system, so that the teacher does not have to waste time locating the next student and bringing that student to the computer for assessment. Often, older students can assist in this type of organisation, but it is *not* recommended that older students should assume responsibility for supervision of the assessments themselves.

2.3.15 Assessing students outside the age range for LASS 11-15

Like all good normative tests, *LASS 11-15* is not generally recommended for use outside its specified age range. Any test which meets basic psychometric criteria (which *LASS* does) must be standardised on a given population and this will determine the range of applicability of the test. *LASS 11-15* is designed for use with students aged 11 years 0 months to 15 years 11 months. Use with students outside this range can create difficulties for interpreting results. If the student is older than 15:11, then the program will use the norms for 15-year-old when analysing results and this could lead to an overestimation of the student's performance. Similarly, if the student is younger than 11:0, then the program will use the norms for 11-year-old when analysing results, and this could lead to an underestimation of the student's performance. Tests appropriate to the students' chronological age should be used wherever possible, to avoid the dangers of inappropriate decisions being made – e.g. that a student is 'at risk' (or not 'at risk') when the evidence for this is unsound.

The preferred solution to the assessment of students older than 15 years 11 months is to use **LADS** [Lucid Adult Dyslexia Screening] (Singleton, Horne and Thomas, 2002), which is designed for ages 16:0 upwards), and for students younger than 11 years 0 months the solution is to use **LASS 8-11** (8:0–11:11). For information on these assessment products, contact Lucid Research Limited or visit the website www.lucid-research.com

When tests appropriate to the student's chronological age are not suitable or available, it is permissible to use *LASS 11-15* outside the stipulated age range. Examples include (a) a very bright or advanced nine-year-old (who would find the *LASS 8-11* tests too easy); (b) a student of sixteen or over who has moderate or severe learning difficulties (and so intellectually would still be within the range covered by *LASS 11-15*); and (c) adults who have limited educational skills, e.g. due to social or educational disadvantage (such individuals are often encountered in prisons and youth offender units). In such cases, *LASS 11-15* results should always be interpreted with caution – see Section 4.5.

When *LASS 11-15* is used outside the stipulated age range, age equivalents would be the preferred form of scores for the teacher or administrator to consider. An age equivalent is defined as the chronological age range of individuals that would be expected to achieve a given raw score (or, in the case of the *LASS 11-15* adaptive tests, adaptive score). Some teachers working in special education prefer to use age equivalents rather than centile scores, because age equivalents enable them to conceptualise the ability level of the student they are teaching, and so pitch the work at the correct level. For further information about using age equivalents see Section 4.5.

2.3.16 Assessing students who have limited English

Assessment of any student who has limited proficiency in spoken English is often problematic. But there is evidence that *LASS* is better than many conventional methods of assessment, because of its strongly visual format and minimal reliance on spoken instructions. The practice items enable most students, even those with very little English, to understand the tasks, and where there is uncertainty a teacher or assistant who speaks the student's mother tongue can help with explaining instructions. Case studies of students for whom English is an additional language (EAL) are given in Section 7.10. Like most students with limited English, these students responded well to the assessment and extremely valuable information was obtained.

It is sometimes found that EAL students gain low scores on certain *LASS* tests (particularly those assessing literacy skills), which mainly reflects their lack of experience with English. When interpreting the results of these tests, teachers may find it more helpful to use age equivalents rather than centile scores (see Section 4.5 for guidance on how to calculate and use age equivalents). However, on the memory and reasoning tests in *LASS* scores will normally reflect their true abilities, as these are largely unaffected by language factors (provided the student can cope with the digits 1–9 in spoken and written form in order to attempt ***Mobile***).

There is some evidence that phonological skills of bilingual students can be assessed in the majority language (in this case English) when no suitable test in the minority language (which would be these students' first language) is available. Miller Guron and Lundberg (2003) found that, given sufficient exposure to the majority language, bilingual students whose mother tongue is a minority language may be expected to score comparably on tests of phonological ability and nonword reading in the majority language (in that particular study, Swedish), and thus poor scores on phonological and nonword tests can be taken as indicative cognitive deficits due to dyslexia rather than necessarily being attributed to lack of experience in the majority language. This result is consistent with findings by Frederickson and Frith (1998) and Everatt et al (2000) that non-dyslexic bilingual students can show normal nonword reading and even enhanced rapid naming skills, possibly as a consequence of the additional demands placed on phonological systems when coping in a multilingual environment. Although further research in needed in this area, the evidence available to date suggests that assessment of phonological ability (such as ***Segments***) and phonic skills (***Nonwords***) in English can reveal difficulties of a dyslexic nature even in students for whom English is an additional language, although obviously teachers have to use caution when interpreting the test results of such students.

For further information on assessment of learning difficulties in literacy (including dyslexia) in EAL students and other multilingual students, see Cline (2000), Cline and Frederickson (1999), Cline and Shamsi (2000), Durkin (2000), and Peer and Reid (2000).

2.3.17 Students with co-ordination difficulties

Students with co-ordination difficulties may experience problems in using the mouse. In some cases, an adapted mouse device may need to be used when assessing disabled students. However, slowness or difficulty in using the mouse should not make any significant difference to a student's performance on *LASS*. Thus, even if a student is totally inexperienced with using a mouse (a rare thing these days) and is consequently very slow, the *LASS* scores will still be a valid measure of their performance. This is because the tests are not speeded (a 'speeded' test is one in which the individual can increase their score by working faster, although in practice there will always tend to be a speed-accuracy trade-off). Although the time taken is recorded and shown in the Data Tables (so that teachers can take this into account when interpreting tests if they wish), it is not scored, as such. In ***Cave*** there is a (fairly generous) time limit (the student has to put the phantoms in their correct positions before the candle burns out). If the teacher suspects that this will create significant problems for the student, or where extreme inefficiency with the mouse is affecting the student's confidence, it is permissible for the teacher to use the mouse and move the phantoms on the student's behalf. In such situations, it will be necessary to decide beforehand on an agreed scheme of signals or verbal instructions to be given by the student (e.g. the student points at the target on the screen and the teacher uses the mouse to click on that target). Alternatively, a touch screen, which plugs into the mouse port, may be used instead of the mouse.

In some cases a student may be slow on a *LASS* test because they are finding it hard — i.e. the cognitive load is high. However, if the test is *far too difficult* the student may appear very speedy because responses are being made at random. Such situations should happen rarely in *LASS*, because the tests are mainly adaptive — i.e. they automatically adjust to the student's ability level.

Sometimes the distinction between students who are slow in using the mouse (perhaps because of inexperience or lack of confidence) and those with more serious motor co-ordination difficulties may be tricky for the teacher. Students with motor co-ordination problems used to be called 'clumsy pupils' (Gubbay, 1975) but are now officially described as having 'Developmental Co-ordination Disorder' (DCD) (American Psychiatric Association, 1994). They are students who have some difficulty in performing skilled, purposive movements, which cannot be attributed to mental abnormality or physical deformity. In adults who have acquired such problems (typically due to stroke or head injury) the term 'apraxia' is normally used, 'praxis' being defined as the ability to manipulate and deal intelligently with objects in the environment (Ayres, 1985). Thus in students who have similar problems, the related term dyspraxia (or developmental dyspraxia) is also often used.

Developmental dyspraxia covers a range of childhood disorders affecting the initiation, organisation and performance of action (Ayres, 1988; Fisher et al., 1991). However, there is no universal agreement amongst neuropsychologists and neurologists about the categorisation of such problems because dyspraxic students do not form a homogeneous group. Some seem to have problems more at the planning stage of skilled action, others more with the execution of actions. Furthermore, successful actions must usually be underpinned by a number of visual processes as well as motor ones and it may be the case that these visual processes are faulty as well as (or instead of) the motor ones (Lord and Hulme, 1987).

Assessment of dyspraxia can cover a very wide range of tasks, including manipulation of small objects, shape copying by drawing, imitating and repetition of actions and postures, ability to co-ordinate arms and legs together, throwing, catching, jumping and skipping. Both large and small muscles may be involved, as well as fast and slow actions. Well-known tests of motor co-ordination include the Test of Motor Impairment (Stott et al., 1984) and the Movement ABC (Henderson and Sugden, 1992). Scores are sometimes averaged to give a 'motor age' but this is not usually very useful, because it is possible for a student to have a co-ordination difficulty in one area and not another. Thus a limited range of tasks may fail to identify a real difficulty and an overall measure may be misleading (Anderson and Fairgrieve, 1996; Beardsworth and Harding, 1996).

For the above reasons, the incidence of DCD is difficult to establish with any certainty. Figures vary according to the procedures used to assess the students. Reviewing this, Hoare and Larkin (1991) conclude that it is safe to assume that about one student in 10 has co-ordination difficulties, although these will vary in severity. Studies generally report a higher incidence in boys than in girls (Piek and Edwards, 1997). Evidence provided by Knuckey and Gubbay (1983) suggests that some young students with observed DCD have a delay in maturation and will eventually 'grow out of it'. Labelling such students 'clumsy' at an early age may consequently be harmful. On the other hand, several recent studies indicate that long-term effects of DCD are common, including continuing motor difficulties as well as a variety of social, educational and emotional problems (see Piek and Edwards, 1997 for a review). Because of this, many educationalists now believe that it is desirable to identify students with DCD as early as possible in their school lives, because it may affect their educational progress, and as such come within the heading 'Special Educational Needs'.

For an overview of the current state of knowledge on motor co-ordination disorders in students, see Sugden and Wright (1998). Guidance on assessing motor organisation and dyspraxia is given by Chapman and Ripley (1999). General advice for teachers and parents is provided by Ripley, Daines and Barrett (1997).

2.3.18 Students with Attention Deficit Hyperactivity Disorder (AD/HD)

'Attention Deficit Hyperactivity Disorder' (AD/HD) is the medical term for students who, in the past, would have usually been called 'hyperactive'. The *Diagnostic and Statistical Manual of Mental Disorders* — DSM–IV (American Psychiatric Association, 1994) distinguishes three types of ADHD:

- Type 1: the student with AD/HD who is predominantly inattentive
- Type 2: the student with AD/HD who is predominantly hyperactive and impulsive
- Type 3: the student with AD/HD who is *both* inattentive *and* hyperactive/impulsive

In the World Health Organisation's *International Classification of Diseases* — ICD–10 (WHO, 1990), the term 'Hyperkinetic Disorder' corresponds to DSM-IV type 3. It can be seen that the symptoms of AD/HD do not just concern hyperactivity — i.e. restlessness, difficulty with sitting still, excessive movement or fidgeting. Rather, such students are equally, or even more, likely to have problems in sustaining attention on the task in hand, inhibiting impulsive responding, and generally in regulating and controlling behaviour. The causes of AD/HD are uncertain, but the evidence for a biological basis is strong, with pre-natal and birth complications being most frequently cited in the research literature. Evidence for AD/HD being *due* to food allergies is rather weak, but there is some evidence that hypersensitivity to aspects of nutrition (e.g. sugars and food additives) can be a feature in individual cases of AD/HD (Hinshaw, 1994). There is considerable national variation in the incidence of AD/HD, which largely reflects differences in culture and diagnostic criteria. In the US, incidence is reported to be between 3–8% of students, while in the UK it is only about 0.5% (Barkley, 1990). Approximately 35% of students with diagnosed AD/HD have delays in reading, spelling, writing, and/or mathematics. Obviously these learning problems could be the result of poor attention and concentration in the learning situation (i.e. an *indirect* effect of AD/HD). In addition it has been suggested that students with AD/HD have problems with working memory, which affects learning *directly*, because information is not stored properly nor is it retrieved fluently and reliably. Treatment for AD/HD usually involves a combination of psychological methods (e.g. behaviour modification) and pharmacological methods (e.g. use of the drug *Ritalin*), but good educational management and committed parent involvement is crucial (Goldstein and Goldstein, 1990, 1992).

Students with AD/HD are liable to experience difficulty with many types of assessment (not just computerised assessment) because of inattention and impulsiveness in responding. In cases of AD/HD students, teachers should therefore be prepared to take such factors into consideration when interpreting the results of *LASS* tests. On the other hand, *LASS* tests are typically found to be more stimulating than conventional tests, so students with AD/HD will generally remain engaged and attentive for longer than might be expected. To maintain engagement and interest, however, and ensure that results are as reliable as possible, it is recommended that only one test per session should be administered to students with AD/HD.

For practical guidance on identifying and teaching students with AD/HD, the book by Cooper and Ideus (1996) is recommended.

2.4 The Report Generator

2.4.1 How the results are displayed

All scores are saved automatically to a single database file on completion of each test. The data saved also includes the date and time the test was completed. **If a test has been abandoned before completion, then no results will be saved for that test.**

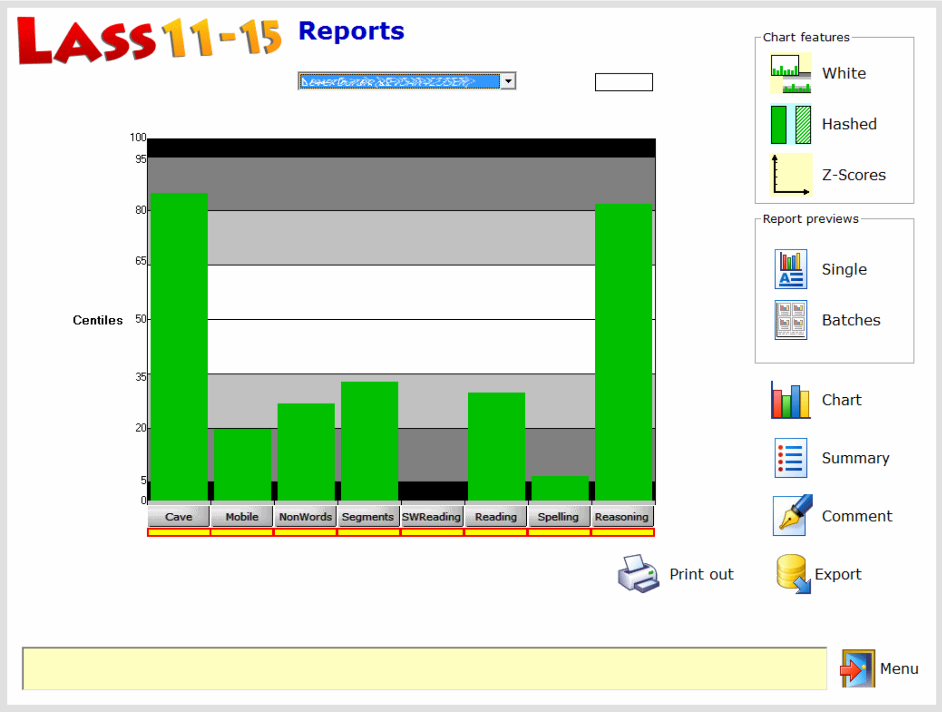
The *Report Generator* can be entered by clicking on the **Report** button from the *Main menu*. Select the appropriate student from the pull down list.

Performance of each test can be viewed in a variety of ways. Results are indicated in the *Summary Table*, the *Data Tables*, or the *Graphical Profile.*

2.4.2 The Graphical Profile

The *Graphical Profile* (see Figure 1) automatically charts the individual student's performance against those of the norm referenced group, which is based on the student's age in the following bands: 11:0–11:11; 12:0–12:11; 13:0–13:11; 14:0–14:11; 15:0–15:11.

Figure 1. Graphical Profile.



The *Graphical Profile* can be viewed in either centile scores or z-scores (standard deviation units), with the former being the default. If bars are missing from any of the tests represented on the bar chart then the student either didn't attempt or didn't complete that test. The appearance of the graphical profile can be altered by clicking on various *Chart features* icons.

2.4.2.1 Centile scores

Here the student's score is shown with reference to the population norms in centile units (sometimes referred to as 'percentile' scores), which range (roughly) from 1 to 99. A centile score of 63, for example, means that the students' score lay at the point where 63% of the population scored less, and 37% scored more. A centile score of 50 indicates that the student's score lay exactly on the median of the distribution, with half the age group scoring higher and half lower.

2.4.2.2 Standard deviation units (z–scores)

These can be viewed by clicking on the **Z-Scores** option. The score is shown with reference to the population norms in standard deviation units. The z-scores are converted directly from the centile scores maintaining a normal distribution. Positive z-scores lie above the mean of the distribution and negative z scores lie below it. A z-score of 0 indicates that the student's score lies exactly on the mean (average) of the distribution. A z-score of +1.0 signifies that the student's score was one standard deviation above the mean of the statistical population.

These charts may be of greatest interest to a trained psychologist or others familiar with working with standard deviation units, but can be used by teachers and others who wish to determine whether or not a difference between two test results is statistically significant — see Section 4.3.3). When dealing with a normal distribution, z-scores may be easily converted to standard scores which have a mean of 100 and a standard deviation of 15. The intelligence quotient (IQ) is a standard score, so the average IQ for the population is 100, and 67% of the population will have IQs falling between 85 and 115 (i.e. from –1.0 to +1.0 standard deviations from the mean). Many educational tests (e.g. tests of reading, spelling, verbal, nonverbal and quantitative ability) also use standard scores.

2.4.3 Data tables

Tables are split into the Summary Table of results and the individual Data Tables for each test.

2.4.3.1 Summary Table

The Summary Table (see Figure 2) is viewed by clicking on the **Summary** button and will show the scores (raw scores or adaptive scores) obtained for each test completed, including centile scores, z-scores and age equivalents (for explanation of what these scores mean see Section 4.1.1). The Summary Table also shows whether any of the test results are significantly different in statistical terms from what would be expected on the basis of the student's Reasoning test score. This is known as the 'Discrepancy' and is shown as a probability value (e.g. p<0.001). Negative discrepancies (marked with a minus sign on the table) indicate a significant area of weakness for the student. Positive discrepancies (marked with a plus sign on the table) indicate a significant area of strength. For further explanation of discrepancy scores, see Sections 4.3.3 and 4.3.4).

To return to the Graphical Profile, click on the **Chart** option button.

Figure 2. Summary Table.

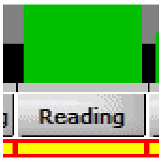
Test Summary for [illegible]

A	B	C	D	E	F	G	H	I
Test name	Score	Centile	Z Score	ZScore diff	discrepancy	Test date	Age at test	Age equiv. range
Cave	32	67	0.44	0.39	Not significant	28/01/2008	11 y 8 m	14y 0m - 14y 05m
Mobile	4	20	-0.842	0.89	- (p < 0.05)	28/01/2008	11 y 8 m	10y 0m - 10y 11m
NonWords	15	69	0.496	0.45	Not significant	28/01/2008	11 y 8 m	14y 0m - 14y 5m
Segments	23	74	0.643	0.59	Not significant	11/02/2008	11 y 9 m	14y 6m - 14y 11m
SWReading	30	99	2.324	2.27	Not significant	11/02/2008	11 y 9 m	Not applicable
Reading	0.5245	84	0.995	0.95	Not significant	11/02/2008	11 y 9 m	15y 0m - 15y 5m
Spelling	0.3047	95	1.644	1.59	Not significant	11/02/2008	11 y 9 m	16y +
Reasoning	0.7192	52	0.05			25/02/2008	11 y 9 m	12y 0m - 12y 5m

2.4.3.2 Data Tables

Individual responses to each item are recorded and can be viewed in the Data Tables, which provide much more detailed analyses of the student's responses. These are accessed by clicking on the grey test name button at the bottom of the bar as shown on the Graphical Profile.

For example, in order to view the Data Table for Reading, click on the grey button with the appropriate test name on the Graphical profile screen (see the illustration on the right).

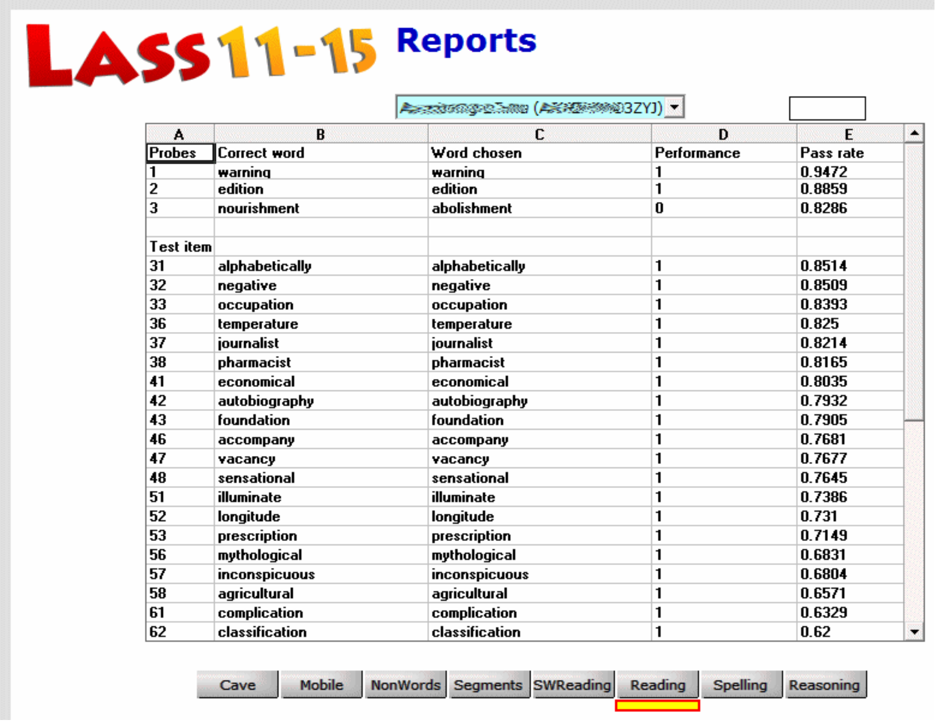


An example Data Table for the Reading test is shown in Figure 3. The column widths may be altered by hovering the mouse pointer over the column border, waiting for the mouse pointer to change to the appropriate indicator, then clicking and dragging the column width to the desired place. To return to the Graphical Profile click on the **Bar chart** button.

A Data Table is available for each of the eight tests (if attempted) and can be printed out. The Data Tables include *Raw Scores*, which in the case of the progressive tests, represent the number of items correct in each test. In the case of the adaptive tests in the suite (i.e. ***Sentence Reading, Spelling,*** and ***Reasoning***) the *Pass Rate* is equivalent to a Raw Score. The Pass Rate is a measure of the difficulty of each item, i.e. it tells you how many students in that age band attempted that item successfully. Pass Rates are expressed as a decimal: 1.0 would mean that all students in the age band passed the item correctly, 0.0 would mean that no students in the age band passed the item correctly, and 0.5 would mean that 50% of the students in the age band passed the item correctly. The most important score to note in such cases is the *Adaptive Score*, which represents the highest level of attainment of the student in that test (i.e. the final Pass Rate achieved).

The Data Table also shows the age equivalent score (for further information on using age equivalent scores, see Section 4.1.3). Note that if using the table of age equivalents (see Appendix, Section 9.4), Adaptive Scores rates have already been converted to percentages for convenience

Figure 3. Example Data Table for Reading test.



A	B	C	D	E
Probes	Correct word	Word chosen	Performance	Pass rate
1	warning	warning	1	0.9472
2	edition	edition	1	0.8859
3	nourishment	abolishment	0	0.8286
Test item				
31	alphabetically	alphabetically	1	0.8514
32	negative	negative	1	0.8509
33	occupation	occupation	1	0.8393
36	temperature	temperature	1	0.825
37	journalist	journalist	1	0.8214
38	pharmacist	pharmacist	1	0.8165
41	economical	economical	1	0.8035
42	autobiography	autobiography	1	0.7932
43	foundation	foundation	1	0.7905
46	accompany	accompany	1	0.7681
47	vacancy	vacancy	1	0.7677
48	sensational	sensational	1	0.7645
51	illuminate	illuminate	1	0.7386
52	longitude	longitude	1	0.731
53	prescription	prescription	1	0.7149
56	mythological	mythological	1	0.6831
57	inconspicuous	inconspicuous	1	0.6804
58	agricultural	agricultural	1	0.6571
61	complication	complication	1	0.6329
62	classification	classification	1	0.62

2.4.4 Monitoring the testing progress of the class

It is possible to display the testing progress of all registered students in the *LASS 11-15* database by clicking on the **Testing progress** button. This opens a *Testing Progress Table* (see Figure 4 below). The students' names are shown down the table with the tests across the top. 'Yes' indicates that the student has completed the test and a dash indicates that the test has not been completed. To return to the previous screen click on **Menu**.

Figure 4. Testing Progress screen

Testing progress for all registered students

User ID	Names	DOB/passwor	Cave	Mobile	NonWords	Segments	S.W.	Reading	Spelling	Reasoning
ARMEMM433ZYJ	[illegible]	01/05/96	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARMSHA754QAR	[illegible]	09/11/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BATDAN334DZV	[illegible]	03/10/93	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BESLAU046QOZ	[illegible]	18/01/93	-	-	-	-	-	-	-	-
BRASAR387UJJ	[illegible]	25/01/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BREMEA360VDU	[illegible]	12/02/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BUCTON624VSA	[illegible]	19/10/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BURCLA075KPE	[illegible]	24/03/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHRHEA714TDL	[illegible]	15/03/96	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CLOMIC740WOV	[illegible]	26/08/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
COLELI335NHG	[illegible]	12/12/93	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CONALI880NFU	[illegible]	12/03/93	-	-	-	-	-	-	-	-
COPROI774BHV	[illegible]	15/05/94	Yes	Yes	Yes	Yes	-	-	-	-
CORSOP243JGM	[illegible]	10/09/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
CRECAD083RYS	[illegible]	27/08/92	-	-	-	-	-	-	-	-
CURAND333NHT	[illegible]	14/03/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DEEMEG746RSH	[illegible]	24/01/96	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DEVSAR211MJQ	[illegible]	18/04/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DONGRA735BPZ	[illegible]	19/09/92	-	-	-	-	-	-	-	-
DORABB043BJL	[illegible]	13/12/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DUNCAT704TDM	[illegible]	29/03/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITSTE744XKI	[illegible]	17/02/93	-	-	-	-	-	-	-	-
FLYCLI281SUL	[illegible]	13/11/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GALAIS113FRK	[illegible]	16/12/92	-	-	-	-	-	-	-	-
GIBSAR884EDJ	[illegible]	15/12/93	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GILLIN540NJT	[illegible]	29/03/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GOOAND150TAU	[illegible]	27/11/92	-	-	-	-	-	-	-	-
HAGROS847JQE	[illegible]	14/01/96	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HUGANN254KNF	[illegible]	11/05/93	-	-	-	-	-	-	-	-
HUGSTA044FQA	[illegible]	30/12/93	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INDIRE014YGD	[illegible]	30/01/93	-	-	-	-	-	-	-	-
IRVSEL025JMP	[illegible]	18/07/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JOUCAT785GCJ	[illegible]	15/03/96	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KANEMM326SKN	[illegible]	06/12/92	-	-	-	-	-	-	-	-
KAVLAU047FMY	[illegible]	19/03/94	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KEEANN517XYU	[illegible]	09/06/93	-	-	-	-	-	-	-	-
KERREB252AMK	[illegible]	12/06/93	-	-	-	-	-	-	-	-
KINANG644PLN	[illegible]	15/11/95	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Number of students: 83

Print out

Menu

2.4.5 Printing out results

Graphical profiles can be viewed and then printed out via the *Print Preview* screen by choosing the item ***Single*** (for one report) or ***Batches*** (for up to 8 thumbnail reports) in the *Report previews* panel (figure 1). Raw Data tables or Summary tables which are displayed on the Report screen can be printed out directly by clicking on the ***Print out*** icon.

2.4.6 Copying LASS 11-15 results to another application

LASS 11-15 Data Tables, Summary Tables and Testing Progress Tables may be copied to other applications such as word processors, spreadsheets etc. The user must first make the selection of the information they wish to copy. This is done by clicking and holding down the mouse button on the first cell of the selection. Whilst still holding down the mouse button drag the mouse pointer to the last cell of the selection which you wish to copy. Once this is done you will see the block of text is highlighted. Press the **Ctrl** and **C** keys together to copy this selection. Start the other Windows application (e.g. word processor or spreadsheet program) and go to the place where you wish to "paste" the selection. Press the **Ctrl** and **V** keys together to paste the selection.

3 Principal applications of LASS 11-15

3.1 Introduction

LASS 11-15 is a *multifunctional* assessment instrument with the following principal applications:

- routine profiling of students' abilities, either on entry to secondary education or at any time between the ages of 11 and 15 years
- screening for special educational needs
- diagnosis and assessment of specific learning difficulties and dyslexia
- monitoring of literacy progress for all students
- evaluation of response to intervention

The following subsections outline the suggested ways in which *LASS* can be used for these applications.

3.2 Routine profiling

Many secondary schools routinely assess the general abilities of all students — especially in verbal and non-verbal abilities — but sometimes in literacy attainment as well as mathematics and quantitative reasoning skills. In many cases, this is carried out at the point of entry to secondary education. *LASS* can fulfil several of these functions, including the non-verbal ability and literacy attainment components. When used for this purpose, it would not normally be necessary to administer the modules assessing memory (***Cave*** and ***Mobile***) or phonological skills (***Nonwords*** and ***Segments***), because these are essentially diagnostic tests.

3.3 Special educational needs screening

LASS 11-15 also provides schools with a straightforward screening system for special educational needs, which can be an adjunct to routine assessment or used at any time between the ages of 11:0 and 15:11. When used for this purpose, students who gain low scores on any of the routine profiling modules (***Reasoning, Single Word Reading, Sentence Reading*** and ***Spelling***) or who display a significant discrepancy between their scores on ***Reasoning*** compared with their score(s) on ***Single Word Reading, Sentence Reading*** or ***Spelling,*** would automatically be administered the diagnostic modules. The procedure then becomes the same as for diagnosis and assessment of specific learning difficulties and dyslexia (see below). Details of calculating discrepancy and determining thresholds for low scores are provided later in this section.

3.4 Identifying dyslexia (specific learning difficulties)

3.4.1 What is dyslexia?

It is not possible here to give a detailed account of the nature of dyslexia. Readers are recommended to consult any one of a number of reputable texts, including Miles (1993), Miles and Miles (1999); Reid (2003), Snowling (2000) and Thomson (1993). The genetic and neurological bases of dyslexia are now well established and reflected in most current definitions of the condition. For example, the International Dyslexia Association (formerly the Orton Dyslexia Society) published the following definition of dyslexia:

> *"Dyslexia is a neurologically-based, often familial disorder which interferes with the acquisition of language. Varying the degrees of severity, it is manifested by difficulties in receptive and expressive language, including phonological processing, in reading, writing, spelling, handwriting and sometimes arithmetic. Dyslexia is not the result of lack of motivation, sensory impairment, inadequate instructional or environmental opportunities, but may occur together with these conditions. Although dyslexia is life-long, individuals with dyslexia frequently respond successfully to timely and appropriate intervention"* (Orton Dyslexia Society, 1994).

However, not all authorities agree that we have sufficient evidence to produce a convincing definition of dyslexia that incorporates aetiology (as in the one given above). In 1999 a Working Party of the British Psychological Society's Division of Educational and Child Psychology produced a report designed to help psychologists deal with the problems of how to assess children with dyslexia (British Psychological Society, 1999b). This group reviewed — albeit inconclusively — research findings and theories in the field, and decided to produce a 'working definition' that was free of aetiological and theoretical assumptions:

> *"Dyslexia is evident when accurate and fluent word reading and/or spelling develops very incompletely or with great difficulty. This focuses on literacy learning at the 'word level' and implies that the problem is severe and persistent despite appropriate learning opportunities. It provides the basis for a staged process of assessment through teaching."*
>
> (British Psychological Society, 1999b, p. 8).

The intentions of the British Psychological Society's Working Party appear to have been to produce recommendations that had a close fit with SEN Code of Practice — which, on the face of it, seems commendable — but the outcome seems to have been to muddy the waters as far as identification of dyslexia is concerned. The British Psychological Society's Working Party definition assumes that the problem will have been picked up in the primary stage (because the difficulties will be '*severe and persistent despite appropriate learning opportunities')* when in fact many teachers know that this does not always happen. Furthermore, dyslexia is a condition that varies in severity and its effects are likely to be more apparent when the work faced by a student gets increasingly difficult. Hence some dyslexic students, despite having difficulties in literacy, are not formally identified in the primary school because they managed to cope (perhaps because they are very bright or work unusually hard) or simply because they have never had the opportunity to be assessed by an educational psychologist or by a teacher using appropriate tests such as *Lucid CoPS Cognitive Profiling System* or *LASS 8-11*. When confronted with much harder work in secondary school, they find they cannot cope, and it may not be until this point that dyslexia is formally identified.

3.4.2 Characteristics of dyslexia

Dyslexia is a variable condition and not all people with dyslexia will display the same range of difficulties or characteristics. Nevertheless, the following characteristics have been widely noted in connection with dyslexia.

- A marked inefficiency in the *working or short-term memory system*, which is regarded by many experts in the field as the fundamental underlying difficulty experienced by people with dyslexia (e.g. Beech, 1997; McLoughlin, Fitzgibbon and Young 1993; Rack, 1997; Thomson, 2001). Memory difficulties may result in problems of retaining the meaning of text (especially when reading at speed), failure to marshall learned facts effectively in examinations, disjointed written work or an omission of words and phrases in written examinations, because pupils have lost track of what they are trying to express.
- Inadequate *phonological processing abilities*, which affects the acquisition of phonic skills in reading and spelling so that unfamiliar words are frequently misread, which may in turn affect comprehension. Not only has it been clearly established that phonological processing difficulties are seen in the majority of children with dyslexia (e.g. Snowling, 2000), but research has also indicated that this occurs in many adults with dyslexia (see Beaton, McDougall and Singleton, 1997a).
- *Difficulties with motor skills or coordination.* Nicolson and Fawcett (1990, 1994) have noted that people with dyslexia can show a particular difficulty in *automatising skills*. Examples of failure to automatise skills in the pupil situation might be the inability to listen with understanding while taking adequate notes, or the inability to concentrate on both the spelling and the content of written work. *Dyspraxia* is the generic term used to cover a heterogeneous range of disorders affecting the initiation, organisation and performance of action (Ayres, 1985; Fisher et al, 1991; Ripley et al, 1997). In childhood it is sometimes referred to as developmental coordination disorder. Pupils with dyspraxic difficulties are likely to have problems with handwriting, especially for when writing for lengthy periods or under conditions of time pressure. It should be noted that by no means all pupils with dyslexia will necessarily have dyspraxic difficulties.
- A range of problems connected with *visual processing*, which can affect reading generally, but especially when dealing with large amounts of text. Such problems can include *binocular instability* and susceptibility to *visual stress* (see Evans, 1997, 2001; Evans, Drasdo and Richards, 1996; Stein, Talcott and Witton, 2001; Wilkins, 1991, 1995, 2003). *Visual discomfort* is a generic term for the effects of hypersensitivity to the irritating effect of strong visual contrast or rapid flicker (e.g. where parallel lines of text create the appearance of a black-and-white grating or consciously or subconsciously perceived flicker of fluorescent lighting or some computer monitors). Movement and colour illusions can be perceived, or the text may appear unstable or obscured. Reading for any length of time may cause headaches and eyestrain, and so can be done only in short bursts, which can disrupt the comprehension process. In some medical conditions (e.g. epilepsy and migraine) susceptibility to visual discomfort is generally more extreme than is usually seen in cases of dyslexia (Wilkins, 1995). It should be noted, however, that although there appears to be a statistical association between dyslexia and visual discomfort, *not all* persons with dyslexia are highly susceptible to visual discomfort and *not all* persons who suffer from visual discomfort will necessarily exhibit the typical characteristics of dyslexia outlined above. There is evidence that use of coloured overlays or filters (e.g. by use of acetate

sheets or tinted lenses) can be beneficial in alleviating the symptoms of visual discomfort in a fair proportion of cases (Irlen, 1991; Wilkins, 2003; Wilkins et al, 1994, 2001; Whiteley and Smith, 2001).

3.4.3 Theories of dyslexia

The term 'specific learning difficulty' (which for a generation or more has been preferred by many educational psychologists to the term 'dyslexia') means little more than a discrepancy between ability and attainment. The principal difference between 'dyslexia' and 'specific learning difficulty' is that dyslexia presupposes the existence of certain cognitive deficits which are believed to underpin the condition. Such cognitive deficits (e.g. in phonological processing, memory, visual processing, or motor co-ordination) are believed to be either inherited or due to neurological anomalies which have arisen before (or during) birth or in early childhood.

There are several theories of dyslexia, which space precludes a detailed discussion of here. There is little disagreement that the condition is a neurological one, and that it has genetic causes in most cases (see Fisher and Smith, 2001). However, the exact neurological and cognitive mechanisms are still the subject of widespread research and theoretical debate (see Frith, 1997). The predominant theory is that dyslexia is due to a fundamental deficiency in the processing of phonological information — this is usually referred to as the Phonological Deficit Theory (Rack, 1994; Rack, Snowling and Olson, 1992; Snowling, 1995). This theory is supported by a wealth of research evidence (for review see Snowling, 2000) but is complicated by it does not explain *all* the phenomena associated with the condition (see previous section). The 'Double Deficit' Theory (see Wolf and O'Brien, 2001) proposes that in addition to phonological deficits, dyslexic individuals have inherent problems in processing information at speed, which interferes with many cognitive activities, including reading and writing. Prominent alternative theories include the Magnocellular Deficit Theory (see Stein, Talcott and Witton, 2001), the Cerebellar Deficit Theory (see Fawcett and Nicolson, 2001), both of which have less evidence in support, but which address particular aspects of the condition that demand further research. Of course, it may turn out that there are distinct subtypes of dyslexia, for which different causal theories may be applicable (see Stanovich, Siegel and Gottardo, 1997).

3.4.4 LASS 11-15 profiles and dyslexia

The chapters that follow show how *LASS* profiles can be used very effectively to identify dyslexia in most cases. It can be seen the composition of the *LASS* tests corresponds to the phonological deficit model more closely than it fits the alternative models of dyslexia. Hence it should be expected that *LASS* will be at its most effective in identifying students with the 'classic' form of dyslexia — which includes by far the majority of the group — characterised by cognitive difficulties that most notably affect the mapping graphemes onto phonemes. But *LASS* is actually rather broader in its scope that first might meet the eye. Since it includes a measure of visual memory measures, *LASS* is also adept at picking up 'atypical' cases of dyslexia where, instead of phonological deficits predominating, instead, the chief problem concerns visual memory. (Note, however, that *LASS* it will not necessarily pick up children with other types of visual processing difficulties —such as susceptibility to visual stress — for which children may need to be referred to an eye clinic for further investigation; see Evans, 2001; Wilkins, 2003). Thus in various ways *LASS* encompasses a wide range of psychological correlates of dyslexia which have theoretical support from different camps and consequently as an all-round screening and assessment tool it is hard to beat.

3.4.5 The pros and cons of the discrepancy approach

The conventional approach to identifying dyslexia is based on the principle of cognitive discrepancy (see Singleton, 1987), which maintains that a significant discrepancy between intelligence and literacy skills is *prima facie* evidence for specific learning difficulty; and where such discrepancy has been found, if there is also evidence of cognitive deficits in memory and/or phonological processing, this is *prima facie* evidence for dyslexia. Other evidence, such as a family history of similar difficulties, developmental history of speech or language problems, or particular difficulties — e.g. in acquiring phonics — would support such a conclusion.

This model – which is similar to that advocated by Pumfrey and Reason (1991), Rack (1997), Thomson (1993) and Turner (1997) – embodies the view that diagnosis of dyslexia is based on the notion of *discrepancy* between what the student *is* achieving in literacy and what they can reasonably be *expected* to achieve on the basis of age and intellectual ability. It is assumed that the student has experienced normal education and that the problems are not primarily due to any emotional or medical cause. This discrepancy accounts for the fact that dyslexia is typically characterised by serious and unremitting literacy problems in students who otherwise would be expected to make reasonable progress in the acquisition of literacy.

It should also be noted that the discrepancy criterion has also come under attack in recent years (e.g. Ashton, 1996; Frederickson and Reason, 1995; Nicolson, 1996; Siegel, 1989a, 1989b, 1992; Solity, 1996; Stanovich, 1991a, 1991b; see also Turner, 1997). One problem is that it is difficult to establish that a significant discrepancy exists if the student is of below average intelligence. Yet, in principle, being a constitutional condition, dyslexia can affect students of *all* abilities (Singleton, 1987). Furthermore, such an approach relies on waiting for the student to fail, often over many years, before action is taken. Another complication is that few, if any, real differences exist in the literacy difficulties manifested by students who do and do not display significant IQ–achievement discrepancies (Stanovich, 1991a, 1991b; Stanovich, Siegel and Gottardo, 1997).

It is well accepted that the discrepancy criterion is problematic when it comes to *early* identification of dyslexia (Fawcett, Singleton and Peer, 1998; Singleton, 1988), which has led to the development of alternative systems such as *CoPS Cognitive Profiling System* (Singleton, Thomas and Leedale, 1996, 1997), *DEST* (Nicolson and Fawcett, 1996), and *PhAB* (Frederickson, Frith and Reason, 1997). However, in the assessment of older students or adults, the abandonment of the discrepancy criterion is more controversial. A report of a working party on identification of dyslexic students, set up by the Division of Educational and Child Psychology of the British Psychological Society, noted that the discrepancy model is vulnerable to criticism on theoretical grounds and advocated a more global approach to assessment (British Psychological Society, 1999b). Nevertheless, in the classroom, it is often the case that *discrepancy* between a student's expected levels of attainment (based on judgements of their overall ability) and their actual attainments (especially in reading, writing and spelling) are what first draw a teacher's attention to the possibility that the student may have dyslexia. It therefore seems premature to abandon altogether the notion of discrepancy. Rather, discrepancy can usefully be regarded as part of the overall evidence on which a teacher makes a judgement. For these reasons, *LASS 11-15* has been developed in such a way that teachers who wish to use a discrepancy approach can do so, but this does not mean that it has to be used in a manner dictated by that model. Indeed, a balanced approach to identifying dyslexia is often recommended – i.e. one that takes account of discrepancies as well as key cognitive indicators, such as phonological processing and memory. This approach is advocated by many experts in the field, including, most notably, Snowling (2000), who one of the most well-known international authorities on dyslexia. *LASS* has been designed to facilitate this type of balanced approach.

3.5 Monitoring of literacy progress

The two main literacy modules in LASS (***Sentence Reading*** and ***Spelling***) are both adaptive tests that can be used at regular intervals to monitor progress. The minimum interval between administration of the same module on a second or subsequent occasion should be about 4 months (i.e. other than in exceptional circumstances, *LASS* should not be given more than once in a school term).

3.6 Evaluation of response to intervention

When a particular problem (e.g. specific learning difficulty or dyslexia) has been identified and intervention, such as specialist teaching, has been implemented, teachers will naturally wish to evaluate the student's response to that intervention. *LASS* can be used for this evaluation, again bearing in mind that the minimum interval between administrations of any given *LASS* module should be about 4 months (i.e. other than in exceptional circumstances, *LASS* should not be given more than once in a school term).

The literacy attainment modules (especially ***Sentence Reading*** and ***Spelling***) are obvious candidates for use in this process, but ***Nonwords*** may also be used to monitor development of phonics skills. It is unlikely that the ***Reasoning*** module would need to be repeated (little change would be expected on this module) unless there were suspicions that the first assessment using ***Reasoning*** had given an unreliable result (e.g. because the student was unwell or was greatly lacking in confidence, or misunderstood the requirements of the task). The memory modules (***Cave*** and ***Mobile***) would be useful for evaluating growth in memorisation ability, especially where a memory training programme has been used.

4 Guidelines on interpretation of results

4.1 Introduction

4.1.1 The nature of LASS 11-15 scores

LASS 11-15 results on each individual test are available in these forms:

Raw scores (progressive tests)
Pass rates (adaptive tests)
Centile scores
Z-scores (standard deviation units)
Age equivalent scores

Raw scores, pass rates and age equivalents are accessed via the on-screen *Data Tables* for every *LASS* test, which also show the means and standard deviations for the population norms of each test (for further explanation of this, see Section 2.4.3.2).

A *Summary Table* shows mean scores for all tests taken (see Section 2.4.3.1). Centile and standard deviation scores are shown in graphical form as bar charts on-screen and both these and the data pages can be printed out if desired. The *Graphical Profile* automatically charts the individual student's performance against those of the norm referenced group, which is based on the student's age in the following bands: 11:0–11:11; 12:0–12:11; 13:0–13:11; 14:0–14:11; 15:0–15:11 (see Section 2.4.2).

In the case of the progressive tests in *LASS*, raw scores represent the number of items correct in each test. In the case of the adaptive tests in the suite (i.e. ***Sentence Reading, Spelling,*** and ***Reasoning***) the *Pass Rate* is equivalent to a Raw Score. The Pass Rate is a measure of the difficulty of each item, i.e. it tells you how many students in that age band attempted that item successfully. Pass Rates are expressed as a decimal: 1.0 would mean that all students in the age band passed the item correctly, 0.0 would mean that no students in the age band passed the item correctly, and 0.5 would mean that 50% of the students in the age band passed the item correctly. The final Pass rate achieved by the student is referred to as the *Adaptive Score*, and it is this that should be used if converting to an age equivalent score — see Section 4.5.

Raw scores are not corrected for age, but centile scores, z-scores, pass rates and adaptive scores all take account of the student's age. Of the different types of scores, centile scores will generally be most useful for teachers, although educational and clinical psychologists may prefer to work with z-scores.

4.1.1.1 Centile scores

A centile score (sometimes referred to as a 'percentile score') should not be confused with percent correct. It reflects a student's ability on any given test on a scale of 1 to 99 in comparison with other students in the reference group (i.e. the norm group or the same age group). Hence the average student will obtain centile scores in the middle range (e.g. in the range 35–65), whilst an above-average student will have centile scores higher than this, and the below-average student will have centile scores lower than this. For example, a student with a centile score of 5 will be just inside the bottom 5% of students for that particular ability, and a student with a centile score of 95 will be just inside the top 5% of students for that particular ability.

4.1.1.2 Z-scores

It is not essential for users to understand the statistical principles behind z-scores, and readers who do not have a particular interest in this may wish to skip this section. The following outline is necessarily brief: it is not intended to be a comprehensive tutorial on the subject. Readers who desire to find out more about these ideas are recommended to consult any standard textbook of statistics.

A z-score (also known as a standard deviation unit) is a statistic based on a normal distribution of scores. Most human characteristics are distributed in a normal[2] (or approximately normal) fashion (i.e. a bell shaped curve), in which individuals cluster towards the mean (or average) and become less common as one approaches the extremes (or 'tails') of the distribution. The proportion of individuals that will fall in any given portion of a normal distribution can be calculated. For example, two-thirds (66%) of individuals will lie between + or – one standard deviation of the mean, while slightly less than 3% will fall below 2 standard deviations of the mean.

An advantage of z-scores is that they facilitate analysis of the *extremeness* of individual scores or of differences between scores, which are not apparent when using the centile score format. For example, consider the following results:

Centile scores	Reasoning	Sentence Reading	Difference
Student 1	60	40	20
Student 2	90	70	20

In both cases, the students' sentence reading performance is 20 centile points below their reasoning scores. Which (if any) of these is a significant difference, i.e. one that we should take notice of when interpreting results? On centile score difference, both appear to be identical, so this format does not help us. The same results in equivalent z-score format reveal a different story:

z-scores	Reasoning	Sentence Reading	Difference
Student 1	0.25	– 0.25	0.5
Student 2	1.6	0.6	1.0

Now it is apparent that the difference between the two scores for Student 2 is *twice* the magnitude of the difference between the same scores for Student 1. In fact, the former would not be regarded as significant, but the latter certainly would (for explanation of how to calculate significance, see Section *4.3.3*). In practice, scores at the tails of the distribution are much rarer than scores in the middle of the distribution, so differences between them will tend to assume greater significance. The z-score format allows us to determine that significance.

[2] The term 'normal' here is being used in its statistical sense.

4.1.1.3 Relationship between centile scores and z-scores

In a normal distribution of scores, centile scores and z-scores have a consistent relationship to each other and also to standard scores, (the latter, like IQ, being most usually expressed with a mean of 100 and a standard deviation of 15). This relationship is depicted in Table 5.

Table 5. Relationship between centile scores, z-scores and standard scores.

centile score	3	5	17	20	25	50	75	83	97
z-score	–2.0	–1.75	–1.0	–0.85	–0.66	0	+0.66	+1.0	+2.0
standard score	70	76	85	87	90	100	110	115	130

4.1.2 Interpreting LASS 11-15 scores

How low must a *LASS* individual test result be before the teacher should be concerned about the student's performance? Put another way: what is the critical cut-off point or threshold that can be used when deciding whether or not a given student is 'at risk'? Unfortunately, this is not a question that can be answered in a straightforward fashion, because much depends on other factors. These include: (a) the particular *LASS* test undertaken, (b) whether the results of other individual *LASS* tests confirm or disconfirm the result being examined, (c) the age of the student being tested, and (d) the school's or L.E.A.'s own SEN criteria or thresholds.

Conventional SEN thresholds are: below 20th centile (i.e. the '1 student in 5' category) and below the 5th centile (the '1 in 20' category). At one time, it was maintained that Statements of Special Educational Needs under the *1981 Education Act* would be appropriate for only about 2% of students. Experience has shown that this, in general, is far too restrictive and that concentrating just on the lowest 2% will result in many students with special educational needs being overlooked.

Any individual *LASS* module result which falls *below the 20th centile* (i.e. near or below *one* standard deviation below the mean) is by definition significantly below average and thus indicates an area of *weakness*. This is a fairly conventional cut-off point in identifying special needs or moderate educational weaknesses. A student who falls below this threshold should always be *considered* for intervention of some kind, depending on other factors (see below). Sometimes a weakness is identified which can be remedied by appropriate training. In some cases the problem is more pervasive and requires a differentiated approach to teaching in basic skills. Where there is strong confirmation (e.g. a *number of related tests* at or below the 20th centile) then the assessor can be convinced that concern is appropriate.

Where a student is scoring *below the 5th centile* on any particular module (near or below *two* standard deviations below the mean), this generally indicates a *serious difficulty* and should always be treated as diagnostically significant, and usually this will be a strong indication that a student requires intervention. Again, where there is strong confirmation (e.g. a *number of related tests* at or below the 5th centile) then the assessor can be even more confident about the diagnosis.

However, it should not be forgotten that *LASS 11-15* is also a *profiling* system, so when making interpretations of results it is important to consider the student's *overall profile*. For example, a centile score of 30 for reading or spelling would not normally give particular cause for concern because it does not fall below the 20th centile threshold. But if the student in question had a centile score of 85+ on the reasoning module, there would be a significant discrepancy between ability and attainment, which *would* give cause for concern. How this is calculated is described in Section 4.3.3).

It should also be noted that the ***Single Word Reading*** test is the only test in the *LASS* suite for which scores are not distributed in a normal curve. In fact, there is a significant negative skew, indicating that most students will achieve a maximum or near-maximum performance (in statistical terms this is sometimes referred to as a '*ceiling effect*'). The ***Single Word Reading*** test does not have sufficient sensitivity to discriminate amongst students within the average range, and so it should be confined to use with students who are *significantly behind* in reading development, either to determine their attainment level or evaluate progress.

4.1.3 Age equivalents

An age equivalent is defined as the chronological age range of students that would be expected to achieve a given raw score (or, in the case of adaptive tests, adaptive score). *LASS* provides age equivalent scores for each module – the can be found in the Summary Table (see Section 2.4.3.1) and in the Data Table for each module (see Section2.4.3.2). In addition, a table of age equivalents for *LASS 11-15* scores has been provided in the Appendix (see Section 9.4).

For various statistical reasons, age equivalent scores cannot be as accurate as centile scores or standard scores (e.g. z scores), so teachers should use these with care. The particular value of age equivalent scores, however, is when the teacher needs to assess a student who is outside the specified age range for *LASS 11-15* (11:0 to 15:11) and there is no other suitable test available. Although as a general rule, *LASS 11-15* should not be used outside the age range for which it is normed, there are exceptional circumstances when it is permissible to do so. For example, in the case of a very bright or advanced nine-year-old or a student of sixteen or over with moderate or severe learning difficulties, or an adult who has limited educational skills. Here, the centile norms may not be particularly helpful because they would be comparing the student with (in the first example) eleven-year-olds, and (in the second example) fifteen-year-olds. In such cases, age equivalents can often provide the teacher with more useful information. In fact, some teachers in special education prefer to work with age equivalents rather than centile scores, because it enables them to conceptualise the ability level of the student they are teaching, and so pitch the work at the correct level.

Age equivalents are designed to be used only in exceptional circumstances such as those illustrated above and should not be used routinely in cases where centile norms are applicable, because age equivalents give only a very rough approximation of the student's ability. Nor should *LASS 11-15* be used routinely above the age of 15 years 11 months to identify dyslexia as there is a screening test designed specifically for this older age group called **LADS** [Lucid Adult Dyslexia Screening] (Singleton, Horne and Thomas, 2002).For further information about LADS visit the website www.lucid-research.com

For examples of using age equivalent scores see Section 4.5.

4.2 General issues in interpretation

4.2.1 Taking all factors into account

Consistent with sound educational practice in general, and with the SEN Code of Practice (DfES, 2001) in particular, teachers should not regard assessment as a single event, but rather as a continuing process. *LASS* results should be considered together with other information about the student, including formal data from sources such as SATs, and informal observations made by the teacher. Strategies for intervention should not be regarded as set in stone, but should be flexible and responsive to a student's progress (or lack of progress). When reviewing a student's progress or Individual Education Plan it may be helpful to reassess them using appropriate tests from *LASS*.

4.2.2 Must students be labelled?

Labels for different special educational needs (especially the label "dyslexia") have been unpopular for the best part of a generation. However, labels are not always undesirable, and there are signs of a change of opinion amongst educationalists. Although all SEN students are individuals, there are broad categories that are useful in teaching. The *1981 Education Act*, which encouraged a non-labelling approach to special educational needs, was then superseded by the *1993 Education Act* and the *Code of Practice for the Identification and Assessment of Special Educational Needs (DfE, 1994).* It is interesting that the latter embodied a fairly broad labelling of special educational needs categories, including the category 'Specific Learning Difficulties (Dyslexia)' [Code of Practice, 3:60]. This development was an acknowledgement of the fact that SEN labels are often necessary to ensure that the student receives the right sort of support in learning. Application of LASS 11-15 in relation to the *Code of Practice* is discussed in detail in Section 4.6. More recently, the *1996 Education Act* consolidated the provisions of previous Acts, in particular the 1993 Act, and the 1994 Code of Practice was superseded by the 2001 SEN Code of Practice, which again moves away from use of labels and focuses instead on areas of need and their impact on learning (DfES, 2001).

On the other hand, there is still a need for differentiation of teaching and learning activities within a single category. This is particularly true of the category 'dyslexia' (or Specific Learning Difficulty), in which some students may be affected more in the *auditory/verbal* domain, others in the *visual/perceptual* domain, and a few in *both* domains or who may have *motor difficulties*. Hence, dyslexic students may exhibit a variety of difficulties and dyslexia has been described as a variable syndrome (Singleton, 1987). Nevertheless, dyslexia is a condition that can usually be helped tremendously by the right type of teaching, even though dyslexic students cannot all be taught in exactly the same way (Thomson, 1993; Augur, 1990; Thomson and Watkins, 1990; Miles, 1992; Pollock and Waller, 1994; Reid, 2003).

Many teachers are justifiably worried that labelling a student — especially at an early age — is dangerous, and can become a 'self-fulfilling prophecy'. Fortunately, the *LASS* approach does *not* demand that students be labelled — instead it promotes the awareness of students' individual learning abilities and encourages taking these into account when teaching. Since the *LASS* graphical profile indicates a student's cognitive *strengths* as well as *limitations*, it gives the teacher important insights into their learning styles (see Section 6.1.3). In turn, this provides essential pointers for curriculum development, for differentiation within the classroom, and for more appropriate teaching techniques. Hence it is not necessary to use labels such as 'dyslexic' when describing a student assessed with *LASS 11-15*, even though parents may press for such labels.

The term 'dyslexia' is often reserved for those students who show a significant discrepancy between ability and attainment that is known to be caused by particular cognitive limitations. Dyslexics also tend to show particular patterns of strengths and weaknesses. By identifying cognitive strengths and weaknesses it is easier for the teacher to differentiate and structure the student's learning experience in order to maximise success and avoid failure. By appropriate early screening (e.g. with **Lucid CoPS**, or **LASS 8-11**) the hope is that students who are likely to fail and who might subsequently be labelled 'dyslexic', never reach that stage because their problems are identified and tackled sufficiently early. (This is not to suggest that dyslexia can be 'cured', only that early identification facilitates a much more effective educational response to the condition.)

If teachers prefer to avoid use of the term 'dyslexia' for whatever reason, it is usually satisfactory to explain to the parents that the screening or assessment using *LASS* reveals the cognitive (or learning) strengths and weaknesses of *all* students. If *LASS* has shown some weaknesses in certain areas for a given student the parents may be informed that the school will be addressing those weaknesses with appropriate teaching. Where *LASS* is being used as an assessment device for diagnosis of students who are already failing in literacy and parents are aware of this (as they should be if the student is already on the SEN register), explanations necessarily have to be more complex. Labels such as 'dyslexic' may become more appropriate and/or even be unavoidable. Nevertheless, the emphasis should still be on matching teaching to the student's pattern of strengths and weaknesses. The *British Dyslexia Association* provides advice for teachers and parents on these matters.

4.3 Essential factors to take into account when interpreting results

4.3.1 LASS 11-15 is not one test, but several

When considering *LASS 11-15* results, it is important to bear in mind that it is not one test that is being interpreted, but the performance of a student on *a number of related tests*. This is bound to be a more complex matter than single test interpretation. Hence the normative information (about how a student is performing relative to other students of that age) must be considered together with the ipsative information (about how that student is performing in certain areas relative to that same student's performance in other areas). The pattern or profile of strengths and weaknesses is crucial.

It is *not* legitimate to average a student's performance across all tests in order to obtain a single overall measure of ability. This is because the modules in *LASS* are measuring very different areas of cognitive skill and attainment. It would be like adding the length of a person's legs to their waist measurement in order to obtain a size for a pair of trousers. The trousers would be unlikely to fit very well!

However, where scores in *conceptually similar areas* are *numerically similar*, it is sometimes useful to average them. For example, if scores on the two memory modules ***(Cave*** and ***Mobile)*** were similar, it would be acceptable to refer to the student's memory skills *overall*, rather than distinguishing between the two types of memory being assessed in *LASS* (i.e. visual memory and auditory-verbal memory). Similarly, if scores on the two phonological modules ***(Nonwords*** and ***Segments)*** were similar, it would be acceptable to refer to the student's phonological skills *overall*. Note that this applies only to conceptually similar areas and where scores are numerically similar (within about 10 centile points of each other). It would not be legitimate to average scores across conceptually dissimilar modules (e.g. ***Reasoning*** and ***Nonwords***). When scores are dissimilar, this indicates a differential pattern of strengths and/or weaknesses, which will be important in interpretation. In such cases it will be essential to consider the scores separately rather than averaging them. For example, if ***Cave*** and ***Mobile*** produce *different* results, this will usually indicate that one type of memory is stronger or better developed (or perhaps weaker or less well developed) than the other. This information will have implications for both interpretation and teaching.

For further information on interpreting strengths and weaknesses see Section 4.3.4

4.3.2 Things which the computer cannot know

The computer is not all-seeing, all-knowing — nor is it infallible. For example, the computer cannot be aware of the demeanour and state of the student at the time of testing. Most students find *LASS* tests interesting and show a high level of involvement in the tasks. In such cases the teacher can have confidence in the results produced. Occasionally, however, a few students do not show such interest or engagement and in these cases the results must be interpreted with more caution. This is particularly the case where a student was unwell at the time of assessment or had some anxieties about the assessment. Teachers should therefore be alert to these possibilities, especially when results run counter to expectations.

4.3.3 Calculating discrepancy

When we observe the scores obtained by any given student, we will almost invariably find some differences. Some scores will be higher than others. But how do we determine whether any observed differences are 'significant'?

By 'significant' we mean 'so much poorer than the level that would be expected on the basis of the person's age and intelligence, that the discrepancy is unlikely to be due to normal variation within the population or to chance'. What is important is not so much the *absolute* level of the student's performance but rather the *degree of discrepancy* between their observed literacy skills and the level of literacy ability that we would reasonably *expect* such students to have. The conventional way in which psychologists make valid comparisons between performance on different tests or measures is by reference to standardised scores (such as centiles or standard deviation units), which have a clear rationale in psychometric test theory and practice.

On the other hand, poor literacy and/or study skills *may* also be the result of inadequate teaching or insufficient learning and/or experience and *do not necessarily* imply that the student has dyslexia. Establishing a discrepancy, as well as seeking evidence of neurological anomalies or cognitive impairments, helps the assessor to rule out these environmental factors as primary causes of the student's problems. However, the discrepancy model of identification should not be used blindly: it should be part of a more extensive process by which the assessor seeks to build up an understanding of the individual's difficulties based on quantitative and qualitative evidence.

There is an ongoing scientific debate about the role of intelligence in dyslexia (e.g. Ashton, 1996; Frederickson and Reason, 1995; Nicolson, 1996; Siegel, 1989a, 1989b, 1992; Solity, 1996; Stanovich, 1991; Turner, 1997). Some researchers argue that other types of discrepancy have better diagnostic value (e.g. between *oral* language abilities and *written* language abilities, or between *listening* comprehension and *reading* comprehension), although these could be problematic in cases of dyslexic individuals who have developed effective strategies for compensating for reading and writing difficulties. Others suggest that identifying those with chronic difficulty in phonological processing would be the most efficient way of diagnosing dyslexia (Snowling et al, 1997), although by no means all dyslexics seem to have phonological difficulties (Rack, 1997). For further discussion of these issues, see Section 3.4.5.

LASS automatically calculate whether or not there is a statistically significant discrepancy between the score on the Reasoning module and all the other scores and displays this in the Summary Table (see Section 2.4.3.1 for information about how to access the Summary Table). The size of the estimated discrepancy[3] is shown and the associated statistical probability (p)

[3] It should be noted that the discrepancy estimates used in LASS are only approximate because (a) the exact value of any discrepancy between scores on two different tests will depend on the overall correlation between each of the tests, and (b) regression to the mean has not been taken into account (i.e. the fact that when an individual obtains

value is also given. A p value of < (i.e. less than) 0.001 means that the observed discrepancy would be found by chance in fewer than one in a thousand occasions (and hence is highly likely to be a true discrepancy not simply the outcome of chance variation in the data). A p value of < 0.01 means that the observed discrepancy would be found by chance in fewer than one in a hundred occasions, and p<0.05 means that the observed discrepancy would be found by chance in fewer than one in a twenty occasions and would represent a true difference in 19 out of 20 occasions. All these values (p<0.001, p<0.01; p<0.5) are regarded as 'statistically significant' but the confidence that one can place in them increases as the probability of a result due to chance variation decreases.

Major strengths will show up as a significant *positive* discrepancy (this is shown as a plus sign the Discrepancy column of the Summary Table). Major weaknesses will show up as a significant *negative* discrepancy when the individual test result is compared with the Reasoning test score (this is shown as a minus sign the Discrepancy column of the Summary Table).

It is sometimes useful to know whether there are significant discrepancies between tests other than the Reasoning test. For example, a teacher might want to know whether a student's visual memory was significantly better than their auditory memory, or whether their phonic skills are much better than their phonological skills. To estimate the discrepancy between the results of any two modules, first consult the 'Assessment Summary' table in the Results engine. This will give z-scores (sometimes called 'standard deviation units') for each completed module. Calculate the difference between the two z-scores and look up the difference in Table 6

In the example given in Section 4.1.1.2, in which a student had a ***Sentence Reading*** score of centile 30 and ***Reasoning*** score of centile 85, the z-scores are –0.67 and +1.12, respectively: a difference of 1.79, which is highly significant.

It should be remembered that when using *LASS* to identify dyslexia, teachers do not have to use a discrepancy approach if they would prefer not to. But the method of identifying cognitive deficits that are consistent with a significant discrepancy between *observed* literacy skills and *expected* literacy skills (on the basis of age and intelligence) is a tried and trusted one.

Table 6. Estimating discrepancy

z-score difference	Discrepancy estimate
less than 0.66	not significant
0.67 to 0.99	significant (p < 0.05)
1.0 to 1.66	significant (p < 0.01)
greater than 1.66	significant (p < 0.001)

4.3.4 Strengths and weaknesses

In considering a student's profile it is important to consider strengths as well as weaknesses. Absolute strengths will appear as centile scores in the range 80+, while absolute weaknesses will appear as centile scores in the range below 20 (see 4.1.2 for explanation of thresholds for interpreting absolute weaknesses). *Relative* strengths and weaknesses, however, are shown in terms of *discrepancies* between scores – usually between the Reasoning score and the other individual scores (see Section 4.3.3 for an explanation of 'discrepancies').

an extreme score on one test they will tend to obtain a less extreme score on a correlated test). Nevertheless, the estimation applied here is fairly conservative and is sufficient for most educational purposes.

Generally, the teacher is most interested in discrepancies that occur when a student's literacy skills are significantly *below* expected levels — i.e. scores that are much lower than the Reasoning score. Occasionally, however, a student will have scores that are much *higher* than the Reasoning score. Discounting Single Word Reading (for reasons that are explained elsewhere: see Sections 2.2.2 and 5.3), the area in which this is most likely to be encountered is in visual memory (and sometimes auditory memory). Some students have visual memory skills that surprisingly good and higher than would be predicted from their Reasoning score. This can still show up as a significant discrepancy — if the difference between the scores is statistically significant — but obviously such results need to be treated differently as what is revealed is a particular and significant *strength* rather than a weakness. This strength can be utilised effectively in teaching and learning (see Chapter 6) and may reflect an individual learning style (see Section 6.1.3), but teachers should also be aware that strengths can sometimes cause problems. For example, students with very good visual memory skills sometimes fail to acquire satisfactory phonic skills in the primary stage because they find they can quite easily read words by remembering their visual patterns as whole units (rather than having to break the words down into component letters and using rules about letter-sound correspondences to decode the text). A student such as this will not necessarily have dyslexia — this will depend on the overall pattern of their *LASS* scores — but they will need help to enable them to improve their phonic skills.

4.4 Unusual profiles

Most *LASS* profiles display a 'logic' that teachers will be able to 'read', especially when they have become reasonably experienced in using the program. Occasionally, however, you may encounter profiles that show a very complex pattern of 'highs' and 'lows' and at first sight appear quite puzzling. For example, a student might have very poor phonological skills ('Segments') but very good phonic skills ('Nonwords').[4] Although this could be a genuine result (e.g. if the student had received and absorbed a lot of exceptionally good phonics tuition), it is sufficiently unusual to ring warning bells and cause the teacher to enquire more closely into the case.

When tackling such profiles it is particularly important to bear in mind any extraneous factors that might have affected the student's performance. Examine the data to see on what days and times different tests were done. Motivation, ill heath (actual or imminent) and impatience are often causes of a student under-performing. Or the student may simply have 'got the wrong end of the stick' (e.g. assuming that they have to do a test as quickly as possible when in fact it is accuracy which is most important). Exceptionally, students may be in an uncooperative mood in some (or all) of the tests, and so their results do not bear any relationship to what the teacher knows are their true abilities. If the teacher is not confident about any particular result, then the safest course of action is first, to speak to the student to see if any reason for the unexpected result can be discovered, and second, to repeat the test(s) in question, taking appropriate steps to ensure that any problems have been resolved.

4.5 Interpreting results of students who are outside the norms range

LASS 11-15 is normed for use with students in the age range 11 years 0 months to 15 years 11 months. Over the age of 15:11, *LASS 11-15* raw scores and pass rates will not conform to a

[4] Generally one would expect students with very poor phonological skills to have serious difficulties in acquiring phonic decoding skills in reading.

normal distribution because many students will achieve a maximum or near-maximum performance (in statistical terms this is sometimes referred to as a '*ceiling effect*'). Similarly, below 11:0, most students will obtain very low scores on the *LASS 11-15* tests, which will create a bunching of scores at the lower end of the distribution (sometimes called a '*floor effect*'). When ceiling and floor effects occur in any test, it is not a good discriminator between students with differing abilities.

Therefore, *LASS* should only be used *psychometrically* (i.e. to compare a given student's performance with that of other students of the same age) within the specified age range of the test. However, outside this age range *LASS* can have a certain limited value if used *clinically* (i.e. to identify students with particular difficulties), or *ipsatively* (i.e. to compare a given student's performance on one test with the same student's performance on another). When employed in this way with older or younger individuals, it should always be used with *extreme caution*, and then only by experienced professionals who fully appreciate the limits within which they are working. Many adults with significant cognitive problems (e.g. dyslexia) are likely to experience difficulties on some *LASS* tests. Nevertheless, this is not *necessarily* the case. When used with adults, absence of any indications of difficulty on *LASS* tests must *never* be taken as evidence that there *are no* underlying difficulties because the tests may just not be sensitive enough. In any case, adults typically develop strategies by which they can compensate for any cognitive limitations, and these can have a masking effect, preventing any limitations from showing up in assessments.

The preferred solution to assessment of students older than 15 years 11 months is to use Lucid's adult screening systems (**LADS**) which is designed for ages 16 years upwards. Students younger that 11:0 should be assessed with **LASS 8-11** (8:0–11:11) or **CoPS Cognitive Profiling System** (4:0–8:11). For more information on these assessment products, contact Lucid Research Limited or visit www.lucid-research.com.

Under exceptional circumstances, age equivalent scores can be used when assessing students outside the norm range. An age equivalent is defined as the chronological age range of students that would be expected to achieve a given raw score. Note, however, that as three of the *LASS 11-15* tests are adaptive, the adaptive score rather than the raw score should be used for calculating age equivalents in these cases.

Age equivalents are designed to be used only in exceptional circumstances, e.g. for students in special education where centile norms are not always helpful. Age equivalents should not be used routinely in cases where centile norms are applicable, because age equivalents give only a very rough approximation of the student's ability. The term 'age equivalent' should also be applied with caution. It can be insulting for adults to be described in terms of age equivalents (e.g. as having a reading age of so-and-so), which might be misinterpreted as implying that they are to be treated like children, rather than grown-ups.

To determine an age equivalent for any *LASS* score see Section 9.4. Note that it is not possible to provide age equivalents for the ***Single Word Reading*** test. This is because the scores for this test are not distributed in a normal curve — in fact, there is a significant negative skew — indicating strong ceiling effects. This is explained in Section 2.2.2.

Example A

Tina, chronological age 17 years 6 months, has moderate learning difficulties. Her measured IQ on WAIS-III was 68, which places her in the lowest 3% of her age group in intelligence terms. Her teacher wants to know what level of texts she might be able to cope with and also what are her relative strengths and weaknesses in learning. Tina has an adaptive score of 0.8720 on ***Sentence Reading*** and raw scores of 31 on ***Cave*** and 5 on ***Mobile***. Her centile scores for these tests shown on the *LASS* Graphical Profile were, respectively, 20, 48 and 26, but of course the norms will automatically compare her with normal 15 year-olds. Referring to the table in Section 9.4, it can be seen that on ***Sentence Reading*** Tina's score places her within the 11:0–11:5 age range, which, although low for her age, indicates that she should be able to manage texts at around Year 6 level (Grade 6). On ***Cave*** Tina is at the 13:6–13:11 range, while on ***Mobile*** she is in the 11:0–11:11 range. In fact, it appears that visual memory is a *relative strength* for Tina, and hence her teachers can make good use of that in learning and teaching. Indeed, it is quite likely that it is her strong visual memory that has enabled her to maintain a reasonable reading ability despite her rather low overall intellectual level.

Example B

Craig is a very bright boy aged 9 years 6 months. His reading skills are believed to be at least three years ahead of his chronological age level. However, his teacher wants to know whether the cognitive skills that underpin reading are as well developed. The teacher administers LASS 11-15, finding that Craig obtains raw scores of 30 on ***Cave***, 4 on ***Mobile***, and 9 on ***Nonwords***. The *LASS 11-15* Graphical Profile gives centile scores of 55, 20 and 38, respectively for these tests, which is not particularly helpful as these compare Craig's results with that of eleven-year-olds. Referring to the table in Section 9.4, it can seen that he is at the 13:0–13:6 age level for ***Cave***, but less than the 11:0 age level for ***Mobile*** and at the 11:0–11:6 level for ***Nonwords***. From this is can be deduced that Craig is probably relying heavily on visual memory when reading and that his phonic skills are not quite as good as might have been expected. A relevant factor would appear to be his auditory-verbal memory, which although above average, is probably not in step with his overall intelligence.

4.6 LASS 11-15 profiles and the SEN Code of Practice

4.6.1 The SEN Code of Practice

The current *Special Educational Needs Code of Practice* (DfES, 2001), which came into force in January 2002, replaced the previous Code (published in 1994). Under the provisions of the *Education Act 1996*, Part IV, all state schools and Local Education Authorities (LEAs) in England and Wales must have regard to the SEN Code when dealing with pupils with special educational needs. It is assumed that most teachers in England and Wales will be familiar with the SEN Code of Practice, especially if they are Special Educational Needs Co-ordinator (SENCo), and so only a brief outline will be given here.

The SEN Code proposes a staged model of identification, assessment and support for all students with special educational needs. The first two stages ('School Action' and 'School Action Plus') are under the responsibility of the school. The next stage corresponds to the point of statutory assessment, in which educational psychologists will formally assess the child and other evidence gathered concerning the child's difficulties. At the final stage a student will have a Statement of Special Educational Needs, which means that additional resources will be provided to the school by the LEA in order to address the child's difficulties. In Scotland a comparable SEN system operates, although the term 'Record of Needs' is used instead of Statement of Special Educational Needs. The assumption is that a child will proceed through these stages according to individual need, with regular reviews at which the views of the parents are taken into consideration. However, the Code avers that "…the special educational needs of the great majority of children should be met effectively with mainstream settings through …*School Action* and *School Action Plus*." [SEN Code of Practice, 2001, 7:1] An LEA may refuse to provide a statutory assessment if there is inadequate evidence that the school has already made reasonable attempts to identify a child's difficulties and deal with them using it own resources at *School Action* and *School Action Plus* stages.

The Education Act 1996, Part IV, Chapter 1 places upon LEAs and Governing Bodies of all maintained schools in England and Wales, the responsibility for identifying and assessing all students with special educational needs "…as early as possible and as quickly as is consistent with thoroughness" Although many pupils will enter secondary education having had their special educational needs already identified at the primary stage, the SEN Code points out that "Secondary schools will need to be aware that any pupil admitted to year 7 may have unidentified special educational needs." [SEN Code of Practice, 2001, 6:1] In this context, the SEN Code of Practice states:

"The continued importance at secondary level of early identification and assessment for any pupil who may have special educational needs cannot be over-emphasised. The earlier action is taken, the quicker appropriate help can be provided without unduly disrupting the organisation of the school, and the more responsive the pupil is likely to be. Schools frequently make use of appropriate screening and assessment tools to assist them in early identification. Whatever systems are in place, however, assessment should not be regarded as a single event but as a continuing process." [SEN Code of Practice, 2001, 6:10]

It further says that to help to identify pupils who may have special educational needs, schools can measure student's progress using a variety of type techniques, including "…*standardised screening or assessment tools."* [SEN Code of Practice, 2001, 6:12]. The SEN Code instructs LEAs, when deciding whether or not to make a statutory assessment, to seek evidence not only about the student's academic progress but also about other factors that could impact on learning, including "…clear, recorded evidence of clumsiness; significant difficulties of sequencing or visual perception; deficiencies in working memory; or significant delays in language functioning*"* [SEN Code of Practice, 2001, 7:43). It is clear, therefore, that the intentions of the *Education Act, 1996* as reflected in the SEN Code of Practice, are that all secondary schools must have in place effective procedures for identifying all special educational needs as early as possible in a student's education. The responsibility for this, in the first instance, lies with the school, its teachers and its governing body. It is also clear that *LASS 11-15* can play a significant role in helping schools and teachers meet their obligations under the Act and the SEN Code.

4.6.2 Guidelines on using LASS 11-15 in conjunction with the SEN Code of Practice

LASS 11-15 is designed to be incorporated within the staged SEN model proposed by the SEN Code of Practice. Table 7 illustrates how this can be accomplished. It should be noted that the SEN Stages recommended in the table are the *minimum* that should normally apply: at this age it is imperative that schools are not over-cautious in allocating SEN provision because students do not have many years remaining in formal education in which to make good any deficiencies in their literacy skills. At the *School Action* stage, the student should have an Individual Education Plan (IEP) setting out the strategies for supporting the student, learning goals and projected review dates. The IEP should only record that which is additional to or different from the provision given to all pupils (which should in any case, be differentiated according to individual learning needs). Support will normally be provided by staff from within the school. At the *School Action Plus* stage, the student will also have an IEP and support from school staff but, additionally, help will usually be sought from specialist outside agencies, such as LEA learning support services, which may provide advice and/or specialist tuition.

LASS results should not be considered in a 'vacuum'. Hence, when applying the guidelines shown in Table 7, other relevant factors should be taken fully into account, including academic progress across the curriculum, the length of time that a student has been experiencing difficulties, then extent to which the student has developed strategies which enable him or her to compensate for difficulties, the emotional impact of any difficulties, and the duration that the student has remained at a given SEN stage. Writing skills are not assessed by *LASS* but when considering results and deciding appropriate courses of action it is important that writing skills are factored in. Consistent with the SEN Code, it should also be remembered that assessment is not a one-off but rather a continuing process in which educational history should be considered and regular reviews undertaken.

The rationale for the recommendations given in Table 7 are that when a student is below the 20^{th} centile in literacy skills s/he is clearly underperforming in relation to age-group norms and hence there is a clearly identified need for SEN support at the School Action stage. When memory and phonological skills are below the 5^{th} centile this is likely to impact on the student's ability to learn and retain information and to tackle work involving new terminology, which also calls for SEN support at the School Action stage. If there is a significant discrepancy between the student's intelligence and their literacy attainment the student is clearly underperforming in relation to ability-group norms and so there is equally a need for SEN support at the School Action stage. However, if <u>both</u> literacy <u>and</u> memory/phonological skills are significantly affected (or where literacy attainment is very poor – below 5^{th} centile), there is a correspondingly greater SEN need, and hence the recommendation for School Action Plus. (Teachers may wonder why the corresponding recommendation is not made for memory and phonological skills below 5^{th} centile, in the absence of any other indicator. The reason for this is that if, despite very poor memory and phonological skills, literacy measures are above the 20^{th} centile this suggests that the student has developed some strategies that enable them to compensate for the cognitive weaknesses.) Similarly, when there a <u>highly</u> <u>significant</u> discrepancy between intelligence and literacy attainment there is a need for greater support as indicated by School Action Plus. When a student has already been on School Action for two years or more (whether in the current or previous school), and the *LASS* results suggest that School Action would be appropriate, the apparent lack of progress indicated by the *LASS* scores calls for a shift to the somewhat higher levels of support offered at the School Action Plus stage. But if a student has already been on School Action Plus for two years or more (whether in the current or previous school), and the *LASS* results suggest that School Action Plus would still be appropriate, the apparent lack of progress indicated by the *LASS* scores implies that even greater support is required and for that it may be necessary to request a statutory assessment.

Table 7. Relating LASS 11-15 results to the stages of the SEN Code of Practice (2001).

If the student has *LASS 11-15* results that:	**SEN action stage recommended**
Are below 20th centile on key literacy measures OR below 5th centile on key diagnostic measures.	**School Action**
Show a significant discrepancy (z score difference between 0.66 and 1.66) between the student's scores on key literacy measures and his/her reasoning score.	**School Action**
Are below 20th centile on key literacy measures AND below 5th centile on key diagnostic measures.	**School Action Plus**
Are below 5th centile on key literacy measures.	**School Action Plus**
Show a significant discrepancy (z score difference greater than 1.66) between the student's scores on key literacy measures and his/her reasoning score.	**School Action Plus**
Meet the above criteria for School Action but the student has already been on School Action for two years or more.	**School Action Plus**
Meet the above criteria for School Action Plus but the student has already been on School Action Plus for two years or more.	**Consider application for Statutory Assessment**

'Key literacy measures' = ***Sentence Reading, Spelling*** and ***Nonwords*** (phonic skills).

'Key diagnostic measures' = ***Cave*** (visual memory), ***Mobile*** (auditory memory), ***Segments*** (phonological processing).

5 Interpreting results from individual tests

5.1 Reasoning

The purpose of the ***Reasoning*** module is to give the assessor a reasonable estimate of the student's general intellectual ability or intelligence. This is a matrix test, in which both visual and verbal reasoning strategies may be employed. There is good evidence that such matrix reasoning tests correlate well with more extensive measures of intelligence and therefore provide a good overall indicator of general intellectual ability. Nevertheless, assessors should be aware that a *small proportion* of students may experience difficulties with this task, even though in other respects their intelligence levels are at least average. Hence in cases of low scoring where the assessor is puzzled by the result because it does not seem to accord with expectations, it would be wise to check the student's intelligence using an alternative measure, such as the *NFER-NELSON Verbal and Non-Verbal Reasoning Test Series*, or the *British Picture Vocabulary Scale (BPVS)*[5].

The ***Reasoning*** module in *LASS 11-15* is not intended to be a speeded test (i.e. performed against the clock), but in the interests of avoiding excessively lengthy assessment sessions, a (fairly generous) time limit of 60 seconds has been allowed for each item. For most students, this should allow sufficient time for a reasonable attempt at each item. To allow greater time would not increase the validity or reliability of the test, so if students run out of time then this must be accepted as part of the exigencies of the task.

5.2 Sentence Reading

Sentence Reading will often be the first test to be administered. Like the reasoning module, it is also an adaptive test, which makes assessment swift and efficient. ***Sentence Reading*** involves both *reading accuracy* (i.e. word recognition using phonological decoding skills and/or whole-word visual strategies) and *reading comprehension* (because in order to decide which of the words offered is the correct word to fit into the sentence, the student has to have some understanding of the meaning of the sentence). Hence it gives a good general estimate of the overall reading skills of students in this age range.

In cases where the student scores at least within the average range on the ***Sentence Reading*** module, and there is no significant discrepancy between this result and the score on the ***Reasoning*** module, there is usually no need to administer the other two reading-related modules (***Single Word Reading*** and ***Nonwords***). This is because the student's performance in reading will not give undue cause for concern. However, if the score of this module falls below centile 20, or there is a significant discrepancy between this result and the score on the ***Reasoning*** module, then there will be cause for concern. In this event it is recommended that both the ***Single Word Reading*** and ***Nonwords*** tests also be administered.

If the ***Sentence Reading*** result is found to be low this may be because the student has dyslexia or specific learning difficulties (e.g. case studies 7.2 and 7.3) or because they have low

[5] These tests are available from NFER-Nelson (see Section 9.2 for address details).

general ability (e.g. case study 7.6). Or it could be because they lack experience of reading texts at an age-appropriate level and simply need to develop their comprehension skills. They would benefit from a variety of activities designed to stimulate reading comprehension skills but if the student has problems of a dyslexic nature, it may be necessary to tackle word recognition and phonic skills before launching to vigorously into more ambitious work on reading for meaning (see Section 6.2.2).

5.3 Single Word Reading

This is a test of word recognition out-of-context: i.e. reading accuracy. ***Single Word Reading*** is the only test in the *LASS* suite for which scores are not distributed in a normal curve. In fact, there is a significant negative skew, indicating that most students will achieve a maximum or near-maximum performance (in statistical terms this is sometimes referred to as a *'ceiling effect'*). The ***Single Word Reading*** test does not have sufficient sensitivity to discriminate amongst students within the average range, and so its use should be confined to students who are *significantly behind* in reading development, either to determine their attainment level or evaluate progress.

Hence there is generally little point in administering ***Single Word Reading*** unless the teacher suspects that the student is a poor reader, because:

- the student has scored below the threshold of concern (less than centile 20) on the sentence reading module; or
- a significant discrepancy between the score for the sentence reading module and the score on the reasoning module has already been detected; or
- there is other evidence to suggest deficient reading skills.

In such cases, the purpose of administering this module is to ascertain whether there is a serious deficiency in word recognition as well as reading comprehension (the latter being judged on the basis of the student's performance on the ***Sentence Reading*** test or some other reading comprehension test).

5.4 Nonwords

This is a test of nonword reading. Nonwords (sometimes called 'pseudowords') are letter strings that are not recognised words in a given language (in this case English), but could be – i.e. they conform to orthographic rules of the language. For example, 'gade' or 'tiphalune' are not English words but are nevertheless pronounceable as though they were words, using phonological decoding skills (and, possibly, analogy processes, e.g. 'gade' might be rhymed with 'fade' or 'glade'). If a student pronounced 'gade' as 'gad´ee' (instead of applying the silent 'e' rule which changed the short 'a' to a long 'a'), or 'tiphalune' as 'tip´hall´unee' (instead of 'tif´aloon' or 'ti´farloon'), we would have good evidence that the student does not possess the appropriate phonological decoding rules (often referred to by teachers simply as 'phonics'). In some cases there may be other phonological problems, such as difficulties in sequencing phonemes or syllables (e.g. the student may pronounce 'tiphalune' as 'till´a´foon'), additional to – or instead of – failure to apply rules of phonics.

Students with dyslexia typically experience difficulties in reading nonwords (Snowling and Hulme, 1994). Indeed, there is evidence from a wide range of different tasks (not just nonwords) that individuals with dyslexia of all ages generally find phonological activities difficult (Bruck, 1992, Snowling et al, 1997, Snowling, 2000) and there is a school of scientific thought that regards dyslexia as essentially a phonological processing difficulty (Rack, 1994; Snowling, 1995, 2000). Hence a low score on the *LASS* ***Nonwords*** test is usually a good indication of dyslexia. However, teachers should be aware that there are other possible explanations for a low score on ***Nonwords***, including:

- the student has never been taught phonics properly
- the student has insufficient experience of English
- the student has hearing problems

In order to resolve these possibilities, the teacher will need to consider other relevant evidence (such as medical history or information about the student's primary or elementary schooling) but must also take into account the student's performance on the other *LASS* tests. For example, if the student also performs poorly on ***Segments***, then this would support conclusions of a phonological processing difficulty. However, although it is true that *most* students with dyslexia have phonological processing difficulties, there are some cases of dyslexia that do not display such difficulties (Beaton, McDougall and Singleton, 1997b; Rack, 1997; Turner, 1997). Hence teachers should beware of assuming that because a student does not have a low score on ***Nonwords*** he or she cannot therefore have dyslexia.

By inspecting the data pages for ***Nonwords***, the assessor can examine the student's results in detail. This will help to determine whether the problem is mainly one of hearing – in which case errors will usually be scattered throughout the test – rather than poor phonics skills, in which case errors will tend to increase as the test gets more difficult.

Lack of experience with English can limit awareness of pronunciation rules. For example, in one of the more difficult items in ***Nonwords***: 'troughilicancy' (pronounced 'troff´ill´ick´an´see'), in order to select the correct answer a student needs to know that '–ough' is pronounced '–off' and that 'c' followed by a vowel is usually pronounced 'k' but when followed by a 'y' is pronounced 's'). Inspection of the data pages for ***Nonwords*** will enable the assessor to determine the nature of the student's difficulties in these respects. Further guidelines on interpreting results obtained by students for whom English is an additional language may be found in Section 7.10.

5.5 Segments

Segments is test of general phonological processing abilities requiring deletion of segments of words. For example, 'butterfly' without the syllable 'ter' would be pronounced 'buh´fly' (strictly: not 'but´fly', unless one was using knowledge that the word was spelt with a double 't', rather than relying on the sounds of the syllables).

As children learn to talk they develop increasingly sophisticated cognitive representations for phonological aspects of speech. They become aware that words can be *segmented* into syllables (e.g. that 'wigwam' is composed of 'wig' and 'wam'), and that different words can contain similar elements (i.e. similar *onsets* like **w**-ig and **w**-am, or similar *rimes* like w-**ig** and p-**ig**). The importance of this phonological awareness for early literacy development has been very well demonstrated in research carried out all over the world in the past twenty years (for reviews and discussion of issues, see Snowling, 1995; Goswami, 1994, 1999, 2001; Goswami and Bryant, 1990; Rack, 1994; Savage, 2001). Phonological awareness in very young students is often assessed by means of an 'oddity task' in which the student has to pick out the one which is different from of list of similar sounding words, e.g. *'mop, hop, tap, lop'; 'ham, tap, had, hat'* (Bradley and Bryant, 1983; Bradley, 1980). However, phonological deletion tasks, such as

Segments, have been found to be more sensitive measures for use with older students (Snowling, 2000).

Dyslexic students are known generally to have poor phonological skills (Rack, Snowling and Olson, 1992; Holligan and Johnston, 1988). In the *phonological deficit model of dyslexia* (Hulme and Snowling, 1991; Snowling, 1995, 2000) it has been hypothesised that the status of students' underlying phonological representations determines the ease with which they learn to read, and that the poorly developed phonological representations of dyslexic students are the fundamental cause of their literacy difficulties. In the CoPS research the *Rhymes* test was found to be a highly significant predictor of later literacy skill (Singleton, Thomas and Horne, 2000).

There is good evidence that individuals of all ages with dyslexia have persistent difficulties with phonological deletion tasks (Bruck, 1990, 1992; Gottardo, Siegel and Stanovich, 1997; Snowling, 2000). Low performance on ***Segments*** is therefore a good indication of dyslexia. However, like ***Nonwords***, teachers should be aware that students with hearing problems may also have low scores on ***Segments***. By inspecting the data pages for the module, the assessor can examine the student's results in detail. This will help to determine whether the problem is mainly one of hearing – in which case errors will usually be scattered throughout the test – rather than phonological processing, in which case errors will tend to increase as the test gets more difficult.

5.6 Spelling

Some teachers take the view that spelling is the least important aspect of literacy and therefore may not bother to assess it. However, many students with specific learning difficulty or dyslexia – especially if they have had a lot of support or special tuition during primary education – may have improved reading skills to the extent that a significant discrepancy between ***Reasoning*** and reading ability is no longer apparent. In most cases, however, spelling is much more difficult to remediate, and so it is important to assess this aspect of literacy because it can shed light on underlying problems that teachers might remain unaware of. Poor spelling (especially in students who are bright and have otherwise satisfactory reading skills) often signals deeper cognitive difficulties (e.g. in memory) that can create problems in many aspects of educational performance, ranging from modern languages to mathematics.

Students with spelling problems tend to experience difficulties with writing generally (Moseley, 1997). This is not only because they have anxieties about not being able to spell words, but also because they are so focused on the *mechanics* of the writing process (spelling, grammar, punctuation) that they have little cognitive capacity left over to monitor the meaning of the text they are producing. They easily lose track of what they want to say, miss words out and leave sentences incomplete. To resolve these difficulties, students may resort to a 'dumbing down' strategy: i.e. writing in a very immature fashion, using easy-to-spell words and simple sentence structures. The resultant written work may not actually contain very many errors but is far below the standard that the students should be capable of, given their levels of understanding. Ideally, spelling – like the other mechanical processes of writing – should be automatised, i.e. be so well practised that they operate largely at a subconscious level, which frees up conscious processes to concentrate on the meaning of what is being written.

It should be noted that poor spelling does not inevitably indicate dyslexia, in which one would normally expect to see evidence of cognitive difficulties (e.g. in memory or phonological skills) that are consistent with, and underpin the spelling problems. When students with poor spelling have no underlying cognitive difficulties that would be indicative of dyslexia, it is usually the case that they have never been taught to spell properly or have had insufficient practice in using their spelling skills so that these skills become automatised (see Section 6.2.5.2 for teaching suggestions on this).

5.7 Cave

Cave is a test of visual memory, involving spatial and temporal sequences. However, since the stimulus items for ***Cave*** can be encoded by use of verbal labels, the part played by verbal memory skills in this task is potentially as great as that played by visual memory. Although auditory-verbal memory is usually regarded as being of greatest significance where literacy skills are concerned (see next section), there is good evidence that visual memory tasks can also give good indications of dyslexia and literacy difficulties (Awaida and Beech, 1995; Beech, 1997; Singleton, Thomas and Leedale, 1996; Singleton, Thomas and Horne, 2000). Hence in cases of literacy difficulties it is important for the teacher to know whether the student's visual memory skills are weak or strong, as these will not only affect the diagnosis but also have implications for subsequent teaching recommendations.

Although working memory is typically conceptualised as being a phonological system subserving speech, a visual equivalent known as the 'visuo-spatial scratch pad' has been hypothesised (Baddeley, 1996). This is believed to enable us to keep small amounts of visual information in short-term memory. Such a system is important in developing visual strategies in reading, especially those used by beginning readers ('look and say'). Models of reading acquisition suggest that visual memory is particularly important in the early stages of learning to read (e.g. Ehri, 1995; Frith, 1985). Conclusions reported by Passenger, Stuart and Terrell (2000) from their study of 80 pre-literate students during their first year of formal schooling lend some support for this view. Stuart, Masterson and Dixon (2000) also found that visual memory influences the acquisition of sight vocabulary in students aged 5 who displayed poor graphophonic skills (i.e. those who had not yet acquired the ability to segment words on the basis of their sounds and who displayed little or no knowledge of sound-to-letter mappings). For students with good graphophonic skills, however, no association between visual memory and word learning was found. Visual memory is also essential in rapid retrieval of visual whole-word representations from the mental lexicon by older and more fluent readers when reading text (particularly of irregular words for which a phonic strategy would not be appropriate). Visual memory also comes into play when retrieving visual sequences of letters in the correct order for spelling (again, particularly where irregular words are concerned). Hence visual memory is a key component of literacy development.

There is also evidence that poor readers have a bias towards visual encoding of words. Johnston and Anderson (1998) reported that poor readers showed a preference for using pictorial rather than verbal information, which they suggest may arise from previous difficulties in learning to attach verbal labels to visual stimuli. Ellis, McDougall and Monk (1996) reported that dyslexics aged 10 years were significantly faster on some visual processing tasks (e.g. picture categorisation) than other groups, including reading age (RA) controls. On word recognition tasks in which the words are paired with either visually similar cues or phonologically similar cues, poor readers are known to perform *better* than RA controls on the visually similar cue items but not on the phonologically similar cue items (Holligan and Johnston, 1988; Rack, 1987). In other words, they display a less pronounced phonological similarity effect and a more pronounced visual similarity effect (Katz, 1986; Mann and Liberman, 1984).

Palmer (2000) used the *Corsi Blocks* test to measure visuospatial span in three groups of 14 year-old students: dyslexics, RA controls, and chronological age (CA) controls with normal reading ability. The *Corsi Blocks* test comprises a set of nine blocks fixed to a base in a predetermined pattern. The test administrator touches the blocks in a set sequence and the testee is required to recall that sequence by touching the same blocks in the same order. This has a direct parallel with ***Cave*** in *LASS*. Palmer found that the dyslexic group significantly outperformed the RA controls on this test. The results also suggested that while all participants showed evidence of using phonological coding to remember pictures, only those in the dyslexic group used visual coding.

Another study by Palmer (2001) provides further evidence that it is useful for teachers to know about students' visual memory skills. In this experiment, it was found that students who maintained a visual representation of words alongside a phonological representation after age 7, were significantly worse readers than those for whom the ability to switch strategies by inhibiting the visual representation had fully developed. Students with good visual memory but poor auditory-verbal memory would not only be expected to find acquisition of an effective phonological decoding strategy in reading rather difficult, but also be inclined to rely for a longer period on visual strategies. This approach is liable to run into trouble as the student's education progresses and the number of new words with which the student is confronted steadily increases.

Some teachers and psychologists assume that problems with short-term memory are entirely verbal rather than visual. However, research suggests otherwise. Awaida and Beech (1995) found that ability to remember letter-like forms at four years of age correlated with reading skills one year later. There is a substantial literature on subtypes of dyslexia, in which visual deficits predominate (Thomson, 1993; Pumfrey and Reason, 1991). Some tests for dyslexia incorporate visual memory tests, e.g. *The Aston Index* (Newton and Thomson, 1982) and the *Coding* sub-test of WISC-III^{UK}, which is one of the key elements of the A–C–I–D profile that is often used as an indicator of dyslexic difficulties (Thomson, 1993). In the CoPS project, WISC Coding given at age 8:0 had a correlation of 0.36 ($p<0.05$) with the *Rabbits* test (a forerunner of ***Cave***) administered at age 5 (Singleton, Thomas and Horne, 2000). Fein, Davenport, Yingling and Galin (1988) found that visual memory is a factor which may be separated from verbal memory in some cases of dyslexia. Finally, there are a variety of other research themes focusing on more physiological aspects of 'visual dyslexia', including work on visual discomfort (e.g. Wilkins, 1991; Wilkins et al, 2001); atypical eye movements in reading (e.g. Pavlidis, 1985); ocular dominance (e.g. Stein, 1991, 1994; Stein, Talcott and Witton, 2001); and defects in the transient visual system (e.g. Lovegrove, 1991, 1993, 1994). However, perhaps with the exception of visual discomfort (sometimes referred to as the 'Irlen syndrome', after Irlen, 1991) the evidence on some of these physiological issues at the present time seems to be equivocal and more research is required before they can be of practical value in diagnosis and education (Stanley, 1994).

Cave also requires careful concentration and good visual attentiveness, since the stimulus items are only displayed for very brief periods of time. Therefore it is possible for a student to perform poorly on ***Cave*** not because of inherent memory difficulties, but because of attention deficit disorder. Where this appears to be a serious possibility, teachers should refer to other information about a student in order to resolve the issue, or refer the student to an educational psychologist for further investigation. Teachers should be aware that it is possible for students to have attention deficit disorder (ADD) without hyperactivity (the latter usually being referred to as AD/HD). ADD (sometimes styled 'AD/HD without hyperactivity') is characterised by persistently poor concentration and attention, daydreaming and passivity. Unlike AD/HD, it is more common in girls and often goes undiagnosed, but can be a significant cause of learning difficulties (Cooper and Ideus, 1995). Students with AD/HD who have hyperactive patterns of behaviour may also experience difficulties with ***Cave*** because of high impulsivity, which can disrupt the processes of memorisation and recall.

When interpreting the results from ***Cave***, as well as determining whether scores fall below the critical thresholds (see Section 4.1.2), significant discrepancies between the scores on this module and that on the ***Reasoning*** module can also be taken into account. In such cases the procedure described in the section *'Calculating discrepancy'* (Section 4.3.3) should be employed. Teachers should be aware that students with very good scores on ***Cave*** (or who show marked discrepancies between scores on this test and ***Mobile***) may develop over-reliance on visual strategies in reading, with a consequent neglect of phonic strategies.

5.8 Mobile

Mobile is a test of auditory-verbal sequential short-term memory, based on recall of digits. It is a well established fact that individuals with dyslexia or specific learning difficulty typically experience problems with recall of digits (Beech, 1997; Thomson, 1993; Turner, 1997), and digit span is a feature of the vast majority of assessment batteries used for diagnosis of dyslexia (Reason, 1998). Although digit span is normally a spoken test, there is good evidence that the form of the test used in *LASS* correlates highly with traditional forms, such as those used in the Wechsler Intelligence Tests and the British Ability Scales, and is therefore a valid measure of auditory-verbal memory.

Auditory-verbal short-term memory is critical for literacy development, especially for the acquisition of phonic skills, i.e. mapping of letters (graphemes) on to sounds (phonemes), and for the storage of phonological codes in short-term memory during word recognition and processing of text. There is also a well-established connection between reading and memory (for reviews, see Baddeley, 1986; Beech, 1997; Brady, 1986; Jorm, 1983; Wagner and Torgesen, 1987). The predominant view in the research literature is that phonological processes underpin the development of a phonological recoding strategy in reading, and that working memory plays a significant role in this strategy, enabling constituent sounds and/or phonological codes to be held in the short-term store until these can be recognised as a word and its meaning accessed in long-term memory (e.g. Gathercole and Baddeley, 1993a; Wagner et al, 1993).

Short-term auditory-verbal memory is sometimes called *'working memory'* because it is the system which we use when we have to hold information for a brief period of time while we process it. Working memory is a limited-capacity system, and unless rehearsed or transferred to longer-term storage, information in working memory is only retained for a few seconds (Baddeley, 1986). For example, in order to understand what a person is saying to us we have to hold their words in working memory until they get to the end of a sentence (or equivalent break), then we can process those words for their meaning. We cannot process each individual word for meaning as we hear it because by themselves words do not convey sufficient meaning. Furthermore, words heard later in an utterance can substantially alter the meaning of words heard earlier (e.g. "The man opened the magazine — then he carefully extracted the remaining bullets it contained"). Other examples of working memory include trying to hold a telephone number in mind while we dial it, and carrying out mental arithmetic.

The relevance of auditory-verbal working memory to literacy skills should be obvious — in the same way that it is necessary to hold spoken words in memory in conversation, the student must hold *letters and syllables* in memory when decoding words. This is very important in the development of phonic skills. The majority of dyslexic students have problems in this area of cognitive processing (Thomson, 1989). Awaida and Beech (1995) found that phonological memory at age 5 predicted nonword reading (i.e. phonics skills) at 6 years. When reading continuous text for meaning the student must also hold *words* in memory until the end of the phrase or sentence. Poor working memory will thus affect reading comprehension. Of course, *visual* memory skills will be involved in much of this cognitive activity, especially for beginning readers who have not progressed to phonics, and also for more competent readers whose capacity for rapid visual recognition of words steadily increases with age. Nevertheless, auditory-verbal working memory remains a significant factor in reading development and in writing as well.

Students with weaknesses in auditory-verbal working memory also tend have difficulty in *monitoring* their written output, and are inclined to miss letters, syllables and/or words out when they are writing. (For reviews of research on the connections between verbal memory and reading see Baddeley, 1986; Brady, 1986; Jorm; 1983; Wagner and Torgeson, 1987.)

More recently, further research has suggested a very close connection between auditory memory span and articulation (speech) rate (Avons and Hanna, 1995; McDougall and Hulme, 1994). It could well be that articulation rate is an index of the efficiency with which phonological representations of words can be located in memory and activated (i.e. spoken). In turn, this could be closely related to how quickly cognitive representations of words being read can be located in the orthographic and semantic lexicons and activated (i.e. recognised and understood). The three lexicons (phonological, orthographic and semantic) are all believed to be closely related (Rayner and Polatsek, 1989).

When interpreting the results from ***Mobile***, as well as determining whether scores fall below the critical thresholds (see Section 4.1.2), significant discrepancies between the scores on this module and that on the ***Reasoning*** module may also be taken into account. In this case, the procedure described in Section 4.3.3 should be employed.

Like the other auditory tasks in *LASS*, ***Mobile*** requires adequate hearing ability. Where a teacher suspects that a low score on ***Mobile*** could be due to poor hearing, inspection of the data pages should help to resolve the question. If the problem is mainly one of hearing, errors will usually be found to be scattered throughout the test results. If it is due to poor memory, errors will tend to increase as the test progresses and the memorisation load steadily increases.

6 Teaching recommendations

6.1 General principles

6.1.1 Addressing learning problems

As a teacher, once the *LASS* tests have been used, you will want to know how to use your student's strengths to develop the identified areas of weakness. Many students tend to have a greater strength in visual, auditory or tactile cognitive areas and this influences their preferred way of learning. The student who has dyslexic problems will tend to have a very uneven profile, with some cognitive areas in the low centiles and others high. Looking at the whole profile will provide you with evidence of the areas that need attention and at the same time indicate where the strengths are, so that you can use those strengths to mitigate or remediate the problem learning areas. Analysis of the problem areas may provide you with insight into the nature of the problem.

When specific areas of learning difficulty have been identified by *LASS*, there are a wide range of teaching strategies that can be used to build on the student's strengths to mitigate or remediate the weaknesses. Most schools will already have a range of reading and spelling activities, worksheets, prompt cards, teaching schemes and devices, which can now be selected and used in a more focused way. Suggestions are made in this chapter on how such materials can be put to most effective use. To supplement and extend existing support materials, there are equally — or, sometimes, more — effective ICT solutions that can be introduced to extend the range of strategies at a teacher's disposal.

In some cases you may have some awareness of a student's difficulties before you use *LASS*. Concern about a student's progress will often be the stimulus to carry out an assessment. A student with dyslexic and/or dyspraxic tendencies will typically present with problems in all or most of these characteristic areas:

- short-term memory (auditory-verbal or visual)
- phonological processing skills
- phonic decoding skills
- poor presentation due to motor skills and/or constantly correcting errors
- arrogance and/or low self-esteem
- disorganised work and life.

Such characteristics are almost bound to create problems for teachers and are likely to become a stimulus for conflict.

It is very likely that a student with dyslexia will have a mismatch between high level oral skills in class discussions and the quantity and quality of any written work that is produced. Possibly, reading skills may be underdeveloped, with lack of fluency, frequent decoding errors and poor comprehension of text. Spelling may be minimal, phonetic or bizarre and only simple words written, when much more complex words are used orally. Especially where there is some element of dyspraxia, the student's handwriting may be erratic, spidery, very small, very large or deeply indented into the page. These are all indicators that a great deal of physical effort is required to write by hand, which puts increased stress on a brain that is struggling to cope with sequencing and orientation difficulties. Great difficulty or inability to organise the content of written work or set a priority on tasks can manifest itself as work not completed in class in the set time, or homework not handed in. There may also be problems of staying on-task due to memory problems, where the dyslexic student loses track of the content of a long sentence and keeps asking the teacher or other students for prompts

Some students will have developed advanced strategies for avoiding stressful work, which may be manifested as:

- lost writing equipment/books
- regular and prolonged visits to the toilet
- acting the class clown
- distracting other students
- provoking dismissal from the room
- truanting
- school phobia.

None of these behaviours are likely to produce a good learning environment and if they become conduct problems, it is unlikely that the student will get the sympathetic support from the class teacher that is needed to address the learning difficulties.

6.1.2 Support versus remediation?

In general, strategies for addressing the learning problems of students in this age range will focus more on *support* than on *remediation*. The latter, particularly if it involves withdrawal from ordinary classes can often be embarrassing and stigmatising for an older student. The most important thing for students with dyslexia and related problems at the secondary education stage is to be enabled to access the curriculum, despite their difficulties. This can be achieved by various strategies, including use of assistive technology and support assistants. However, some students may still need to improve their basic skills, particularly in phonic decoding, word recognition and spelling. In such cases, suitable computer software designed to provide stimulating practice in the appropriate areas, can often be the most acceptable and effective solution.

Throughout this chapter, teachers will find recommendations regarding ICT solutions (hardware and software) and other resources. These materials were available at the time of printing, and addresses of suppliers are given in the Appendix (section 9.2). In the course of time these materials may become unavailable, while new materials are likely to come on to the market. Teachers should consult the Lucid website (www.lucid-research.com) for up-to-date information about current software and resources. Teaching strategies and suggested software for students with dyslexia and other literacy difficulties have been reviewed by Crivelli (2001) and Keates (2000). Teachers will find many additional suggestions in these highly recommended books. For further suggestions on suitable software see the British Dyslexia Association website (www.bdadyslexia.org.uk) which is updated on a regular basis.

6.1.3 Learning styles

Here we are much more concerned with a student's areas of strength rather than their weaknesses. Areas of cognitive strength tend to lead to the student preferring certain approaches to learning over others. As time goes by, practice in using those strengths tends to create a firm basis for definite **learning styles**. For example, the student with strengths in visual memory will usually find that they recall pictorial information better than textual or verbal information. In time, this often tends to result in a preference for more 'visual' subjects (such as design and technology, geography, art and design) and in using visual ways to represent information that has to be leaned for examinations (e.g. mind mapping). At the point where the student (intuitively or deliberately) approaches learning in a qualitatively different way to some other students, we can say that they have a 'learning style'. Learning styles (sometimes called 'cognitive styles') have been defined as an individual's personal, consistent or characteristic approach to organizing, processing and representing information (Tennant, 1988; Riding and Rayner, 1998). Research suggests that learning styles can develop quite early in life and although they tend to be relatively stable, some changes can occur over time (Pinto and Geiger, 1991; Riding and Agrell, 1997).

There are many different models of learning style and there is insufficient space to consider all of these here, although a useful review has been provided by Riding and Cheema (1991). Early models of learning style which identified several different dimensions of style (e.g. Kolb, 1977, and Dunn and Dunn, 1978) have been criticised on theoretical and practical grounds, and in research studies have often produced inconsistent results (e.g. Murray-Harvey, 1994). More recent approaches (e.g. Riding and Rayner, 1998) have tended to focus on two principle dimensions: a wholist – analytic dimension, and verbal – visual dimension.

LASS can be useful in estimating where a student is likely to be on the visual–verbal learning styles dimension. If a student's scores on ***Cave*** are better than those on ***Mobile*** then the student is likely to lie more towards the visual end of the continuum, whereas if the opposite result is found (i.e. scores on ***Mobile*** better than those on ***Cave***) then the student is more likely to lie more towards the verbal end of the continuum. Visualisers will tend to find pictorial information easier to understand and remember — they prefer to think in pictures and use diagrams to explain themselves, while verbalisers will tend to find verbal information easier to understand and remember — they prefer to think in words and to use verbal descriptions to explain themselves. Clearly, when teaching in a group situation provision need to be made for *both* learning styles, but when an individual is learning by themselves, it is often beneficial for them to adopt their preferred learning style and to have materials that fit well with this learning style. On the other hand, in the interests of helping all students to be well-rounded, independent, efficient and flexible learners, it is useful to encourage them to enlarge their repertory of learning styles — e.g. to introduce the visualiser to ways in which they can develop their verbal learning skills and to help the verbaliser to think more visually when this is required. For ideas on how this can be achieved in the classroom, see Banner and Rayner (1997); Given and Reid (1999); Riding (2002); Riding and Rayner (1998); Riding and Sadler-Smith (1992).

6.2 Strategies for specific problem areas

6.2.1 Poor phonological processing ability

The evidence that training in phonological skills facilitates literacy development is extremely strong (for reviews see Bryant and Bradley, 1985; Goswami and Bryant, 1990; and Rack, 1994). In the Cumbria study, Hatcher, Hulme, and Ellis (1994) found that integrated sound-categorisation and letter-knowledge training produced the largest improvements in reading and spelling of a group of seven-year-olds who were failing in reading. However, at secondary age, the need for basic teaching on phonological skills is much less likely than at the primary stage. Only in most severe cases are you likely to find that the student still requires work of this nature, and in such cases care must be taken to ensure that the student does not perceive such activities to be babyish and therefore demeaning.

Phonological awareness can be developed by a variety of methods. For example:

Rhyming and **alliteration** — suitable techniques include playing rhyming snap or 'odd-one-out' games with pictures and objects; using plastic letters to discover and create rhyming word families
Deletion of the first sound (e.g. '*near–ear'*) or of the last sound (e.g. *'party–part'*), or of whole syllables (e.g. saying '*alligator'* without the '*all'*)
Elision of the middle sound (e.g. snail–sail) or syllable ('*alligator*' without the '*ga'*).
Correspondence — e.g. tapping out the number of syllables in a word.

Many phonological discrimination activities are also useful for phonological training. For ideas on phonological awareness activities see Goswami and Bryant (1990); Layton and Upton (1993); Layton, Deeney, Tall and Upton (1996); Buckley, James and Kerr (1994); James, Kerr and Tyler (1994); Yopp (1992). ***Sound Linkage*** (Hatcher; 1994) is based on the Cumbria project on phonological awareness (Hatcher, Hulme and Ellis, 1994) and includes materials for testing and training. Snowling and Stackhouse (1996) provide a useful compendium of recommendations on teaching dyslexic students with speech and language difficulties.
Unfortunately, most computer-based activities for practising phonological skills are more suitable for younger children (e.g. ***Rhymes and Analogy, Sound Stories, Tizzy's Toybox*** and ***Talking Animated Alphabet*** [Sherston], ***Talking Rhymes*** [Topologika], ***Letterland*** [Harper Collins]), so these must be used with caution.

Dyslexic students who continue to experience persistent phonological difficulties into secondary age are likely to require particularly careful literacy teaching. In such cases, a well-structured multisensory approach incorporating plenty of practice in phonic skills (over-learning) is strongly recommended. Without adequate training in applying phonics, students with such weaknesses are liable to develop an over-reliance on visual (whole word) and contextual strategies in reading (especially if they are bright). This, in turn, will have a deleterious effect on their text comprehension, especially in dealing with more complex curriculum-related material.

6.2.2 Poor phonic decoding skills

For the reasons explained above, the student who displays major difficulties in *auditory-verbal* memory is likely to have problems in acquiring effective phonic skills. Nevertheless, this type of student may make satisfactory progress in the *early* stages of reading — where the emphasis tends to be on building up simple visual word recognition skills — if visual memory skills are quite good. Because of this, it is very easy to overlook this student's problems and assume that because an apparently satisfactory early start has been made, everything else will follow automatically. In fact, this student would probably learn to rely almost exclusively on visual strategies in reading. It could be as late as nine or ten years of age (or even into secondary age) before the underlying problems become fully appreciated, by which time so much learning opportunity has been wasted. Many dyslexics have a pattern of development like this. The recommendations here would be for an early introduction of a highly-structured *multisensory phonic approach* to literacy learning. This should not only provide ample practice to compensate for memory weakness, but should in this case also make use of the student's strong visual skills in order to reinforce learning and help to maintain confidence.

Examples of well-structured phonics schemes suitable for students with dyslexic difficulties include the following (books marked † also have worksheets):

Alpha to Omega (Hornsby and Shear, 1975) †
Spelling Made Easy (Brand, 1988) †
The Bangor Teaching System (Miles, 1989)

The Hickey Multisensory Language Course (Augur and Briggs, 1992)
The Star Track Reading Scheme (Beadle and Hampshire, 1995) †
THRASS (a collection of printed, audio, video and software resources to teach phonics; see www.thrass.co.uk) †

Good computer software for use by older students for developing phonic skills includes ***Wordshark4*** (Whitespace), ***Gamz Player*** (Inclusive Technology), ***Nessy*** (Iansyst) and ***Lexia Reading System*** (LexiaUK). In addition, ***AcceleRead, AcceleWrite*** (Clifford and Miles, 1994) is a structured scheme for basic literacy learning that can be used with any good talking word processor (Miles, 2000).

Wordshark4 offers 36 different computer games which use sound, graphics and text to teach and reinforce word recognition and spelling. The program includes phonics, onset and rime, homophones, spelling rules, common letter patterns, visual and auditory patterns, prefixes, suffixes, roots, word division, high frequency words, use of words in context, alphabet and dictionary skills and more. In an evaluation of ***Wordshark*** by Singleton and Simmons (2001) in 403 schools (about one-third of which were secondary schools), teachers reported significant benefits to reading, spelling and confidence in using the program, which was used up to age 15.

Gamz Player is a computerised version of a range of card games designed to develop word recognition, spelling and memory skills. ***Nessy*** is a collection of worksheets and multisensory games

Lexia Reading System is an interactive computer program designed specifically for students who are not yet proficient readers. Students work independently as voice prompts lead them through a comprehensive set of activities. The program introduces over 3,000 words in hundreds of phonic exercises that ease the acquisition of reading skills. It was originally designed for dyslexic students but many schools use the program with a wide range of special needs students (e.g. MLD, SLD, EBD and ESL).

Use of a talking word processor is beneficial because it gives the student auditory feedback and encourages them to pay attention to the phonic components of words when writing. Recommended software includes: ***Write:Outloud*** (Don Johnston); ***Penfriend*** (Iansyst); ***textHELP! Type and Talk*** (textHELP Systems). Further information on techniques for teaching the dyslexic student can be found in Augur (1995); Cooke (1992); Crombie (1992); Hornsby (1982); Pollock and Waller (1994); Reid (2003); Thomson and Watkins (1990).

Talking books, which use digitised speech to accompany story texts are very useful classroom resources. They enable poor readers independently to practice reading skills at text level, and develop confidence, fluency and comprehension. Most of these programs allow the reader to click on individual words and hear these read aloud, so enabling reading to continue and understanding to be maintained. The books and CDs in the ***Read Right Away*** series (Don Johnston) are a particularly useful resource, as they have been designed specifically for secondary-age students with reading problems.

6.2.3 Poor auditory-verbal working memory

It is commonly found that memory limitations are more difficult to improve by direct training, especially with younger children, than are weaknesses in either phonological awareness or auditory discrimination. On the other hand, older students can respond well to *metacognitive* approaches to memory improvement, i.e. techniques designed to promote understanding of their own memory limitations and to develop appropriate compensatory strategies (see Buzan, 1986). The emphasis should be on variety and on stretching the student steadily with each training session. The tasks should not be too easy for the student (which would be boring) nor much too difficult (which would be discouraging), but just give the right amount of *challenge* to motivate the student to maximum effort. Use of prizes, star charts for improvement, etc., should all be used if these will help motivation. Activities can usually be carried out at home as well as in school. Competition between students can be motivating for some students, but it can also be discouraging for the student with severe difficulties, because they will easily perceive and be embarrassed by the discrepancy between their performance and that of other students.

Auditory-verbal training activities include:

I went to the supermarket — teacher says to the student sentences of increasing length and complexity and the student has to repeat these back verbatim (e.g. *"I went to the supermarket and bought three tins of beans, one loaf of bread, a carton of milk, a packet of sweets, two bars of chocolate...."* etc.)
Find the changed (or missing) word — teacher says sequence of words to the student (e.g. *dog, cat, fish, monkey, spider*) and then repeats it changing one (or missing one out altogether), either slightly or more obviously (e.g. *dog, cat, fox, monkey, spider*) and the student has to identify the change.
What's their job? — teacher says to the student a list of name-occupation associations (e.g. *"Mr Pearce the painter, Mrs Jolly the grocer, Miss Fish the hairdresser, Mr Brown the electrician"*) and then asks for recall of one (e.g. *"Who was the grocer?"* or *"What is Mr Brown's job?"*). Occupational stereotypes can be avoided if desired.
Word repetition — teacher says sequences of unrelated words to the student (e.g. *hat, mouse, box, cup, ladder, tree, biscuit, car, fork, carpet*) and the student has to repeat them in the correct order. The length of the list can be gradually extended. If the words are semantically related it is more difficult, and if they are phonologically related (e.g. *fish, film, fog, fun, phone, finger*) it is more difficult still.
Phoneme repetition — as word repetition, but with phonemes (*"oo, v, s, er, d"*). Note that phonologically similar lists will be much more difficult (e.g. *"p, b, k, d, t"*)
Letter name repetition — as word repetition, but with letter names.
Digit repetition — as word repetition, but with digits. About one per second is the maximum difficulty for short sequences. Slightly faster or slower rates are both easier for ordinary individuals to remember, but dyslexics tend to find a slower sequence harder (because their rehearsal processes in working memory are deficient).

The computer program ***Mastering Memory*** (CALSC) is most appropriate for developing memory skills. This program, however, requires close supervision by the teacher, applying the memory training techniques explained in the manual. Use of the system ***AcceleRead, AcceleWrite*** (Clifford and Miles, 1994; see Section 6.3) has also been found to improve working memory ability while students are learning phonic rules (Miles, 2000).

Students who have poor memory skills may find learning and revision for examinations very difficult. Their revision tends to be badly organised and because typically they are conscious of the fact that their memory generally lets them down they become discouraged and feel that there is no point in revising for examinations. The solution is to help the student to revise more efficiently. ***Timely Reminders*** (CALSC) is computer program designed to achieve this. This is a content-free program into which the student (or the teacher) enters material to be learned, and the program will test the student on that material in a structured and progressive fashion over a period of time so as to maximise recall. A version for junior-school children (called ***Time 2 Revise***) is also available. Many books about developing study skills have advice on how to improve memory skills (see Section 6.2.7).

6.2.4 Poor visual memory

It is widely acknowledged that the *predominant* problems found in dyslexic students are phonological rather than visual (Pumfrey and Reason, 1991; Snowling and Thomson, 1994). Indeed, dyslexic individuals often have excellent visual skills (West, 1991). Nevertheless, teachers and educational psychologists are not infrequently confronted by cases of students who appear to have inordinate difficulties in remembering various types of information presented visually. Such cases are undoubtedly less common than those of students with phonological difficulties. However, they do form a very important group because these are the students who are likely to struggle with whole-word reading activities, including recognition and spelling of irregular words (for which phonic strategies are ineffective). They will tend to remain slow, inaccurate readers.

In cases where the student is experiencing difficulty with word recognition or spelling because of visual memory problems this can lead to discouragement and frustration which can easily affect the whole of the student's educational activities. The student can become a reluctant learner. Spelling and writing are also likely to be a struggle. Visual memory training would be beneficial (see below). However, the most effective solution is to use a rigorous multisensory approach to word recognition and spelling, building on any auditory and kinaesthetic strengths. By ensuring that phonic skills are thoroughly learned, well practised and applied fluently, there is less vulnerability to visual inadequacies. A list of suitable phonics programmes and associated activities is given in Section 6.2.2.

The following are suggested training activities for students with poor visual memory:

What's wrong here — use pictures of everyday things with parts of the pictures wrong (e.g. house with the door halfway up the wall; person with feet pointing backwards instead of forwards) and ask the student to identify what is wrong. To do this the student has to recall visual images of the relevant objects.

Kim's game — an array of familiar objects on a tray (or picture of an array of objects). The student scans this for two minutes (or whatever period of time is appropriate) and then has to remember as many as possible.

Symbols — show student a sequence of symbols, letters or shapes of increasing length, and then jumble them up and the student has to rearrange them in the correct order. Remember that this can become more of a verbal task than a visual task — if you want to practice *visual* skills then it is best to have stimuli which are not easily verbally coded.

Who lives here? — make a set of pictures of people (these may be cut from magazines) and a set of houses of different colours, or different appearance in some way. The people are matched with the houses, and then jumbled up. The student has to rearrange them in the correct relationship. If the people are given names then the task becomes more verbal.

Pelmanism — remembering matching pairs of cards from a set, when cards are individually turned over and then turned back. The student has to remember where the other one of the pair is, and if both are located these are removed from the set, and so on.

Card games — e.g. Snap, Happy Families.

Mastering Memory (CALSC) is a very suitable program for developing visual memory skills. This program, however, requires close supervision by the teacher, applying the memory training techniques explained in the manual.

Students who have poor visual memory skills may also find learning and revision for examinations very difficult. See Section 6.2.3 for possible solutions.

6.2.5 Writing skills

6.2.5.1 Word processing

Writing is one of the most demanding intellectual activities faced by all students. For students with dyslexia or other learning problems, writing is typically the area that presents the greatest difficulties and is the hardest to deal with. The reason for this is that when writing the student is forced to do many things at once — deciding what to say, what words to use, how to spell those words, making sure that letters are legible, remembering to keep writing aligned on the page with appropriate gaps between words, putting punctuation in the right places, etc., etc. — and still keep track of what the message s/he is trying to convey. No wonder it doesn't always come out right! Often, some aspects — such as spelling and punctuation — have to be abandoned altogether in order to bring the cognitive load to within manageable proportions.

A talking word processor is probably the single most effective support for writing and this can be provided in a specially designed program such as ***Pages***, ***Talking TextEase***, ***Write:Outloud6***, ***Write Away***, or ***Read&Write 9.***

Many students with dyslexia have strong visualisation skills and are helped by the speech plus rebus word processing in ***Co:Writer6***, where rebuses (small symbols and images) can be seen above or below the text in traditional orthography. Younger, less confident readers can have a rebus for every correctly spelt word; as their skills and confidence increase, the use of rebus support can be decreased, until it is only used to check the odd word. At any time, the rebuses can be removed from the final printing, so the essay looks like any other piece of word processed work.

Some dyspraxic students, who have ill-formed handwriting, lose many of their spelling errors once they see the words clearly displayed in word processed text. Others who have neat, clear handwriting may use excessive pressure, shown by marked indentations through several pages. They may be called lazy, when they appear to produce too short pieces of work, but can be liberated by using a word processor to create work more suited to their apparent ability.

AcceleRead, AcceleWrite is not a computer program, but it is a structured teaching programme which uses sentences related to a spelling pattern, in conjunction with a talking word processor. The student is required to type in the sentence from memory and use the speech in the word processor to help identify errors. This activity is undertaken, preferably daily, for a period of at least 20 sessions. This programme has proved helpful in developing spelling, typing and reading skills, but especially in improving short-term memory and the ability to stay on task, including work away from the computer.

6.2.5.2 Spelling

Computer spell checkers are a mixed blessing for students with spelling difficulties, as the list of suggestions can be daunting, when the original word was already a problem, and completely misleading, if the wrong initial letter was chosen.

The algorithms for computer spellcheckers are mainly based on likely typing, rather than conventional spelling errors, but they do indicate to the writer that there is a problem with a word. Some individuals with dyslexia find that when the word is identified as incorrect, using a ***Franklin Spellmaster*** to try and help can solve the problem, especially with the ***Elementary Spellmaster***, where the page reference to the dictionary gives the meaning of the word.

When someone finds it hard to remember how to spell words, it is usually easier to recognise a specific word than recall its spelling. There is specialised word processing software that provides access to word banks and there are utility programs that will run alongside mute word processors, databases or spreadsheets (for suggested software see Section 6.4.3). Most of these allow the words to be spoken before selection and some can also contain picture or rebus prompts. This is a more positive approach to spelling than spell checking for a weak speller, as correctly spelt words will be seen more regularly, which helps the brain to remember them. Where the utility allows phrases to be stored, it can be an effective prompt for organising ideas and reduces the likelihood of the student not 'getting started', when faced by a blank page.

The best simple support for a poor speller is a word processor that provides speech feedback and an error indicator (highlighting or underlining) to indicate inappropriate spellings. However, especially as they get older, students with dyslexia may feel the need to try and improve their spelling skills. There are many titles of spelling software, which address spelling in different ways. In a school, it is a good idea to have several programs, partly to provide a variety of approaches to cater for different learning styles, but also to enable the student to tackle the tedious activity of learning spelling rules, in as many ways as possible.

Most spelling programs can be customised to cater for the word/phonic patterns that are being currently taught; all have some files that come with the programs and many now have the primary Literacy Hour words and/or lists from recognised teaching schemes like ***Alpha to Omega***, ***Gamz*** and ***THRASS***. Regular, daily access to a customised spelling program (e.g. ***Wordshark, Starspell***) does build confidence and spelling skills. In an evaluation of ***Wordshark*** by Singleton and Simmons (2001) in 403 schools, teachers reported significant benefits to reading, spelling and confidence in using the program.

6.2.5.3 Predictive typing

Most poor spellers can recognise more words than they can recall, so predictive typing can be much more helpful. Choosing the first letter of the proposed word generates a list of possible words in the prediction window; if one of those words is the correct one, then that word can be selected; if not, typing in a second letter produces a new list of possibilities and so on; the more frequently a word is used, the more likely it is to come up in the first window. Where the prediction program has speech, the word can be heard before selection, there is an even greater chance of prediction succeeding. Recommended programs include ***Penfriend, Read&Write, WriteOnline*** and ***Co:Writer***.

6.2.5.4 Touch typing

If students are going to do most of their writing using a word processor then it is usually a good idea for them to learn to touch type. Although many students become competent typists once they have regular access to a computer, unless they can touch type, a considerably number of mistakes will be inevitable when they attempt to type with any great speed. If the student has spatial awareness or dyspraxic difficulties, it is usually essential for them to use a keyboard training program to avoid frustration later on.

Learning to touch type is an activity that should be undertaken for short, daily sessions, so is ideal for doing at home or during lunchtime or in after-school sessions. It is purely a function of practice so there is no point undertaking it unless the student is prepared to do their daily practice until the required level of proficiency is reached, which can be surprisingly quick with many students. Recommended computer programs for developing touch typing skills include ***Type to Learn v3; Typequick for Students; Kaz Typing Tutor; Typing Instructor Deluxe***
For a review and comparison of different typing tutor programs see the website link: http://www.dyslexic.com/typing-tutors

6.2.6 Reading comprehension difficulties

Many students have difficulties understanding what they read. Although sometimes this may be due to an underlying cognitive problem such as dyslexia or a general limitation in intelligence, more often will be due to lack of practice in reading more complex texts. Reading is a skill (actually a composite of several skills) and so unless students engage in reading they won't get any better at it. Many students do little, if any, reading outside school, and often the reading they are required to do when in school is of insufficient length to challenge and develop their comprehension skills. So the first recommendation for any student who is suspected of having poor reading comprehension is to *'read more'*. It doesn't particularly matter whether the texts are fiction or non-fiction, as long as they meet the student's interest and provide sufficient challenge. But beware texts that are *far too* difficult — these are likely to cause frustration and be counterproductive. However, the mere act of reading — in the sense of passing one's eye over the print or vocalizing the words — does not guarantee good understanding. Students have to learn the trick of reading the words whilst simultaneously registering (and remembering) the meaning. This is partly achieved by ensuring that the processes of word recognition and phonic decoding are sufficiently well-practised so have become automatic (so that the student does not have to think about them), and partly by an active focus on the meaning of the text. When word recognition and phonic decoding are *not* automatic, these activities take up a lot of conscious cognitive processing capacity, leaving little capacity for processing meaning.

There are various ways in which the student can learn to focus his or her mind on the text being read, but basically these all boil down to making reading an *active* rather than a passive process. One way is to take notes while reading — not simply copying down the text that is read, but paraphrasing and summarising it. Another active method is to frame questions about the text before reading so that the task, in effect, becomes one of searching the text for answers to these questions. This, in essence, is the principle underlying the well-known 'SQ3R' (survey – question – read – recall – review) technique. These approaches, used alone, or in combination, are very suitable for what might be called 'reading for study', in which the important thing is to grasp the essential concepts in the text and recall the key facts. But students benefit from reading for pleasure as well, and these techniques may not be so well suited to this type of reading.

In story reading the anticipation of 'what might happen next' is an important factor in maintaining good understanding. This may be broken down into four key strategies:

- **Summarizing** — i.e. identifying the main events in the story so far
- **Questioning** — i.e. generating questions about what might happen next
- **Predicting** — i.e. describing what is most likely to happen next
- **Clarifying** — i.e. identifying difficult or unusual words and ideas in the text

A number of studies have highlighted the importance of these strategies in effective story reading and have shown that when students are helped to develop these strategies, either by direct instruction, by interactive sessions in which the teacher first models the strategies, or by shared group work, reading comprehension tends to improve as a result (see Doran and Cameron, 1995; Paliscar, Brown and Martin, 1987). For a review of research on reading comprehension, see Oakhill and Garnham (1988), and for practical insights on developing reading comprehension in the secondary classroom, see Dean (2000).

6.2.7 Study skills

The term 'study skills' covers an enormous compendium of skills that students need if they are to be effective, independent learners. Such skills include being able to:

- locate information as and when required
- read and assimilate such information
- combine information with existing knowledge
- apply information to answering questions and resolving issues
- analyse and think about questions and issues
- write coherent reports
- learn and prepare for examinations
- recall facts and ideas in examinations and demonstrate understanding by written answers

This is not an exclusive list, but it covers some of the main tasks that confront the learner. *LASS* provides clues to teachers about which of these skills certain students may find difficult. In the case of students who have dyslexia or other types of literacy difficulties, the chief stumbling blocks are likely to be reading and writing, although many students with dyslexia are also very disorganised, so that they do not use their study time as effectively as they could. If a student has memory weaknesses (which is also the case in dyslexia), it is probably examinations that will be the principal problem, both in learning/preparation and recall/execution. If a student has low reasoning ability, then analyzing questions and thinking through issues are likely to be problematic.

There is insufficient space here to provide a comprehensive discussion of techniques for addressing all these various difficulties, although in this chapter as a whole there are many suggested solutions to some of them. Teachers are recommended to consult the following books for practical suggestions on how they can help their students to develop better study skills:

Study skills and dyslexia in the secondary school: a practical approach by Marion Griffiths (published by David Fulton, 2002). This is a practical guide for classroom teachers that includes many photocopiable resources.

Study skills: a pupil's survival guide by Christine Ostler (published by Ammonite Books, 1997 and available from SEN Marketing.) This is a practical, self-help guide for secondary students who have studying difficulties (e.g. due to dyslexia), written in plain language by a special needs teacher who is also the mother of a dyslexic student. A version called *Advanced study skills* is also available from SEN Marketing; this is more suitable for students at A level.

The Study Skills Handbook by Stella Cottrell (2nd edition; published by Palgrave Macmillan, 2003). This is a very comprehensive guide to studying, designed for students in, or about to enter, higher education.

6.2.8 Maths difficulties

Students with dyslexia or other specific learning difficulties often experience problems with maths, not necessarily because they cannot understand the concepts or grasp the principles, but because their cognitive or literacy weaknesses (e.g. in memory, visual perception, attention, reading or writing) interfere with the *application* of their understanding. The following examples illustrate these difficulties.

1. The student can understand and do the maths, but makes errors from misreading the problem, misreading mathematical symbols (e.g. reading × as +), reversing numbers or mis-sequencing digits. Such errors, which may be interpreted by the teacher as 'careless', then make nonsense of the calculations. Such students will need to be trained to check their work carefully.

2. Students who cannot read the maths problems, or do not read sufficiently accurately, will be unable to work to their mathematical ability level. Tapes of the maths book can often solve this problem, especially when the recorder has small headphones for privacy. A talking word processor can help with 'wordy' problem worksheets, but not when formulae are involved (see above).
3. The student understands the maths at a conceptual level, but has memory difficulties that interfere with the application of that understanding, e.g. failure to remember multiplication tables, or to recall the correct sequence of procedures required when carrying out a particular calculation. Often, the problem lies in the student having *insufficient practice* in doing calculations, so that the rules and operations have not become automatised (e.g. in carrying digits in arithmetic). Students with memory weaknesses will require additional practice, and one of the most efficient ways of gaining that practice is by use of appropriate computer programs, such as ***NumberShark4*** (White Space), ***MathsBook*** (Topologika), ***Maths Circus*** (4Mation), and ***Easy Peasy*** (Easy Peasy).
4. Poor co-ordination and spatial awareness can be a problem for the student with dyspraxia. The 'craft' aspect of drawing, cutting and pasting involved in tessellation, tangram, some data handling activities and some geometry, can be reduced by using ***My World*** screens or a CAD (Computer Aided Design) or art program. ***MathsBook*** (Topologika) can be used as a maths processor, with prompts when errors are made. The ***Foundation Bundle*** (E-Soft) provides interactive ways of learning fractions, decimals and tables, which can help students with visualisation or spatial problems to look at the processes in another way.

All students with numeracy problems can help improve their understanding of maths by exploring maths adventure programs (see Hillage, 2000). This approach can be especially effective if there is an element of maths phobia and it is undertaken at home or in a computer club, where they learn the maths incidentally. For further suggestions regarding strategies for supporting students with maths difficulties, see Chinn and Ashcroft (1993), and Henderson (1998).

6.3 Computer support

Most students enjoy using a computer, so they tend to be well disposed to technology suggestions. There is often a reluctance to produce written material on paper, when it has to be re-written after spelling errors are corrected and/or great efforts still produce unattractive handwriting. Using any electronic keyboard removes much of the hassle of editing spellings and punctuation and the final printed product looks smart. For students who need more support, a computer with sound and a Windows environment, facilitates the writing process even more, as spoken prompts of errors come instantly and on-screen word banks provide access to a richer range of vocabulary.

For details of software mentioned in this section, see Section 6.4.

6.4 List of principal resources and publishers

The following software is available from the publisher (in brackets after each item) or from REM (see Section 9.2, for address details).

6.4.1 Talking books

Electronic Library (Carron)

Living Books (Broderbund)

Matti Mole (Sherston)

Oxford Reading Tree (Sherston)

Rusty Dreamer (Sherston)

Sherlock (Sherston)

6.4.2 Keyboard software

Type to Learn (Scholastic)

First Keys to Literacy (Widgit)

Kaz (Kaz Learning Systems)

6.4.3 Word bank and predictive utilities

Co:Writer6 (iANSYST)

Penfriend (Concept Design)

Read&Write (textHELP Systems)

WriteOnline (Crick Computing)

6.4.4 Talking word processors

ClaroRead (Claro Software)

Ginger (Ginger Software)

Kurzweil 3000 (Kurzweil Educational Systems)

Pages (Granada Learning)

Read & Write GOLD (textHELP Systems)

Talking First Word 4.2 (www.RM.com)

Talking TextEase (SoftEase)

Write Away (Black Cat)

Write:Outloud6 (Inclusive Technology)

6.4.5 Spelling and phonics software

GAMZ2 (Inclusive Technology)

Ginger (Ginger Software)

Magic-e (Xavier)

PhonicsTutor (PhonicsTutor.com)

Soapbox (Xavier)

Sounds and Rhymes (Xavier)

Starspell (Fisher Marriott)

THRASS-IT (THRASS)

Wordshark4 (White Space)

6.4.6 Organisation software

Inspiration v9 (iANSYST)

IDONS (IDON Software)

Thinksheet (Fisher Marriott)

6.4.7 Maths software

Amazing Maths (Iona)

Easy Peasy (Easy Peasy)

Logical Journey of the Zoombinis (Broderbund)

Mad about Maths (Dorling Kindersley)

MathMania (Topologika)

Maths Circus (4Mation)

MathSphere (REM)

Maths Quest (Disney)

NumberShark4 (White Space)

6.4.8 Other resources

AcceleRead, AcceleWrite (iANSYST) – book.

Handwriting for Windows (KBER) – software for creating handwriting sheets in your school's style.

The Literacy File (John Bald) – reference file for literacy resources.

A–Z of Reading Schemes (NASEN) – book and CD-ROM.

7 Case studies

7.1 Introduction

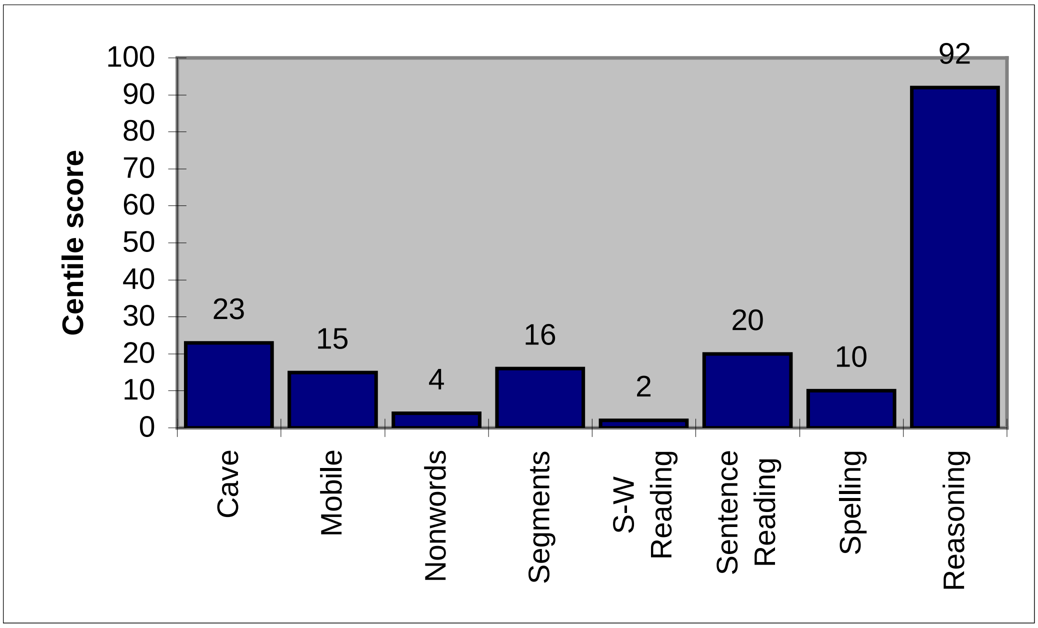
The following case studies provide an illustrative range of profiles obtained from *LASS 11-15*. Many other types of profile are possible, of course, but by studying these particular case studies, teachers should gain insights into interpreting *LASS* results and deciding on appropriate strategies for learning and teaching. For further details regarding any specific resources suggested, please see Chapter 6.

7.2 Classic dyslexia

Background

Alwyn, a boy aged 13 years 10 months, was assessed on LASS because his teachers felt that he was not performing up to standard. He was regarded as average in general ability, but his written work was very poor. Alwyn also had a tendency to be disruptive in the classroom and was frequently on report for misbehaviour, failure to complete work or to hand in homework. He was clumsy, forgetful and slightly hyperactive.

Figure 5. Alwyn – a case of classic dyslexia.



Interpretation of LASS 11-15 results

The *LASS* results show that Alwyn is clearly a very bright student (***Reasoning***: centile 92), with poor reading (***Sentence Reading***: centile 20; ***Single Word Reading***: centile 2) and very poor ***Spelling*** (centile 10). There is a highly significant discrepancy between his literacy skills and his intellectual ability, which warrants use of the label 'specific learning difficulties'. It is likely that teachers have underestimated his intelligence because of his poor literacy skills and failure to display his talents in writing.

Alwyn has virtually no phonic decoding skills (***Nonwords***: centile 4), and so he is obviously relying on visual strategies to recognise words. Because he is bright he is able to apply intelligent guessing and use of context when reading for meaning, which is why his ***Sentence Reading*** module result (centile 20) is rather better than might be expected from his ***Single Word Reading*** score (centile 2).

Alwyn also displays a clear cognitive weakness in auditory memory (***Mobile***: centile 15) and his visual memory is also low in comparison with his intellectual ability (***Cave***: centile 23). Phonological abilities are also relatively low (***Segments***: centile 16). These findings of cognitive impairment justify the use of the term 'dyslexia' to describe his difficulties. In fact, his problems are fairly severe.

Educational recommendations

Alwyn's dyslexia was subsequently confirmed by full psychological assessment. It then transpired that his father also had literacy difficulties and only a few months later (triggered by these revelations) his younger brother (age 9½) was also identified as having dyslexia. His parents reported that Alwyn had a very unhappy time at primary school, but it is not entirely clear why his difficulties were not picked up earlier in his education. In retrospect, it appears that his disruptive behaviour may have been an effect of his undiagnosed learning difficulties. The school immediately put Alwyn on the Special Educational Needs Register at Stage 3 and arranged for him to receive specialist tuition for his dyslexia twice a week using the scheme ***Alpha to Omega***, backed up by daily computer practice using ***Wordshark4***.

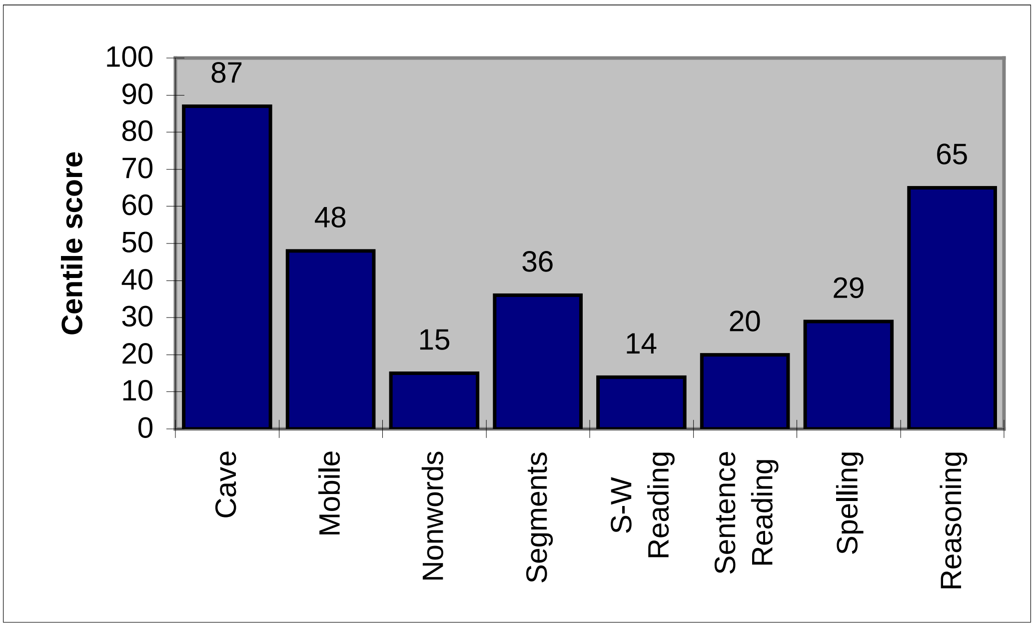
As Alwyn is bright but has poor reading skills, a short but intensive programme of activities using ***Clicker5*** would develop his confidence and skills. He could progress to ***WriteOnline*** and ***Co:Writer6***, which would use his visual strengths to develop reading and spelling skills. Alternatively, ***ClaroRead*** or ***Read & Write*** would provide him with speech feedback to assist the development of his writing.

7.3 Specific learning difficulties without dyslexia

Background

Belle is a girl aged 11 years 4 months who was administered *LASS 11-15* as part of the school's routine assessment of the new intake. There were no indications from her primary school of literacy or learning difficulties, and she was generally described in primary school reports as performing at an 'average' level.

Figure 6. Belle – a case of specific learning difficulties without dyslexia



Interpretation of LASS 11-15 results

Belle is a girl of average intellectual ability (***Reasoning***: centile 65), but she clearly has weaknesses in literacy skills (***Sentence Reading***: centile 20; ***Single Word Reading***: centile 14; ***Spelling***: centile 29). In fact, all the discrepancies between the literacy measures and ***Reasoning*** are statistically significant, so the term 'specific learning difficulty' would be justified. However, Belle's visual memory is strong (***Cave***: centile 87) and her auditory memory (***Mobile***: centile 48) and phonological abilities (***Segments***: centile 36) are both within the average range so there do not appear to be any cognitive indications of dyslexia. Examination of Belle's ***Nonwords*** result (centile 15) shows that she has poor phonic skills, so it is most likely that she has failed to acquire adequate phonic decoding skills and so has become over-dependent on visual strategies in reading, relying on her good visual memory.

Educational recommendations

Further investigation revealed that Belle had suffered from persistent glue ear from early childhood up to late primary stage, leading to auditory discrimination difficulties. This impeded her acquisition of effective phonic skills and so she became increasingly reliant on visual and contextual strategies in reading. When confronted by unfamiliar words (or, in *LASS*, nonwords) she had few decoding strategies that she could use, and so tended to guess. However, she managed to cope on this basis during primary school and hence her teachers did not have cause to regard her as having any special educational needs. Already the visual approach is failing her and will continue to do so in the face of the more demanding secondary school curriculum. Belle therefore needs attention to be paid to her phonic decoding skills as a matter of urgency. The school immediately placed Belle on the Special Educational Needs Register at Stage 2 and arranged for her to attend a phonics tuition group once a week, with daily practice activities based around use of ***Wordshark4***.

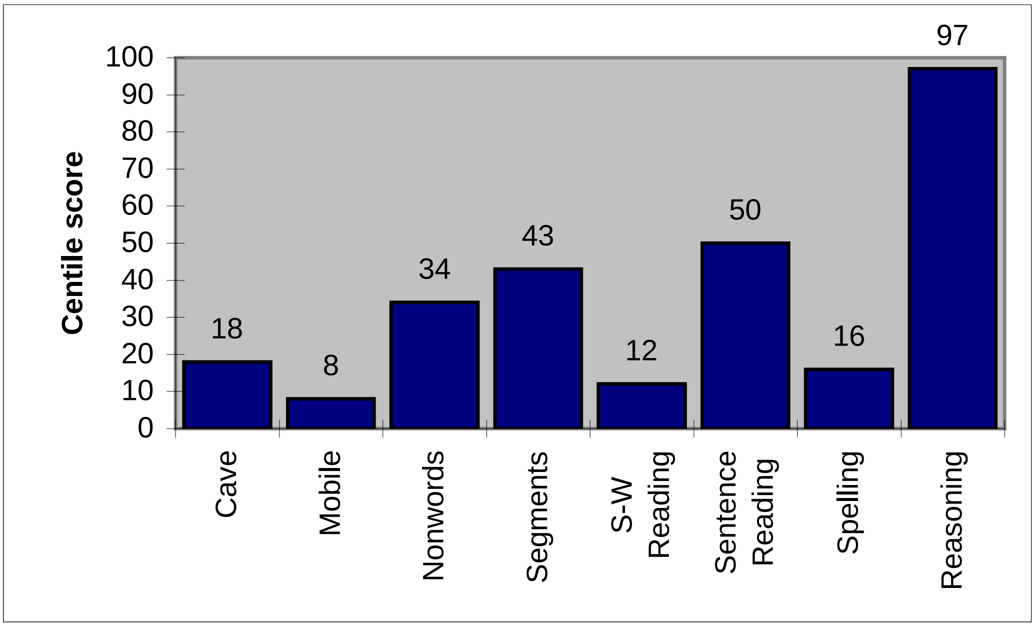
If she uses ***Co:Writer6*** for written work, relating the rebus to words could speed the flow of her writing. A course of daily sessions on ***Starspell*** to develop her spelling skills would be beneficial. ***Franklin Spellmaster*** could be used for spelling support when she is not doing written work on a computer.

7.4 Partially compensated dyslexia

Background

Colm is a boy of 12 years 5 months, who was referred for assessment with *LASS 11-15* because of persistent spelling difficulties.

Figure 7. Colm – a case of partially compensated dyslexia.



Interpretation of LASS 11-15 results

Colm is obviously very bright (***Reasoning***: centile 97), with average reading skills in context (***Sentence Reading***: centile 50) but poor ***Single Word Reading*** (centile 12) and ***Spelling*** (centile 16). This discrepancy clearly justifies the label 'specific learning difficulties'. His phonological skills are satisfactory (***Segments***: centile 43) and he can cope fairly well with ***Nonwords*** (centile 34), suggesting that he has absorbed some phonics knowledge. Nevertheless, the clear evidence of memory weaknesses (***Cave***: centile 18; ***Mobile***: centile 8) strongly suggests quite serious dyslexia. His high intelligence enables him to compensate for his difficulties to a certain extent (e.g. in prose reading) but he will definitely require further support otherwise he is likely to under perform in many areas of the curriculum.

Debriefing

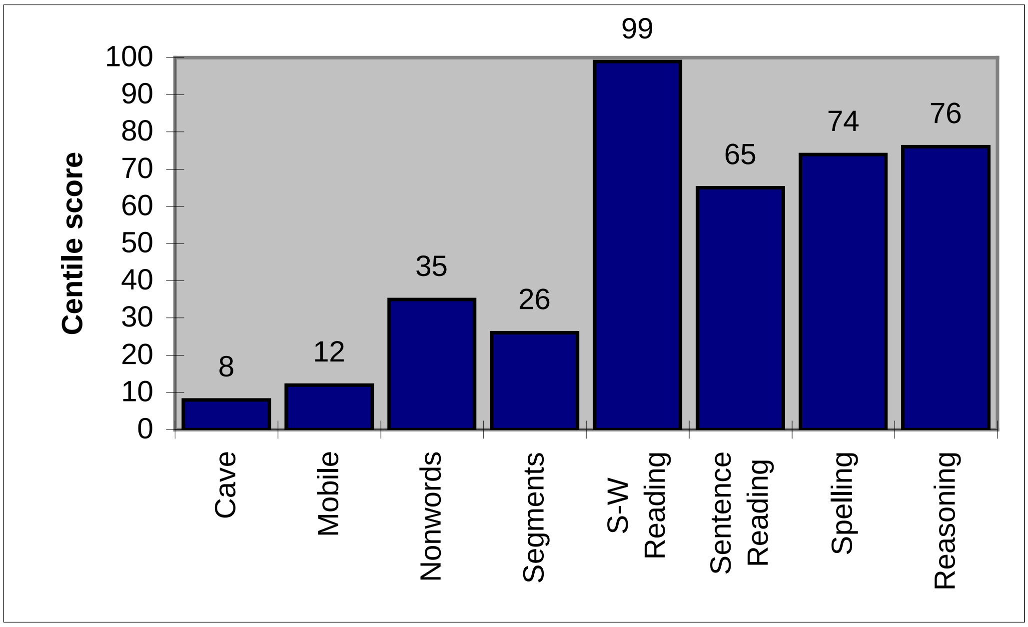
Subsequent enquiries with Colm's parents revealed that Colm had received some specialist tuition, focusing on phonic skills, when he was at primary school. However, since this was from a private tutor, it had not appeared on his school records. It was decided by the school's SENCo that because of Colm's memory difficulties he needed tuition in study skills, especially organisation of work and essays. There were worries that unless he was prepared well in advance for GCSE examinations, his attainment would fall far short of his potential. He was given help to develop mind-mapping techniques and a range of IT support strategies was implemented, including use of a talking word processor, word prediction and good spell-checking facilities ***(textHELP! Read&Write 9, ClaroRead or Ginger Software)***.

7.5 Well-compensated dyslexia

Background

Duncan is a boy aged 15 years 3 months. He was regarded by his teachers as a bright and very well-motivated student, but of late there had been serious concern about his failure to live up to expectations in examinations. There was a suspicion that perhaps he had lost interest in his school work and was devoting rather too much time to sporting activities. He was assessed on LASS 11-15, and the results are shown in Figure 8.

Figure 8. Duncan – a case of well-compensated dyslexia.



Interpretation of LASS 11-15 results

The results of *LASS* confirmed the teachers' view that Duncan is bright, and his literacy skills are commensurate with expectations. However, a surprising discovery was that his memory skills were very poor (***Cave:*** centile 8, and ***Mobile:*** centile 12), which put his difficulties with examinations in a new light. Clearly, Duncan was having problems in recalling material in examinations, and was getting low marks as a result. A further discovery was that his phonic skills were below expected levels (***Nonwords:*** centile 35), and he also showed rather poor phonological processing ability (***Segments:*** centile 26). The special needs co-ordinator thought that Duncan's profile looked suspiciously like dyslexia, and his parents immediately had him assessed by an educational psychologist. A diagnosis of dyslexia was confirmed, with the comment that Duncan was 'extremely well-compensated'. It transpired that Duncan's grandmother had been a primary school teacher and she had taught him to read as well as supporting him in his literacy development throughout the primary stage. Consequently, Duncan's dyslexic difficulties had been masked, firstly by having received exceptionally good one-to-one tuition in literacy, and secondly, by his very good work habits and personal application.

Educational recommendations

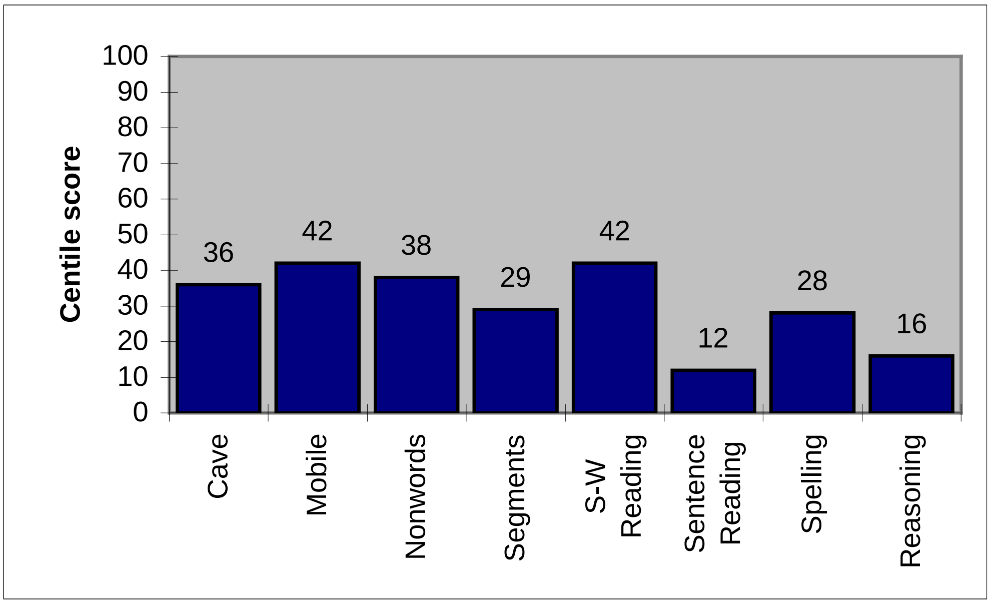
Because of his dyslexia, Duncan was granted additional time in examinations, which helped him somewhat. The most significant strategy, however, was to teach him to convert his revision notes and other material to be learned for examinations into mind maps, using the program ***Inspiration***. This enabled him to develop a clear and logical visual structure for each topic, which he could review frequently and test himself on. As a result his performance in examinations improved significantly.

7.6 Low general ability

Background

Eva is a girl aged 12 years 2 months. Her teachers have regarded her as a student of somewhat below average general ability, and in particular it had been noted that she had immature language skills. She was not on the school's SEN register. However, her parents have raised the question of whether Eva has dyslexia, and so *LASS* was administered by her class teacher. The results are shown in Figure 9.

Figure 9. Eva – a case of low general ability.



Interpretation of LASS 11-15 results

With the score on ***Reasoning*** at the 16th centile it is clear that Eva is rather below average, although it should be remembered that this only assesses non-verbal intelligence. To check Eva's verbal intelligence, a test such as the British Picture Vocabulary Scale (BPVS) could be given.

It is notable that Eva appears to be holding her own in some areas, such as reading accuracy (***Single Word Reading***: centile 42) and ***Spelling*** (centile 28), since these are higher than might have been predicted from her intelligence. Her phonic skills (***Nonwords***) are also in the average range (centile 38), suggesting that decoding has been well taught. Her main problem is with ***Sentence Reading*** (centile 12), which suggests problems of comprehending text. It is also likely that her poor vocabulary knowledge is affecting her text reading ability. But Eva's diagnostic test results are all in the low-average range (rather than being well below average), so it is unlikely that she has dyslexia (***Cave***: centile 36; ***Mobile***: centile 42; ***Segments***: centile 29).

Educational recommendations

The special educational needs co-ordinator felt that the level of Eva's difficulties, when considered in the context of her intellectual ability, did not justify a significant amount of additional support. However, she was put on the SEN register at Stage 1, and arrangements were made for her to participate in regular shared reading work with students from the local college who visited the school to support literacy work every week as part of their community education programme, with the objective of developing her text comprehension ability.

Although Eva is of low intelligence, she has learned to read words, but she has problems with sentences and a limited vocabulary. If she used ***Clicker5*** as her writing tool, she could have grids of words supplemented by pictures, if needed, for new curriculum words. She could have her own talking wordbook and banks of phrases to stimulate better sentence construction. Use of a talking books series such as ***Read Right Away*** would help to develop reading comprehension.

7.7 Poor auditory-verbal memory

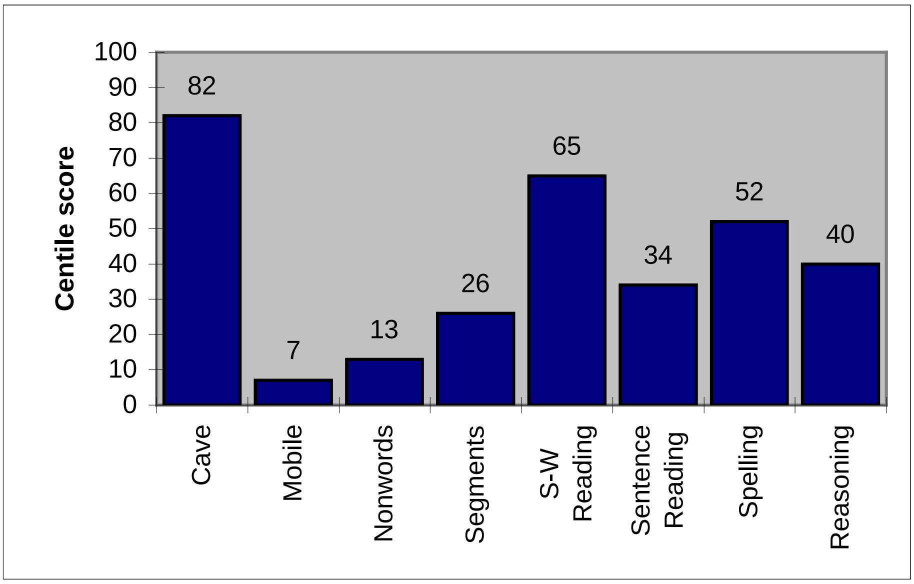
Background

Ffyon is a girl aged 11 years 7 months who was tested with *LASS* on entry to secondary school, as part of the school's routine assessment programme for the new intake, the results being shown in Figure 10. Her primary school record showed no evidence of difficulties.

Interpretation of LASS 11-15 results

The scores show that Ffyon is of average ability and is in the average range for reading and spelling. However, what is really striking about her profile is the very good visual memory (***Cave***; centile 82) and very poor auditory-verbal memory (***Mobile***; centile 7). Not surprisingly, she has had difficulty in acquiring phonic skills, which shows in her poor ***Nonwords*** score of centile 13. In fact, her profile is consistent with a diagnosis of dyslexia. Her visual memory strengths have obviously been compensating for lack of phonic skills, and she has tended to use whole-word visual strategies when reading. Until recently, that approach has obviously been adequate to her needs, but decline in reading ability and school performance would be predicted unless specific help is provided to enable Ffyon to develop better phonic skills.

Figure 10. Ffyon – a case of poor auditory-verbal memory.



Educational recommendations

Based on the *LASS* results, the school placed Ffyon on the SEN register at Stage 1, and instigated a programme of phonics training twice each week in a small group of SEN students. During her lunch break each day, Ffyon attended a computer club at which she could practice her phonic skills using ***AcceleRead, AcceleWrite*** and ***Wordshark4***. One of the learning support teachers provides weekly activities using ***Mastering Memory***, to help Ffyon improve her weak auditory memory.

7.8 Poor fluency in reading and spelling

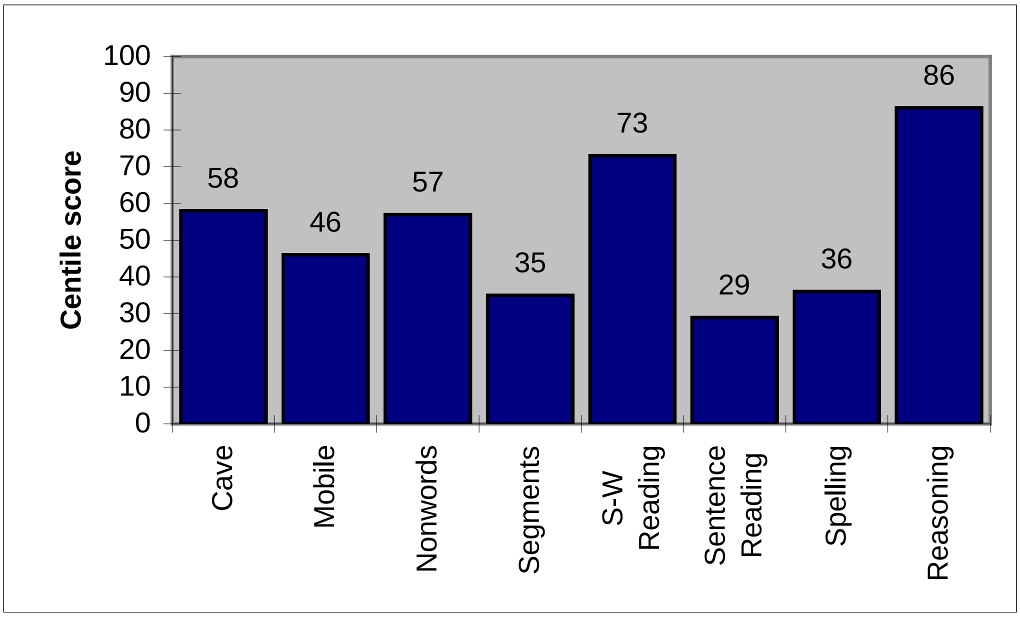
Background

Gavin was assessed on *LASS 11-15* at age 13 years 5 months because of underperformance in school. His teachers felt that he was a bright boy who had a good grasp of concepts but was weak at using text-based resource materials and in his written work did not come up to expected standards. A query had been made regarding whether Gavin might be dyslexic, although he was not on the SEN register. His results are shown in Figure 11.

Interpretation of LASS 11-15 results

Gavin's results reveal no evidence of dyslexia, but ***Segments***, ***Sentence Reading*** and ***Spelling*** are below expected levels for such a bright boy. Further investigation suggested that the most probable cause was lack of reading and writing experience, resulting in poor fluency and lack of automaticity of literacy skills. His parents reported that Gavin 'Hates reading and writing and never reads unless forced to'. He was obsessed with sports and computer games.

Figure 11. Gavin – a case of poor fluency in reading and spelling.



Educational recommendations

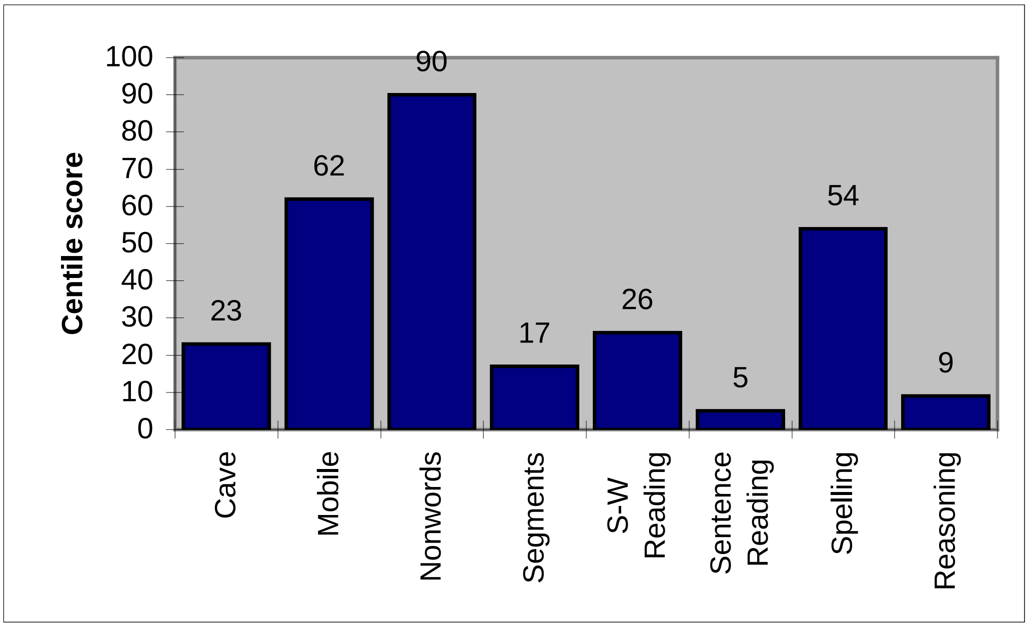
Clearly, Gavin requires more practice in both reading and writing. His parents were keen to participate in this, so they were encouraged to read with him every evening (something they had not done since he was seven), and also to support him in regular writing activities at home using a word processor. Gavin likes computers, so using a computer with ***WriteOnline*** could motivate him to write more; the words, phrases and sentence starters would reduce the 'blank page phobia', so that he gets started and experiences some success. A talking word processor or screen reader (such as ***textHELP! Read&Write 9 or ClaroRead***) would enable him to hear his work for reviewing, editing and organising his ideas.

7.9 Hyperlexia

Background

Hugo is a 14-year-old boy with high grade autistic spectrum disorder (Asperger's syndrome), who attends a Special School. The Local Education Authority is implementing an inclusion policy for students with disabilities and special needs, and the education officers are in discussion with his teachers and his parents about whether he should be moved to a mainstream school. To assist in these deliberations, Hugo was assessed on *LASS* .
The results are shown in Figure 12.

Figure 12. Hugo – a case of hyperlexia.



Interpretation of LASS 11-15 results

Hugo is clearly of low ability (***Reasoning***; centile 9) but his rote memory (***Mobile***) is good (centile 62) and his ability to read nonwords is quite astounding (***Nonwords***; centile 90). However, his profile conforms to that of a hyperlexic reader, i.e. Hugo can decode text, read aloud superficially well and can recognise words within his rather limited vocabulary, but he understands very little of what he is reading. This is shown by the very poor ***Sentence Reading*** score (centile 5). Hugo's good rote memory also helps him to spell fairly well, but he cannot use those words in a meaningful context when writing.

Educational recommendations

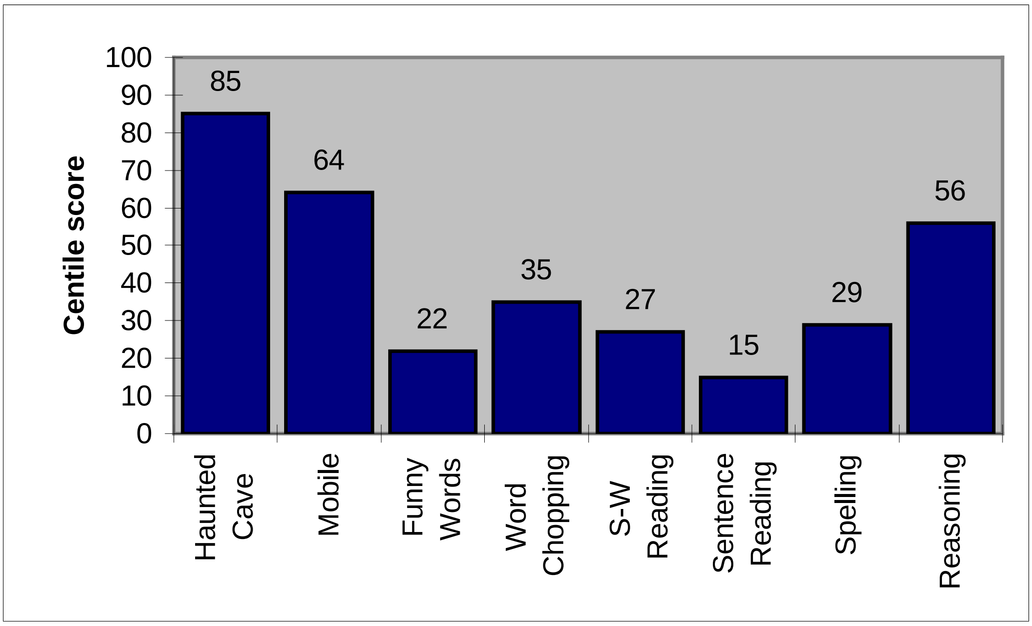
It was decided to try Hugo in a mainstream secondary school, providing him with a support assistant in the classroom to help him deal with the work, and a number of computer support techniques were also put in place. The rebuses and speech in ***Co:Writer6*** could help to keep Hugo's mind on track, especially if linked with prompt grids from ***Co:Writer6*** or ***WriteOnline***. If he has good story ideas, as many Asperger's students do, he could be encouraged to relate his story onto tape and then transcribe it into ***Co:Writer6*** later. Use of talking books (e.g. Read Right Away) would help to develop his reading comprehension, with interesting and absorbing stories.

7.10 English as an additional language

Background

Jamira, a girl aged 12 years 2 months, and Kopur, a boy aged 13 years 1 month, are both students for whom English is an additional language. Despite several years in school neither had acquired a particularly good standard of spoken English and their literacy skills were poor. The teachers are divided regarding the likely cause of their problems. Some believe that their difficulties were those of the typical student for whom English is an additional language, and that a greater amount of language stimulation was needed. Other teachers wondered whether Jamira and Kopur were perhaps not as bright as they had first imagined, and that consequently educational expectations were being set too high. Finally, some thought that there might be more serious underlying problems that were impeding these students' progress. To help understand these cases, *LASS* was administered to both students and the results are shown in Figure 13 and Figure 14.

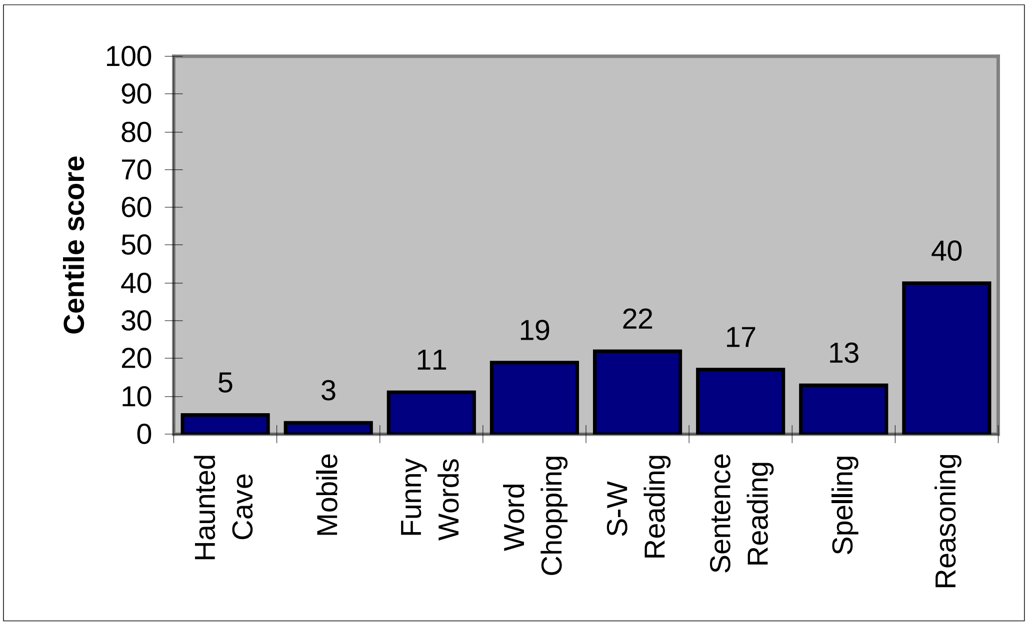
Figure 13. Jamira – a girl with limited English.



Interpretation of LASS 11-15 results

Of the two, Jamira is clearly the brighter (at least as far as non-verbal reasoning is concerned) and in neither case could low ability be taken to be the cause of their problems. But they differ markedly in their diagnostic test results. Jamira has good memory skills while Kopur has poor memory skills — in fact, his profile is that of dyslexia. Jamira, on the other hand, appears to be making some progress in reading and spelling, suggesting that the teaching methods that had been adopted were working, albeit rather more slowly that her teachers would have expected.

Figure 14. Kopur – a boy with limited English.



Educational recommendations

Both of these students require continuing support in English, but Kopur needs a more highly structured multisensory programme directed at his dyslexic difficulties (see Section 6.2.2), together with daily practice using a program such as ***Wordshark4***. Jamira, on the other hand, should be able to cope with ordinary classroom literacy activities supplemented by some additional practice to help her increase her fluency.

7.11 Test anxiety

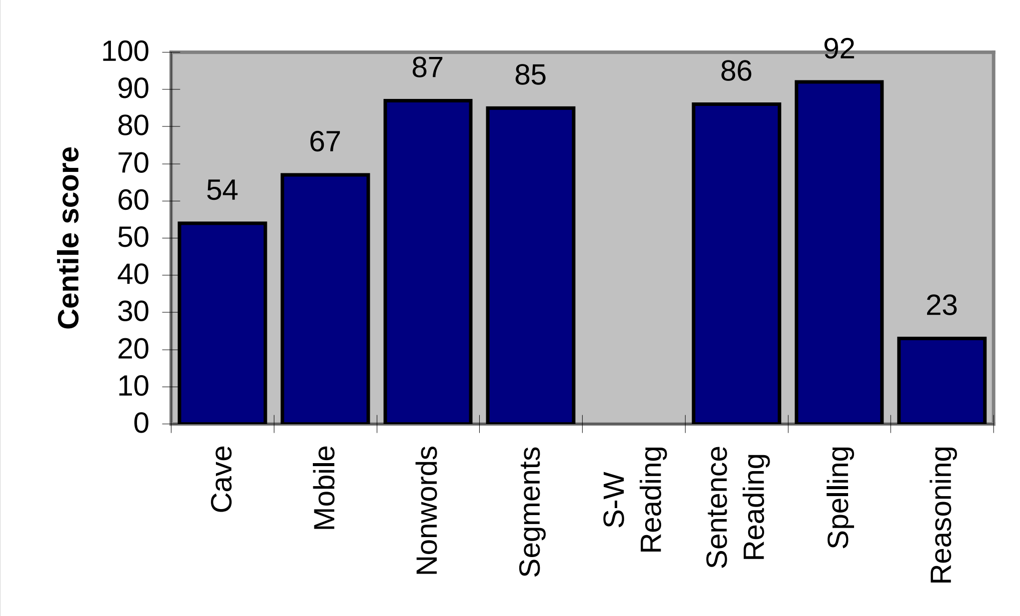
Background

Laura, aged 11 years 7 months, was assessed on *LASS 11-15* as part of the school's routine screening programme. Her results are shown in Figure 15. She was not on the SEN register and her educational performance had never given cause for concern in the past: indeed, her primary school records suggested that she was a bright and conscientious student.

Interpretation of LASS 11-15 results

The school's policy was to screen all students on entry using the ***Sentence Reading, Spelling*** and ***Reasoning*** modules only, and then to administer further tests if these revealed any problems. In Laura's case, although her literacy skills were clearly very good, the ***Reasoning*** module produced an unexpected low score (centile 23). It was therefore decided as a precaution to administer the diagnostic tests in the *LASS* suite. However, none of these showed any difficulties. The poor ***Reasoning*** test result, however, remained a puzzle.

Figure 15. Laura – a case of test anxiety and panic.



The teacher supervising the screening decided to interview Laura to try to get to the bottom of the problem. It turned out that ***Reasoning*** had been the first of the tests that Laura had attempted, and she had panicked. She explained that she had desperately wanted to do well but was nervous. She had never done a test on a computer before, and thought that unless she answered very quickly, she would be marked down. As a result she had guessed much of the time, rather than working out the answers, and so had done badly. After reassuring Laura, the teacher asked her to attempt the *LASS* ***Reasoning*** test once again, and this time she obtained a centile score of 78. To make absolutely sure, the teacher also administered a test of verbal intelligence (the ***British Picture Vocabulary Scale***) on which she obtained a standard score of 120 (centile 83).

8 Implementing LASS 11-15 in two different schools

8.1 Introduction

This Chapter has been written by **Anita Keates**, a specialist dyslexia teacher and educational consultant who has many years' experience of working with SEN students of all types. At the time of writing (2001), she was chair of the computer committee of the *British Dyslexia Association*. Anita works in two schools: Foxhills Technology School, a comprehensive in Scunthorpe, North Lincolnshire; and St. Hugh's School, an independent school at Woodhall Spa in rural Lincolnshire. The former caters for students aged 11–16 years and the latter for students aged 3–13 years. Anita has incorporated *LASS 11-15* into the SEN assessment processes in both these schools and here describes how the program has been applied in these different settings.

8.2 St Hugh's School

St. Hugh's school wished to have a continual assessment system that would screen and assess all students, from their entry into Kindergarten through to their leaving at the end of Y8. Having already successfully introduced ***CoPS Cognitive Profiling System*** for the younger students, we found we needed an assessment system that offered the same benefits to the school that CoPS did. CoPS had made the school aware of the advantages of a quick, objective and easy to administer assessment tool.

In the meantime, the teachers at St. Hugh's were quickly becoming aware of all different kinds of SEN issues and were presenting the Deputy Head, who is also the SENCo, with numerous names of students in Year 3 – Year 8, for further diagnostic testing. For me to test these students using paper-based systems meant that we were constantly facing a back-log of assessments needing to be done. It soon became apparent that there was an immediate need for a computerised assessment tool that would cater for students aged between 7–14 years. *LASS 11-15* fitted the bill perfectly for those aged 11–14, and *LASS 8-11* will now cater for the younger students.

Whilst I worked with one student, it was possible, by using *LASS 11-15*, to have another student being assessed at the same time. Headphones meant that the student working on *LASS 11-15* was able to work undisturbed and the process caused no disruption to my usual lesson. The resultant data provided me with valuable information and from that, I was quickly able to determine whether the student was likely to be dyslexic, or have different SEN difficulties.

The staff of St. Hugh's were impressed with *LASS 11-15* and are now using it for all students aged 11 years and over. At the time of writing this, they are eagerly awaiting the arrival of LASS Junior to complete their assessment suite of programs.

8.3 Foxhills Technology School

Concurrently, I also introduced *LASS 11-15* at Foxhills Technology School, where I appreciated the potential of its use in assessing many students in a relatively short period of time.

Coincidentally, it was at this time that I was asked to organise and run a Summer Literacy Scheme for Foxhills. The Government criteria for this scheme was that the students selected should be at least one grade lower in their SATs results at KS2 for English, than they were for their SATs results in Mathematics. It also stated that they should be level 3-4 in Mathematics and level 2-3 in English. These criteria meant that I was likely to get many dyslexic students attending the scheme.

This group of students provided a perfect target group to screen using *LASS 11-15*. There were some 30 students in all and when tested, I found that I was presented with 20 printouts that suggested those particular students were dyslexic. We were particularly interested in the Reasoning results *LASS* presented us with, especially when compared to the behaviour profiles of some of the students. Many of the students with dyslexic profiles had somewhat 'challenging' behaviour.

The Summer Literacy Scheme was designed specifically for dyslexic students, but also aimed at catering for non-dyslexic students. The teachers delivering the scheme were fantastically dedicated and talented, They viewed my use of *LASS* as interesting and innovative. I appreciated their skills, abilities and professionalism in using the data to influence their teaching and delivery of the scheme of work. The result of this very successful two-week course was that the students really had a fantastic time; learned a great deal; never stopped working, including in the evenings according to parents; and were keen and eager to start at Foxhills Technology School in the September. The Scheme had also resulted in the teaching staff being made aware of the benefits of *LASS*.

Both schools very quickly became aware of the potential of using *LASS 11-15* and wished to extend its usage accordingly. For St. Hugh's this was relatively easy, as it is a small school. For Foxhills Technology School, which had assessment arrangements already in place, the story was a rather different one. A greater number of students gave bigger practical problems.

Foxhills Technology School assessed its students on entry by giving them the Cognitive Abilities Tests (CAT), as well as by using National Curriculum data, SATs results and information from the 'feeder schools'. The CAT is a means of assessing students' verbal, non-verbal and quantitative reasoning and is done via a paper-based system. The administration is carried out under examination conditions and the papers have to be sent away for marking. The results are usually returned some 4–6 weeks later. Although this was not a particularly easy method of assessing the students, the school had found it worthwhile and had operated this system for quite a few years.

A particular disadvantage of the CATs tests at Foxhills Technology School was that the school hall had to be booked for a few days whilst all of a particular year group were tested. This caused some inconvenience, which was compounded by the teaching staff having to be released from their normal timetables to cover the adjudication of the CATs. Cover-lists for supervision were the outcome, with resultant disruption, although good organisation kept this to a minimum. The tests were delayed in being sent away for marking as it usually takes about one term for the Year 7 population to 'settle' and any late arrivals to the school were tested throughout the term. When the school felt that the student population was stabilised, then the tests were sent away for marking and the results eagerly awaited.

LASS was soon appreciated as an assessment tool that was both useful and speedy. Indeed, the teachers quickly recognised how good it was for its job and its usage was extended, with the result that any student, who was causing concern in any way, was duly assessed using *LASS*. The advantages were obvious for, within an hour, I could assess a student accurately, and provide a printout that would be clear and easy to interpret. One could recognise at a glance the potential of the individual student. Not only did *LASS* give a good estimate of IQ, but it also gave us the reading centile, spelling centile and other diagnostic results. From this battery of data, one can quickly identify if the student is likely to be dyslexic or have other learning difficulties.

LASS 11-15 was used for students who:

1. Arrived in the school with no documentation and the Year Heads were unsure as to which set to put them in.
2. Arrived in school on any stage of the SEN Code of Practice.
3. Were a concern to a teacher, e.g. by not appearing to work at a level equivalent to the peer group or setting group, or whose behaviour was a little challenging.
4. Had parents who requested a test or screening for dyslexia.
5. Requested that they be tested for dyslexia.
6. Were not achieving similar grades for literacy as they were for numeracy.
7. Appeared to be assigned to wrong sets.

Our response to the student's needs could be implemented within minutes of the completion of the *LASS* assessments; including responding to parents and consulting them. These advantages were discussed and the school, which is often at the leading edge in using ICT, decided to network *LASS*, so that whole classes and year groups could be assessed.

8.3.1 Implementing LASS 11-15 at Foxhills

Although *LASS* is a relatively new and quite different form of assessment, for specialist teachers who are used to assessing students, its usage is easy to assimilate. However, for classroom and subject teachers, *LASS* presents a new approach and concept. Many classroom teachers are not involved with diagnostic assessments or administering them. Indeed, many might not be aware of the advantages of, or need for, this type of screening.

It is therefore very important to have initial awareness training sessions for all staff. The second stage is for those members of staff who are likely to administer *LASS* to be trained on how to carry out the assessment. The third stage is training in interpreting and using the data. This training enables the teachers to have ownership of the system, as well as empowerment, so that they can have greater involvement in using the information. These data can help them in being aware of the students' needs, learning styles and through this knowledge, help determine their lesson content and delivery. By taking this approach, the school is using *LASS* to the benefit of everyone, the staff, the students and, through the latter, the parents.

The staff at Foxhills were already aware that for students who had barely left a Year 6 primary classroom environment, being placed under examination conditions, which are known to cause stress even to accustomed Year 11 students, was not necessarily the best approach to take. Some students were so overawed that they just froze in their chairs. Some looked totally lost, with their feet swinging away, as their legs were too short to reach the floor. Some, who possibly felt they had already failed at a paper-based system, were disengaged from the first sentence. Some students also had a phonological processing deficit and did not clearly understand the instructions, even when repeated slowly. This was possibly compounded by the use of the large hall, with resultant acoustic problems. Therefore, for a significant number of students, the tests were not reliable. This is not to criticise the tests in themselves, but the environment in which they had to be administered. Indeed, within the limitations of conventional assessments the CAT tests are very good and were deemed by the school to be the best option at that point in time.

Many schools are looking to increase examination results and thus to identify a source of students who are possibly not achieving their true potential. Dyslexic students are unable to access the curriculum within the classroom as well as their peers, with consequent lower examination results. By using *LASS* the school can quickly identify the dyslexic students. Following this, the school can target the provision of appropriate support for those students to enable better access to the curriculum. This will result in those students achieving subsequent higher grades in their examinations, and benefits all concerned.

8.3.2 The advantages of LASS 11-15

The following list gives some of the main advantages of *LASS 11-15* that were noted by the staff at Foxhills:

- It is easy to administer.
- It takes about one hour to administer (indeed, all we had to do was ask the teacher who was responsible for the ICT lesson with a particular class, to spend one double lesson, about one hour, in doing the *LASS 11-15* testing; this caused no disruption).
- At the end of the hour, the school can have the results instantly.
- The results are not only for reasoning ability (IQ), but also for reading ability and spelling.
- The results also contained extra diagnostic information, which the school finds particularly useful.
- The battery of information provided is very useful to all staff.
- The students enjoy the testing immensely.
- The students find it a non-stressful environment — indeed, often laughing and enjoying the session.
- In trial testing, no student was disengaged by the *LASS* assessment tool, so the school had a reliable set of data for every student.
- If a student is absent, it is easy for the school to arrange for the assessment to be done on return.
- Late arrivals at the school can be tested at the earliest convenient opportunity.
- The teachers preferred *LASS*, stating how much easier it is to administer. They also found it interesting.
- The SENCo soon realised the potential of *LASS*, as did other senior staff within the school.

8.3.3 Practical issues

When implementing any new system of screening or assessment, especially when this is being applied to large groups of students, there are inevitable practical problems that must be addressed.

1. There is a training implication for the staff and possible costs attached to this.
2. Time constraints on staff when trying to fit in the necessary training. Without this the staff will not be aware of the potential of the program and its advantages might not be fully realised.

3. For the training to occur, senior managers within the school have to be aware of the advantages of *LASS* as its implementation needs to come from the top. Without that support *LASS* usage will be limited, possibly to the SEN department. However, even then it will prove very useful.
4. The printing out of the *LASS* profiles for every student can be a time-consuming task. This can be solved by:
   a) printing only the summary data per student, or
   b) by providing a network machine with a local printer, which can be left running. In any year group there can be many printouts to do, and this can take as long as one minute per printout. A dedicated printer must be located where the students cannot access the hard copies as they are being printed, as this is private and confidential information which students will not wish their peers to see and know about. The solution at Foxhills is that in my office one of the computers is due to be networked and the printer will be designated to do the printing. I oversee this process and ensure that privacy is maintained, along with also ensuring that the printer does not run out of paper or ink cartridges.
5. Headphones are required for the *LASS* program and so it is essential that these are available. It is necessary to have enough headphones for one set per machine, and if there are three or more networks in the school, locating the headphones, or obtaining enough of them, can be problematic.
6. It is also essential that there is technical support available, so that the technician can ensure that the sound is working on each computer and that everything is operating as it should.
7. The previous point implies that technical staff also need to be aware of the importance of *LASS*. It would be preferable for the technical staff to attend the training given to the teachers, so that they can share the knowledge and thus understand what the school is doing.
8. A printed guide should be provided for the staff, setting out the way to access the LASS program, and how to go through the various screens, including the passwords. I also included which tests to do and in what order.
9. The staff, in their training, need to be aware that *LASS* is an important assessment tool and that the lesson must follow examination standard rules.
10. The latter point means that the use of supply staff who have not been trained, is not really advisable for administering *LASS*.

8.4 Case Studies

In each of the following three cases of students at Foxhills, a quick diagnosis using *LASS 11-15* has assisted the school in being able to identify and target support for these students. Their success is a testament as to how important that initial screening and diagnosis is, so that support can be provided at the earliest stage.

8.4.1 John

John arrived at Foxhills School at the start of Year 8. We were informed that he had an IQ of 53 (WISC–III). As a result, and coupled with the fact that he had an EBD Statement, John was placed in a low banding. I tested this boy using *LASS 11-15*. John's ***Reasoning*** centile was over 80, although his ***Sentence Reading*** and ***Spelling*** centiles were quite low. When all of the tests on *LASS* were completed, it was apparent that John had a dyslexic profile. I also knew that he had a diagnosis of dyspraxia, so I added dyslexia to that. However, *LASS* was giving a very different reasoning level of ability than any other tests had given this boy.

I worked with John for a few lessons and noted other problems as well. He was later confirmed as also having Asperger's Syndrome. By using the information provided by *LASS*, I immediately put into place a support structure appropriate for this student. As a result, some 15 months' later he has been moved into Set 2 out of 8, which is an A band class, and he is quite able to cope with the lessons. He has already completed for music, over half the GCSE course and played a solo on his electronic keyboard at the Christmas Concert, gaining a standing ovation. His knowledge and ability with ICT is phenomenal and he is a delight to work with. His parents are overjoyed. He is currently expected to achieve at least 7–8 GCSEs grades A–C.

8.4.2 Malcolm

This student was on the Summer Literacy Scheme in Year 8 and we were immediately aware that he was a student who might have challenging behaviour. However, when tested using *LASS 11-15*, he had a dyslexic profile and a ***Reasoning*** centile of 82. Our immediate task was to encourage this student to enjoy an academic environment and when I spoke to him and noted his good intelligence, he was rather surprised, although very pleased. He worked very hard over the two weeks; indeed, he even spent three hours one evening making a mediæval hovel out of wood. It was impressive and the local museum service displayed it, along with the work done by the students during the Scheme, in local museums.

With this level of immediate co-operation, we put into place a 'fast track' support programme aimed at raising Malcolm's confidence and self esteem, as well as his ability to read, write and access the curriculum with appropriate study skills and usage of ICT. Malcolm responded well. Some 15 months' later, he has recently won a Bronze Medal in the World Championships for Karate; been given a gold medal by Kris Akabusi; been chosen by Leeds United Football Club to play in their under 14s and is due to meet their Chairman. Malcolm can now read at a level equivalent to his chronological age and is currently in an A band class. He is likely to exceed 6+ GCSEs with grades A-C, and is talking excitedly about going to university.

8.4.3 Jane

Jane arrived at Foxhills Technology School at the end of Year 10. She had previously attempted suicide and suffered from depression. I tested her using *LASS* and obtained a dyslexic profile. This student was in urgent need of help and support and a programme was immediately put into place. That programme included specialist teaching from me for 35 minutes per week, as part of a small group of three students, and a teacher's aide to help in some lessons in order to gain access to the curriculum. ICT was part of the support and the school makes available its resources for students during the school day and in the evenings. Jane made full use of these and we managed to increase her reading age by some five years in 15 months. She enjoyed the progress she was making and soon gained in confidence and self-esteem. Indeed, when she left school, her examination results were six GCSEs all with good grades. As a result, she was able to start work with disabled adults in a specialist residential home, which was her chosen career path. She has since obtained, in only 18 months, an NVQ level 1 and 2. She is currently taking NVQ level 3 and enjoying the work tremendously.

9 Appendices

9.1 References

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9.2 Addresses

Please check on possible late changes to address and contact details by doing a web search.

The **British Dyslexia Association**, Unit 8 Bracknell Beeches, Old Bracknell Lane, Bracknell, RG12 7BW. Tel: 0845 251 9002. Fax: 0845 251 9005. Website: www.bdadyslexia.org.uk Email: helpline@bdadyslexia.org.uk

Dyslexia Action, Park House, Wick Road, Egham, Surrey TW20 0HH
Tel: 01784 222300 Fax: 01784 222333
Website: www.dyslexiaaction.org.uk Email: info@dyslexiaaction.org.uk

iANSYST Ltd.,Tel: 01223 420101 Fax: 01223 426644. www.dyslexic.com

Inclusive Technology, Tel: 01457 819790. Fax: 01457 819799. www.inclusive.co.uk

LexiaUK. Tel: 0191 4900099 Website: www.lexiauk.co.uk

REM, Great Western House, Langport, Somerset, TA10 9YU.
Tel: 01458 254700. Fax: 01458 254701. Website : www.r-e-m.co.uk

SEN Marketing, 618 Outwood Road, Wakefield, WF1 2LT. Tel/Fax: 01924 871697
Website: www.senbooks.co.uk

9.3 LASS 11-15 Comments Sheet

Name of student .... Date of Birth ....

Class.. Supervisor ....

School or Centre ....

Test	Date	Testing room	Health	Attention	Other comments	Initials of tester
Cave						
Mobile						
Nonwords						
Segments						
Single Word Reading						
Sentence Reading						
Spelling						
Reasoning						

General comments...

....

....

....

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This sheet may be freely photocopied for use in conjunction with LASS 11-15 testing.

9.4 Calculating age equivalent scores

An age equivalent is defined as the chronological age range of students that would be expected to achieve a given raw score or adaptive score. Age equivalents are designed to be used only in exceptional circumstances, e.g. for students in special education where centile norms are not always helpful. Age equivalents should not be used routinely in cases where centile norms are applicable, because age equivalents give only a very rough approximation of the student's ability. For an explanation of this issue, please see Section 2.3.15.

To calculate the age equivalent for any *LASS 11-15* score, first find the student's Raw Score (or Adaptive Score, in the case of the adaptive tests) for that test by consulting the relevant Data Table in the Report Generator (for an explanation of how to do this see Section 2.4.3.2). Next, locate the corresponding score (or score range) in the body of Table 8 (page 103). The age equivalent for that score is given in the left-hand column of the table on the same row. Note that it is not possible to calculate age equivalent scores for the Single Word Reading Test — for explanation and examples see Section 4.5.

Table 8. Table of Age Equivalents for LASS 11-15 Tests.

Age equivalent range	**Cave RS**	**Mobile RS**	**Non-words RS**	**Seg-ments RS**	**Sentence Reading AS%**	**Spell-ing AS%**	**Reason-ing AS%**
< 11y 0m	< 18	< 5	< 7	< 11	> 95	> 96	> 90
11y 0m – 11y 5m	18 – 26	5	7 – 9	11 – 15	82 – 95	84 – 96	80 – 89
11y 6m – 11y 11m	27		10	16 – 17	74 – 81	81 – 83	73 – 79
12y 0m – 12y 5m	28	6	11	18	70 – 73	78 – 80	70 – 72
12y 6m – 12y 11m	29		12	19	68 – 70	76 – 77	68 – 69
13y 0m – 13y 5m	30	7	13	20	65 – 67	74 – 75	66 – 67
13y 6m – 13y 11m	31		14	21	62 – 64	66 – 74	63 – 65
14y 0m – 14y 5m	32	8	15	22	59 – 61	60 – 65	60 – 62
14y 6m – 14 y 11m	33 – 34		16	23	55 – 58	55 – 59	57 – 59
15y 0m – 15y 5m	35 – 36	9	17	24	51 – 54	52 – 54	48 – 56
15y 6m – 15 y 11m	37 – 40		18 – 19	25 – 27	37 – 50	48 – 51	38 – 47
> 15 y 11m	> 40	> 9	> 19	> 27	< 37	< 48	< 38

RS = Raw Score (i.e. number correct on the test) [Progressive Tests]

AS = Adaptive Score expressed as a percentage (e.g. 0.5792 rounded to 0.58 = 58%) [Adaptive Tests]