GL Assessment®

GL Education®

# USER MANUAL

## LASS

For ages 8 to 11 years

Fifth Edition
April 2020

Educational Consultant
Dr Joanna Horne

Published by GL Education

1st Floor, Vantage London, Great West Road, Brentford, TW8 9AG

www.gl-assessment.co.uk



Typeset by Words & Pictures Ltd, London



5th edition, revised April 2020

# Contents

## Figures

**Tables** . . . . . .

# About LASS 8–11

LASS 8–11 is a fully digitised multifunction assessment system for use with students in the age range 8 years 0 months to 11 years 11 months.

LASS 8–11 comprises the following nine subtests:

- Sentence reading
- Spelling
- Non-verbal reasoning
- Verbal reasoning
- Auditory sequential memory (***Mobile phone***)
- Visual memory (***Sea creatures***)
- Phonic skills (***Funny words*** / ***Non-words***)
- Phonological processing (***Word chopping*** / ***Segments***)
- Single word reading

The full suite of nine core digitised subtests takes about 45 minutes, on average, to administer. Most of the subtests 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 8–11 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
- 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.

Dr Joanna Horne is a Chartered Psychologist and Chartered Scientist, and has worked on the development of computerised educational assessments for 25 years. For much of this time she was employed as a Lecturer in Psychology at the University of Hull, teaching research methods and statistics, educational psychology and educational testing, and carrying out research, primarily within the educational psychology field. Joanna has published widely in peer-reviewed journals and presented research findings at national and international conferences. She is also a Test Reviewer for the British Psychological Society's Psychological Testing Centre and is the Educational Editor of 'Assessment and Development Matters'. Joanna is now a freelance consultant psychologist working in test development and psychometrics, and educational and psychological research.

# Getting Started

## Accessing LASS 8–11 via GL Ready

LASS 8–11 runs on the GL Ready platform at www.glready.com. After being set up with a GL Ready account and a subscription for LASS 8–11, an email will be sent from glready@gl-assessment.co.uk with information on how to access the platform.

Before logging in, set a new password via the 'Set or reset your password' link – www.glready.com/password/reset. Once this is done, log in to your GL Ready account to start setting up students and assigning LASS 8–11.

To check the status of the school's subscription to LASS 8–11, go to the 'Manage school' tab at the top of the GL Ready page.

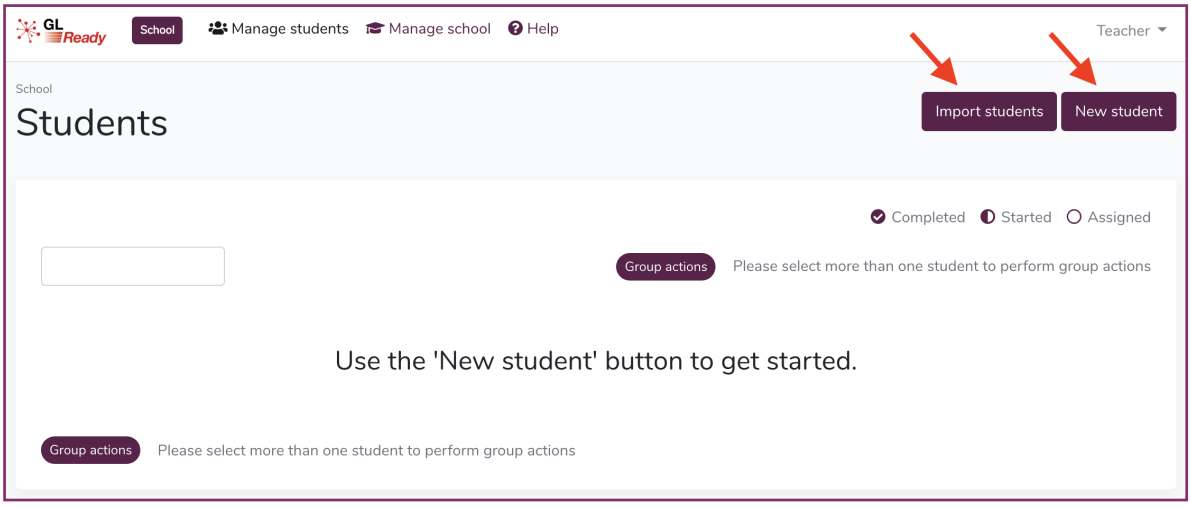
For further information about accessing and using LASS 8–11 on the GL Ready platform, please visit www.glreadysupport.com.

## Adding students to GL Ready and assigning LASS 8–11

To administer LASS 8–11, first add students to the GL Ready platform.

Students can be added from the 'Manage students' page (www.glready.com/students) either individually, by using the 'New student' button and completing the form, or in batches via CSV import by using the 'Import students' button and following the instructions on the page.

Figure 1. Adding students

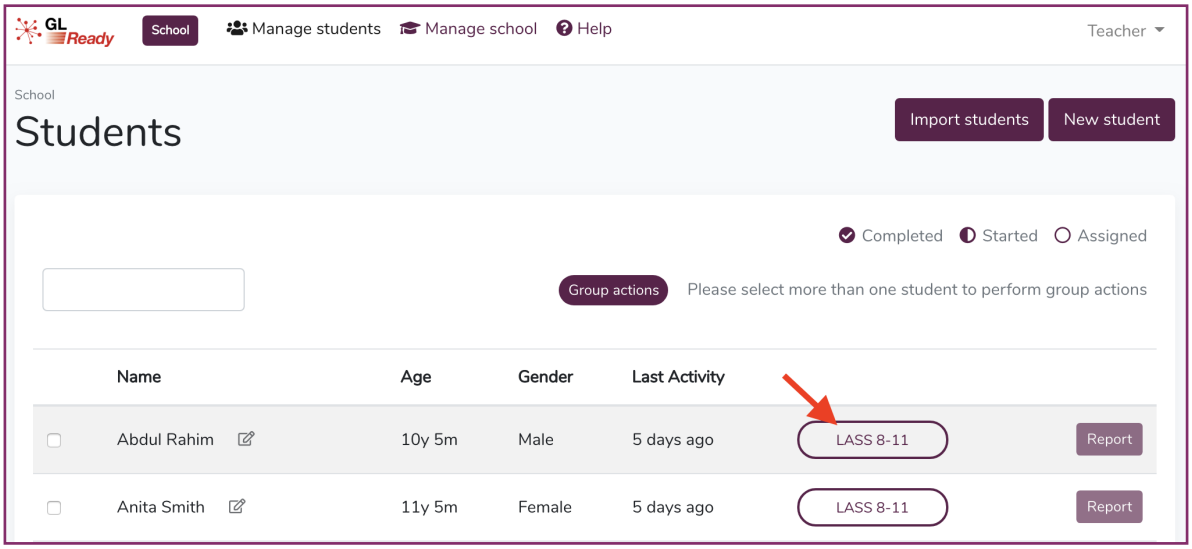



**It is very important that the date of birth of each student is entered correctly as the subtests that are given to each student and the norms that are applied in their report is determined by their age.**

Once students have been added to the GL Ready platform, assign LASS 8–11 to them.

To assign LASS 8–11 to an individual student, click on the 'LASS 8–11' button next to their name.

Figure 2. Assigning LASS 8–11 to an individual student

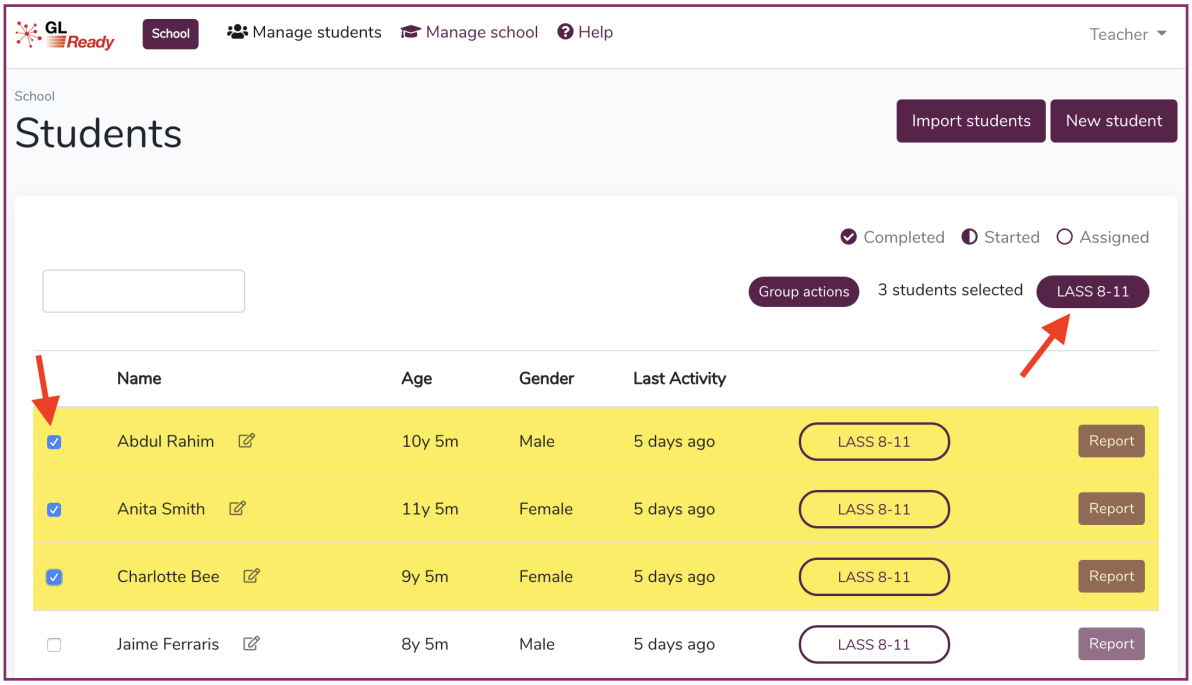



Two options are given:

- Start testing the student immediately on the machine you are using (this will take you straight to the student's session and will log you out of your teacher account) **OR**
- Confirm and return to the 'Manage students' page. This allows the student to start testing at another time or on a different machine.

To assign LASS 8–11 to multiple students, select the students by ticking the boxes next to their names, then in the group actions above the list of students click on the 'LASS 8–11' button.

Figure 3. Assigning LASS 8–11 to multiple students



When a student has successfully been assigned LASS 8–11, an empty circle will appear in the LASS 8–11 button against their name.

Figure 4. Assigned student

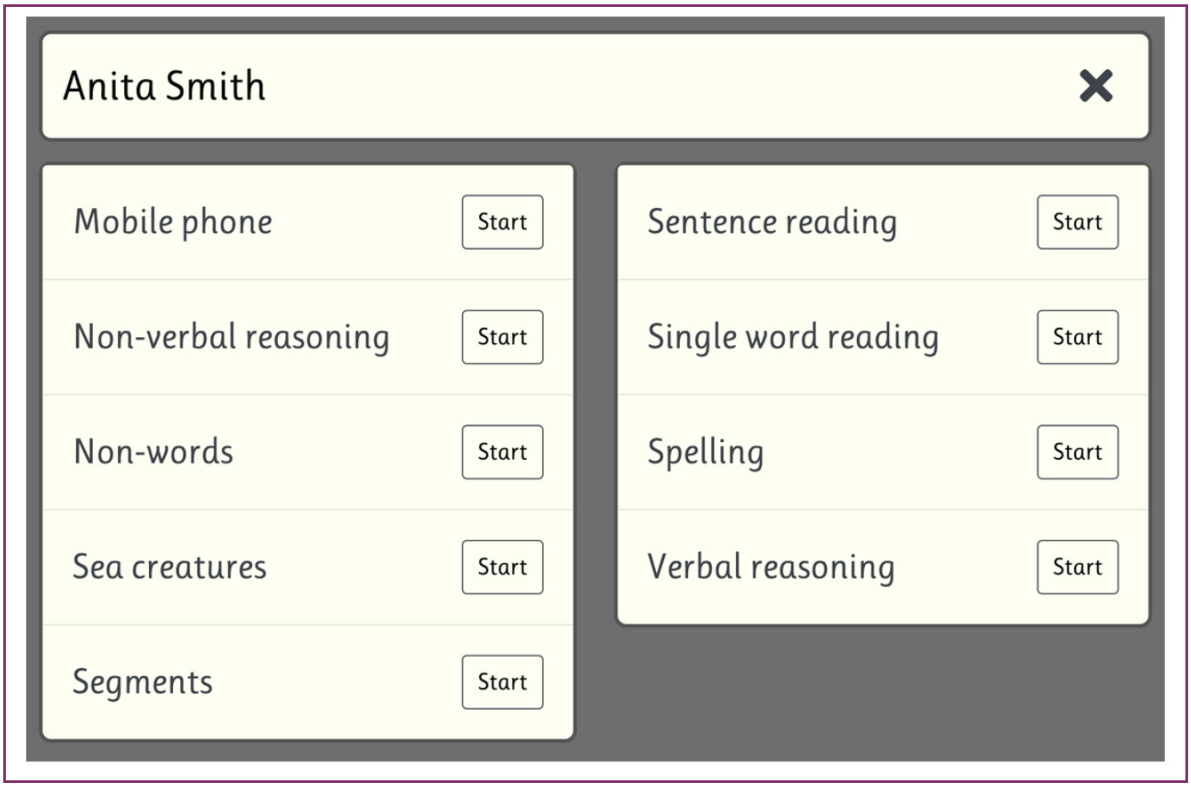

For further information about adding students and assigning LASS 8–11, please visit www.glreadysupport.com.

## Starting a student session

To start testing on a machine, go to www.glready.com/student and enter the school password (found on the 'Manage school' page at www.glready.com/school). This gives access to a student login page that lists the names of each student that has subtests available to complete.

To start a student session, select the name of a student, enter their date of birth and press start. A list of the subtests available to that student will show on screen. To start a subtest, click on the 'Start' button next to a subtest name.

Figure 5. Student session



# Monitoring the progress of your students

To easily track the progress of each student, go to 'Manage students' on the school's GL Ready account and look at the 'LASS 8–11' buttons against each of the students' names.

| | |
|---|---|
|  | Figure 6. Student has not been assigned LASS 8–11 |
|  | Figure 7. Student has been assigned LASS 8–11 but has not started testing |
|  | Figure 8. Student has started testing on LASS 8–11 |
|  | Figure 9. Student has completed all subtests in LASS 8–11 |

# Using this manual

Please be aware that in this manual 'teachers' is used to refer to anyone who will be administering LASS 8–11.

## Using the subtests in LASS 8–11

Before administering any subtest in LASS 8–11 teachers should first read *Getting started*, *Before you begin* and *Administering LASS 8–11*. Together, these provide detailed guidance on how to select LASS 8–11 subtests and administer them.

## Interpreting LASS 8–11 results

Before attempting to interpret LASS 8–11 results, and especially when drawing up an Individual Education Plan (IEP) or considering educational provision for any pupil in detail, teachers are strongly advised to consult *Guidelines on interpretation of results*. *Case studies* provides case studies in interpreting LASS 8–11 results, which teachers will find very helpful.

# Before you begin

## Is the teacher familiar with the subtest being administered?

Assessing students with LASS 8–11 is straightforward but before attempting to test any student teachers should first run through the complete suite of subtests to familiarise themselves with it thoroughly. To do this, teachers can add themselves as a 'student' and assign themselves LASS 8–11.

## 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 8–11 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 or tablet 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 screen. The best position for this is usually in the corner of the room. To minimise auditory distraction, headphones should be used. Inexpensive lightweight headphones 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 screen (not too high or low in order to see the screen satisfactorily). It is not recommended that students attempt the subtests 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 screen and can also disrupt the student's response accuracy and speed. The teacher should check for reflections on the screen from windows and lights that could impair the student's perception. To do this the teacher should check by viewing the screen from the same position that the student will adopt.

It is not recommended that students attempt the subtests 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.

## Is the equipment functioning correctly?

Run the diagnostic tool – available from www.glready.com/student – on the computers before administering the product to students.

Additionally, the teacher should check that (a) the screen is clear and its colours correct, (b)

the sound (using speakers or headphones) is audible (not too loud or too soft, and without interference), and (c) if using a mouse, that it is functioning correctly and is positioned in front of the student on a suitable surface so that its movements are unimpeded.

For further information about the technical requirements for running LASS 8–11 on your machines, please visit www.glreadysupport.com.

## Is the student prepared for the task?

It is important that the student *understands* the nature of the task, *how* to indicate responses, and *when* to respond (essentially when the subtests will allow them to respond). Students should not be allowed to take the subtests 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 teacher may express them again in a more suitable manner. For example, in ***Mobile phone*** some younger students may not fully understand what 'order' means. Here the teacher may give examples of what is a correct order (and what is an incorrect order) to aid comprehension. Explaining and re-expressing the task requirements to the student may continue into the demonstration and practice stages of each subtest. 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 through 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.

# Administering LASS 8–11

## Choosing which subtests to administer

LASS 8–11 comprises nine subtests, each of which has a different function. LASS 8–11 is a complex assessment package and a great deal of research and careful thought has gone into its development. Each and every subtest is there for a specific purpose and each subtest 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 subtests are administered, thereby accessing the fullest information. 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.

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 subtests rather than administering all of them.

In order to make sensible choices about which subtests to administer and which to leave out, teachers first need to understand what each of the subtests is for. To develop understanding of the subtests, teachers are advised to study *About the subtests* and *Interpreting results from individual subtests*.

## Order in which subtests are administered

The order in which LASS 8–11 subtests are attempted is not particularly important. As teachers become more experienced with LASS 8–11, they will find that they develop their own views about what subtests are most useful to begin with, or to use in certain cases.

## Number of subtests to be administered per session

A satisfactory test result cannot be obtained if students are not attending to the tasks and attempting to do their best. However, the LASS 8–11 subtests are mentally demanding and students can easily become mentally fatigued after a few subtests. Their level of effort can diminish significantly, although they may still enjoy the activity. Consequently, it is recommended that not more than three or four subtests are given to a student in a continuous session. This may vary according to the concentration level of the student and other factors. The teacher should use their discretion in these matters.

It is sometimes preferable to spread administration of the subtests over a number of days. This avoids the situation where results may be grossly distorted because a student has an 'off day'

through illness or some other idiosyncratic reason. Where any individual subtest result appears anomalous or unrepresentative the subtest may be re-administered after a suitable time period has elapsed.

## 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 teacher 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 teacher or other students)
- there is no cheating – this may take the form of the student placing their hands on the computer screen to circumvent the memory element of the test (e.g. in ***Sea creatures***)
- feedback from the teacher is minimised and encouragement consistent.

## Giving encouragement, prompts and feedback

As much as possible, the teacher should avoid giving specific feedback to students during the subtests 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 8–11 itself provides limited feedback (e.g. 'good') where appropriate. Nevertheless, some students will try to elicit additional feedback from the teacher about their performance. This may take the form of verbal and non-verbal behaviours. For example, the student may ask directly if they were correct. Many students will look for the teacher's facial and bodily reactions to their responses. Some students may even try to evaluate the teacher's reaction by observing the teacher's reflection in the monitor screen. For these reasons it is usually preferable that the teacher 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 subtests include: 'well done'; 'you were good at that game, now try the next one'; 'you will like this game'; 'now concentrate on this'; 'try hard'; 'listen very carefully'; 'have a go at this one'; 'have a try'; 'just do your best'. Unless it is felt to be absolutely necessary, prompting during the actual test items should be kept to a minimum. For the most part any necessary prompting should occur between the subtests.

# 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 8–11 testing, particularly noting such factors as health, tiredness, attention, concentration, distractions and general motivation. A template **LASS 8–11 Comments Sheet** is provided on the following page. This may be printed out or photocopied freely and used for recording any observations during testing. This record can then be referred to when interpreting the student's LASS 8–11 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 8–11 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?"'

# LASS 8–11 Comments Sheet

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

Class ..... Tester .....

School or Centre .....

| Test | Date | Testing room | Health | Attention | Other comments | Initials of tester |
|---|---|---|---|---|---|---|
| **Sea creatures** | | | | | | |
| **Mobile phone** | | | | | | |
| **Funny words / Non-words** | | | | | | |
| **Word chopping / Segments** | | | | | | |
| **Sentence reading** | | | | | | |
| **Single word reading (if applicable)** | | | | | | |
| **Spelling** | | | | | | |
| **Non-verbal reasoning** | | | | | | |
| **Verbal reasoning** | | | | | | |

General comments

.....

.....

.....

.....

# Retesting with LASS 8–11

Teachers often ask 'How soon can a student be retested with LASS 8–11?' The answer depends on why retesting 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 retesting can be as soon as is convenient. 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 retesting.

**Retesting will overwrite the student's previous results.**

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 retesting. In general, four months would be recommended as the minimum interval, but this could be less if the teacher had good reason for doing so. Repeated retesting 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.

For guidance on how to re-administer a subtest, go to www.glreadysupport.com.

# Problems of time-shortage for testing

In cases where teachers wish to administer all the subtests in the LASS 8–11 suite but are prevented from doing so due to lack of time, they could try some of the useful strategies listed below for solving time-shortage problems.

- Ensure that administration of LASS 8–11 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 8–11 to students does take time, but the information gained is valuable in students' education.
- Encourage staff to recognise that LASS 8–11 is a useful educational activity in its own right. The LASS 8–11 subtests 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 subtest has a wider educational value.
- Ensure that a student is clear about what any given LASS 8–11 subtest requires, so that only minimal supervision is needed. It is not essential for the teacher to observe the whole subtest administration.
- Train non-teaching personnel to administer LASS 8–11. Although it is essential that the interpretation of LASS 8–11 results is carried out by an experienced teacher, administration of the subtests can be done by any adult who understands the essentials of what the task involves. In particular, students need to know that they are tests, so they have 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 8–11 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.
- Register all students in a block to be more time-efficient, rather than registering students

singly at the time of testing. To add multiple students at once use the 'Import student' button on the GL Ready platform. Instructions on how to upload students via a CSV file are provided on the upload page (for more guidance, please visit www.glreadysupport.com).

- Give all students in the class the same LASS 8–11 subtest, before moving on to another subtest. That way, the teacher can get into a rhythm and does not have to re-adjust to delivery of each different subtest.
- Organise activities in order to use available time most effectively. Using playtime or lunchtime can work in some cases. Amalgamating classes for some activities (e.g. story time) can free up one teacher who can use that time to administer LASS 8–11.
- Operate 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.
- Test students in small groups, if more than one computer or tablet is available and headphones are being used.

## Assessing students who have limited English

Assessment of any student who has limited proficiency in spoken English is always problematic (see Cline and Shamsi, 2000). However, LASS 8–11 is less problematic than many conventional methods of assessment due to 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 first language can help with explaining instructions. Case studies of two students for whom English is an additional language (EAL) are given in *Case studies*. Like most students with limited English, these students responded well to the assessment and extremely valuable information was obtained.

It will often be found that EAL pupils gain low scores on some of the LASS 8–11 subtests (particularly those assessing literacy and phonological skills), which reflects their lack of experience with English. However, on the memory and non-verbal reasoning subtests in LASS 8–11, scores will normally reflect their true abilities because 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 phone***).

For further information on assessment of learning difficulties in literacy (including dyslexia) in EAL pupils and other multilingual children, see Cline (2000), Cline and Frederickson (1999), Cline and Shamsi (2000), Durkin (2000), Mortimore et al. (2012), Peer and Reid (2016) and Tsagari and Spanoudis (2013).

## Assessing students with coordination difficulties

Students with coordination difficulties may experience problems in using a mouse, or even a touchscreen device. In some cases, an adapted mouse device may need to be used when assessing disabled students. Alternatively, testing on a tablet (where the response utilises the touchscreen) may be preferable. Slowness or difficulty in using the mouse or touchscreen should not make any significant difference to a student's performance on LASS 8–11. Thus, even if a student is totally inexperienced with using a mouse or touchscreen (a rare thing these days) and

is consequently very slow, the LASS 8–11 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). In ***Sea creatures*** there is a (fairly generous) time limit. 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 creatures 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, testing using a tablet or touchscreen may be preferable.

Sometimes the distinction between students who are slow in using the mouse or touchscreen (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 are described as having 'Developmental Co-ordination Disorder' (DCD) (American Psychiatric Association, 2013). They are students with significantly poor motor performance which may manifest as co-ordination problems, poor balance, clumsiness, dropping or bumping into things, delays in achieving developmental motor milestones or the acquisition of basic motor skills. These symptoms interfere with daily life, onset in the early developmental period and are not explained by intellectual disability, visual impairment or a neurological condition. 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. Tests of motor co-ordination include the Movement ABC-2 (Barnett, Henderson and Sugden, 2007) and the Developmental Test of Visual-Motor Integration-6 (Beery, Beery and Buktenica, 2010). 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 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 (Losse et al., 1991; Piek and Edwards, 1997). Gueze (2007) concludes that, although the incidence of DCD decreases with age, particularly during adolescence, 50% of cases continue to have motor difficulties. 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'. *The Special Educational Needs and Disability Code of Practice: 0 to 25 Years* (DfE, 2015) states that 'schools should have a clear approach to identifying and responding to SEN. The benefits of early identification are widely recognised – identifying need at the earliest point and then making effective provision improves long-term outcomes for the child or young person'. The *SEND Code of Practice* includes dyspraxia within the category of 'specific learning difficulties', which comes under the 'cognition and learning' area of need.

For an overview of the current state of knowledge on developmental coordination disorder, see Zwicker et al. (2012). Guidance on assessing dyspraxia / DCD is given by SASC (SASC Working Group on Dyscalculia: New Guidance on Dyscalculia, 2019). General advice for teachers and parents is provided by Ripley, Daines and Barrett (1997), Boon (2010) and the Movement Matters organisation (www.movementmattersuk.org).

## Assessing students with Attention Deficit Hyperactivity Disorder (ADHD)

The *Diagnostic and Statistical Manual of Mental Disorders* – DSM–V (American Psychiatric Association, 2013) distinguishes three presentations of ADHD:

- Inattentive: the student with ADHD who is predominantly inattentive
- Hyperactive/impulsive: the student with ADHD who is predominantly hyperactive and impulsive
- Combined: the student with ADHD who is *both* inattentive *and* hyperactive/impulsive

In the World Health Organisation's *International Classification of Diseases* — ICD–10 (WHO, 2016), the term 'Hyperkinetic Disorder' corresponds to DSM-V combined type. It can be seen that the symptoms of ADHD 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. There are strong indications of genetic factors causing ADHD, although perinatal complications have also been associated with it (Amor et al., 2005). Current estimates suggest that the incidence of ADHD in school-aged students is between 5.9% and 7.1% (Willcutt, 2012). Between 18% and 45% of individuals with diagnosed ADHD also have dyslexia (Germano, Gagliano and Curatolo, 2010). Obviously, these reading difficulties could be the result of poor attention and concentration in the learning situation (i.e. an *indirect*

effect of ADHD). In addition, it has been suggested that students with ADHD have problems with working memory (Holmes et al., 2014), which affects learning *directly*, because information is not stored properly nor is it retrieved fluently and reliably. Treatment for ADHD 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, 1993, 1998).

Students with ADHD are liable to experience difficulty with many types of assessment (not just computerised assessment) because of inattention and impulsiveness in responding. In cases of students with ADHD, teachers should therefore be prepared to take such factors into consideration when interpreting the results of LASS 8–11 tests. On the other hand, LASS 8–11 tests are typically found to be more stimulating than conventional tests, so students with ADHD will generally remain engaged and attentive for longer than might be expected. To maintain engagement and interest, however, and to ensure that results are as reliable as possible, it is recommended that only one test per session should be administered to students with ADHD. Particular care should be taken when administering ***Sea creatures*** as the student needs to watch the screen carefully to notice whereabouts the creatures appear. Lapses in concentration and attention would be particularly expected to affect this test.

For practical guidance on identifying and teaching students with ADHD, the book by Cooper and Bilton (2002) is recommended.

# Accessing reports

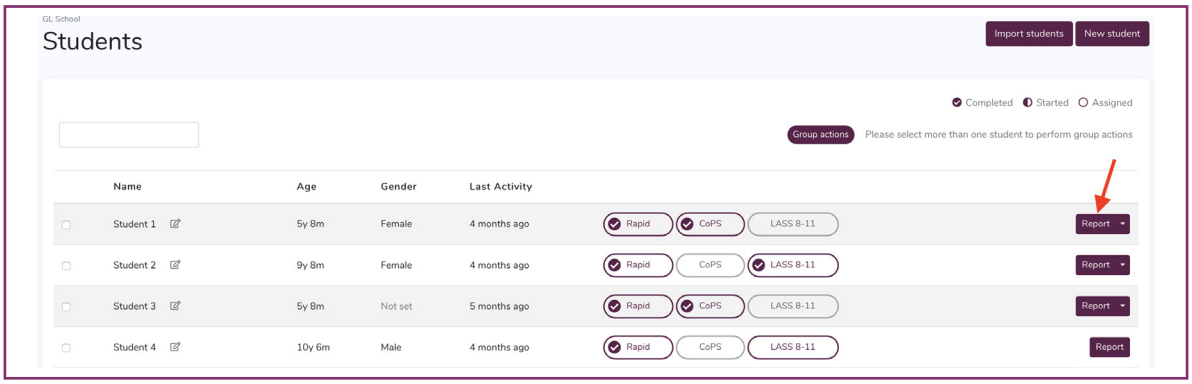
All scores are saved automatically on completion of each subtest. The data saved also includes the date the subtest was completed. **If a subtest has been abandoned before completion, then no results will be saved for that subtest.**

There are two types of report: graphical and CSV.

## Graphical reports

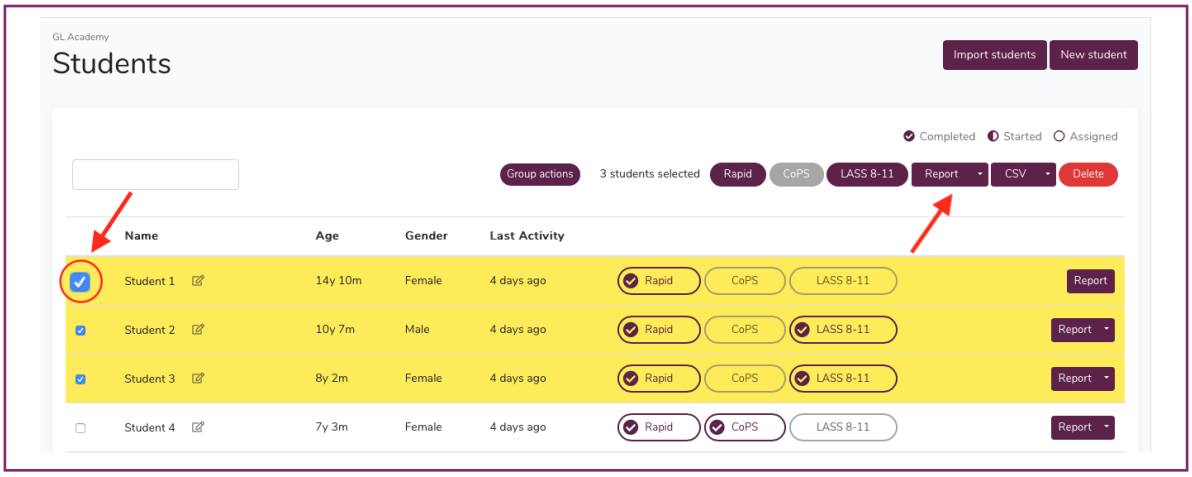
To access a student's graphical report, go to the 'Manage student' page on GL Ready and click on the 'Report' button against that student's name.

Figure 10. Accessing the graphical report of an individual student



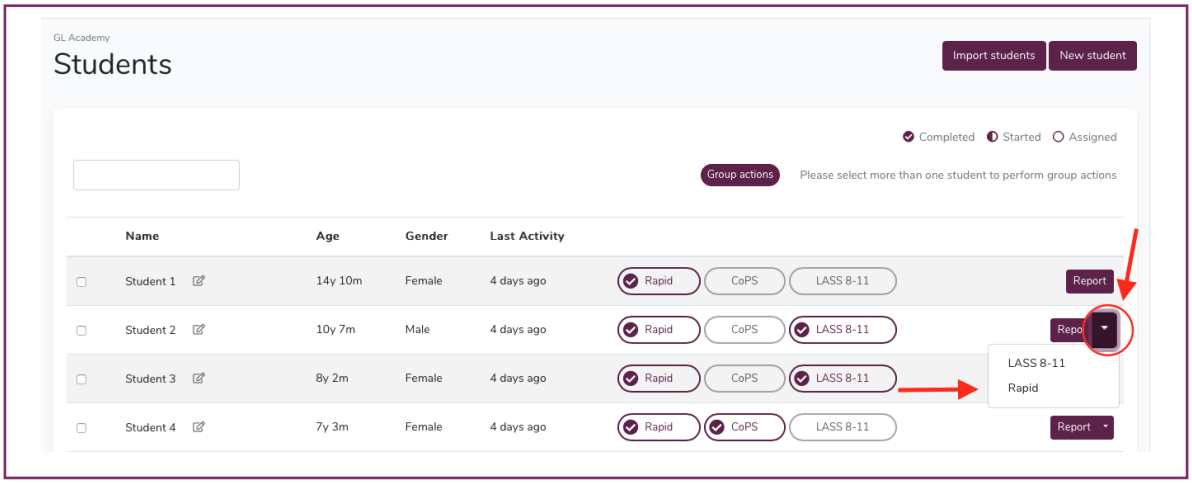

To pull up the reports of multiple students, select those students by ticking the boxes next to their names and then click on the 'Report' button in the group actions above the list of students.

Figure 11. Accessing graphical reports for multiple students



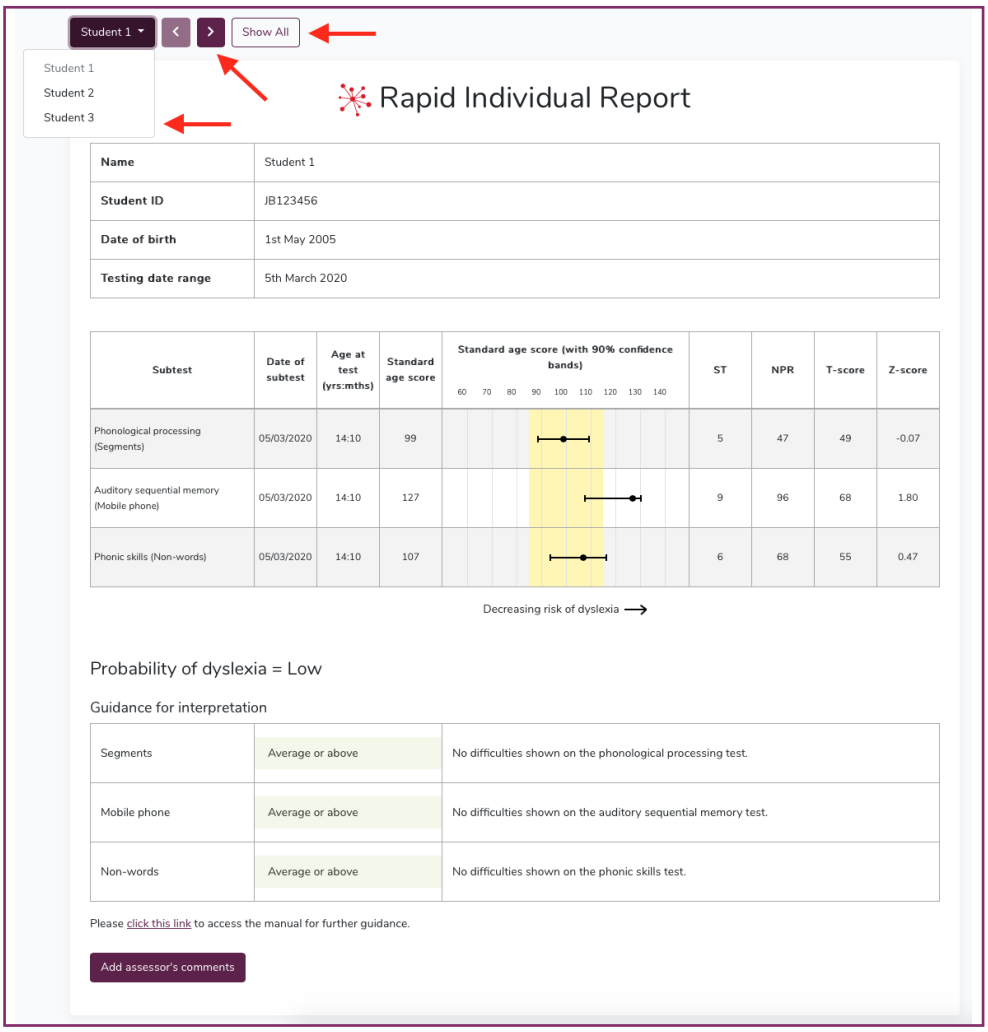

If the school is subscribed to multiple products on GL Ready and a student has more than one report available, use the dropdown arrow to select the correct report.

Figure 12. Selecting the correct graphical report for a student



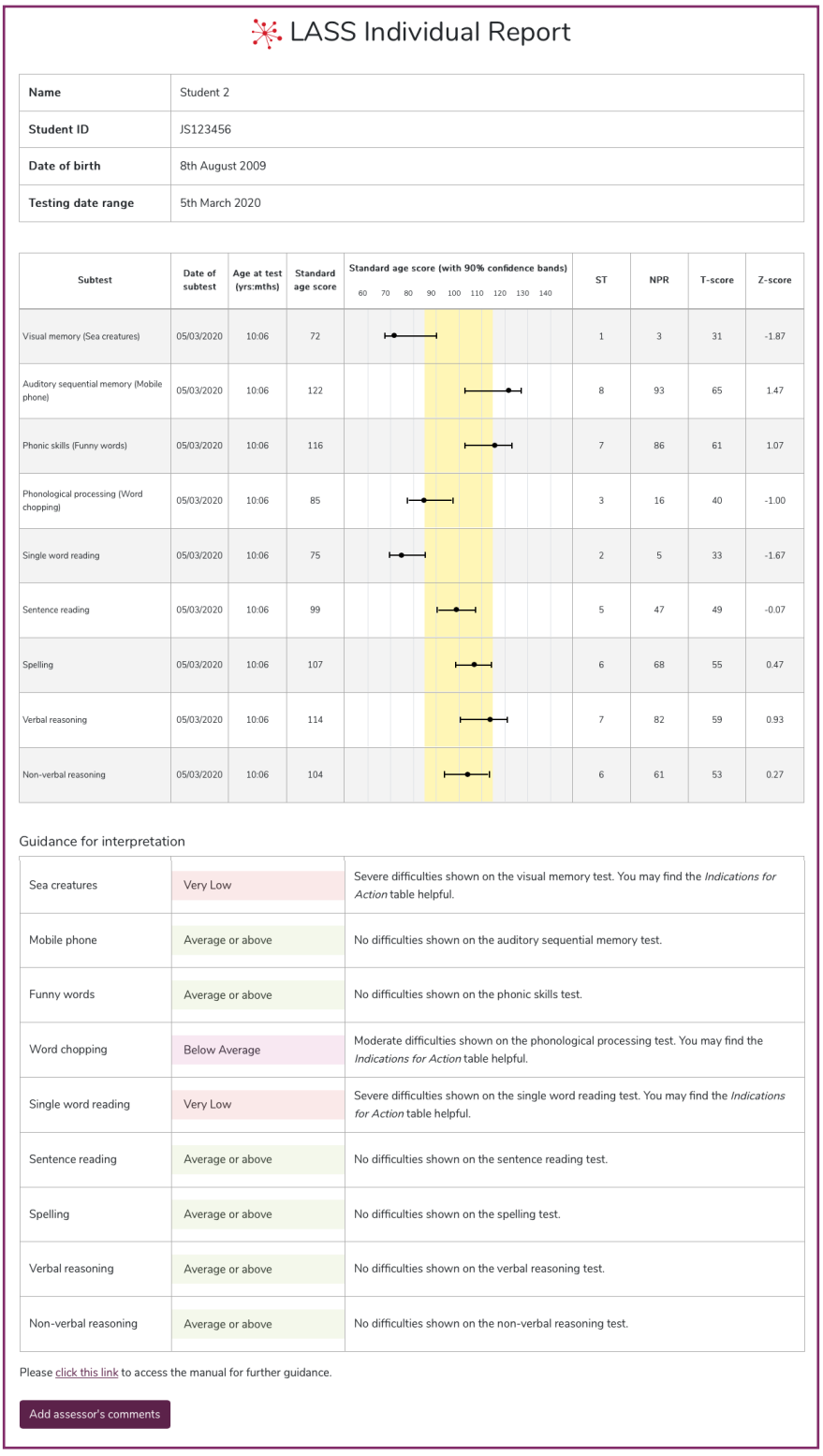

To navigate between reports, use the dropdown list of names, the arrows at the top of the screen or select 'Show All' to view all reports consecutively.

Figure 13. Navigating between graphical reports




To add comments to a report, click on 'Add assessor's comments', type the comments in the box and click 'Save'. To print out a report, use your internet browser's printing options.

Figure 14. Example graphical student report



LASS Individual Report

| | |
|---|---|
| **Name** | Student 2 |
| **Student ID** | JS123456 |
| **Date of birth** | 8th August 2009 |
| **Testing date range** | 5th March 2020 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 05/03/2020 | 10:06 | 72 | | 1 | 3 | 31 | -1.87 |
| Auditory sequential memory (Mobile phone) | 05/03/2020 | 10:06 | 122 | | 8 | 93 | 65 | 1.47 |
| Phonic skills (Funny words) | 05/03/2020 | 10:06 | 116 | | 7 | 86 | 61 | 1.07 |
| Phonological processing (Word chopping) | 05/03/2020 | 10:06 | 85 | | 3 | 16 | 40 | -1.00 |
| Single word reading | 05/03/2020 | 10:06 | 75 | | 2 | 5 | 33 | -1.67 |
| Sentence reading | 05/03/2020 | 10:06 | 99 | | 5 | 47 | 49 | -0.07 |
| Spelling | 05/03/2020 | 10:06 | 107 | | 6 | 68 | 55 | 0.47 |
| Verbal reasoning | 05/03/2020 | 10:06 | 114 | | 7 | 82 | 59 | 0.93 |
| Non-verbal reasoning | 05/03/2020 | 10:06 | 104 | | 6 | 61 | 53 | 0.27 |

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Very Low | Severe difficulties shown on the visual memory test. You may find the *Indications for Action* table helpful. |
| Mobile phone | Average or above | No difficulties shown on the auditory sequential memory test. |
| Funny words | Average or above | No difficulties shown on the phonic skills test. |
| Word chopping | Below Average | Moderate difficulties shown on the phonological processing test. You may find the *Indications for Action* table helpful. |
| Single word reading | Very Low | Severe difficulties shown on the single word reading test. You may find the *Indications for Action* table helpful. |
| Sentence reading | Average or above | No difficulties shown on the sentence reading test. |
| Spelling | Average or above | No difficulties shown on the spelling test. |
| Verbal reasoning | Average or above | No difficulties shown on the verbal reasoning test. |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test. |

Please click this link to access the manual for further guidance.

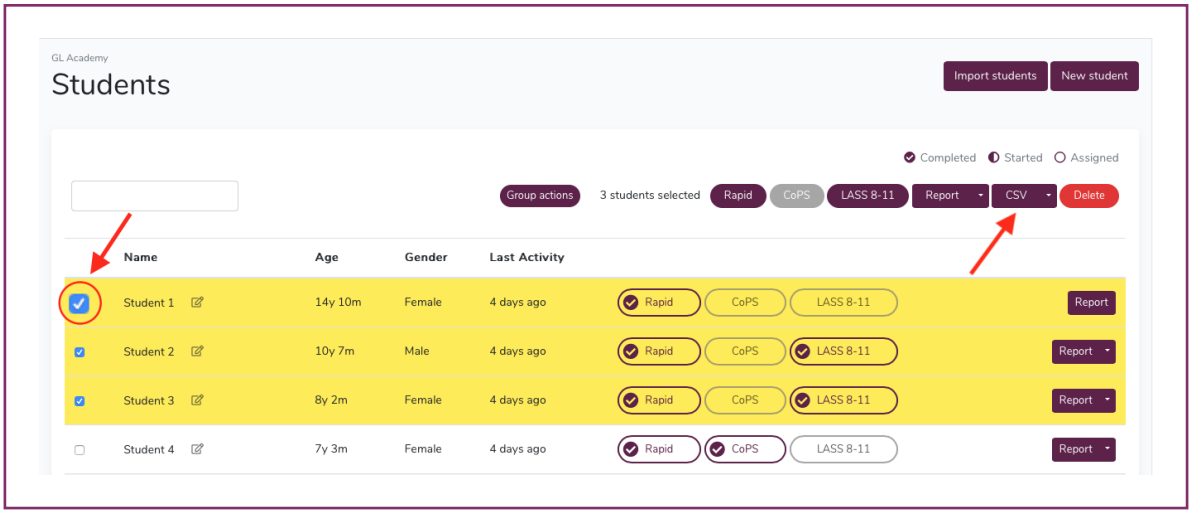
Add assessor's comments

All scores are saved automatically on completion of each subtest. If a subtest has been abandoned before completion, then no results will be saved for that subtest.

## CSV reports

To download the CSV reports of individual or multiple students, select those students by ticking the boxes next to their names and then click on the 'CSV' button in the group actions above the list of students.

Figure 15. Accessing CSV reports for multiple students




A CSV file will automatically download and can be found in your 'Downloads' folder, or the equivalent location on your device. You need to select at least one student to activate the 'CSV' button.

Figure 16. Example CSV report

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | Name | StudentID | DateOfBirth | TestDate | SubTestName | SAS | Interpretation_IndividualSubtest |
| 2 | Student 3 | CharlotteBee | 01/01/2012 | 05/03/2020 | Word chopping | 129 | Average or above |
| 3 | Student 3 | CharlotteBee | 01/01/2012 | 05/03/2020 | Mobile phone | 111 | Average or above |
| 4 | Student 3 | CharlotteBee | 01/01/2012 | 05/03/2020 | Funny words | 132 | Average or above |
| 5 | Student 2 | JS123456 | 08/08/2009 | 05/03/2020 | Word chopping | 85 | Below Average |
| 6 | Student 2 | JS123456 | 08/08/2009 | 05/03/2020 | Mobile phone | 122 | Average or above |
| 7 | Student 2 | JS123456 | 08/08/2009 | 05/03/2020 | Funny words | 116 | Average or above |
| 8 | Student 1 | JB123456 | 01/05/2005 | 05/03/2020 | Segments | 99 | Average or above |
| 9 | Student 1 | JB123456 | 01/05/2005 | 05/03/2020 | Mobile phone | 127 | Average or above |
| 10 | Student 1 | JB123456 | 01/05/2005 | 05/03/2020 | Non-words | 107 | Average or above |

For further information about accessing reports on the GL Ready platform, please visit www.glreadysupport.com.

# About the subtests

LASS 8–11 comprises three attainment subtests (***Single word reading***, ***Sentence reading*** and ***Spelling***), two ability subtests (***Verbal reasoning*** and ***Non-verbal reasoning***) and four diagnostic subtests (***Mobile phone***, ***Sea creatures, Funny words*** and ***Word chopping***). An outline of each subtest is given in Table 1. Seven of the nine subtests are adaptive, i.e. the items delivered are based on the performance of the student (see below). The remaining two subtests (***Sea creatures*** and ***Mobile phone***) are progressive in format, i.e. they utilise a graded series of items of increasing difficulty, together with a discontinuation algorithm whereby the test will automatically cease once the student's ability level has been exceeded beyond reasonable statistical error.

For each subtest, instructions are spoken by the computer, and practice items are given to familiarise the student with the subtest requirements. When the student has completed the practice items, the test phase begins. The program automatically discontinues the subtest when the student's ability level has been exceeded.

Table 1. The LASS 8–11 subtests

| TEST | CATEGORY | TYPE | DESCRIPTION |
|---|---|---|---|
| **Sentence reading** | Attainment | Adaptive | Close reading – completing sentences by identifying the missing word from a choice of five alternatives. No spoken assistance is given. |
| **Single word reading** | Attainment | Adaptive | Reading individual words out of context – identifying the printed word, from a choice of five alternatives, that corresponds to a spoken word. |
| **Spelling** | Attainment | Adaptive | Spelling individual real words that are spoken by the computer. |
| **Non-verbal 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. |
| **Verbal reasoning** | Ability | Adaptive | Verbal intelligence – conceptual similarities where the correct word, from a choice of six, has to be selected that provides the best conceptual link between two pictures. |
| **Mobile phone** | Diagnostic | Progressive | Auditory sequential memory (digit span) – recall of between two and nine digits in correct (forwards) sequential order, and recall of between two and seven digits in reverse order. |
| **Sea creatures** | Diagnostic | Progressive | Visual memory – immediate recall of objects and their spatial positions, beginning with two items and progressing to seven items. |
| **Funny words / Non-words** | Diagnostic | Adaptive | Reading individual non-words – a pure measure of phonic decoding skills. For each non-word there is a choice from four spoken alternatives. |
| **Word chopping / Segments** | Diagnostic | Adaptive | Phonological processing ability – segmentation and deletion of syllables and phonemes in real words. For each item there is a choice from four spoken alternatives. |

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, digitised assessments 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.

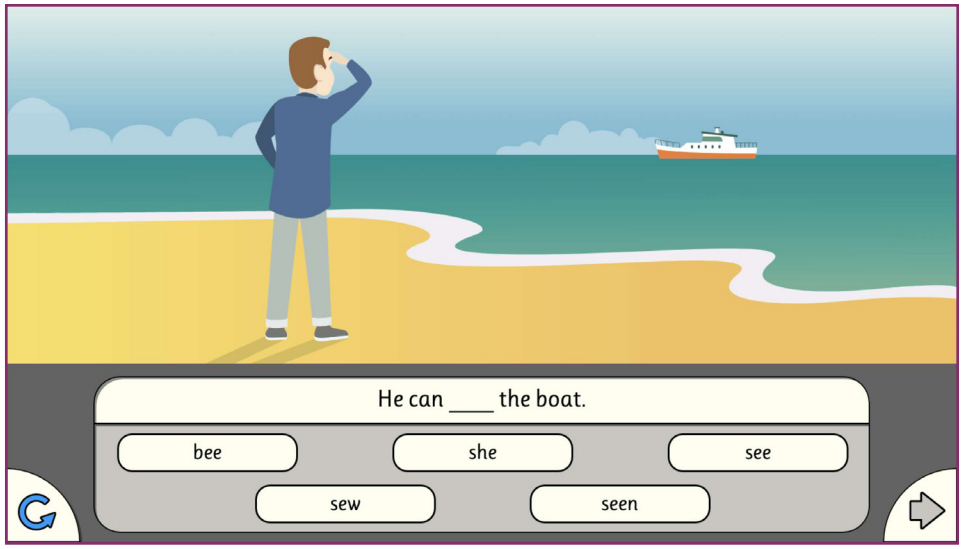
Conventional tests can be very crude instruments in which, much of the time, the individual’s abilities are not being assessed with great precision because the items are either too difficult or too easy. In an adaptive test the individual can be moved swiftly to that zone of the test that will most efficiently discriminate their capabilities, thus making the assessment shorter, more reliable, more efficient, and often more acceptable to the person being tested. 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. This finding is further supported by research by Carson, Gillon and Boustead (2011) and Senel and Kutlu (2018).

In the adaptive subtests in LASS 8–11, 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 pupil’s approximate ability or current attainment level.

## Sentence reading

Sentence reading is an adaptive subtest 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. The student starts by attempting some ‘probe’ items to determine the level at which they should start the test. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

Figure 17. Sentence reading subtest

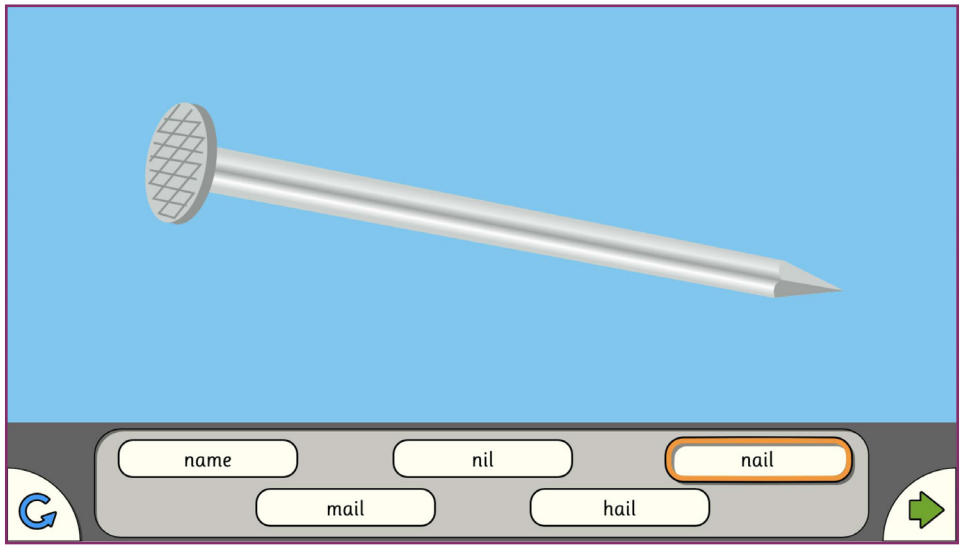



## Single word reading

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. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

***Single word reading*** is the only subtest in LASS 8–11 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*** subtest 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.

Figure 18. Single word reading subtest



## Spelling

Spelling is an adaptive subtest 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 type the individual word. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

Figure 19. Spelling subtest (desktop)

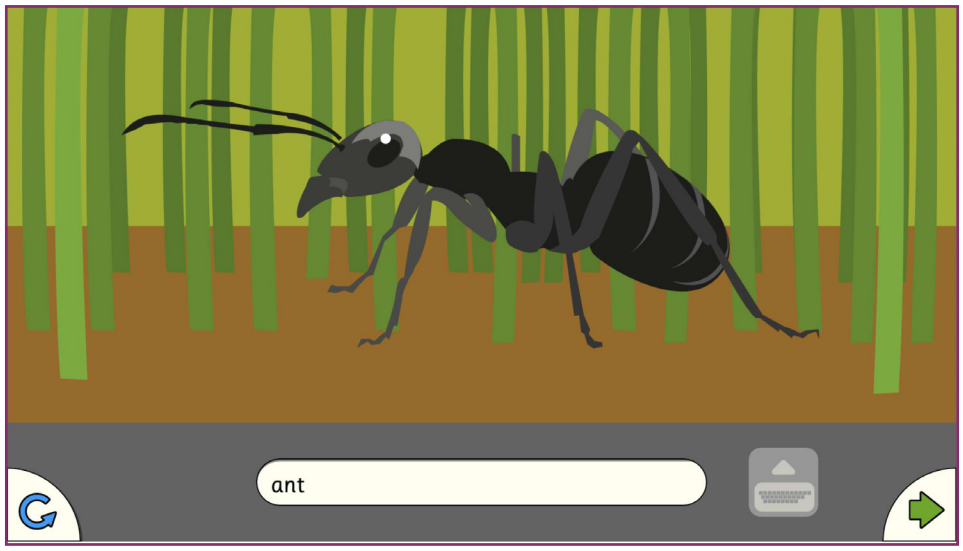


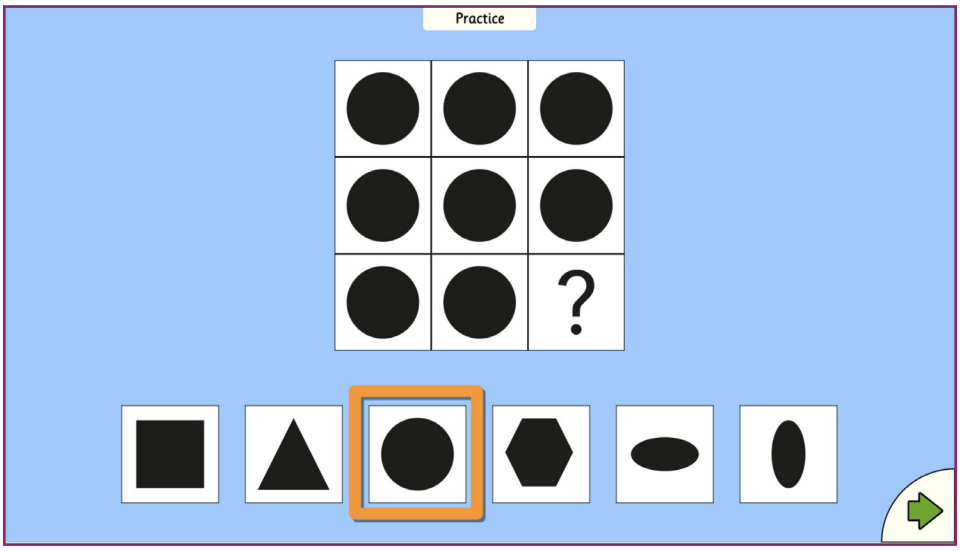

Figure 20. Spelling subtest (tablet)


## Non-verbal reasoning

Non-verbal reasoning is an adaptive subtest 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 completes the pattern. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress

through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

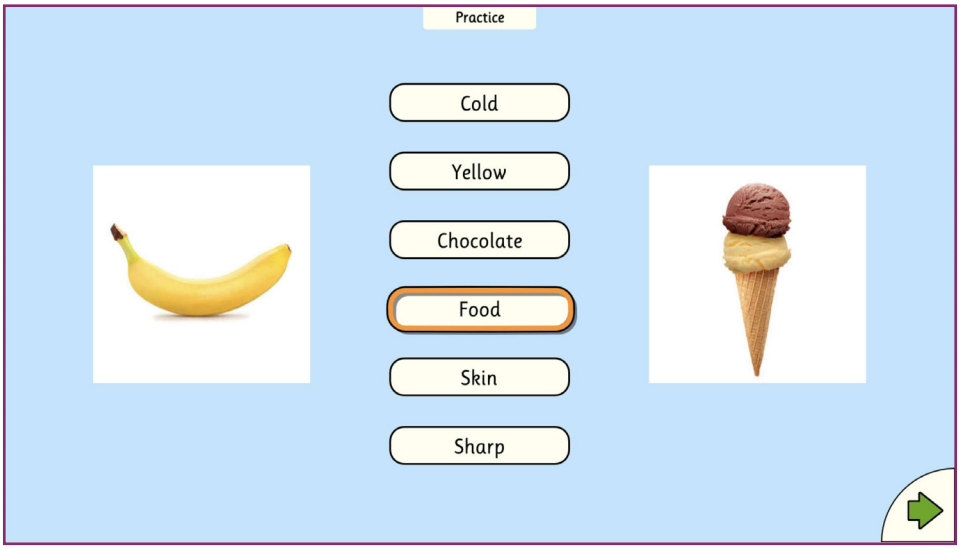
Figure 21. Non-verbal reasoning subtest




## Verbal reasoning

Verbal reasoning is a test of conceptual relationships. In each item, two pictures are presented on the screen, separated by six words. The student's task is to identify the word that provides the best conceptual link between the two pictures: this is the target word; the other five are distractors. The student can choose to hear the words by clicking or tapping on them, so reading competence is not necessary. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

Figure 22. Verbal reasoning subtest



# Sea Creatures

Sea creatures is a visual spatial memory test set under the sea, with eight hollows in the underwater scene. Different sea creatures appear in different hollows one at a time and then disappear. The student must remember which creature went in which hollow. After the sea creatures have disappeared, they are shown on the bottom of the screen along with two distractors. The student must select the sea creatures that were presented and drag them to the correct hollow. The student can put the creatures 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.

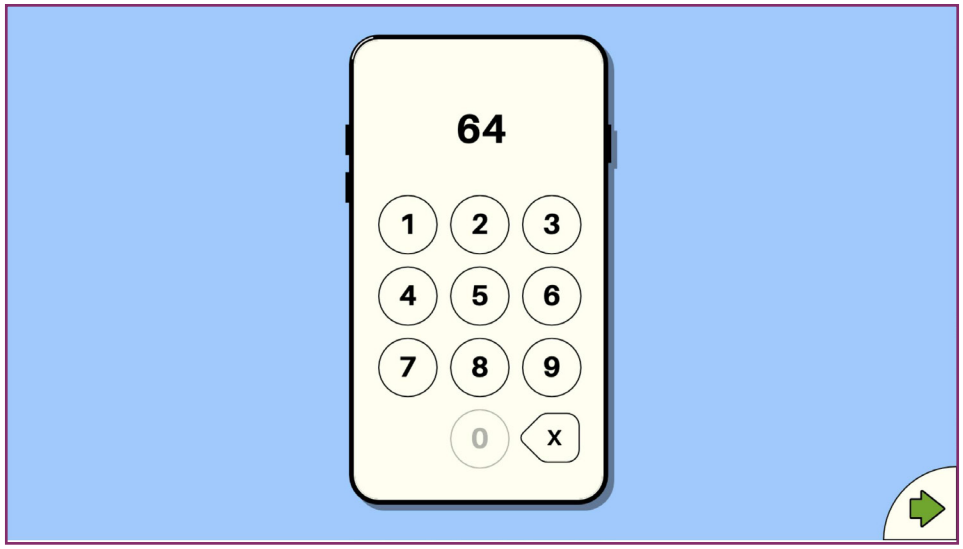
All students start with a presentation of two creatures and complete twelve trials in total. When a student has correctly placed two creatures on two occasions they move on to three creatures and so on until the twelve trials have been completed. The maximum number of creatures that can be presented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

Figure 23. Sea creatures subtest

# Mobile phone

Mobile phone is a measure of auditory sequential memory involving digit span, containing two parts. For the first part, the student is given a sequence of digits (a telephone number) to remember, which they then enter onto a mobile phone in the same order. Students must get both practice items (two-digit sequences) correct before moving on to the test items. All students start with two trials of two-digit sequences and if they answer one or both correctly then they move on to two trials of three-digit sequences and so on up to nine digits. If a student fails both trials within a level, then this part of the test is discontinued. For the second part, the student is required to enter the digits in reverse order. Again, they start with two trials of two-digit sequences and if they answer one or both correctly then they move on to two trials of three-digit sequences and so on up to seven digits. If a student fails both trials within a level, then the subtest is discontinued.

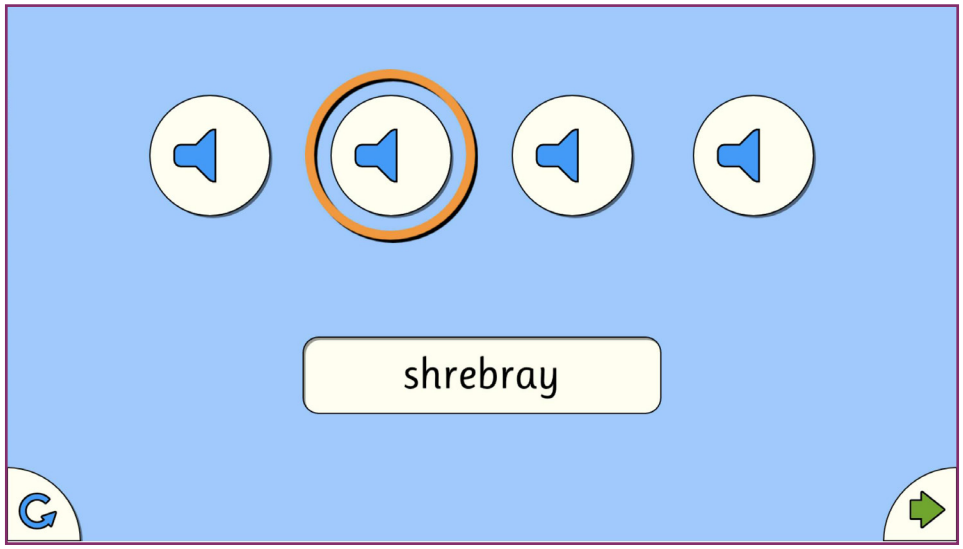
Figure 24. Mobile phone subtest




## Funny words / Non-words

Funny words (or Non-words for students aged 11) is a test of phonic decoding skills. A non-word is presented visually on the screen, and four speakers represented on screen play four different versions of the word. The student can hear these different versions as many times as they want to by clicking or tapping on each speaker. When they hear the version of the word that they think is correct they select that speaker and then use the green arrow to move on to the next item. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

Figure 25. Funny words subtest

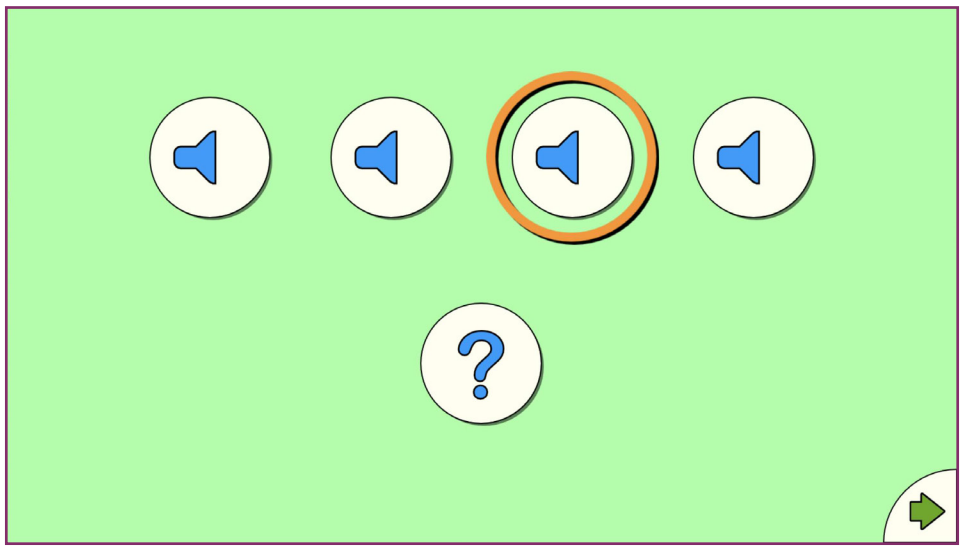



## Word chopping / Segments

Word chopping (or Segments for students aged 11) is a test of syllable and phoneme deletion that identifies poor phonological processing ability. Students are verbally presented with real words and asked what the 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 or tapping on the question mark. The four speakers play four different answers which the student can hear as many times as they want to by clicking or tapping on the speaker. When they hear the answer that they think is correct they select that speaker and then use the green arrow to move on. The student starts by attempting some 'probe' items to determine the level at which they should start the subtest. Their progress through the subtest depends on their performance and the subtest is discontinued when the student fails a certain number of items within a level.

Figure 26. Word chopping subtest



# Principal applications of LASS 8–11

LASS 8–11 is a *multifunctional* assessment instrument with the following principal applications:

- routine profiling of students' abilities
- screening for special educational needs
- assessment of dyslexia
- monitoring of literacy progress for all students
- evaluation of response to intervention

The following paragraphs outline the suggested ways in which LASS 8–11 can be used for these applications.

## Routine profiling

Many primary 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. LASS 8–11 can fulfil several of these functions, including the verbal and non-verbal ability and literacy attainment components. When used for this purpose, it would not normally be necessary to administer the modules assessing memory (***Sea creatures*** and ***Mobile phone***) or phonological skills (***Funny words / Non-words*** and ***Word chopping / Segments***), because these are essentially diagnostic tests.

## Special educational needs screening

LASS 8–11 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 8:0 and 11:11. When used for this purpose, students who gain low scores on any of the routine profiling subtests (***Non-verbal reasoning***, ***Verbal reasoning***, ***Sentence reading*** and ***Spelling***) or who display a significant discrepancy between their reasoning scores compared with their score(s) on ***Sentence reading*** or ***Spelling***, should be administered the diagnostic modules. The procedure then becomes the same as for assessment of dyslexia (see below).

## Assessment of dyslexia

### Dyslexia and its impact on learning

It is not possible here to give a detailed account of the nature of dyslexia. Readers are recommended to consult Reid (2016).

In 2007, the British Dyslexia Association adopted the following definition of dyslexia:

*"Dyslexia is a specific learning difficulty that mainly affects the development of literacy and language related skills. It is likely to be present at birth and to be life-long in its effects. It is characterised by difficulties with phonological processing, rapid naming, working memory, processing speed, and the automatic development of skills that may not match up to an individual's other cognitive abilities. It tends to be resistant to conventional teaching methods, but its effect can be mitigated by appropriately specific intervention, including the application of information technology and supportive counselling."*

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

- A marked inefficiency in the working or short-term memory system (Beech, 1997; Gathercole et al., 2006; Jeffries and Everatt, 2004; McLoughlin, Fitzgibbon and Young 1994; Rack, 1997). Memory difficulties may result in problems of retaining the meaning of text (especially when reading at speed), failure to marshal learned facts effectively in examinations, disjointed written work or an omission of words and phrases in written examinations, because students have lost track of what they are trying to express.
- Inadequate phonological processing abilities, which affect the acquisition of phonic skills in reading and spelling so that unfamiliar words are frequently misread, 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 (Snowling, 1995; Catts et al., 2005), but research has also indicated that this occurs in many adults with dyslexia (Beaton, McDougall and Singleton, 1997a; Ramus et al., 2003).

### LASS 8–11 profiles and dyslexia

The chapters that follow show how LASS 8–11 profiles can be used to identify dyslexia. LASS 8–11 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 of graphemes on to phonemes. However, as LASS 8–11 includes a measure of visual memory, it is also adept at picking up 'atypical' cases of dyslexia where, instead of phonological deficits predominating, the chief problem concerns visual memory.

## Monitoring of literacy progress

The two main literacy subtests in LASS 8–11 (***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 subtest on a second or subsequent occasion should be about 4 months (i.e. other than in exceptional circumstances, LASS 8–11 should not be given more than once in a school term).

## Evaluation of response to intervention

When a particular problem (e.g. 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 8–11 can be used for this evaluation, again bearing in mind that the minimum interval between administrations of any given LASS 8–11 subtest should be about 4 months (i.e. other than in exceptional circumstances, LASS 8–11 should not be given more than once in a school term).

The literacy attainment subtests (***Sentence reading*** and ***Spelling***) are obvious candidates for use in this process, but ***Funny words / Non-words*** may also be used to monitor development of phonics skills. It is unlikely that the reasoning subtests would need to be repeated (little change would be expected on these) unless there were suspicions that the first assessment on either ***Non-verbal reasoning*** or ***Verbal reasoning*** had given an unreliable result (e.g. because the student was unwell, was greatly lacking in confidence, or misunderstood the requirements of the task). The memory subtests (***Sea creatures*** and ***Mobile phone***) would be useful for evaluating growth in memorisation ability, especially where a memory training programme has been used.

# Guidelines on interpretation of results

## Standard Age Scores in LASS 8–11

LASS 8–11 results on each subtest are given as Standard Age Scores (SAS). Standard Age Scores, like IQ, are usually expressed with a mean of 100 and a standard deviation of 15. These scores reflect the student's performance compared to those of the norm referenced group, which is based on the student's age, in three-month age bands from 8:0–8:2 up to 11:9–11:11.

Any test score is only an estimate of the student's ability, based on their performance on a particular day. Performance on any test can be affected by several factors. The LASS 8–11 report provides confidence bands, which give an indication of the range within which a student's score lies. The dot on each subtest row within the table represents the student's SAS and the horizontal line represents the 90% confidence band. The shaded area shows the average score range. 90% confidence bands are a very high-level estimate; if the test were taken again, we would expect the score to fall within this range 90% of the time.

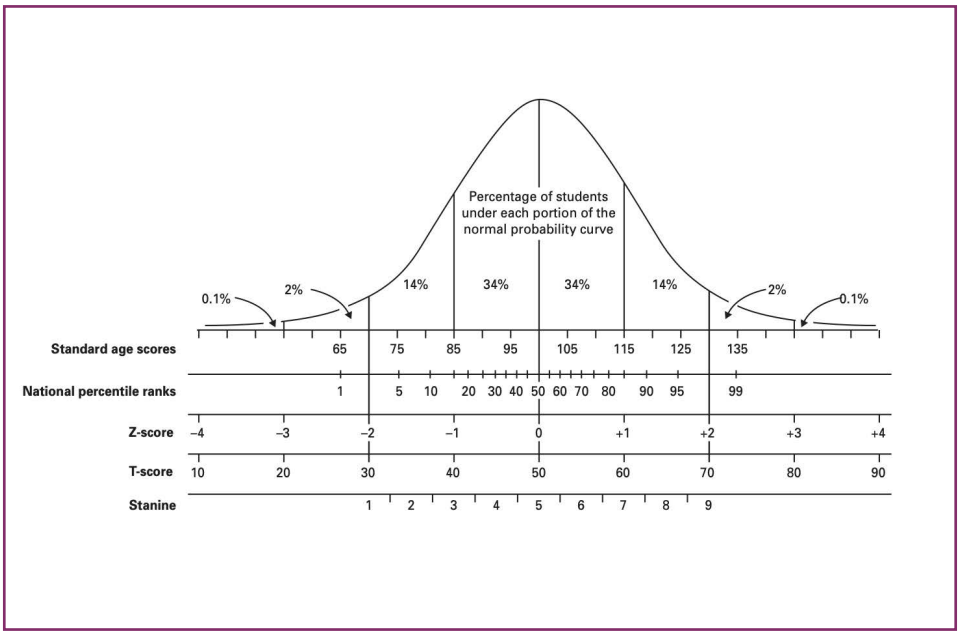
## Additional scores

The LASS 8–11 reports also provide Stanine scores (ST), National Percentile Ranks (NPR), T-Scores and Z-Scores:

- The Stanine places the student's score on a scale of 1 (low) to 9 (high) and offers a broad overview of performance.
- The National Percentile Rank relates to the SAS score and shows the percentage of students obtaining a certain score or below. An NPR of 50 is average since 50% of students obtained an SAS of 50 or below. An NPR of 5 indicates that a student's score is within the lowest 5% of the nationally representative sample and an NPR of 95 means that a student's score is within the highest 5% of the national sample.
- T-scores have a mean of 50 and a Standard Deviation (SD) of 10, so a T-score of 40 is one SD below the mean and a T-score of 60 is one SD above the mean. 68% of T-scores would fall within the 40-60 range, so a T-score below 40 would be considered below average and a T-score above 60 would be considered above average.
- Finally, Z-scores show us the student's score in standard deviation units, with a mean of 0 and an SD of 1. So, a Z-score of -1.0 would indicate that the student's score is one SD below the mean and a Z-score of +1.0 would indicate that the student's score is one SD above the mean.

The relationships between these different scores are shown in Figure 27 below.

Figure 27. Relationship between scores




# Interpreting scores and profiles

## Critical thresholds

How low must a LASS 8–11 subtest score 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 8–11 subtest undertaken, (b) whether the results of other LASS 8–11 subtests confirm or disconfirm the result being examined, and (c) the age of the student being tested.

Traditionally, a score which falls below an SAS of 85 (which is below one standard deviation below the mean) is by definition significantly below average and thus indicates an area of weakness, which requires some intervention. However, as stated at the start of this chapter, any test score is only an estimate of the student's ability, based on their performance on a particular day. As there is some error in any test score, those test scores in the borderline range (i.e. just above SAS 85) could potentially represent 'true scores' that are within the 'at risk' range. Therefore, the LASS 8–11 report identifies SAS scores of 88–94 as being 'Slightly below average' and SAS scores of 75–87 as 'Below average'. As such, action is recommended where SAS scores are in either of these ranges and the LASS 8–11 report will refer the tester to the Indications for Action table on the GL website, where appropriate. Where there is strong confirmation (e.g. a number of related subtests below an SAS of 88) then the assessor can be convinced that concern is appropriate.

Where a student is scoring below an SAS of 75 on any subtest (which is 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. The LASS 8–11 report identifies SAS scores below 75 as being 'Very low' and will refer the tester to the Indications for Action table on the GL website. Again, where there is strong confirmation (e.g. a number of related subtests below an SAS of 75) then the assessor can be even more confident about the diagnosis.

However, it should not be forgotten that LASS 8–11 is also a profiling system, so when making interpretations of results it is important to consider the student's overall profile. For example, an SAS of 95 for reading or spelling would not normally give particular cause for concern. But if the student in question had an SAS of 120 or more on one or both of the reasoning subtests, there would be a significant discrepancy between ability and attainment, which would give cause for concern.

It should also be noted that ***Single word reading*** is the only subtest in the LASS 8–11 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'). ***Single word reading*** 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.

## Understanding profiles

When considering LASS 8–11 results, it is important to bear in mind that it is not one test which is being interpreted, but the performance of a student on a number of related subtests. 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.

However, it is not legitimate to average a student's performance across all subtests in order to obtain a single overall measure of ability. This is because the subtests in LASS 8–11 are measuring very different areas of cognitive skill and attainment.

On the other hand, where scores in conceptually similar areas are numerically similar, it is sometimes useful to average them. For example, if scores on the two memory subtests (***Sea creatures*** and ***Mobile phone***) were at similar levels, 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 8–11 (i.e. visual memory and auditory sequential memory). On the same basis, if scores on the two phonological subtests (***Funny words*** / ***Non-words*** and ***Word chopping*** / ***Segments***) were at similar levels, 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. It would not be legitimate to average scores across conceptually dissimilar subtests (e.g. ***Non-verbal reasoning*** and ***Funny words*** / ***Non-words***). 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 ***Sea creatures*** and ***Mobile phone*** 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.

Teachers should also remember that 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 the LASS 8–11 subtests 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.

Many LASS 8–11 reports display a complex pattern of 'highs' and 'lows' that at first sight appears quite puzzling. 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 report to see on what days different subtests were done. Motivation, ill health (actual or imminent) and impatience are often causes of a student under-performing, or the student may simply have misunderstood the task (e.g. assuming that they have to do a subtest as quickly as possible when in fact it is accuracy which is most important). Very occasionally it may be found in such cases that the student was simply not taking the test seriously. The fundamental rule of thumb is: if the teacher is not confident about any particular result, then the safest course of action is to repeat the subtest(s) in question after first checking that the student does understand the task(s), is not unwell, and has the right frame of mind to attempt the activities to the best of their abilities.

## Guidance for interpretation table

Figure 28. Example of the Guidance for Interpretation section of the report

Guidance for interpretation

| | | |
|---|---|---|
| Rabbits | Average or above | No difficulties shown on the visual spatial sequential memory test. |
| Crayons | Average or above | No difficulties shown on the visual-verbal sequential memory test. |
| Toybox | Below Average | Moderate difficulties shown on the visual associative memory test. You may find the *Indications for Action* table helpful. |
| Letters | Average or above | No difficulties shown on the visual sequential memory test. |
| Letter names | Average or above | No difficulties shown on the visual-verbal associative memory test. |
| Races | Average or above | No difficulties shown on the auditory sequential memory test. |
| Rhymes | Slightly below average | Borderline difficulties shown on the phonological awareness test. You may find the *Indications for Action* table helpful. |
| Wock | Very Low | Severe difficulties shown on the auditory discrimination test. You may find the *Indications for Action* table helpful. |
| Clown | Below Average | Moderate difficulties shown on the colour discrimination test. You may find the *Indications for Action* table helpful. |

The Guidance for Interpretation table on the report provides enhanced guidance for interpreting each student's results. Match the guidance to the LASS 8–11 Indications for Action Table, found on the GL Ready Support website (www.glreadysupport.com).

Interpreting the results from LASS 8–11 requires interpretation of the overall profile, and not just consideration of each individual subtest separately. Please see the Case Studies chapter for further guidance on interpreting the whole profile.

## Must students be labelled?

Labels for different special educational needs (especially the label 'dyslexia') have been controversial for some years. *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). The latter embodies a fairly broad labelling of special educational needs categories, including the category 'Specific Learning Difficulties (Dyslexia)' [*Code of Practice*, 3:60]. The *1996 Education Act* consolidated the provisions of previous Acts, in particular the 1993 Act. However, the *1994 Code of Practice* was superseded by the *2001 SEN Code of Practice*, which again moved away from use of labels and focused instead on areas of need and their impact on learning (DfES, 2001). The latest *SEND Code of Practice* (DfE, 2014) reiterates that 'The purpose of identification is to work out what action the school needs to take, not to fit a pupil into a category… The support provided to an individual should always be based on a full understanding of their particular strengths and needs and seek to address them all using well-evidenced interventions targeted at their areas of difficulty' [*SEND Code of Practice*, 2014,].

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 8–11 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 8–11 report indicates a student's cognitive strengths as well as limitations, it gives the teacher important insights into their learning styles. 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 8–11, even though parents may press for such labels.

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 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.

# LASS 8–11 results and the *SEND Code of Practice*

## The *SEND Code of Practice*

The current *Special Educational Needs and Disability Code of Practice* (DfE, 2014), which came into force in September 2014, replaced the previous Code (published in 2001). Under the provisions of the *Children and Families Act 2014, Part III*, all schools, academies and Local Education Authorities (LEAs) in England must have regard to the *SEND Code of Practice* when dealing with students with special educational needs or disabilities. It is assumed that most teachers in England will be familiar with the *SEND Code of Practice*, especially if they are Special Educational Needs and Disabilities Co-ordinators (SENDCo), and so only a brief outline will be given here.

The *SEND Code of Practice* (2014) provides guidance for education settings on taking a graduated approach to identifying and supporting students with SEN, which replaces the stages of School Action and School Action Plus from the previous code, and with Education and Health Care Plans (EHCPs) replacing statements of SEN. The *SEND Code of Practice* states that schools should assess students' skills and attainment on entry and make regular assessments of progress. Where students are making less than expected progress, the first response should be high quality teaching targeting their areas of weakness. If progress continues to be less than expected then schools should assess whether the student has SEN, whilst continuing to provide extra teaching or interventions. When a student is identified as having SEN, schools should put in place a four-part cycle of Assess, Plan, Do and Review, which may involve outside specialists. Where, despite the school having taken action to assess and meet the SEN of the student, they have not made expected progress, the school or parents should consider requesting an Education, Health and Care needs assessment.

The *Children and Families Act 2014, Part III*, Chapter 6 places upon LEAs in England, the responsibility for identifying all students with special educational needs. The SEND Code states that 'The benefits of early identification are widely recognised – identifying need at the earliest

point and then making effective provision improves long-term outcomes for the child or young person' [SEND Code].

It is clear that LASS 8–11 can play a significant role in helping schools and teachers meet their obligations under the *Children and Families Act* and the *SEND Code of Practice.*

## Guidelines on using LASS 8–11 in conjunction with the *SEND Code of Practice*

LASS 8–11 results should not be considered in a vacuum. Hence, 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, the extent to which the student has developed strategies which enable them to compensate for difficulties, and the emotional impact of any difficulties. Writing skills are not assessed by LASS 8–11, but when considering results and deciding appropriate courses of action it is important that writing skills are factored in. Consistent with the SEND 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.

# Interpreting results from individual subtests

## Non-verbal reasoning

The purpose of ***Non-verbal reasoning*** is to give the teacher a reasonable estimate of the student's non-verbal intellectual ability or intelligence. ***Non-verbal reasoning*** is an adaptive subtest, which makes assessment swift and efficient. 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.

***Non-verbal reasoning*** in LASS 8–11 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 validity or reliability of the subtest, so if students run out of time then this must be accepted as part of the exigencies of the task.

Since humans endeavour to play to their strengths whenever they can, it follows that where one aspect of intelligence is much better than the other, the former is more likely to be utilised in tackling problems, e.g. if ***Non-verbal reasoning*** is much higher than ***Verbal reasoning***, the student is more likely to problem solve using non-verbal rather than verbal strategies, and vice versa. The greater the disparity between the two, the more prominent this effect is likely to be.

## Verbal reasoning

The purpose of ***Verbal reasoning*** is to give the teacher a reasonable estimate of the student's verbal intellectual ability or intelligence. ***Verbal reasoning*** is an adaptive test, which makes assessment swift and efficient. ***Verbal reasoning*** is a test of conceptual similarities. In each item two pictures are presented on the screen, separated by six words. The student's task is to identify the word that provides the best conceptual link between the two pictures: this is the target word; the other five are distractors. The student will hear the words when they are clicked on, so reading competence is not necessary. There is good evidence that such conceptual similarities tests provide a good indicator of verbal intellectual ability. Nevertheless, teachers 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.

Since humans endeavour to play to their strengths whenever they can, it follows that where one aspect of intelligence is much better than the other, the former is more likely to be utilised in tackling problems, e.g. if ***Non-verbal reasoning*** is much higher than ***Verbal reasoning***, the student is more likely to problem solve using nonverbal rather than verbal strategies, and vice versa. The greater the disparity between the two, the more prominent this effect is likely to be.

## Sentence reading

***Sentence reading*** will often be the first subtest to be administered. Like the reasoning subtests, 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 ***Sentence reading***, and there is no significant discrepancy between this result and the scores on the reasoning subtests, there is usually no need to administer the other two reading-related subtests (***Single word reading*** and ***Funny words / Non-words***). This is because the student's performance in reading will not give undue cause for concern. However, if the score of this subtest falls below an SAS of 85, or there is a significant discrepancy between this result and the scores on the reasoning subtests, then there will be cause for concern. In this event it is recommended that both ***Single word reading*** and ***Funny words / Non-words*** also be administered.

If the ***Sentence reading*** score is found to be low, this may be because the student has dyslexia or because they have low general ability. It could alternatively be because they lack experience of reading texts at an age-appropriate level and simply need to develop their comprehension skills. Such students would benefit from a variety of activities designed to stimulate reading comprehension skills. However, if the student has problems of a dyslexic nature, it may be necessary to tackle word recognition and phonic skills before launching too vigorously into more ambitious work on reading for meaning.

## Single word reading

This is a test of word recognition out-of-context, i.e. reading accuracy. ***Single word reading*** is the only subtest in LASS 8–11 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'). ***Single word reading*** 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 an SAS of 85) on ***Sentence reading***; or
- a significant discrepancy between the score for ***Sentence reading*** and the scores on the reasoning subtests has already been detected; or
- there is other evidence to suggest deficient reading skills.

In such cases, the purpose of administering this subtest 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 ***Sentence reading*** or some other reading comprehension test). Where ***Single word reading*** is administered, teachers should be aware that results may not correspond to those obtained from an oral single-word recognition test in which the student has to pronounce the words in the test. This is obviously a rather different (and considerably harder) task than that of identifying the target word on hearing the word spoken in the subtest, as in LASS 8–11. Where the teacher is in doubt, it would be prudent to check the student's oral word recognition skills using a suitable test.

## Funny words (ages 8–10) / Non-words (age 11)

This is a test of non-word 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; Griffiths and Snowling, 2002; Verhoeven and Keuning, 2018). 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; Suarez-Coalla and Cuetos, 2015; Cavalli et al., 2018) and there is a school of scientific thought that regards dyslexia as essentially a phonological processing difficulty (Rack, 1994; Snowling, 1995, 2000; Griffiths and Snowling, 2002; Ramus, 2003; Lindgren and Laine, 2011; Saksida et al., 2016). Hence a low score on LASS 8–11 ***Funny words / Non-words*** is usually a good indication of dyslexia. However, teachers should be aware that there are other possible explanations for a low score on ***Funny words / Non-words***, 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 schooling) but must also take into account the student's performance on the other LASS 8–11 subtests. For example, if the student also performs poorly on ***Word chopping / 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; Joanisse et al.,

2000). Hence teachers should beware of assuming that, because a student does not have a low score on ***Funny words / Non-words***, they cannot therefore have dyslexia.

Lack of experience with English can limit awareness of pronunciation rules. For example, in one of the more difficult items in ***Funny words / Non-words***: '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').

## Word chopping (ages 8–10) / Segments (age 11)

***Word chopping / Segments*** is a test of general phonological processing abilities requiring deletion of segments of words. For example, 'dragonfly' without the syllable 'on' would be pronounced 'drag´fly'.

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 d-**ig**). The importance of this phonological awareness for early literacy development has been very well demonstrated in research (Snowling, 1995; Goswami, 1994, 1999, 2001; Goswami and Bryant, 1990; Rack, 1994; Savage, 2001; Ziegler and Goswami, 2005). Phonological awareness in very young children is often assessed by means of an 'oddity task' in which the child has to pick out the one which is different from a list of similar sounding words, e.g. 'mop, hop, tap, lop'; 'ham, tap, had, hat' (Bradley and Bryant, 1983; Bradley, 1980; Goswami, 2012). However, phonological deletion tasks, such as ***Word chopping / Segments***, have been found to be more sensitive measures for use with older children (Snowling, 2000; Landerl et al., 2013).

Dyslexic children 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 children's underlying phonological representations determines the ease with which they learn to read, and that the poorly developed phonological representations of dyslexic children are the fundamental cause of their literacy difficulties. In the CoPS research the ***Rhymes*** subtest 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; Vellutino et al, 2004; Jimenez, et al., 2010). Low performance on ***Word chopping / Segments*** is therefore a good indication of dyslexia. However, as with ***Funny words / Non-words***, teachers should be aware that students with hearing problems may also have low scores on ***Word chopping / Segments***.

# Spelling

Many students with 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 their 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 (Abbott, Berninger and Fayol, 2010; Aram, 2005; 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. Indeed, 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 for these skills to become automatised.

# Sea creatures

***Sea creatures*** is a test of visual memory, involving spatial and temporal sequences. However, since the stimulus items for ***Sea creatures*** 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 ***Mobile phone***), 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; Bogon et al., 2014). 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, 1986). This is believed to enable us to keep small amounts of visual information in short-term memory. Stuart, Masterson and Dixon (2000) found that visual memory influences

the acquisition of sight vocabulary in children 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 children 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.

A study by Palmer (2000) found that children 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. Children 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 child's education progresses and the number of new words with which the child is confronted steadily increases.

***Sea creatures*** 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 ***Sea creatures*** not because of inherent memory difficulties, but because of difficulties with attention. 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 child to an educational psychologist for further investigation. Students with ADHD who have hyperactive patterns of behaviour may also experience difficulties with ***Sea creatures*** because of high impulsivity, which can disrupt the processes of memorisation and recall.

Students with very good scores on ***Sea creatures*** (or who show a significantly higher score on this subtest than on ***Mobile phone***) may develop an over-reliance on visual strategies in reading, with a consequent neglect of phonic strategies. Although such students may develop quite a large sight vocabulary and, superficially, may appear to be progressing well in their reading development, this state of affairs is not satisfactory because without adequate phonic skills (that have become fluent through regular use and practice) they are highly likely to struggle in reading later on in education. The teacher can always check the student's phonic skills by using LASS 8–11 ***Funny words / Non-words***, but this will not reveal whether students are actively applying their phonic skills in text reading. Some students (particularly if they are bright) develop the maladaptive strategy of skipping words in text that they do not recognise immediately and using their common sense to construct the meaning of the text in the absence of the skipped words. Although they may get away with this in the primary classroom, they are likely to find that such a strategy lets them down when they get to secondary school, where they will be introduced to many new, often difficult, words. Teachers should therefore try to prevent this by (a) ensuring that all students have a good working knowledge of phonics, and (b) can apply those phonic skills fluently when reading text. The latter should be apparent when listening to a student read an unfamiliar piece of text aloud. A miscue analysis approach could be adopted, which will help the teacher to identify what type of reading errors the student is making. Fluency in text processing can only be achieved by proper practice in reading: teachers should beware that

although students may claim to read regularly (e.g. at bedtime) this may involve reading rather unchallenging material. When reading some children's stories, for example, it is often much easier for the student to skip words that they cannot recognise and still retain a fairly high level of comprehension. By contrast, reading of non-fiction material and 'classic' children's fiction (which often contains a more sophisticated vocabulary) is more likely to encourage children to decode unfamiliar words. However, the text should not be too difficult for the student to tackle otherwise the activity will become excessively frustrating and counterproductive. Ideally there should be no more than about 5% of words that are unknown to the student. More than that amount will mean that the student is too frequently interrupting text reading processes in order to decode unfamiliar words, with the result that it will be difficult for them to hold the meaning of the passage in memory.

## Mobile phone

***Mobile phone*** is a test of auditory sequential short-term memory, based on recall of digits. It is a well-established fact that individuals with dyslexia 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 8–11 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 sequential memory.

Auditory 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 (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 (Gathercole and Baddeley, 1993; Wagner et al, 1993).

Short-term auditory 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').

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, 1982). 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 more competent readers whose capacity for rapid visual recognition of words steadily increases with age. Nevertheless, auditory working memory remains a significant factor in reading development and in writing as well. Students with weaknesses in auditory working memory also tend to have difficulty in monitoring their written output, and are inclined to miss letters, syllables and/or words out when they are writing (Baddeley, 1986; Brady, 1986; Jorm; 1983; Wagner and Torgeson, 1987.)

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).

Like the other auditory tasks in LASS 8–11, ***Mobile phone*** requires adequate hearing ability. Where a teacher suspects that a low score on ***Mobile phone*** could be due to poor hearing, the student's hearing should be tested.

# Teaching recommendations

Once the LASS 8–11 tests have been used, teachers will want to know how to use their student's strengths to develop the identified areas of weakness. Looking at the whole profile will provide them with evidence of the areas that need attention and at the same time indicate where the strengths are, so that those strengths can be used to mitigate or remediate the problem learning areas. Analysis of the problem areas may provide insight into the nature of the problem.

When specific areas of learning difficulty have been identified by LASS 8–11, 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 spelling games, 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.

Throughout this chapter, teachers will find recommendations regarding software and other resources. Teaching strategies and suggested software for pupils with dyslexia and other literacy difficulties have been reviewed by Reid (2016) Crivelli (2013), Keates (2002) and Stansfield (2012) and Shaywitz, Morris and Shaywitz (2008). The Rose report (Rose, 2009) also gives an overview of strategies for supporting students with dyslexia. For further suggestions on suitable software see the British Dyslexia Association New Technologies Committee website (www.bdatech.org) which is updated on a regular basis. For other teaching resources visit (www.bdadyslexia.org.uk).

Teachers should be aware that the educational software that is recommended in this manual may have been withdrawn from sale, superseded or augmented by new programs since this manual was published.

Use of LASS 8–11 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 pupil. 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 pupils who have specific learning difficulties.

## Key areas of learning difficulty to address

In some cases, you may have some awareness of a student's difficulties before you use LASS 8–11. Concern about a student's progress will often be the stimulus to carry out an assessment. A student with dyslexic tendencies will typically present with problems in all or most of these characteristic areas:

- short-term memory (auditory and/or visual)
- phonological processing skills

- phonic decoding skills
- poor presentation of written work
- disorganised work and life.

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 pupil'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.

# Strategies for specific problem areas

## Poor phonological processing ability

The evidence that training in phonological skills facilitates literacy development is extremely strong (see Bryant and Bradley, 1985; Goswami and Bryant, 1990; and Rack, 1994). Lundberg, Frost and Peterson (1988) showed that relatively short daily sessions of phonological activities (15–20 minutes) carried out with kindergarten pupils resulted in improved phonological skills and significant gains in reading and spelling (compared with a control group) through at least to their second year of schooling. In this particular study, activities progressed from simple listening and rhyming games, to segmentation of sentences into words, words into syllables

and, finally, syllables into phonemes. 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.

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

- **Rhyming** and **alliteration** – suitable techniques range from simple rhyming songs and games to more structured activities involving making books with rhyming or alliterative themes, 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 of these activities are very suitable for playing at home, so parental involvement is strongly encouraged. Many phonological discrimination activities are also useful for phonological training. For ideas on phonological awareness activities see Goswami and Bryant (1990); Layton and Upton (1992); Layton, Deeney, Tall and Upton (1996); James, Kerr and Tyler (1994); Yopp (1992). *Sound Linkage* (Hatcher, Duff & Hulme, 2014) is based on the Cumbria project on phonological awareness (Hatcher, Hulme and Ellis, 1994) and includes materials for testing and training. Snowling and Stackhouse (2006) provide a useful compendium of recommendations on teaching dyslexic students with speech and language difficulties. The *PAT books* (Phonological Awareness Training; Buckinghamshire County Council) includes levels that are suitable for primary students. Recommended computer-based activities for practising phonological skills include ***Tizzy's Toybox*** and ***Talking Animated Alphabet*** (Sherston); ***Letterland***; and ***Sounds and Rhymes*** (Xavier).

In general, younger students respond well to phonological training activities and skills swiftly improve. However, some dyslexic students may have more persistent difficulties that will require particularly careful literacy teaching. In such cases, a well-structured multisensory approach incorporating plenty of practice in phonic skills (over-learning) is recommended. Examples of suitable schemes are given later. Without phonological awareness training, many 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). They can easily slip through the net, only to re-appear as a student who is failing in reading and spelling later in their schooling.

## Poor auditory working memory

Commonly, weaknesses in either phonological awareness or auditory discrimination are easier to improve through direct training than memory limitations are, especially with younger students. 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 (Buzan, 2006; Reid, 2016). However, that does not mean that memory training is not worthwhile with young students. Indeed, it may well be the case that with improved training techniques, remediation of memory

weaknesses could turn out to be a much more promising approach in the future. 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 they should give just 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 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 others.

Auditory memory training activities include:

- **I went to the supermarket** – teacher says 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 a 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 teacher, Mr Fish the hairdresser, Miss Brown the electrician') and then asks for recall of one (e.g. 'Who was the teacher?' or 'What is Miss Brown's job?').
- **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, generally, easier to remember, but dyslexics tend to find a slower sequence harder (because their rehearsal processes in working memory are deficient).

Recommended computer software for developing auditory memory includes ***Mastering Memory*** (CALSC), which is a very flexible tool for practising memory strategies, but it does require quite a lot of teacher input. Use of the phonic teaching system ***AcceleRead***, ***AcceleWrite*** (Iansyst) has also been found to improve working memory ability (Miles, 2000).

## Poor phonic decoding skills

For the reasons explained above, the student who displays major difficulties in auditory memory is likely to have problems in acquiring effective phonic skills. The recommendations here would

be for a highly-structured *multisensory phonic approach* to literacy learning. This should not only provide ample practice to compensate for memory weakness, but it should 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 younger students with dyslexic difficulties include ***Alpha to Omega***, ***Toe by Toe***, ***The Bangor Dyslexia Teaching System***, ***The Phonics Handbook***, ***Sound Linkage***, ***Spelling Made Easy***, ***The Hickey Multisensory Language Course***, ***Star Track Reading and Spelling***, ***Sounds-Write*** and ***Sound Discovery***.

Good computer software for practising phonic skills includes: ***Wordshark5***, ***Talking Animated Alphabet***, ***Nessy*** and ***Lexia***.

***Wordshark5*** offers 60 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*** in 403 schools (Singleton and Simmons, 2001), teachers reported significant benefits to reading, spelling and confidence in using the program. ***Talking animated alphabet*** helps young children develop their knowledge of the shapes, sounds and names of the alphabet. ***Nessy Reading and Spelling*** is an online program including 100 structured lessons for students (age 5–12) to work through. ***Lexia*** (suitable for Reception to Year 6) provides explicit, systematic, personalised learning in six areas of reading instruction (phonological awareness, phonics, structural analysis, automaticity/fluency, vocabulary and comprehension). ***Lexia*** is web-enabled, allowing students to access the software seamlessly between school and home.

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. For example: ***Clicker 7***, ***DocsPlus***, ***SymWriter 2*** and ***Texthelp Read and Write***. A generic structured learning scheme such as ***AcceleRead***, ***AcceleWrite*** (Iansyst) can be used with any good talking word processor.

Further information on techniques for teaching the dyslexic pupil can be found in Augur (1996); Cooke (2002); Crombie (2018); Hornsby (1995); Pollock, Waller and Politt (2004); Reid (2016); Thomson and Watkins (2007).

## 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, 2000; Snowling and Thomson, 1991). Indeed, dyslexic individuals often have excellent visual skills (West, 2009). Nevertheless, teachers and educational psychologists are not infrequently confronted by cases of young students who appear to have inordinate difficulties in remembering various types of information presented visually.

Structured phonics work, with ample practice (over-learning) will compensate for visual memory weaknesses. A multisensory approach is strongly recommended, building on any auditory and

kinaesthetic strengths. Suitable phonics programmes and associated activities are given later.

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

- **Find the missing part** – create pictures of everyday things with parts of the pictures missing (e.g. doll with one arm, table with only three legs) and ask the student to identify what is missing. To do this the student has to recall visual images of the relevant objects.
- **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** – put an array of familiar objects on a tray (or a 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 the 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.
- A recommended computer program for developing visual memory skills is ***Mastering Memory***.

## Maths difficulties

Maths can cause problems and below are examples of the three main ways it impacts students:

1. The student who can understand and do the maths but makes careless errors from mis-reading the problem, or reversing digits or sequences of digits, which makes nonsense of the calculations.

2. The student who may be able to do the maths, but if they cannot read the maths problem, or read it sufficiently accurately, they will be unable to work to their mathematical ability level. Audio versions of the maths book can often solve this problem, especially when headphones are used for privacy. A talking word processor can help with wordy problem worksheets, but not when formulae are involved (see above).

3. The student who has dyscalculia (specific mathematical difficulties) and so will have much more serious problems. Recommended programs include ***NumberShark5***, ***Maths Circus***, ***Dynamo Maths*** and ***123Maths***.

All students with numeracy problems can help improve their understanding of maths by

exploring maths adventure programs. This 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 (2016) and Henderson (2012).

# Computer support

Most children 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 a computer removes much of the hassle of editing spellings and punctuation and the final printed product looks smart. For students who need more support, a talking word processor 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.

## Developing reading skills

Talking books, which use digitised speech to accompany story texts are very useful classroom resources. They enable poor readers to independently practice reading skills at text level, and develop confidence, fluency and comprehension. These programs allow the reader to click on individual words and hear these read aloud, enabling reading to continue and understanding to be maintained. Recommended programs include the ***Oxford Reading Tree Talking Stories***.

If pupils have problems with phonic decoding then training programs such as ***Wordshark5***, ***Talking Animated Alphabet***, ***Nessy*** and ***Lexia*** can be used. In an evaluation of ***Wordshark*** in 403 schools by Singleton and Simmons (2001), teachers reported significant benefits to reading, spelling and confidence in using the program.

## Keyboard skills

Some students become fast typists once they have regular access to a keyboard, but if there are spatial awareness or other dyspraxic difficulties, it is essential for the student to use a keyboard training program. All students will get going faster and become more comfortable about using a keyboard if they spend some intensive time mastering keyboard skills. This is an activity that should be undertaken for short, daily sessions, and so is ideal for doing at home or in lunchtime or homework club sessions. Useful computer programs for developing typing skills are:

- ***First Keys 3*** – useful for students with low reading skills
- ***Kaz*** – a ‘quick-fix’ sentence approach which is effective for some
- ***Nessy Fingers*** – uses a game format and is suitable for students aged 7–12

Developing touch typing is purely a matter of practice – preferably daily – so there is little point in undertaking it unless the student is prepared to devote the necessary time. It is often a good idea to do this at home during a school holiday, and if more than one member of the family can be involved, so much the better. A reward system for achievement might be adopted.

## Developing writing skills

A talking word processor is probably the single most effective support for writing. Use of a talking word processor is beneficial because it gives the pupil auditory feedback and encourages them to pay attention to the phonic components of words when writing. For example: ***Clicker 7***, ***DocsPlus***, ***SymWriter 2*** and ***Texthelp Read & Write***. A generic structured learning scheme such as ***AcceleRead***, ***AcceleWrite*** can be used with any good talking word processor.

Many students with dyslexia have strong visualisation skills and are helped by the speech plus symbol word processing in ***SymWriter***, where symbols and images can be seen below the text. Younger, less confident readers can have a symbol for every correctly spelt word; as their skills and confidence increase, the use of symbol support can be decreased, until it is only used to check the odd word. At any time, the symbols can be removed from the final printing, so it 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. Dyspraxic students can be liberated by using a word processor to create work more suited to their apparent ability.

***AcceleRead***, ***AcceleWrite*** is a structured teaching program 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 program 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.

## Spelling

Computer spell checkers can be a mixed blessing for students with spelling difficulties, as the list of suggestions can be daunting, especially for students who also have reading difficulties. The algorithms are usually based on likely typing errors, rather than spelling errors, so these programs will rarely be helpful in dealing with phonic spelling errors (e.g. 'city' spelled 'siti'; 'elephant' spelled 'lyfunt'). Homophones (e.g. 'there' – 'their') are a major problem for many students (particularly those with dyslexia). ***Texthelp Read & Write*** and other similar talking word processors, are designed to deal with phonic spelling errors and homophones, and includes a talking dictionary and thesaurus.

When someone finds it hard to remember how to spell words, it is usually easier to recognise a specific word than recall its spelling. Specialised word processing software (such as ***Clicker 7***, ***Co:Writer 6***, ***Texthelp Read & Write***) provide access to word banks and allow the words to be spoken before selection. 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.

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 pupil 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 have word lists from recognised teaching schemes like ***Alpha to Omega*** and ***THRASS***. Regular, daily access to a customised spelling program (e.g. ***Wordshark5***, ***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.

## Predictive typing

Most poor spellers can recognise more words than they can recall, so predictive typing can be much more helpful. Suitable programs include ***Texthelp Read&Write***, ***Clicker7*** and ***Co:Writer6***. 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.

# Case Studies

The following case studies provide an illustrative range of reports obtained from LASS 8–11. Many other types of report profile are possible, of course, but by studying these particular case studies, teachers should gain insights into interpreting LASS 8–11 results and deciding on appropriate strategies for learning and teaching. For further details regarding any specific resources suggested, please see *Teaching Recommendations*.

## Classic dyslexia

Tim, a boy aged 8 years 7 months, was assessed on LASS 8–11 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. Tim 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. Tim's LASS 8–11 results are shown in Figures 29a and 29b.

Figure 29a. Tim – a case of classic dyslexia

### LASS Individual Report

| | |
|---|---|
| **Name** | Tim Morton |
| **Student ID** | TM12345 |
| **Date of birth** | 2nd February 2011 |
| **Testing date range** | 4th September 2019 - 5th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 05/09/19 | 08:07 | 88 | | 3 | 21 | 42 | -0.80 |
| Auditory sequential memory (Mobile phone) | 04/09/19 | 08:07 | 84 | | 3 | 14 | 39 | -1.07 |
| Phonic skills (Funny words) | 05/09/19 | 08:07 | 75 | | 2 | 5 | 33 | -1.67 |
| Phonological processing (Word chopping) | 05/09/19 | 08:07 | 85 | | 3 | 16 | 40 | -1.00 |
| Single word reading | 04/09/19 | 08:07 | 70 | | 1 | 2 | 30 | -2.00 |
| Sentence reading | 04/09/19 | 08:07 | 87 | | 3 | 19 | 41 | -0.87 |
| Spelling | 04/09/19 | 08:07 | 81 | | 2 | 10 | 37 | -1.27 |
| Verbal reasoning | 04/09/19 | 08:07 | 114 | | 7 | 82 | 59 | 0.93 |
| Non-verbal reasoning | 05/09/19 | 08:07 | 117 | | 7 | 87 | 61 | 1.13 |

Figure 29b. Tim – a case of classic dyslexia

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Slightly below average | Borderline difficulties shown on the visual memory test. You may find the Indications for Action table helpful. |
| Mobile phone | Below average | Moderate difficulties shown on the auditory sequential memory test. You may find the Indications for Action table helpful. |
| Funny words | Very low | Severe difficulties shown on the phonic skills test. You may find the Indications for Action table helpful |
| Word chopping | Below average | Moderate difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Very low | Severe difficulties shown on the single word reading test. You may find the Indications for Action table helpful |
| Sentence reading | Below average | Moderate difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Below average | Moderate difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Average or above | No difficulties shown on the verbal reasoning test |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

The results show that Tim is clearly a very bright student (***Non-verbal reasoning***: SAS 117; ***Verbal reasoning***: SAS 114), with poor reading (***Sentence reading***: SAS 87; ***Single word reading***: SAS 70) and very poor ***Spelling*** (SAS 81). There is a highly significant discrepancy between his literacy skills and his intellectual ability. It is likely that teachers have underestimated his intelligence because of his poor literacy skills and failure to display his talents in writing.

Tim has virtually no phonic decoding skills (***Funny words***: SAS 75), 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*** result (SAS 87) is rather better than might be expected from his ***Single word reading*** score (SAS 70).

Tim also displays a clear cognitive weakness in auditory sequential memory (***Mobile phone***: SAS 84) and his visual memory is also low in comparison with his intellectual ability (***Sea creatures***: SAS 88). Phonological abilities are also relatively low (***Word chopping***: SAS 85). These findings of cognitive impairment justify the use of the term 'dyslexia' to describe his difficulties. In fact, his problems are fairly severe. Tim'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 older brother (age $12\,^{1}/_{2}$) was also identified as having dyslexia. Tim had a very unhappy time in the infant department, and it appears that his disruptive behaviour may have been an effect of his undiagnosed learning difficulties. The school immediately arranged for Tim to receive specialist tuition for his dyslexia twice a week, with daily practice activities.

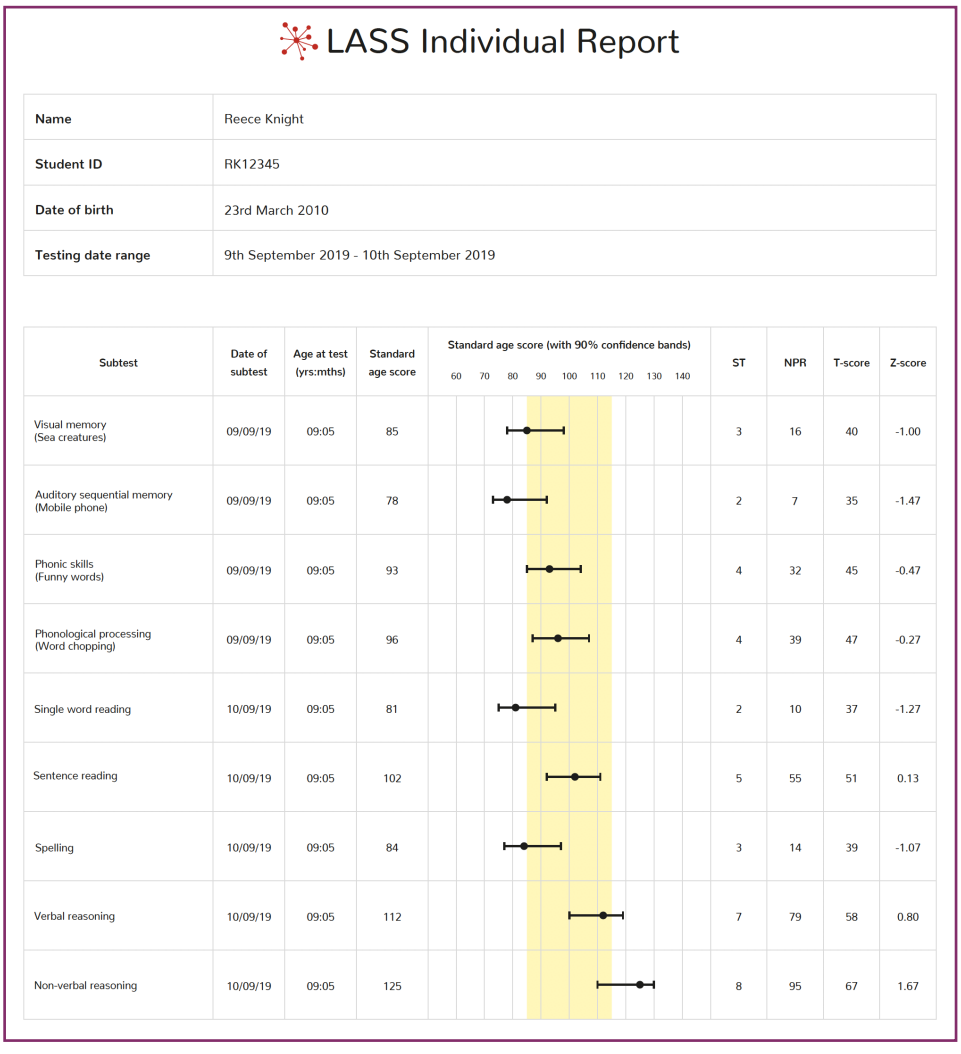
As Tim is bright but has poor reading skills, a short but intensive use of ***Clicker7*** would develop his confidence and skills. He could progress to ***DocsPlus*** and ***SymWriter2***, which would use his visual strengths to develop reading and spelling skills. ***Wordshark5*** could be used at home or after-school club to help develop his spelling skills.

# Partially compensated dyslexia

Reece is a boy of 9 years 5 months, who was referred for assessment with LASS 8–11 because of persistent spelling difficulties. His results (shown in Figures 30a and 30b) indicate that he is obviously very bright (***Non-verbal reasoning***: SAS 125; ***Verbal reasoning***: SAS 112), with average reading skills in context (***Sentence reading***: SAS 102) but poor ***Single word reading*** (SAS 81) and ***Spelling*** (SAS 84). His phonological skills are satisfactory (***Word chopping***: SAS 96) and he can cope fairly well with ***Funny words*** (SAS 93), suggesting that he has absorbed some phonics knowledge. Nevertheless, the clear evidence of memory weaknesses (***Sea creatures***: SAS 85; ***Mobile phone***: SAS 78) 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 underperform in many areas of the curriculum.

Subsequent enquiries with Reece's parents revealed that he had received some specialist tuition, focusing on phonic skills, when he was 6–7 years old. However, since this was from a private tutor, it had not appeared on his school records. The school immediately arranged for Reece to receive weekly support in spelling from the special needs coordinator, with daily practice activities using computer programs designed for this purpose.

Figure 30a. Reece – a case of partially compensated dyslexia



LASS Individual Report

| | |
|---|---|
| **Name** | Reece Knight |
| **Student ID** | RK12345 |
| **Date of birth** | 23rd March 2010 |
| **Testing date range** | 9th September 2019 - 10th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 09/09/19 | 09:05 | 85 | | 3 | 16 | 40 | -1.00 |
| Auditory sequential memory (Mobile phone) | 09/09/19 | 09:05 | 78 | | 2 | 7 | 35 | -1.47 |
| Phonic skills (Funny words) | 09/09/19 | 09:05 | 93 | | 4 | 32 | 45 | -0.47 |
| Phonological processing (Word chopping) | 09/09/19 | 09:05 | 96 | | 4 | 39 | 47 | -0.27 |
| Single word reading | 10/09/19 | 09:05 | 81 | | 2 | 10 | 37 | -1.27 |
| Sentence reading | 10/09/19 | 09:05 | 102 | | 5 | 55 | 51 | 0.13 |
| Spelling | 10/09/19 | 09:05 | 84 | | 3 | 14 | 39 | -1.07 |
| Verbal reasoning | 10/09/19 | 09:05 | 112 | | 7 | 79 | 58 | 0.80 |
| Non-verbal reasoning | 10/09/19 | 09:05 | 125 | | 8 | 95 | 67 | 1.67 |

Figure 30b. Reece – a case of partially compensated dyslexia

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Below average | Moderate difficulties shown on the visual memory test. You may find the Indications for Action table helpful. |
| Mobile phone | Below average | Moderate difficulties shown on the auditory sequential memory test. You may find the Indications for Action table helpful. |
| Funny words | Slightly below average | Borderline difficulties shown on the phonic skills test. You may find the Indications for Action table helpful. |
| Word chopping | Average or above | No difficulties shown on the phonological processing test |
| Single word reading | Below average | Moderate difficulties shown on the single word reading test. You may find the Indications for Action table helpful. |
| Sentence reading | Average or above | No difficulties shown on the sentence reading test |
| Spelling | Below average | Moderate difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Average or above | No difficulties shown on the verbal reasoning test |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

Reece is bright and can read words in context, but not isolated, and has severe spelling difficulties. LASS 8–11 indicated memory problems, so he should have a course of ***AcceleRead***, ***AcceleWrite***, supplemented by using ***DocsPlus***. At home he should have daily sessions on ***Starspell***, using files suggested by the SENCo. He should be taught how to use ***Co:Writer6*** or ***Texthelp Read&Write*** to develop predictive typing skills, and to increase his independence in spelling.

# Low general ability

Dani is a girl aged 10 years 2 months. Her teachers have regarded her as a pupil of somewhat below average general ability, and in particular it has been noted that she had immature language skills. Her parents have raised the question of whether Dani has dyslexia and so LASS 8–11 was administered by her class teacher. The results are shown in Figures 31a and 31b. With an SAS score of 84 on ***Non-verbal reasoning***, it is clear that Dani is rather below average, although her ***Verbal reasoning*** score is within the average range.

It is notable that Dani appears to be holding her own in some areas, such as reading accuracy (***Single word reading***) and ***Spelling***. Her phonic skills (***Funny words***) are also in the average range, suggesting that decoding has been well taught. Her main problem is with ***Sentence reading*** (SAS 81), which suggests problems of comprehending text. However, her diagnostic test results are all in the average range, so it is rather unlikely that she has dyslexia.

Figure 31a. Dani – a case of low general ability

## LASS Individual Report

| | |
|---|---|
| **Name** | Dani Watson |
| **Student ID** | DW12345 |
| **Date of birth** | 28th June 2009 |
| **Testing date range** | 11th September 2019 - 12th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 12/09/19 | 10:02 | 93 | | 4 | 32 | 45 | -0.47 |
| Auditory sequential memory (Mobile phone) | 12/09/19 | 10:02 | 96 | | 4 | 39 | 47 | -0.27 |
| Phonic skills (Funny words) | 12/09/19 | 10:02 | 94 | | 4 | 34 | 46 | -0.40 |
| Phonological processing (Word chopping) | 12/09/19 | 10:02 | 91 | | 4 | 27 | 44 | -0.60 |
| Single word reading | 12/09/19 | 10:02 | 97 | | 5 | 42 | 48 | -0.20 |
| Sentence reading | 11/09/19 | 10:02 | 81 | | 2 | 10 | 37 | -1.27 |
| Spelling | 11/09/19 | 10:02 | 91 | | 4 | 27 | 44 | -0.60 |
| Verbal reasoning | 11/09/19 | 10:02 | 95 | | 4 | 37 | 47 | -0.33 |
| Non-verbal reasoning | 11/09/19 | 10:02 | 84 | | 3 | 14 | 39 | -1.07 |

Figure 31b. Dani – a case of low general ability

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Slightly below average | Borderline difficulties shown on the visual memory test. You may find the Indications for Action table helpful. |
| Mobile phone | Average or above | No difficulties shown on the auditory sequential memory test |
| Funny words | Slightly below average | Borderline difficulties shown on the phonic skills test. You may find the Indications for Action table helpful. |
| Word chopping | Slightly below average | Borderline difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Average or above | No difficulties shown on the single word reading test |
| Sentence reading | Below average | Moderate difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Slightly below average | Borderline difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Average or above | No difficulties shown on the verbal reasoning test |
| Non-verbal reasoning | Below average | Moderate difficulties shown on the non-verbal reasoning test. You may find the Indications for Action table helpful. |

Please see the manual for further guidance.

The special educational needs coordinator felt that the level of Dani's difficulties, when considered in the context of her intellectual ability, did not justify a significant amount of additional support. However, arrangements were made for her to participate in regular shared reading work with pupils 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 Dani is of low intelligence, she has learned to read words, but she has problems with sentences. 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 word book and banks of phrases to stimulate better sentence construction.

# Poor auditory-verbal memory

Megan is 8 years 5 months. She had been coping reasonably well in her literacy development to date, but her teacher noted that she had particular difficulty in decoding new or unfamiliar words. She was tested with LASS 8–11, with the results shown in Figures 32a and 32b.

The scores show that Megan is of average ability and is in the average range for reading and spelling. However, what is really striking about her results is her very good visual memory (***Sea creatures***: SAS 113) and very poor auditory sequential memory (***Mobile phone***: SAS 77). Not surprisingly, she has had difficulty in acquiring phonic skills, which shows in her poor ***Funny words*** SAS of 82. 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 been fairly successful, but of late she has begun to fall behind. Further decline in reading ability and school performance would be predicted unless specific help is provided to enable her to develop better phonic skills.

Figure 32a. Megan – a case of poor auditory-verbal memory

## LASS Individual Report

| | |
|---|---|
| **Name** | Megan Perkins |
| **Student ID** | MP12345 |
| **Date of birth** | 6th April 2011 |
| **Testing date range** | 6th September 2019 - 10th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 10/09/19 | 08:05 | 113 | | 7 | 81 | 59 | 0.87 |
| Auditory sequential memory (Mobile phone) | 06/09/19 | 08:05 | 77 | | 2 | 6 | 35 | -1.53 |
| Phonic skills (Funny words) | 10/09/19 | 08:05 | 82 | | 3 | 12 | 38 | -1.20 |
| Phonological processing (Word chopping) | 10/09/19 | 08:05 | 89 | | 4 | 23 | 43 | -0.73 |
| Single word reading | 06/09/19 | 08:05 | 106 | | 6 | 66 | 54 | 0.40 |
| Sentence reading | 06/09/19 | 08:05 | 92 | | 4 | 30 | 45 | -0.53 |
| Spelling | 09/09/19 | 08:05 | 98 | | 5 | 45 | 49 | -0.13 |
| Verbal reasoning | 09/09/19 | 08:05 | 90 | | 4 | 25 | 43 | -0.67 |
| Non-verbal reasoning | 10/09/19 | 08:05 | 97 | | 5 | 42 | 48 | -0.20 |

Figure 32b. Megan – a case of poor auditory-verbal memory

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Average or above | No difficulties shown on the visual memory test |
| Mobile phone | Below average | Moderate difficulties shown on the auditory sequential memory test. You may find the Indications for Action table helpful. |
| Funny words | Below average | Moderate difficulties shown on the phonic skills test. You may find the Indications for Action table helpful. |
| Word chopping | Slightly below average | Borderline difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Average or above | No difficulties shown on the single word reading test |
| Sentence reading | Slightly below average | Borderline difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Average or above | No difficulties shown on the spelling test |
| Verbal reasoning | Slightly below average | Borderline difficulties shown on the verbal reasoning test. You may find the Indications for Action table helpful. |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

Megan should benefit from an ***AcceleRead***, ***AcceleWrite*** course, supplemented by using a talking word processor or screen reader to read back what she had already written. This would also help develop her auditory memory. She could use ***SymWriter2*** to enable her good visual skills to support her writing. ***Starspell*** and ***Wordshark5*** would improve her spelling.

# Poor fluency in reading and spelling

Tom was assessed on LASS 8–11 at age 11:5 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 Tom might be dyslexic.

His test results, which are shown in Figures 33a and 33b, 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 Tom 'hates reading and writing and never reads unless forced to'. He is obsessed with sports and computer games.

Clearly, Tom requires more practice in both reading and writing. As his parents were keen to participate in this, 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. He likes using computers, so ***DocsPlus*** could motivate him to write more; the words, phrases and sentence starters would reduce the 'blank page phobia', so that he gets started and has some success. A talking word processor or screen reader would enable him to hear his work for reviewing, editing and organising his ideas.

Figure 33a. Tom – a case of poor fluency in reading and spelling

## LASS Individual Report

| | |
|---|---|
| **Name** | Tom Bishop |
| **Student ID** | TB12345 |
| **Date of birth** | 16th March 2008 |
| **Testing date range** | 3rd September 2019 - 4th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 04/09/19 | 11:05 | 102 | | 5 | 55 | 51 | 0.13 |
| Auditory sequential memory (Mobile phone) | 03/09/19 | 11:05 | 97 | | 5 | 42 | 48 | -0.20 |
| Phonic skills (Non-words) | 04/09/19 | 11:05 | 103 | | 5 | 58 | 52 | 0.20 |
| Phonological processing (Segments) | 04/09/19 | 11:05 | 92 | | 4 | 30 | 45 | -0.53 |
| Single word reading | 03/09/19 | 11:05 | 108 | | 6 | 70 | 55 | 0.53 |
| Sentence reading | 03/09/19 | 11:05 | 91 | | 4 | 27 | 44 | -0.60 |
| Spelling | 04/09/19 | 11:05 | 92 | | 4 | 30 | 45 | -0.53 |
| Verbal reasoning | 03/09/19 | 11:05 | 119 | | 8 | 90 | 63 | 1.27 |
| Non-verbal reasoning | 04/09/19 | 11:05 | 115 | | 7 | 84 | 60 | 1.00 |

Figure 33b. Tom – a case of poor fluency in reading and spelling

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Average or above | No difficulties shown on the visual memory test |
| Mobile phone | Average or above | No difficulties shown on the auditory sequential memory test |
| Non-words | Average or above | No difficulties shown on the phonic skills test |
| Segments | Slightly below average | Borderline difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Average or above | No difficulties shown on the single word reading test |
| Sentence reading | Slightly below average | Borderline difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Slightly below average | Borderline difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Average or above | No difficulties shown on the verbal reasoning test |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

# Hyperlexia

Harvey is a 9-year-old boy with high functioning autistic spectrum disorder (Asperger's syndrome), who attends a Special School. The Local Education Authority are in discussion with his teachers and his parents about whether he should be moved to a mainstream school. To assist in these deliberations, Harvey was assessed on LASS 8–11. The results are shown in Figures 34a and 34b.

Harvey is clearly of low ability (***Non-verbal reasoning***: SAS 80; ***Verbal reasoning***: SAS 85) but his auditory sequential memory (***Mobile phone***) is good and his ability to read nonwords is quite astounding (***Funny words***: SAS 118). However, his profile conforms to that of a hyperlexic reader, i.e. Harvey 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 (SAS 74). Harvey's good rote memory also helps him to spell fairly well, but he cannot use those words in a meaningful context when writing.

It was decided to try Harvey in a mainstream primary 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 ***SymWriter2*** could help to keep his mind on track, especially if linked with prompt grids from ***SymWriter2*** or ***DocsPlus***. Use of talking books would also help to develop his reading comprehension.

Figure 34a. Harvey – a case of hyperlexia

## LASS Individual Report

| | |
|---|---|
| **Name** | Harvey Mason |
| **Student ID** | HM12345 |
| **Date of birth** | 1st January 2010 |
| **Testing date range** | 9th September 2019 - 10th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 09/09/19 | 09:08 | 88 | | 3 | 21 | 42 | -0.80 |
| Auditory sequential memory (Mobile phone) | 09/09/19 | 09:08 | 107 | | 6 | 68 | 55 | 0.47 |
| Phonic skills (Funny words) | 09/09/19 | 09:08 | 118 | | 7 | 88 | 62 | 1.20 |
| Phonological processing (Word chopping) | 09/09/19 | 09:08 | 85 | | 3 | 16 | 40 | -1.00 |
| Single word reading | 10/09/19 | 09:08 | 89 | | 4 | 23 | 43 | -0.73 |
| Sentence reading | 10/09/19 | 09:08 | 74 | | 2 | 4 | 33 | -1.73 |
| Spelling | 10/09/19 | 09:08 | 102 | | 5 | 55 | 51 | 0.13 |
| Verbal reasoning | 10/09/19 | 09:08 | 85 | | 3 | 16 | 40 | -1.00 |
| Non-verbal reasoning | 10/09/19 | 09:08 | 80 | | 2 | 9 | 37 | -1.33 |

Figure 34b. Harvey – a case of hyperlexia

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Slightly below average | Borderline difficulties shown on the visual memory test. You may find the Indications for Action table helpful. |
| Mobile phone | Average or above | No difficulties shown on the auditory sequential memory test |
| Funny words | Average or above | No difficulties shown on the phonic skills test |
| Word chopping | Below average | Moderate difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Slightly below average | Borderline difficulties shown on the single word reading test. You may find the Indications for Action table helpful. |
| Sentence reading | Very low | Severe difficulties shown on the sentence reading test. You may find the Indications for Action table helpful |
| Spelling | Average or above | No difficulties shown on the spelling test |
| Verbal reasoning | Below average | Moderate difficulties shown on the verbal reasoning test. You may find the Indications for Action table helpful. |
| Non-verbal reasoning | Below average | Moderate difficulties shown on the non-verbal reasoning test. You may find the Indications for Action table helpful. |

Please see the manual for further guidance.

# English as an additional language

Mena, a girl aged 8 years 2 months, and Rajid, a boy aged 9 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 child for whom English is an additional language, and that a greater amount of language stimulation was needed. Other teachers wondered whether Mena and Rajid 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 8–11 was administered to both students and the results are shown in Figures 35a and 35b, and Figures 36a and 36b.

Figure 35a. Mena – a girl with limited English

## LASS Individual Report

| | |
|---|---|
| **Name** | Mena Garcia |
| **Student ID** | MG12345 |
| **Date of birth** | 27th June 2011 |
| **Testing date range** | 10th September 2019 - 11th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 11/09/19 | 08:02 | 116 | | 7 | 86 | 61 | 1.07 |
| Auditory sequential memory (Mobile phone) | 11/09/19 | 08:02 | 105 | | 6 | 63 | 53 | 0.33 |
| Phonic skills (Funny words) | 11/09/19 | 08:02 | 88 | | 3 | 21 | 42 | -0.80 |
| Phonological processing (Word chopping) | 11/09/19 | 08:02 | 94 | | 4 | 34 | 46 | -0.40 |
| Single word reading | 10/09/19 | 08:02 | 91 | | 4 | 27 | 44 | -0.60 |
| Sentence reading | 10/09/19 | 08:02 | 84 | | 3 | 14 | 39 | -1.07 |
| Spelling | 10/09/19 | 08:02 | 92 | | 4 | 30 | 45 | -0.53 |
| Verbal reasoning | 10/09/19 | 08:02 | 90 | | 4 | 25 | 43 | -0.67 |
| Non-verbal reasoning | 10/09/19 | 08:02 | 102 | | 5 | 55 | 51 | 0.13 |

## Figure 35b. Mena – a girl with limited English

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Average or above | No difficulties shown on the visual memory test |
| Mobile phone | Average or above | No difficulties shown on the auditory sequential memory test |
| Funny words | Slightly below average | Borderline difficulties shown on the phonic skills test. You may find the Indications for Action table helpful. |
| Word chopping | Slightly below average | Borderline difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Slightly below average | Borderline difficulties shown on the single word reading test. You may find the Indications for Action table helpful. |
| Sentence reading | Below average | Moderate difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Slightly below average | Borderline difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Slightly below average | Borderline difficulties shown on the verbal reasoning test. You may find the Indications for Action table helpful. |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

## Figure 36a. Rajid – a boy with limited English

### LASS Individual Report

| | |
|---|---|
| **Name** | Rajid Ahmed |
| **Student ID** | RA12345 |
| **Date of birth** | 20th July 2010 |
| **Testing date range** | 12th September 2019 - 13th September 2019 |

| Subtest | Date of subtest | Age at test (yrs:mths) | Standard age score | Standard age score (with 90% confidence bands) 60 70 80 90 100 110 120 130 140 | ST | NPR | T-score | Z-score |
|---|---|---|---|---|---|---|---|---|
| Visual memory (Sea creatures) | 12/09/19 | 09:01 | 76 | | 2 | 5 | 34 | -1.60 |
| Auditory sequential memory (Mobile phone) | 12/09/19 | 09:01 | 72 | | 1 | 3 | 31 | -1.87 |
| Phonic skills (Funny words) | 12/09/19 | 09:01 | 81 | | 2 | 10 | 37 | -1.27 |
| Phonological processing (Word chopping) | 12/09/19 | 09:01 | 87 | | 3 | 19 | 41 | -0.87 |
| Single word reading | 13/09/19 | 09:01 | 88 | | 3 | 21 | 42 | -0.80 |
| Sentence reading | 13/09/19 | 09:01 | 86 | | 3 | 18 | 41 | -0.93 |
| Spelling | 13/09/19 | 09:01 | 83 | | 3 | 13 | 39 | -1.13 |
| Verbal reasoning | 13/09/19 | 09:01 | 90 | | 4 | 25 | 43 | -0.67 |
| Non-verbal reasoning | 13/09/19 | 09:01 | 96 | | 4 | 39 | 47 | -0.27 |

Figure 36a. Rajid – a boy with limited English

Guidance for interpretation

| | | |
|---|---|---|
| Sea creatures | Below average | Moderate difficulties shown on the visual memory test. You may find the Indications for Action table helpful. |
| Mobile phone | Very low | Severe difficulties shown on the auditory sequential memory test. You may find the Indications for Action table helpful |
| Funny words | Below average | Moderate difficulties shown on the phonic skills test. You may find the Indications for Action table helpful. |
| Word chopping | Below average | Moderate difficulties shown on the phonological processing test. You may find the Indications for Action table helpful. |
| Single word reading | Slightly below average | Borderline difficulties shown on the single word reading test. You may find the Indications for Action table helpful. |
| Sentence reading | Below average | Moderate difficulties shown on the sentence reading test. You may find the Indications for Action table helpful. |
| Spelling | Below average | Moderate difficulties shown on the spelling test. You may find the Indications for Action table helpful. |
| Verbal reasoning | Slightly below average | Borderline difficulties shown on the verbal reasoning test. You may find the Indications for Action table helpful. |
| Non-verbal reasoning | Average or above | No difficulties shown on the non-verbal reasoning test |

Please see the manual for further guidance.

Of the two, Mena 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. For both students, their ***Verbal reasoning*** score is lower than their ***Non-verbal reasoning*** score, which would appear to be due to their limited use of English. But they differ markedly in their diagnostic test results. Mena has good memory skills while Rajid has poor memory skills – in fact, his profile is that of dyslexia. Mena, 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. Both of these pupils require continuing support in English, but Rajid needs a more highly structured multisensory programme directed at his dyslexic difficulties (see *Teaching Recommendations*), together with daily practice using a program such as ***Wordshark5***. Mena, 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.

# Statistical information

## Standardisation

The nine subtests in LASS 8–11 have been standardised so that teachers using the system can establish where any given student falls on any of the subtests, in relation to the population norms. This means that direct and meaningful comparisons can be made between the individual subtests 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.

LASS 8–11 underwent a full national re-standardisation in May – July 2019. The standardisation was conducted in 44 schools (England n = 33; Northern Ireland n = 9; Scotland n = 1; Republic of Ireland n = 1). Of those schools where an Ofsted assessment has been published, 25% were rated as Outstanding, 63% were rated as Good and 12% were rated as Requiring Improvement (which compares reasonably well to national figures for the 2018/19 academic year: 20% Outstanding; 66% Good; 11% Requires improvement). The number of students on the roll for the sample schools ranged from 30 to 683, with an average of 273.

School characteristics (where these were available on Gov.uk or the equivalent websites for Scotland, Northern Ireland and the Republic of Ireland) for the sample schools were compared to the national average (for English state-funded Primary schools) – see Table 2. It can be seen that the schools overall included a slightly higher proportion of girls than the national average and a slightly lower proportion of pupils with an ECHP than the national average.

Table 2. Characteristics of schools within the standardisation sample

| School characteristic | School sample Mean | National average |
|---|---|---|
| **Girls on roll** | 50.0% | 48.7% |
| **Pupils with an SEN Education, Health and Care Plan** | 2.3% | 3.1% |
| **SEN Support** | 12.1% | 12.2% |
| **Pupils whose first language is not English** | 19.8% | 21.3% |
| **Pupils eligible for free school meals at any time during the past 6 years** | 25.1% | 24.3% |

Within the selected schools, students were included in the standardisation on an entire class basis, to avoid any selection bias. The number of students completing each subtest, within each age group of the standardisation sample, are shown in Table 3.

Table 3. Students per age group for each subtest

| Subtest | Age 8 | Age 9 | Age 10 | Age 11 | Total |
|---|---|---|---|---|---|
| **Sentence reading** | 910 | 839 | 740 | 378 | 2867 |
| **Single word reading** | 910 | 850 | 755 | 387 | 2902 |
| **Spelling** | 862 | 789 | 739 | 380 | 2770 |
| **Non-verbal reasoning** | 948 | 841 | 734 | 376 | 2899 |
| **Verbal reasoning** | 815 | 729 | 670 | 343 | 2557 |
| **Mobile phone** | 900 | 780 | 695 | 803 | 3178 |
| **Sea creatures** | 890 | 793 | 690 | 353 | 2726 |
| **Funny words (Non-words)** | 891 | 775 | 681 | 851 | 3198 |
| **Word chopping (Segments)** | 776 | 719 | 684 | 777 | 2956 |

Demographic information concerning the students within the standardisation sample are given in Table 4 (note that information was not provided for all students). Population parameters are also provided, but these are based only on English state-funded Primary schools, whereas the sample also includes students from Northern Ireland, Scotland and the Republic of Ireland, so the comparisons are limited. It can be seen that the sample included a slightly higher proportion of female students than the national average for English state-funded Primary schools. With regards to ethnicity, the sample has a higher proportion of Asian students than is found in the population and lower proportions of White, Black, Mixed and Other students, although ethnicity information was not provided for 10.1% of the sample. The number of students within the sample who are eligible for Free School Meals is slightly higher than in the population. However, it should be noted that the national average for Northern Ireland (where 9 of the schools were based) is 29.4%, which may account for the higher proportion of students eligible for FSM within the sample. With regard to language, the percentage of students within the sample speaking English as an Additional Language is very close to the population average. The proportion of students within the sample with a diagnosed SEN is slightly higher than within the population, whereas those with an Education, Health and Care plan reflects the national average. Again, it should be noted that the national average for SEN in Northern Ireland is 21.0%, which may account for the slightly higher proportion of students with SEN within the sample.

Table 4. Demographic details of sample

| Variable | Classification | Percentage of sample | Population parameters* |
|---|---|---|---|
| **Gender** | Male | 47.6% | 51.3% |
| | Female | 50.6% | 48.7% |
| | Not available | 1.8% | |
| **Ethnicity** | White | 62.7% | 73.6% |
| | Asian | 18.6% | 11.7% |
| | Black | 3.3% | 5.5% |
| | Mixed | 4.6% | 6.3% |
| | Other | 0.8% | 2.0% |
| | Not available | 10.1% | 1.0% |
| **Free School Meals (FSM)** | Eligible for FSM | 18.5% | 15.8% |
| | Not eligible for FSM | 74.7% | |
| | Not available | 6.8% | |
| **English as an Additional Language (EAL)** | EAL | 21.6% | 21.2% |
| | Not EAL | 57.9% | |
| | Not available | 20.5% | |
| **Special Educational Need / Disability (SEND)** | Diagnosed SEND | 16.1% | 14.2% |
| | Suspected SEND | 3.6% | |
| | No SEND | 78.2% | |
| | Not available | 2.1% | |
| **Education, Health and Care Plan (EHCP)** | Has EHCP | 1.6% | 1.6% |
| | No EHCP | 91.8% | |
| | Not available | 6.7% | |

* Based on DfE school census data for English state-funded Primary schools, January 2019

Of the standardisation sample, 84% undertook the tests using desktop computers, whilst 16% used tablets. Analysis shows no evidence of a platform effect (with the exception of a negligible effect (Cohen's d = 0.13) on ***Non-verbal reasoning***, where desktops produced slightly higher scores than tablets).

The sample data has been weighted according to age, gender and SEND proportion against population parameters. Using a non-parametric age-standardisation model, the raw scores for each age group were transformed into Standardised Age Scores (SAS) with a mean of 100 and a standard deviation of 15. This builds on previous work conducted by Schagen (1990). SAS scores for the subtests range from 65 to 135, although on ***Single word reading***, where there is a ceiling effect, the SAS is capped at 110 at the upper end (note that the cap does not distort the scoring at the lower end of abilities, which is what we are most commonly interested in).

Table 5 shows the correlations between all LASS 8–11 subtests. The correlations range from .310 to .732, with the majority being within the moderate range (.4 to .6). All correlations are significant at the $p<.001$ level.

Table 5. Intercorrelations between subtests

| | SR | SWR | Sp | NVR | VR | MP | SC | FW | WC |
|---|---|---|---|---|---|---|---|---|---|
| **Sentence reading (SR)** | 1 | | | | | | | | |
| **Single word reading (SWR)** | .655* (2757) | 1 | | | | | | | |
| **Spelling (Sp)** | .732* (2640) | .645* (2700) | 1 | | | | | | |
| **Non-verbal reasoning (NVR)** | .492* (2726) | .364* (2752) | .388* (2630) | 1 | | | | | |
| **Verbal reasoning (VR)** | .635* (2434) | .502* (2498) | .497* (2412) | .471* (2444) | 1 | | | | |
| **Mobile phone (MP)** | .518* (2243) | .432* (2253) | .507* (2162) | .446* (2292) | .463* (1983) | 1 | | | |
| **Sea creatures (SC)** | .386* (2604 | .318* (2598) | .329* (2501) | .407* (2626) | .340* (2296) | .430* (2219) | 1 | | |
| **Funny words (FW)** | .537* (2188) | .469* (2221) | .571* (2128) | .373* (2236) | .431* (1994) | .461* (2156) | .310* (2153) | 1 | |
| **Word chopping (WC)** | .622* (2087) | .531* (2129) | .597* (2051) | .462* (2107) | .552* (1987) | .540* (2000) | .382* (2015) | .542* (1987) | 1 |

*all correlations are significant at p<.001; (N is shown in brackets)

In order to check for any gender bias, comparisons were made between males and females (where gender had been identified) on each subtest (see Table 6). Small effects were found on ***Verbal reasoning*** and Mobile phone (auditory sequential memory), with both subtests slightly favouring girls. There were no other gender effects.

Table 6. Gender differences

| Subtest | Gender | N | Mean | SD | SE of Mean | Cohen's d* |
|---|---|---|---|---|---|---|
| **Sentence reading** | Female | 1449 | 101.40 | 14.191 | 0.373 | 0.17 |
| | Male | 1386 | 98.79 | 16.130 | 0.433 | |
| **Single word reading** | Female | 1471 | 100.33 | 11.095 | 0.289 | 0.16 |
| | Male | 1399 | 98.39 | 13.051 | 0.349 | |
| **Spelling** | Female | 1409 | 100.61 | 14.089 | 0.375 | 0.07 |
| | Male | 1328 | 99.55 | 15.998 | 0.439 | |
| **Non-verbal reasoning** | Female | 1462 | 101.83 | 14.398 | 0.377 | 0.18 |
| | Male | 1400 | 99.09 | 15.449 | 0.413 | |
| **Verbal reasoning** | Female | 1289 | 101.79 | 14.240 | 0.397 | 0.25 |
| | Male | 1234 | 98.03 | 15.560 | 0.443 | |
| **Mobile phone** | Female | 1228 | 102.47 | 14.742 | 0.421 | 0.24 |
| | Male | 1122 | 98.89 | 15.196 | 0.454 | |
| **Sea creatures** | Female | 1387 | 101.00 | 14.806 | 0.398 | 0.15 |
| | Male | 1306 | 98.75 | 15.276 | 0.423 | |
| **Funny words (Non-words)** | Female | 1193 | 100.36 | 14.846 | 0.430 | 0.07 |
| | Male | 1128 | 99.31 | 15.450 | 0.460 | |
| **Word chopping (Segments)** | Female | 1101 | 100.95 | 14.764 | 0.445 | 0.18 |
| | Male | 1055 | 98.16 | 15.596 | 0.480 | |

* Cohen's d is a measure of effect size of the difference between two means

Checks were also made for ethnic group bias. Due to the small numbers in some ethnic minority groups, comparisons were made between White students and Other ethnic groups combined (where ethnicity had been identified) on each subtest (see Table 7). A small effect was found on ***Verbal reasoning***, slightly favouring White students. There were no other ethnicity effects.

Table 7. Ethnic group differences

| Subtest | Ethnicity | N | Mean | SD | SE of Mean | Cohen's d* |
|---|---|---|---|---|---|---|
| **Sentence reading** | White | 1830 | 100.46 | 15.347 | 0.359 | 0.03 |
| | Other | 755 | 100.89 | 14.893 | 0.542 | |
| **Single word reading** | White | 1834 | 99.33 | 11.897 | 0.278 | 0.05 |
| | Other | 781 | 99.99 | 12.359 | 0.442 | |
| **Spelling** | White | 1756 | 99.60 | 14.504 | 0.346 | 0.19 |
| | Other | 729 | 102.56 | 16.173 | 0.599 | |
| **Non-verbal reasoning** | White | 1848 | 100.77 | 14.874 | 0.346 | 0.01 |
| | Other | 762 | 100.65 | 15.382 | 0.557 | |
| **Verbal reasoning** | White | 1568 | 101.17 | 15.279 | 0.386 | 0.21 |
| | Other | 703 | 97.95 | 14.912 | 0.562 | |
| **Mobile phone** | White | 1538 | 101.13 | 14.632 | 0.373 | 0.04 |
| | Other | 626 | 100.56 | 15.839 | 0.633 | |
| **Sea creatures** | White | 1778 | 99.86 | 14.749 | 0.350 | 0.00 |
| | Other | 679 | 99.84 | 16.160 | 0.620 | |
| **Funny words (Non-words)** | White | 1494 | 100.13 | 15.215 | 0.394 | 0.03 |
| | Other | 632 | 99.65 | 15.152 | 0.603 | |
| **Word chopping (Segments)** | White | 1381 | 100.46 | 15.010 | 0.404 | 0.15 |
| | Other | 589 | 98.13 | 15.520 | 0.639 | |

* Cohen's d is a measure of effect size of the difference between two means

# Validation

Validity is the extent to which a test measures what it claims to be measuring and appropriate inferences can be made from the test score. There are a variety of methods used in estimating the validity of a test. Construct validity relates to how well the test measures the intended construct and one way of assessing this involves comparison of mean scores of groups for which score differences would be expected. For LASS 8–11, this analysis looks at the differences between dyslexic and non-dyslexic students for each LASS 8–11 subtest (see Table 8).

This analysis indicates medium to large effects on those subtests where we would expect non-dyslexics to outperform dyslexic students (i.e. ***Spelling***, ***Sentence reading***, ***Word chopping / Segments*** and ***Funny words / Non-words***) and small or no effect sizes on those subtests where we would not expect differences between these two groups (i.e. ***Non-verbal reasoning***, ***Verbal reasoning*** and ***Sea creatures***). Note that, due to the ceiling effect on ***Single word reading***, this subtest only shows a small effect size, and this subtest should only be administered to students who perform poorly on ***Sentence reading***.

Table 8. Construct validity

| Subtest | Group | N | Mean | SD | SE of Mean | Cohen's d* |
|---|---|---|---|---|---|---|
| **Sentence reading** | Dyslexic | 90 | 90.78 | 14.615 | 1.541 | 0.65 |
| | Non-dyslexic | 2508 | 100.38 | 15.119 | 0.302 | |
| **Single word reading** | Dyslexic | 68 | 96.19 | 11.45 | 1.389 | 0.29 |
| | Non-dyslexic | 1282 | 99.59 | 11.92 | 0.333 | |
| **Spelling** | Dyslexic | 88 | 87.40 | 11.398 | 1.215 | 0.99 |
| | Non-dyslexic | 2433 | 100.49 | 14.879 | 0.302 | |
| **Non-verbal reasoning** | Dyslexic | 90 | 99.58 | 15.285 | 1.611 | 0.05 |
| | Non-dyslexic | 2545 | 100.41 | 15.014 | 0.298 | |
| **Verbal reasoning** | Dyslexic | 82 | 96.79 | 11.837 | 1.307 | 0.25 |
| | Non-dyslexic | 2190 | 100.25 | 15.110 | 0.323 | |
| **Mobile phone** | Dyslexic | 71 | 95.48 | 12.867 | 1.527 | 0.39 |
| | Non-dyslexic | 2088 | 100.95 | 14.992 | 0.328 | |
| **Sea creatures** | Dyslexic | 91 | 96.33 | 14.436 | 1.513 | 0.25 |
| | Non-dyslexic | 2388 | 99.98 | 15.007 | 0.307 | |
| **Funny words (Non-words)** | Dyslexic | 73 | 93.59 | 11.499 | 1.346 | 0.48 |
| | Non-dyslexic | 2067 | 100.05 | 15.195 | 0.334 | |
| **Word chopping (Segments)** | Dyslexic | 63 | 92.35 | 12.364 | 1.558 | 0.55 |
| | Non-dyslexic | 1846 | 99.94 | 15.146 | 0.353 | |

* Cohen's d is a measure of effect size of the difference between two means

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).

For LASS 8–11, concurrent validity was measured by comparing the LASS 8–11 subtest scores with scores from the Suffolk Reading Scale, using Pearson's r correlation (see Table 9), for a subset of the standardisation sample. A correlation of .55 is considered to be an adequate level of concurrent validity, with .65 considered as good. The results show good evidence of congruent validity, with correlations of .732, .655 and .569 for those subtests that would be expected to correlate well with the Suffolk Reading Scale (***Sentence reading***, ***Spelling*** and ***Single word reading***). The results also show clear evidence of divergent validity, as those subtests that measure constructs that differ from the Suffolk Reading Scale (i.e. ***Non-verbal reasoning***, ***Mobile phone*** and ***Sea creatures***) show correlations well below .55. Those subtests that do not measure

exactly the same construct as the Suffolk Reading Scale, but where there is some degree of overlap between them (i.e. ***Verbal reasoning***, ***Funny words*** and ***Word chopping***) show mid-range correlations, as would be expected.

Table 9. Correlations with Suffolk Reading Scale

| Subtest | Pearson's r | N |
|---|---|---|
| **Sentence reading** | .732 | 444 |
| **Single word reading** | .569 | 444 |
| **Spelling** | .655 | 419 |
| **Non-verbal reasoning** | .376 | 459 |
| **Verbal reasoning** | .574 | 411 |
| **Mobile phone** | .426 | 336 |
| **Sea creatures** | .315 | 431 |
| **Funny words (Non-words)** | .544 | 358 |
| **Word chopping (Segments)** | .519 | 303 |

# Reliability

'Reliability' generally refers to the extent to which a test can be expected to give the same results when administered on a different occasion (test-retest reliability) or to which the components of a test give consistent results (internal consistency).

Internal consistency is a measure of whether each item in a test measures the same concept. There are several methods of calculating this, although the most commonly used is Cronbach's alpha, which is based on the ratio of the sum of the individual item variances to the overall subtest score variance. However, Cronbach's alpha presumes a complete set of responses to the items, since all items need to contribute to the factor score equally, which is not case with all the LASS 8–11 subtests. An alternative formula is the standardised Cronbach's alpha (shown below), which is based on the average non-redundant item correlation.

$$\alpha\ standardised = \frac{(\text{Number of items} \times \text{mean of non redundant correlations})}{(1+((\text{Number of items}-1) \times \text{mean of non redundant correlations}))}$$

Table 10 shows the standardised Cronbach's alpha estimates (note that for ***Mobile phone***, ***Funny words*** and ***Word chopping***, the calculations are based on 8–10-year-olds only, as 11-year-olds are included in the LASS 11–15 sample for these subtests). An internal consistency of $\alpha > .7$ is generally considered to be adequate, whilst $\alpha > .8$ is deemed as good, and $\alpha > .9$ as excellent. It can be seen from Table 10, that ***Spelling*** shows an excellent level of internal consistency, with the majority of the remaining subtests showing a good level, and a few at an adequate level. ***Mobile phone*** is showing a lower level of internal consistency due to the strict discontinuation rule on this particular subtest (whereby the test stops when the student fails both items at a level – similar to other digit span tests). However, a normal Cronbach's alpha calculation (based on the remaining more difficult items being failed after discontinuation) estimates the internal consistency on this subtest as .831.

Table 10. Internal consistency

| Subtest | Standardised α | Cronbach's α |
|---|---|---|
| **Sentence reading** | .893 | .982 |
| **Single word reading** | .892 | .963 |
| **Spelling** | .906 | .983 |
| **Non-verbal reasoning** | .832 | .963 |
| **Verbal reasoning** | .774 | .978 |
| **Mobile phone** | .629 | .831 |
| **Sea creatures** | .749 | .739 |
| **Funny words (Non-words)** | .805 | .953 |
| **Word chopping (Segments)** | .813 | .959 |

Test-retest reliability estimates the degree to which a test provides stable measurements over time. A small subset (n = 120) of the LASS 8–11 standardisation sample repeated the LASS 8–11 subtests 4-6 weeks after the first administration. Correlations (using Pearson's r) between scores on the two sittings are given in Table 11. A correlation of .60 is considered to be an adequate level of test-retest reliability, with .70 considered as good, and .80 as excellent. As can be seen in Table 11, ***Spelling*** shows an excellent level of test-retest reliability, with ***Sentence reading*** and ***Single word reading*** showing good levels. The remaining subtests are mostly within or around the acceptable level, although ***Sea creatures*** (visual memory) is a little below. Earlier research on LASS 11–15 also found lower correlations on the memory subtests than on the literacy subtests, which appeared to be due to greater susceptibility of these tasks to practice effects arising from enhanced motivation and application of strategic thinking at the retest.

Table 11. Test-retest reliability

| Subtest | Pearson's r |
|---|---|
| **Sentence reading** | .78 |
| **Single word reading** | .74 |
| **Spelling** | .80 |
| **Non-verbal reasoning** | .68 |
| **Verbal reasoning** | .63 |
| **Mobile phone** | .57 |
| **Sea creatures** | .50 |
| **Funny words (Non-words)** | .59 |
| **Word chopping (Segments)** | .62 |

# References


**A**

Abbott, R., Berninger, V.W. and Faol, M. (2010) Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*, 281-298.

American Psychiatric Association (2013) *Diagnostic and Statistical Manual for Mental Disorders* (5th edition) (DSM-V). Washington, DC: APA.

Amor, L.B., Grizenko, N., Schwartz, G., Lageix, P., Baron, C., Ter-Stepanian, M., Zappitelli, M., Mbekou, V. and Joober, R. (2005) Perinatal complications in children with attention-deficit hyperactivity disorder and their unaffected siblings. *Journal of Psychiatry and Neuroscience, 30(20)*, 120-126.

Anderson, D.M. and Fairgrieve, E. (1996) Assessment of sensori-motor impairments. In L. Harding and J.R. Beech (Eds.) *Assessment in Neuropsychology*. London: Routledge, pp. 82-96.

Aram, D.M. (2005) Continuity in children's literacy achievements: A longitudinal perspective from kindergarten to school. *First language*, 25, 259-289.

Arms, E., Bickett, J. and Graf, V. (2008) Gender bias and imbalance: Girls in US special education programmes. *Gender and Education, 20(4)*, 349-359.

Augur, J. (1990) Dyslexia – have we got the teaching right? In P. Pinsent (Ed.) *Children with literacy difficulties*. London: Fulton, pp. 52-65.

Augur, J. (1996) *This book doesn't make sense.* Second edition. London: Whurr.

Avons, S.E. and Hanna, C. (1995) The memory-span deficit in children with specific reading disability: is speech rate responsible? *British Journal of Developmental Psychology, 13*, 303-311.

Awaida, M. and Beech, J.R. (1995). Children's lexical and sublexical development while learning to read. *Journal Experimental Education, 63*, 97-113.

Ayres, A.J. (1985) *Developmental Dyspraxia and Adult Onset Dyspraxia*. Torrance, CA: Sensory Integration International.

Ayres, A. J. (1988) *Sensory integration and praxis tests*. Los Angeles: Western Psychological Services.

**B**

Baddeley, A.D. (1986) Working memory, reading and dyslexia. In E. Hjelmquist and L. Nilsson (Eds.) *Communication and handicap: aspects of psychological compensation and technical aids.* Amsterdam: Elsevier.

Barnett, A., Henderson, S.E. and Sugden, D.A. (2007) *Movement Assessment Battery for Children – Second Edition.* Oxford: Pearson Assessment.

Beardsworth, E. and Harding, L. (1996) Developmental neuropsychology and the assessment of children. In L. Harding and J.R. Beech (Eds.) *Assessment in Neuropsychology.* London: Routledge, pp.16-46.

Beaton, A., McDougall, S., and Singleton, C.H. (Eds.) (1997a) Dyslexia in literate adults. (Special issue of the *Journal of Research in Reading*, 20, 1). Oxford: Blackwell.

Beaton, A., McDougall, S. and Singleton, C.H. (1997b) Humpty Dumpty grows up? – Diagnosing dyslexia in adulthood. *Journal of Research in Reading, 20*, 1-6.

Beech, J.R. (1997) Assessment of memory and reading. In J. Beech and C.H. Singleton (Eds.) *The Psychological Assessment of Reading, 143-159.* London: Routledge.

Beery, K.E., Beery, N.A. and Buktenica, N.A. (2010) *Developmental Test of Visual-Motor Integration – Sixth Edition*. Oxford, UK: Pearson Assessment.

Bogon, J., Finke, K., Schulte-Korne, G., Muller, H.J., Schneider, W.X. and Stenneken, P. (2014) Parameter-based assessment of disturbed and intact components of visual attention in children with developmental dyslexia. *Developmental Science, 17(5)*, 697-713.

Boon, M. (2010) *Understanding dyspraxia: A guide for parents and teachers*. London: Jessica Kingsley Publishers.

Brady, S. (1986) Short-term memory, phonological processing and reading ability. *Annals of Dyslexia, 36*, 138-153.

Bradley, L. (1980) *Assessing reading difficulties.* Windsor: NFER-Nelson.

Bradley, L. and Bryant, P.E. (1983) Categorising sounds and learning to read: a causal connection. *Nature, 271*, 746-747.

Bruck, M. (1990) Word-recognition skills of adults with childhood diagnoses of dyslexia. *Developmental Psychology, 26*, 439-454.

Bruck, M. (1992) Persistence of dyslexics' phonological awareness deficits. *Developmental Psychology, 28*, 874-886.

Bryant, P.E. and Bradley, L. (1985) *Children's reading problems: psychology and education.* London: Blackwell.

Buchmann, C., DiPrete, T.A. and McDaniel, A. (2008) Gender inequalities in education. *Annual Review of Sociology, 34,* 319-337.

Buzan, A. (2006) *Use your memory: Understand your mind to improve your memory and mental power*. London: BBC Books.

## C

Carson, K., Gillon, G. and Boustead, Y. (2011) Computer-administrated versus paper-based assessment of school-entry phonological awareness ability. *Asia Pacific Journal of Speech, Language and Hearing, 14(2)*, 85-101.

Catts, H.W., Adlof, S.M., Hogan, T. and Weismer, S.E. (2005) Are specific language impairment and dyslexia distinct disorders? *Journal of Speech, Language and Hearing Research, 48(6)*, 1378-1396.

Cavalli, E., Cole, P., Leloup, G., Poracchia-George, F., Sprenger-Charolles, L. and El Ahmadi, A. (2018) Screening for dyslexia in French-speaking university students: An evaluation of the detection accuracy of the *"Alouette" test. Journal of Learning Disabilities, 51(3)*, 268-282.

Chinn, S.J. and Ashcroft, J.R. (2016) Mathematics for dyslexics and dyscalculics: A teaching handbook – Fourth Edition. Chichester, UK: Wiley-Blackwell.

Cline, T. (2000) Multilingualism and dyslexia: Challenges for research and practice. *Dyslexia: An international journal of research and practice, 6(1)*, 3-12.

Cline, T. and Frederickson, N. (1999) Identification and assessment of dyslexia in bi/multilingual children. *International Journal of Bilingual Education and Bilingualism, 2(2)*, 81-93.

Cline, T. and Shamsi, T. (2000) *The assessment of learning difficulties in literacy among children learning English as an additional language* (Research Report RR184). London: Department for Education and Employment.

Cooke, A. (2002) *Tackling dyslexia – Second Edition*. Chichester: Wiley.

Cooper, P. and Bilton, K. M. (2002) Attention Deficit / Hyperactivity Disorder: A practical guide for teachers (Second Edition). London: Routledge.

Crivelli, V. (2013) *Using technology to support dyslexic pupils.* Bracknell, UK: British Dyslexia Association.

Crombie, M. (2018) Dyslexia: *A practical guide for teachers.* Wakefield, UK: SEN Books.

**D**

Durkin, C. (2000) Dyslexia and bilingual children – Does recent research assist identification? *Dyslexia: An international journal of research and practice, 6(4)*, 248-267.

**F**

Fisher, A. G., Murray, E. A. and Bundy, A.C. (1991) *Sensory integration, theory and praxis*. Phil, PA: F.A. Davis.

**G**

Gathercole, S.E. and Baddeley, A.D. (1993) Phonological working memory: A critical building block for reading development and vocabulary acquisition? *European Journal of Psychology of Education, 8(3)*, 259-272.

Gathercole, S.E., Packiam-Alloway, T., Willis, C. and Adams, A-M. (2006) Working memory in children with reading disabilities. *Journal of Experimental Child Psychology, 93(3)*, 265-281.

Germano, E., Gagliano, A. and Curatolo, P. (2010) Comorbidity of ADHD and dyslexia. *Developmental Neuropsychology, 35(5)*, 475-493.

Goldstein, S. and Goldstein, M. (1993) *Hyperactivity – why won't my child pay attention?* New York: John Wiley and Sons, Inc.

Goldstein, S. and Goldstein, M. (1998) Managing attention deficit hyperactivity disorder in children: a guide for practitioners. New York: John Wiley and Sons, Inc.

Goswami, U. (1994) Onsets and rimes as functional units in reading. In E.M.H. Assink (Ed.) *Literacy acquisition and social context*. Hemel Hempstead: Harvester Wheatsheaf, pp. 47-69.

Goswami, U. (1999) Causal connections in beginning reading: The importance of rhyme. *Journal of Research in Reading, 22(3)*, 217-240.

Goswami, U. (2001) Rhymes are important: a comment on Savage. J*ournal of Research in Reading, 24(1)*, 19-29.

Goswami, U. (2012) Reading and spelling: revisiting Bradley and Bryant's study. In A.M. Slater & P.C. Quinn (Eds) *Developmental Psychology: Revisiting the classic studies* (pp. 132-147). London: Sage Publications.

Goswami, U. and Bryant, P.E. (1990) *Phonological skills and learning to read.* London: Erlbaum.

Gottardo, A., Siegal, L.S. and Stanovich, K.E. (1997). The assessment of adults with reading disabilities: what can we learn from experimental tasks? *Journal of Research in Reading, 20*, 42-54.

Griffiths, Y.M. and Snowling, M.J. (2002) Predictors of exception word and nonword reading in dyslexic children: The severity hypothesis. *Journal of Educational Psychology, 94(1)*, 34-43.

Gueze, R.H. (2007) Characteristics of DCD: On problems and prognosis. In R.H. Gueze (Ed.) *Developmental Coordination Disorder: A review of current approaches*. Marseille, France: Solal.

**H**

Hatcher, P.J., Duff, F.J. and Hulme, C. (2014) *Sound linkage: an integrated programme for overcoming reading difficulties (Third Edition).* Chichester, UK: John Wiley and Sons.

Hatcher, P.J, Hulme, C., and Ellis, A.W. (1994) Ameliorating early reading failure by integrating the teaching of reading and phonological skills. *Child Development*, 65, 41-57.

Henderson, A. (2012) Dyslexia, dyscalculia and mathematics: A practical guide. London: Routledge.

Hoare, D. and Larkin, D. (1991) Coordination problems in children. *National Sports Research Centre Review, 18*, 1-16.

Holligan, C. and Johnston, R. (1988) The use of phonological information by good and poor readers in memory and reading tasks. *Memory and Cognition, 16*, 522-532.

Holmes, J., Hilton, K.A., Place, M., Alloway, T.P., Elliott, J.G. and Gathercole, S.E. (2014) Children with low working memory and children with ADHD: same or different? *Frontiers in Human Neuroscience, 8*, 976.

Horne, J.K. (2007) Gender differences in computerized and conventional educational tests. *Journal of Computer Assisted Learning, 23*, 47-55.

Hornsby, B. (1995) *Overcoming dyslexia: A straightforward guide for families and teachers*. London: Random House.

Hulme, C. and Snowling, M.J. (1991) Phonological deficits in dyslexia: A 'sound' re-appraisal of the verbal deficit hypothesis? In N. Singh and I. Beale (Eds.) *Progress in Learning Disabilities.* Berlin: Springer-Verlag.

**J**

James, F., Kerr, A., and Tyler, B. (1994) *Sounds interesting: Practical ideas for developing phonics in the classroom.* Ipswich: Suffolk County Council Education Department.

Jeffries, S. and Everatt, J. (2004) Working memory: Its role in dyslexia and other specific learning difficulties. *Dyslexia, 10(3)*, 196-214.

Jimenez, J.E., Garcia, E. and Venegas, E. (2010) Are phonological processes the same or different in low literacy adults and children with or without reading disabilities. *Reading and Writing: An Interdisciplinary Journal, 23(1)*, 1-18.

Joanisse, M.F., Manis, F.R., Keating, P and Seidenberg, M.S. (2000) Language deficits in dyslexic children: Speech perception, phonology and morphology. *Journal of Experimental Child Psychology, 77(1)*, 30-60.

Jorm, A.F. (1983) Specific reading retardation and working memory: a review. *British Journal of Psychology, 74*, 311-342.

**K**

Keates, A. (2002) *Dyslexia and Information and Communication Technology: A Guide for Teachers and Parents*. London: Routledge.

Knuckey, N.W. and Gubbay, S. S. (1983) Clumsy children: a prognostic study. *Australian Paediatric Journal, 19*, 9-13.

**L**

Landerl, K. et al. (2013) Predictors of developmental dyslexia in European orthographies with varying complexity. *Journal of Child Psychology and Psychiatry, 54(6)*, 686-694.

Layton, L., Deeney, K., Tall, G. and Upton, G. (1996) Researching and promoting phonological awareness in the nursery class. *Journal of Research in Reading, 19(1)*, 1-13.

Layton, L. and Upton, G. (1992) Phonological training and the pre-school child. *Education 3-13*, 20, 34-36.

Lindgren, S-A. and Laine, M. (2011) Cognitive linguistic performances of multilingual university students suspected of dyslexia. *Dyslexia, 17(2)*, 184-200.

Logan, S. and Johnston, R. (2010) Investigating gender differences in reading. *Educational Review, 62(2)*, 175-187.

Lord, R. and Hulme, C. (1987) Kinaesthetic sensitivity of normal and clumsy children. *Developmental Medicine and Child Neurology, 29*, 720-725.

Losse, A., Henderson, S.E., Elliman, D., Hall, D., Knight, E. and Jongmans, M. (1991) Clumsiness in children – do they grow out of it? A ten year follow-up study. *Developmental Medicine and Child Neurology, 33*, 55-68.

Lundberg, I., Frost, J. and Peterson, O. (1988) Effects of an intensive program for stimulating phonological awareness in pre-school children. *Reading Research Quarterly, 23*, 263-284.

**M**

Machin, S. and McNally, S. (2005) Gender and student achievement in English schools. *Oxford Review of Economic Policy, 21(3)*, 357-372.

McDougall, S. and Hulme, C. (1994) Short-term memory, speech rate and phonological awareness as predictors of learning to read. In C. Hulme and M. J. Snowling (Eds.) *Reading Development and Dyslexia.* London: Whurr.

McLoughlin, D., Fitzgibbon, G. and Young, V. (1994) *Adult Dyslexia: Assessment, Counselling and Training*. London: Whurr.

Miles, E. (1992) *The Bangor Teaching System 2nd Edition*, London: Whurr.

Miles, M. (2000) *Using talking computers to help children experiencing literacy difficulties.* Unpublished Ph.D. thesis, University of Exeter.

Mortimore, T., Hansen, L., Hutchings, M., Northcote, A., Fernando, J., Horobin, L., Saunders, K. and Everatt, J. (2012) *Dyslexia and multilingualism: Identifying and supporting bilingual learners who might be at risk of developing SpLD / dyslexia*. British Dyslexia Association and the Lottery Fund. Research Reports for External Bodies. Bracknell, UK: The British Dyslexia Association.

Moseley, D.V. (1997) Assessment of spelling and related aspects of written expression. In J. Beech and C.H. Singleton (Eds.) *The Psychological Assessment of Reading*. London: Routledge, pp. 204-223.

**O**

Olsen, J. B. (1990) Applying computerized adaptive testing in schools. *Measurement and Evaluation in Counselling and Development, 23*, 31-38.

Organisation for Economic Co-operation and Development (2012) *Education at a glance 2012: OECD indicators*. Paris: OECD.

**P**

Palmer, S. (2000) Development of phonological recoding and literacy acquisition: a four-year cross-sequential study. *British Journal of Developmental Psychology, 18(4)*, 533-556.

Peer, L. and Reid, G. (Eds) (2016) *Multilingualism, literacy and dyslexia: Breaking down barriers for educators (Second edition).* London: Routledge.

Piek, J. P. and Edwards, K. (1997) The identification of children with developmental coordination disorder by class and physical education teachers. *British Journal of Educational Psychology, 67*, 55-67.

Pollack, J., Waller, E. and Politt, R. (2004) *Day-to-day dyslexia in the classroom* (Second Edition). London: Routledge.

Pumfrey, P.D. and Reason, R. (1991) *Specific Learning Disabilities (Dyslexia): Challenges and Responses*. NFER-Nelson.

**R**

Rack, J.P. (1994) Dyslexia: the phonological deficit hypothesis. In A. Fawcett and R. Nicholson (Eds.) *Dyslexia in children: multidisciplinary perspectives.* London: Harvester Wheatsheaf, pp. 5-38.

Rack, J. (1997) Issues in the assessment of developmental dyslexia in adults: theoretical and applied perspectives. *Journal of Research in Reading, 20,* 1997, 66-76.

Rack, J.P., Snowling, M.J. and Olson, R. K. (1992) The nonword reading deficit in developmental dyslexia: a review. *Reading Research Quarterly, 27*, 28-53.

Ramus, F. (2003) Developmental dyslexia: specific phonological deficit or general sensorimotor dysfunction? *Current Opinion in Neurobiology, 13(2)*, 212-218.

Ramus, F., Rosen, S., Dakin, S.C., Day, B.L., Castellote, J.M., White, S. and Frith, U. (2003) Theories of developmental dyslexia: Insights from a multiple case study of dyslexic adults. *Brain, 126*, 841-865.

Rayner, K. and Polatsek, A. (1989) *The Psychology of Reading*. Hillsdale, N.J.: Erlbaum.

Reason, R. (1998) Effective academic interventions in the United Kingdom: Does the 'specific' in specific learning difficulties (disabilities) now make a difference to the way we teach. *Educational and Child Psychology, 15,* 71-83.

Reid, G. (2016) *Dyslexia: a practitioner's handbook* (5th Edition). Chichester, UK: Wiley.

Ripley, K., Daines, B. and Barrett, J. (1997) *Dyspraxia: A guide for teachers and parents.* London: Fulton.

Rose, J. (2009) *Identifying and teaching children and young people with dyslexia and literacy difficulties.* London: DCSF.

## S

Saksida, A., Ianuzzi, S., Bogliotti, C., Chaix, Y., Demonet, J-F., Bricout, L., Billard, C., Nguyen-Morel, M-A., Le Heuzey, M-F., Soares-Boucaud, I., George, F., Ziegler, J.C., Ramus, F. (2016) Phonological skills, visual attention span and visual stress in developmental dyslexia. *Developmental Psychology, 52(10)*, 1503-1516.

SASC (2013) *Updated guidance on the assessment of DCD / dyspraxia*. Evesham, UK: SpLD Assessment Standards Committee.

Savage, R. (2001) A re-evaluation of the evidence for orthographic analogies: a reply to Goswami (1999). *Journal of Research in Reading, 24(1)*, 1-18.

Schagen,I.P. (1990) A method for the age standardization of test scores. *Applied Psychological Measurement, 14(4),* 387-393.

Senel, S. and Kutlu, O. (2018) Comparison of two test methods for VIS: paper-pencil test and CAT. *European Journal of Special Needs Education, 33(5)*, 631-645.

Shaywitz, S.E., Morris, R. and Shaywitz, B.A. (2008) The education of dyslexic children from childhood to young adulthood. *Annual Review of Psychology, 59*, 451-475.

Singleton, C.H. (1987) Dyslexia and cognitive models of reading. *Support for Learning, 2*, 47-56.

Singleton, C.H. (1997a) Screening for literacy. In J.R.Beech and C.H.Singleton (Eds) *Psychological Assessment of Reading*. London: Routledge.

Singleton, C.H. (1997b) Computer-based assessment of reading. In J.R.Beech and C.H.Singleton (Eds) *Psychological Assessment of Reading.* London: Routledge.

Singleton, C.H. and Simmons, F.R. (2001) An evaluation of Wordshark in the classroom. *British Journal of Educational Technology, 32(3)*.

Smeets, E. and Roeleveld, J. (2016) The identification by teachers of special educational needs in primary school pupils and factors associated with referral to special education. *European Journal of Special Needs Education, 31(4),* 423-439.

Snowling, M. J. (1995) Phonological processing and developmental dyslexia. *Journal of Research in Reading, 18*, 132-138.

Snowling, M. J. (2000) *Dyslexia* (Second edition). Oxford: Blackwell.

Snowling, M.J. and Hulme, C. (1994) The development of phonological skills. *Transactions of the Royal Society B, 346*, 21-28.

Snowling, M.J., Nation, K., Moxham, P., Gallagher, A. and Frith, U. (1997) Phonological processing skills of dyslexic students in higher education: a preliminary report. *Journal of Research in Reading, 20*, 31-41.

Snowling, M.J. and Stackhouse, J. (Eds.) (2006) *Dyslexia, Speech and Language: A Practitioner's Handbook* (Second Edition). Chichester, UK: Whurr Publishers Ltd.

Snowling, M.J. and Thomson, M. (Eds.) (1991) *Dyslexia: Integrating theory and practice.* London: Whurr.

Stansfield, J. (2012) *Dyslexia: Early identification.* Reading, UK: British Dyslexia Association.

Stuart, M., Masterson, J. and Dixon, M. (2000) Spongelike acquisition of sight vocabulary in beginning readers? J*ournal of Research in Reading, 23,* 12-27.

Suarez-Coalla, P. and Cuetos, F. (2015) Reading difficulties in Spanish adults with dyslexia. *Annals of Dyslexia, 65(1),* 33-51.

**T**

Thomson, M.E. (1982) The assessment of children with specific reading difficulties (dyslexia) using the British Ability Scales. *British Journal of Psychology, 73,* 461-478.

Thomson, M. (1993) *Developmental Dyslexia* (Third edition). London: Whurr.

Thomson, M.E. and Watkins, W. (2007) *Dyslexia: A teaching handbook (Second Edition)*. Chichester, UK: Wiley.

Tsagari, D. and Spanoudis, G. (Eds) (2013) *Assessing L2 students with learning and other disabilities*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Turner, M. (1997) *Psychological Assessment of Dyslexia*. London: Whurr.

**V**

Verhoeven, L. and Keuning, J. (2018) The nature of developmental dyslexia in a transparent orthography. *Scientific Studies of Reading, 22(1)*, 7-23.

**W**

Wagner, R., and Torgesen, J. (1987) The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*, 192-212.

Wagner, R K., Torgesen, J.K., Laughon, P., Simmons, K. and Rashotte, C.A. (1993) Development of young readers' phonological processing abilities. *Journal of Educational Psychology, 85*, 83-103.

West, T.G. (2009) In the mind's eye: Creative visual thinkers, gifted dyslexics and the rise of visual technologies. Buffalo, NY: Prometheus Books.

Willcutt, E.G. (2012) The prevalence of DSM-IV Attention Deficit / Hyperactivity Disorder: A meta-analytic review. *Neurotherapeutics, 9(3)*, 490-499.

**Y**

Yopp, H.K. (1992) Developing phonemic awareness in young children. *The Reading Teacher, 45*, 698-708.

**Z**

Ziegler, J.C. and Goswami, U. (2005) Reading acquisition, developmental dyslexia and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin, 131*, 3-29.

Zwicker, J. G., Missiuna, C., Harris, S. R. and Boyd, L. A. (2012) Developmental coordination disorder: A review and update. *European Journal of Paediatric Neurology, 16(6)*, 573-581.