

# Readability

Do your students actually read the text-book you have chosen for them? Or do they see it as just a dull series of homework questions?

Do they think of it as a friendly source of information . . . or as something to battle through?

Does it show them science as a *human* activity that is relevant to their lives?

Does the language level hinder them, or can they get past the language easily in order to get to grips with the scientific concepts?

Readability is concerned with the factors that affect your pupils' success in reading and understanding a text. These factors include:

- the legibility of the print and illustrations,
- the interest and motivation of the reader,
- the reading level of the text in relation to the reading ability of the reader.

These key ideas of readability are at the heart of choosing the best textbooks for your students.

These factors are discussed in turn.

## Legibility

Modern textbook printing is of such consistently high quality that any concerns about legibility would focus on the artwork, where pupils may find complex and confusing diagrams that are difficult to decipher.

Diagrams that are clear to us, through long familiarity, may be baffling to the new reader.

## The interest and motivation of the reader

For many students the motivation for reading school books is likely to be low.

Indeed, a textbook has been defined as 'a book that no-one would read unless they had to'.

Interest and motivation can be strongly affected by factors such as:

- the attractiveness of illustrations,
- the relevance of the material to the reader,
- the extent to which *people* (including the reader) are involved.

In the tables, two 'Human Interest' scores are shown for some science textbooks.

In the column headed '*faces*', a value A - E is based on the number of illustrations (on the first 100 pages) that include one or more human faces. (A is >70 illustrations; E is <10)

In the column headed '*you*', a value A - E is based on the number of personal pronouns ('you', 'your', 'we', etc) and names (Isaac Newton, etc) found on the first 20 pages. (A is >180; E is <50)

Of course, since these scores are based on a number of pages (and the number of words per page varies) they are not truly comparable. But they do give you a guide to the friendliness of the opening sections of the books.

Research shows that the motivation to read a text can also be increased if the reader's effort is reduced. In practice this means that the prose in a school book should usually be much simpler than the readers are capable of reading.

In science, the subject matter itself is challenging enough without the extra burden of difficult prose.

## Physics books

The '4F' averages of 4 reading level tests ('4F' = Fry, FOG, Flesch-Kincaid, and Forcast) were found for the same 8 topics in each book. ie. 32 tests per book. The topics were the *introductions* to: refraction of light; sound; Hooke's law; solar system; thermal conduction; electric circuits; electromagnetic induction; alpha, beta, gamma rays. Books marked \*\* did not include the solar system.

Reading Level (y)	Author, <i>Title</i> (Publisher)	Human interest	
		faces	'you'
15½+	Tom Duncan, <i>GCSE Physics</i> (John Murray)	C	D
	Graham Booth, <i>GCSE Physics</i> (Letts)	D	C
15+	John Avison, <i>The World of Physics</i> (Nelson)**	D	D
	Stephen Pople, <i>Explaining Physics</i> (Oxford)**	C	E
	K Foulds, <i>Physics</i> (John Murray)	C	C
14½+	Shirley Parsons & Ian Pritchard, <i>Physics</i> (Collins)	B	A
	Robin Millar, <i>Understanding Physics</i> (Collins)**	B	A
	Dolan, Duffy & Percival, <i>Physics</i> (Higher) (Heinemann)	C	D
	Ken Dobson, <i>Physics</i> or <i>The Physical World</i> (Nelson)	C	B
14+	David Brodie, <i>Physics</i> (Longman)	B	A
	Jim Breithaupt, <i>Key Science:Physics</i> (Nelson Thornes)	D	B
	Jim Breithaupt, <i>N.Mod.Sci.:Physics</i> (Nelson Thornes)	D	B
13½+	--		
13+	Jones, Jones & Marchington, <i>Physics</i> (Cambridge)	D	A
	Charles Tracy, <i>Physical Processes</i> (Hodder&Stoughton)	B	A
	Nick England, <i>Physical Processes</i> (Hodder&Stoughton)	C	A
12½+	David Sang, <i>Physics</i> (Foundation) (Heinemann)	B	C
	Stephen Pople & Peter Whitehead, <i>Physics</i> (Oxford)	A	D
12+	Keith Johnson, <i>Physics for You</i> (Nelson Thornes)	A	A

## Chemistry books

The '4F' averages of 4 reading age tests ('4F' = Fry, FOG, Flesch-Kincaid, Forcast) were found for the introductions to 10 topics in each book. ie. 40 tests per book. Readability tests normally expect at least 3 samples per book.

Reading Level (y)	Author, <i>Title</i> (Publisher)	Human interest	
		faces	'you'
16½+	B. Earl & L. Wilford, <i>GCSE Chemistry</i> (John Murray)	D	D
16+	Jean McLean, <i>Chemistry</i> (Longman)	C	A
15½+	--		
15+	Jane Morris, <i>Chemistry</i> (Collins)	D	E
	L. Wilford & B. Earl, <i>Chemistry</i> Double Award (J Murray)	C	C
	Graham Hill, <i>Materials</i> (Hodder & Stoughton)	C	D
	Philip Stone, <i>Focus on Science</i> (Hodder & Stoughton)	D	D
	Eileen Ramsden, <i>Key Sci: Chemistry</i> (Nelson Thornes)	D	B
	Graham Hill, <i>Chemistry Counts</i> (Hodder & Stoughton)	C	C
	T. Lister & J. Renshaw, <i>Chemistry</i> (Nelson Thornes)	D	C
14½+	Martin Stirrup, <i>Chemistry</i> (Higher) (Heinemann)	C	C
14+	Bob McDuell, <i>GCSE Chemistry</i> (Letts)	D	D
	Renfrew & Conquest, S G <i>Chemistry</i> (Hodder&Stoughton)	E	C
	John Holman, <i>Chemistry</i> or <i>The Material World</i> (Nelson)	C	A
13½+	Gallagher, Ingram & Whitehead, <i>Chemistry</i> (Oxford)	C	D
	M.Jones, G.Jones & D.Acaster, <i>Chemistry</i> (Cambridge)	E	C
13+	Bethell, Dexter, Griffiths, <i>Chemistry</i> (Found'n) Heinemann	A	B
	Lawrie Ryan, <i>Chemistry for You</i> (Nelson Thornes)	A	A

## The reading level of the text in relation to the reading ability of the reader.

The statistical distribution of reading ability in the population of a given age is roughly normal. The expectation is that the range of reading achievement is likely to be two-thirds of the median chronological age of the group. ie. in a mixed-ability class of 12-year-olds, the reading ages could vary from 8 to 16. In a science 'set', selected on the basis of the pupils' ability in *science*, the range of reading ability can still be large.

Teachers are constantly assessing the suitability of written material for their pupils. However subjective assessment has been shown to be unreliable, with teachers usually *under*-estimating the difficulty of the text (and by up to 8 years). The more familiar a subject teacher is with the topic, perhaps the less likely s/he is to see the problems from the pupils' point of view.

Objective measures of readability are now widely used. They are formulae or graphs (with names like Fry, FOG-Gunning, Flesch-Kincaid, Forcast) which are based on an enormous amount of research evidence.

A readability formula predicts the reading level for the text. This is expressed as a chronological age and is accurate to about  $\pm$  one year.

The reading level ('reading age') predicted indicates that an *average* reader of that age could cope with the text.

However the reading level predicted is the 'break-off' point for an average reader of that age. So a reading level of 14 years would indicate that an average 14-year-old would be at the *limit* of his/her reading comprehension ability with that book. The reason for this is that most readability formulae are linked to a 50 per cent correct answer score in a comprehension test.

So if a book has a reading level of 14 years, an average 14-year-old pupil would score only 50 per cent on a test of comprehension of that text. 50 per cent is a long way from full comprehension !

When comparing books it is important to use the average of more than one formula (we have used the '4F' average) because different tests may give different reading levels, depending on the criteria used to devise each test. The '4F' tests used here are all very widely used and well accepted.

In other subjects the required reading ability may be lower than in science. For example, three books commonly used for GCSE English ('*Lord of the Flies*', '*Kes*', '*To Kill a Mocking Bird*') have reading levels of only 10½ - 11½ years.

Furthermore, in subjects like English, teachers tend to support the text by using it in the

classroom, often reading it aloud and using it as the basis for discussion. The teacher is present and actively explaining the text or is at least available to answer any questions.

Science books, by comparison, are used infrequently in class (except for setting work when the teacher is absent). They are used mostly as a basis for homework or revision, unsupported by the presence of the teacher.

Research shows that the reading levels of science texts used in this way ought to be about **two years below** the pupil's reading level.

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### Biology books

The '4F' averages of 4 reading age tests ('4F' = Fry, FOG, Flesch-Kincaid, Forcast) were found for the introductions to 10 topics in each book. ie. 40 tests per book.

Reading Level (y)	Author, <i>Title</i> (Publisher)	Human interest	
		faces	'you'
16½+	J Torrance, <i>S Grade Biology</i> (Hodder & Stoughton)	E	E
16+	Gareth Price & Jane Taylor, <i>GCSE Biology</i> (Collins)	D	E
15½+	D.G.Mackean, <i>GCSE Biology</i> (John Murray) David Applin, <i>Key Science: Biology</i> (Nelson Thornes)	E D	E D
15+	--		
14½+	R.Fosbery & J.McLean, <i>Biology</i> (Higher) (Heinemann) David Applin, <i>N. Mod. Sci.: Biology</i> (Nelson Thornes)	C D	C A
14+	Mary Jones & Geoff Jones, <i>Biology</i> (Cambridge) Terry Parkin & John Simpkins, <i>Biology</i> (Longman) Mary Jones & Geoff Jones, <i>Biology</i> Coord (Cambridge) David Baylis, <i>GCSE Biology</i> (Letts)	E C C D	C A D D
13½+	J Sears & S Taylor, <i>Life &amp; living</i> (Hodder & Stoughton) Jane Vellacott, <i>Life &amp; Living</i> (Hodder & Stoughton)	D C	D D
13+	S.Gater & V.Wood-Robinson, <i>Biology</i> (John Murray) M.B.V.Roberts, <i>Biology for Life</i> (Nelson)	C D	A A
12½+	Michael Roberts, <i>Biology</i> (Nelson) Michael Roberts, <i>The Living World</i> (Nelson) A.Stuart & S.Webster, <i>Biology</i> (Foundation) (Heinemann)	D C D	A A D
12+	Brian Beckett & RoseMarie Gallagher, <i>Biology</i> (Oxford) Gareth Williams, <i>Biology for You</i> (Nelson Thornes)	C B	E C

### Key Stage 3 Science books

The averages of 3 readability tests ('3F' = Fry, FOG-Gunning, Flesch-Kincaid) were found for the introductions to 10 topics in each book intended for Year 7 pupils. ie. 30 tests per book. (The Forcast test is inappropriate for this age range.) For these books the human interest scores are all high, so the A ranges have been subdivided into upper (A1) and lower (A2) sections.

Reading Level (y)	<i>Title</i> (Publisher)	Human interest	
		faces	'you'
12½+	<i>Science Connections 1</i> (Collins) <i>New Horizons 1</i> (Cambridge)	B B	B B
12+	<i>Science in Action 1</i> (Blackie) <i>New Understanding Science 1</i> (John Murray)	B A2	A2 C
11½+	<i>Starting Science 1</i> (Oxford) <i>Science Scene 1</i> (Hodder & Stoughton) <i>Salters' Science Focus 1</i> (Heinemann) <i>Science World 1</i> (Nelson)	A2 A2 A1 A2	A2 D A2 A1
11+	(old) <i>Understanding Science 1</i> (John Murray)	A1	C
10½+	<i>Science Companion 3-5</i> (Nelson Thornes) <i>Core Science 1</i> (Cambridge)	C B	B B
10+	<i>Spotlight Science 7</i> (Nelson Thornes) <i>Science Now 1</i> (Heinemann) <i>Go for Science! 1</i> (Nelson) <i>Active Science 1</i> (Collins)	A1 A1 A2 A1	A1 A2 E A1

### Key Stage 4 Science books

The averages of 4 readability tests ('4F' = Fry, FOG-Gunning, Flesch-Kincaid, Forcast) were found for the introductions to at least 12 topics in each book or series of books. ie. at least 48 tests per course (112 tests for each 3-book series). Readability tests normally expect at least 3 samples per book.

Reading Level (y)	Publisher, Series (Authors)	Human interest	
		faces	'you'
16	John Murray, GCSE (Duncan / Earl & Wilford / Mackean)	D	D
15½+	--		
15+	Collins, GCSE Science (Parsons & Pritchard / Morris / Price & Taylor)	C	D
	Nelson Thornes, Key Science (Breithaupt / Ramsden / Applin)	D	C
	Longman, Coordinated Science (Brodie / McLean / Parkin & Simpkins)	C	A
14½+	Nelson Thornes, Northern Modular Science (Breithaupt / Lister & Renshaw / Applin)	D	B
	Heinemann, Coord Science, Higher (Dolan, Duffy & Percival / Stirrup / Fosbery & McLean)	C	C
	Letts, GCSE Classbooks (Booth / McDuell / Baylis)	D	D
	John Murray, Science Double Award (Foulds / Wilford & Earl / Gater & Wood-Robinson)	C	B
14+	Hodder & Stoughton, Science Matters (England / Hill / Sears & Taylor)	C	C
	Heinemann, New Modular Science for GCSE (Deloughry et al)	C	C
13½+	Collins, MEG Coordinated Science (Dobson & Sunley)	C	B
	Oxford, Science to GCSE Summary book (Pople & Williams)	D	A
	Nelson, Essential Science (Lakin & Patefield)	C	C
	Nelson, Balanced Science, or Science (Dobson / Holman / Roberts)	C	A
	Cambridge, Coord Science or Balanced Science (Jones, Jones, Marchington & Acaster)	D	B
13+	Heinemann, The Salters' Approach (Campbell, Lazonby, Millar & Smyth)	A	B
12½+	Oxford, Coord Science (Pople & Whitehead / Gallagher & Ingram / Beckett & Gallagher)	B	D
	Nelson Thornes, . . . for You series (Johnson / Ryan / Williams)	A	B

Several publishers have now amalgamated.

In all the tables, Stanley Thornes and Nelson are now Nelson Thornes,  
Longman are now Longman Pearson  
Hodder & Stoughton and John Murray are now Hodder Murray.

The values given in the 5 tables were measured on the *introductions* to topics, and also ignored any formulae or numerical calculations in the text -- so the overall reading level for each book is likely to be *higher* than the value shown.

In choosing a suitable textbook for your students, there are other factors to be considered . . . syllabus coverage, cost, artwork and writing style, for example . . . but I hope you will find the information in these tables helpful in choosing the best for your pupils.

There are more details of the Readability Tests, and more details of the results for each book at [www.timetabler.com](http://www.timetabler.com)

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