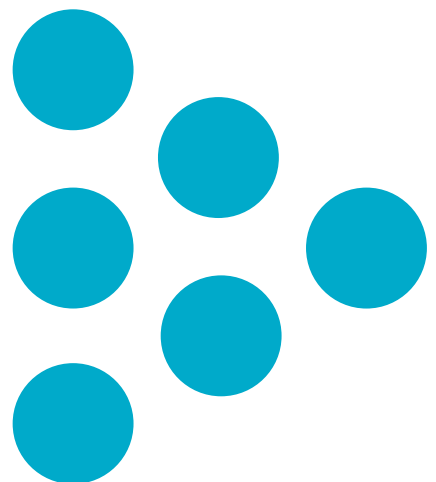

Technical Report

Technical information for NFER Tests in reading and mathematics

Year 1 (Summer)

National Foundation for Educational Research (NFER)



Technical information for NFER Tests in reading and mathematics

Year 1 (Summer)

Centre for Assessment

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1 Introduction

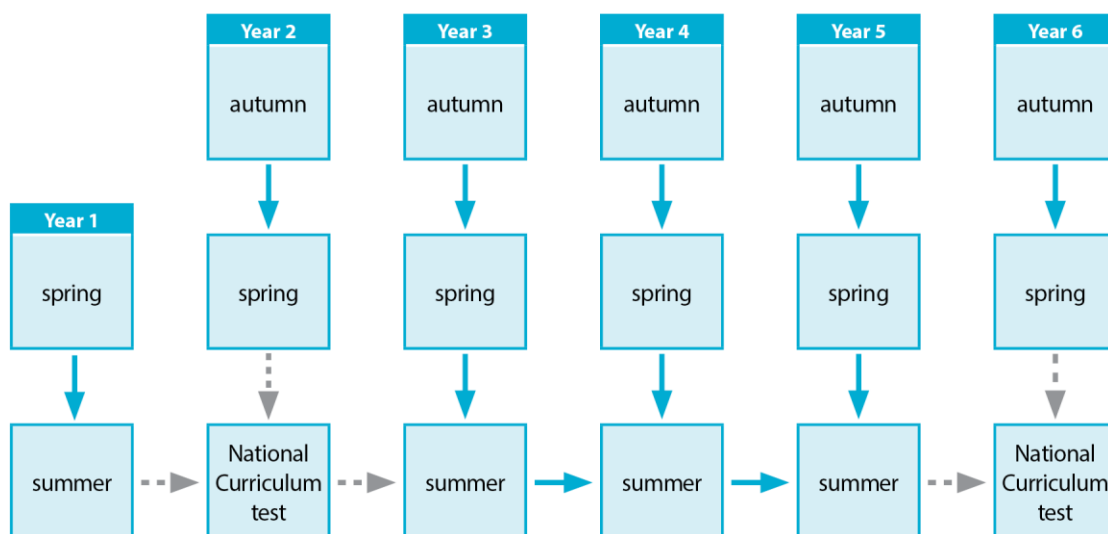
This manual has been published for transparency and to demonstrate the quality of the NFER Tests, so that readers can understand the rigorous development process and appraise the trial data which supports the published materials. It is intended to be of interest to an audience with knowledge of assessment, for example those who develop assessments or those who take an assessment lead in schools.

2 The NFER Tests

Following the introduction of the new national curriculum in 2014 and the abolition of the eight-level scale of assessment, NFER developed a new suite of assessments to help inform teacher assessment. The design of these assessments reflects the changes to the model of statutory assessment used since 2016 and they have been standardised with a large nationally representative sample of pupils who have been taught the new curriculum for at least a year and at a time point in the school year which matches the intended use of the assessments.

The suite has been expanded across the years and now consists of a series of termly assessments for use in Year 1 through to Year 6. The diagram below shows the current extent of the suite and indicates the possible pathways through which pupil progress can be monitored. In addition to the assessments themselves, NFER Tests users also have access to the NFER Tests Analysis Tool. This tool can be used to record pupils' marks and results across the whole suite of assessments and therefore enables progress to be monitored between terms and across years. The arrows on the figure below show some of the stages between which progress can be monitored. However, the tool allows comparison between any two terms and also provides an indication of pupil performance across the different skills that make up the assessment. Looking at the way in which a pupil is progressing relative to their peer group within the school and on a national scale, will help teachers to identify pupils who may be in need of additional support in order to make more progress. (The term 'item' is used within assessment development to refer to a numbered question within the assessment.)

Although the suite of tests is extensive, this report pertains only to the reading and mathematics summer assessments for Year 1, as these assessments were developed in tandem.



3 Early development of texts and items

Following the initial development of texts / contexts and items by the researchers at NFER, qualitative trialling was conducted at a variety of primary schools. Qualitative trialling involves discussing the texts and/or items with small groups of pupils and gathering information on how these can be improved. This provides early feedback on the appropriateness of the texts and items, contributes to an informed review of the materials and influences the selection of items in preparation for the standardisation trial.

Teacher feedback is very important in the development of NFER Tests. Not only is teacher input gathered on the early versions of the materials during informal trialling but it is also collected through a questionnaire completed by teachers taking part in the large scale standardisation trial. This questionnaire gathers teacher feedback on different aspects of the assessments; this information is very useful in refining the materials and informing the selection of items that comprise the final assessments.

In addition to feedback from teachers, the materials were reviewed by inclusion and subject experts. This allows us to ensure that, as far as possible, the assessments are appropriate for the pupils who will be taking them.



4 Standardisation sample characteristics

The NFER assessments in reading and mathematics Year 1 (summer) were standardised in June 2017 with a sample of schools from across England. Over 3000 pupils participated in the trial of the materials for each subject (reading and mathematics).

The standardisation trial has several purposes. Firstly, it provides item level data from which we can discern exactly how each pupil has performed on each question. This enables us to eliminate items which pupils have misunderstood or not completed as expected. This may be because of imprecise or misleading wording or some other source of misunderstanding. Additionally it allows us to remove from the item pool any items that are too hard or too easy, and to select a final set of items which present an appropriate range of difficulty overall.

A second purpose of the standardisation trial is to refine mark schemes. This is done by selecting exemplar responses that pupils give to items during the trial to refine and clarify the marking points. In addition, for responses on the borderline, knowing the proportions of pupils that have given certain types of responses and the associated ability of these pupils, we can also make final decisions as to which responses may be credited or not.

Of course, the standardisation trial is also used to collect data which enables us to calculate the standardised scores provided in the teacher guide and available in the Analysis Tool. These standardised scores enable schools to compare the performance of each child against the performance of other children nationally or within their own school. When standardising an assessment, it is important to ensure that the sample of schools taking the assessment is representative of the national school population. In order to select the sample, all schools in England were divided into separate groups, called strata, based on their characteristics. This was carried out for several characteristics (stratifiers) including school type. In this stratifier, the strata are: primary/combined schools, junior schools, middle schools and independent schools. A random sample is then selected to match the proportions of schools nationally in each stratum, a process known as 'stratified sampling'. The standardisation sample for these tests was stratified according to the following characteristics:

- KS2 overall performance band 2015 (average point score)
- Primary school type
- School governance
- Region: government office region

When a standardisation sample is selected, it is necessary to ensure that the percentage of schools in each of the groups (strata) reflects the national picture. For example, if nationally 84 per cent of schools are categorised as primary schools then this should be mirrored in the sample (i.e. around 84 per cent of the sample should be primary schools). In order to ensure the characteristics of the schools included in the standardisation sample were representative nationally, school level

characteristics were compared with the national population and chi-squared significance tests¹ were conducted. The achieved sample representations across the above characteristics are shown and compared with the national population in Tables 1 to 2. The gender breakdown of the sample is shown in Table 3. The samples were representative of the national population at the school level.

Table 1: Representation of the sample at school level: Reading

		population		sample	
		Number	%	Number	%
KS2 overall performance band 2015 (av. point score)	Lowest 20%	2709	16	15	12
	2nd lowest 20%	2589	15	19	15
	Middle 20%	2319	14	16	12
	2nd highest 20%	2450	14	26	20
	Highest 20%	2838	17	26	20
	missing	4217	25	27	21
Primary school type	Nursery, Infants, First School, Infant & Junior (Primary)	15677	92	117	91
	Independent schools	1307	8	10	8
	All Through school	138	1	2	2
School governance	Academy or Free school	3867	23	18	14
	Maintained	11947	70	101	78
	Independent	1308	8	10	8
Urban/Rural	Rural	5004	30	43	33
	Urban	11873	70	86	67
Region	North	5156	30	43	33
	Midlands	5346	31	39	30
	South	6620	39	47	36
Total schools		17122	100	129	100

Since percentages are rounded to the nearest integer, they may not always sum to 100.

¹ A chi-squared test is used to determine whether there is a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories.

The Year 1 reading sample is representative of the national population at the school level. Any differences between the population and the achieved sample are small and are not statistically significant.

Table 2. Representation of the sample at school level: Mathematics

		population		sample	
		Number	%	Number	%
KS2 overall performance band 2015 (av. point score)	Lowest 20%	2709	16	14	11
	2nd lowest 20%	2589	15	19	15
	Middle 20%	2319	14	16	13
	2nd highest 20%	2450	14	25	20
	Highest 20%	2838	17	26	21
	missing	4217	25	26	21
Primary school type	Nursery, Infants, First School, Infant & Junior (Primary)	15677	92	114	90
	Independent schools	1307	8	10	8
	All Through school	138	1	2	2
School governance	Academy or Free school	3867	23	18	14
	Maintained	11947	70	98	78
	Independent	1308	8	10	8
Urban/Rural	Rural	5004	30	42	33
	Urban	11873	70	84	67
Region	North	5156	30	41	33
	Midlands	5346	31	39	31
	South	6620	39	46	37
Total schools		17122	100	126	100

Since percentages are rounded to the nearest integer, they may not always sum to 100.

The Year 1 maths sample is representative of the national population at the school level. Any differences between the population and the achieved sample are small and are not statistically significant.

Table 3. Representation of the sample at pupil level: Gender

		population	sample	
		%	Number	%
Reading	Boys	50	1620	50
	Girls	50	1622	50
	Total	100	3247	100
Mathematics	Boys	50	1594	50
	Girls	50	1607	50
	Total	100	3207	100

Since percentages are rounded to the nearest integer, they may not always sum to 100.

In terms of gender, all the year group samples were representative of the national population at pupil level.

5 Whole assessment functioning

The following table provides information on the overall performance (or “functioning”) of each paper in both the reading and maths assessments. An explanation of each measure listed in the tables is also provided below.

Standardisation sample (*n*): A standardised assessment is one that has been trialled with a nationally representative sample of pupils. The size of the pupil sample is important if you are benchmarking pupils against attainment nationally, as larger samples give more accurate scores. The tables below show that the assessments have been standardised on sufficiently large samples and therefore provide accurate standardised scores.

Reliability (*Cronbach’s alpha*): Cronbach’s alpha is a statistical measure of internal consistency, which is an aspect of reliability. It indicates the strength of the relationship between all the items in the assessment. It is a form of ‘split-half’ reliability, which means if you split the assessment into two similar sub-tests it tells you how consistent the scores on the two halves of the assessment would be. The values produced are a form of correlation and can range from 0 to 1; values above 0.8 are usually considered to indicate good reliability. Cronbach’s alpha was calculated for each test and the figures in the table below show that all tests were found to have good levels of reliability.

Maximum score: The maximum score is the available number of marks on each assessment.

Mean and Median: The mean and the median are both measures of central tendency; they give an indication of the average value of a distribution of scores.

The mean is the arithmetic average of a group of scores; that is, the scores are added up and divided by the total number of scores.

The median is the middle score in a list of scores written in numerical order; it is the score point at which half the scores are greater and half the scores smaller.

Standard deviation (SD): Standard deviation is a measure of the amount of variation or dispersion of a set of data values. Put simply, it is telling you how diverse the scores on this assessment were. A low SD indicates that the scores tend to be close to the mean, whereas a high SD indicates that the scores are spread out over a large range of values. The SD will, to some extent, be limited by the total number of marks available in each assessment.



Table 4. Whole assessment functioning

	Reading Paper 1	Reading Paper 2	Mathematics Paper 1	Mathematics Paper 2
Standardisation sample <i>n</i>	3247		3207	
Reliability (Cronbach's alpha)	0.90	0.77	0.86	0.84
Maximum score	36	12	25	15
Mean	23.05	6.00	13.95	7.53
Median	24.00	6.00	14.00	8
Standard deviation	7.74	3.14	5.58	4.01

6 Item level functioning

6.1 Item level statistics

Information about item functioning is available in the NFER Tests analysis tool. This is available on the NFER portal for purchasers of the Teacher Guides. It provides an indication of the difficulty of each item so that teachers can see whether an item that their pupils found difficult was also generally difficult for the population or alternatively was completed more easily by the population and therefore performance maybe symptomatic of an underlying misconception or gap in teaching.

6.2 Differential item functioning

During the development of the assessments we analysed whether different groups of pupils performed differently on the assessment items. This was carried out using differential item functioning (DIF) analysis and separate analyses were completed for gender and EAL. DIF identifies particular items for which two groups (e.g. girls and boys) perform differently above and beyond the disparity in their achievement on the assessment as a whole. This analysis is one way of establishing whether or not there could be any bias in the assessment items, that is, are there items which potentially discriminate inappropriately against one group of learners? The results of this analysis are important as they demonstrate that performance on these NFER Tests is not related to other factors irrelevant to the skill being tested.

However, it is important to recognise that sometimes there are valid reasons why one group might perform differently from another. Therefore, although the presence of DIF *may* indicate that an item may be biased, it does not necessarily mean that the item is unfair. For example, it is recognised that EAL pupils often perform better on mathematics items using specific technical vocabulary as they are more used to learning words and meanings than native speakers, while native speakers often do better at written '*explain your answer*' items. In reading, there is a tendency for girls, on average, to perform slightly better than boys on items requiring an understanding of character.

A number of items within the assessments showed differential item functioning, although it should be noted that similar results may not occur if the materials were trialled with a different sample. The results of the DIF analysis are presented in terms of the severity of any difference in performance relative to that expected given the overall difference on the assessment as a whole. There are three levels of severity: negligible, medium and large. The greater the severity, the larger the magnitude of the differential performance. Experience suggests that items classified as having 'negligible' DIF have minimal impact on the overall difference in performance.

Where DIF analysis identified items with a significant difference in performance between two groups, the items were reviewed to ensure that there were no specific features of that item that would make it globally biased towards one group or the other (e.g. gender). Given that there are always likely to be items within an assessment that demonstrate DIF, it is important to ensure that across the assessment, the effect of DIF is largely balanced out.



The tables below show DIF performance by gender is largely balanced. However, EAL pupils tended to do relatively better on paper one of both the reading and maths assessments, which is more supported and has less reading demand than paper two. For example, guided teacher support is given in the aural comprehension section of the reading assessment and visual support is given in the question responses in the maths assessment.

Table 5: Differential item functioning by gender: reading

Year	Total number of items	Number of items with no statistically significant DIF	Number of items with a DIF greater than negligible
1	48	38	Girls: 1* Boys: 1*

**All items were trialled in two assessment versions. The items with an asterisk, both showed a DIF of medium severity in one assessment version but negligible significance in the other.*

Table 6: Differential item functioning by gender: mathematics

Year	Total number of items	Number of items with no statistically significant DIF	Number of items with a DIF greater than negligible
1	39	26	Girls: 5* Boys: 7*

**All items were trialled in two assessment versions. Nine out of twelve items with an asterisk showed medium severity in one assessment version but no significant DIF in the other and the remaining three showed medium severity DIF in both versions.*

Table 7: Differential item functioning by EAL: reading

Year	Total number of items	Number of items with no statistically significant DIF	Number of items with a DIF greater than negligible
1	48	32	EAL: 7* Non-EAL: 5*

**All items were trialled in two assessment versions. Ten out of twelve items with an asterisk showed medium severity DIF in one assessment version but no significant DIF in the other. The other two items showed medium severity in both assessment versions.*

Table 8: Differential item functioning by EAL: mathematics

Year	Total number of items	Number of items with no statistically significant DIF	Number of items with a DIF greater than negligible
1	39	19	EAL: 9* Non-EAL: 6*

**All items were trialled in two assessment versions. Nine out of fifteen items with an asterisk showed medium severity DIF in one assessment version but no significance in the other; four items showed medium severity in both assessment versions; one item showed medium severity DIF in one assessment version and large severity DIF in the other and one item showed medium severity in one assessment version and negligible severity DIF in another.*

7 Assessment outcomes

The following outcomes are available from this suite of assessments:

- Raw score – the total number of marks attained by each pupil
- Standardised score
- Age standardised score
- Age-related expectations in the National Curriculum.

More details of each are available in the relevant teacher guide.

It is worth noting that the scaled score of 100, defined by the Department for Education as the national expectation at the end of Key Stage 1, is **not the same as, nor equivalent to**, a standardised score or age standardised score of 100 on these tests. On NFER Tests, a standardised score or age standardised score of 100 represents the average performance, based on a normal distribution, of the sample of pupils on which the assessments were standardised. At the end of key stage 1, the DfE's scaled score of 100 represents the 'expected standard' and is not the average.

Standardised scores

Standardised scores enable a comparison to be made between the performance of a pupil and that of a large nationally representative sample who took the same assessment. Such comparisons can be useful for grouping a class by ability and for identifying those pupils in need of targeted interventions. Standardised scores can be averaged to provide an overview of the performance of the class as a whole.

The average standardised score is set at 100, based on the performance of a nationally representative sample. About two-thirds of pupils will have standardised scores between 85 and 115 and scores within this range can be broadly described as 'average'. Almost all pupils fall within the range 70 to 140. The assessment is not able to distinguish between pupils performing above or below this range as such pupils are not performing at the level of the assessment. As reliable standardised scores cannot be obtained outside of this range, they are not produced. In some reports, scores outside of the range may be denoted 69 and 141 to enable them to be plotted.

It may be helpful to further divide the average category in which case scores from 85 to 94 inclusive may be classified as 'low average' and scores from 106 to 115 inclusive may be classified as 'high average'. Scores from 85 to 105 remain as 'average'

Standardisation score	Description	
70 to 84	Below average	All pupils within this group are working at an average standard
85 to 94	Low average	
95 to 105	Average	
106 to 115	High average	
116 to 140	Above average	

Age standardised scores

Age standardised scores take into account a pupil's age in years and months at the time of sitting an assessment, in order that his or her performance can be compared with the performance of other pupils the same age in a nationally representative sample. The age standardisation that has been undertaken on the NFER Tests means that these assessments can be administered at different time points and comparative information still be obtained.

As with standardised scores, the average age standardised score is set at 100, based on the performance of a nationally representative sample. About two-thirds of pupils will have standardised scores between 85 and 115 and scores within this range can be broadly described as 'average'. Almost all pupils fall within the range 70 to 140. As stated above, the assessment is not able to distinguish between pupils performing above or below this range as such pupils are not performing at the level of the assessment. As reliable age standardised scores cannot be obtained outside of this range, they are not produced. In some reports, scores outside of the range may be denoted 69 and 141 to enable them to be plotted.

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