



nace ● **essentials**
guide

Realising the
potential of more
able learners in
GCSE science

Guide 7

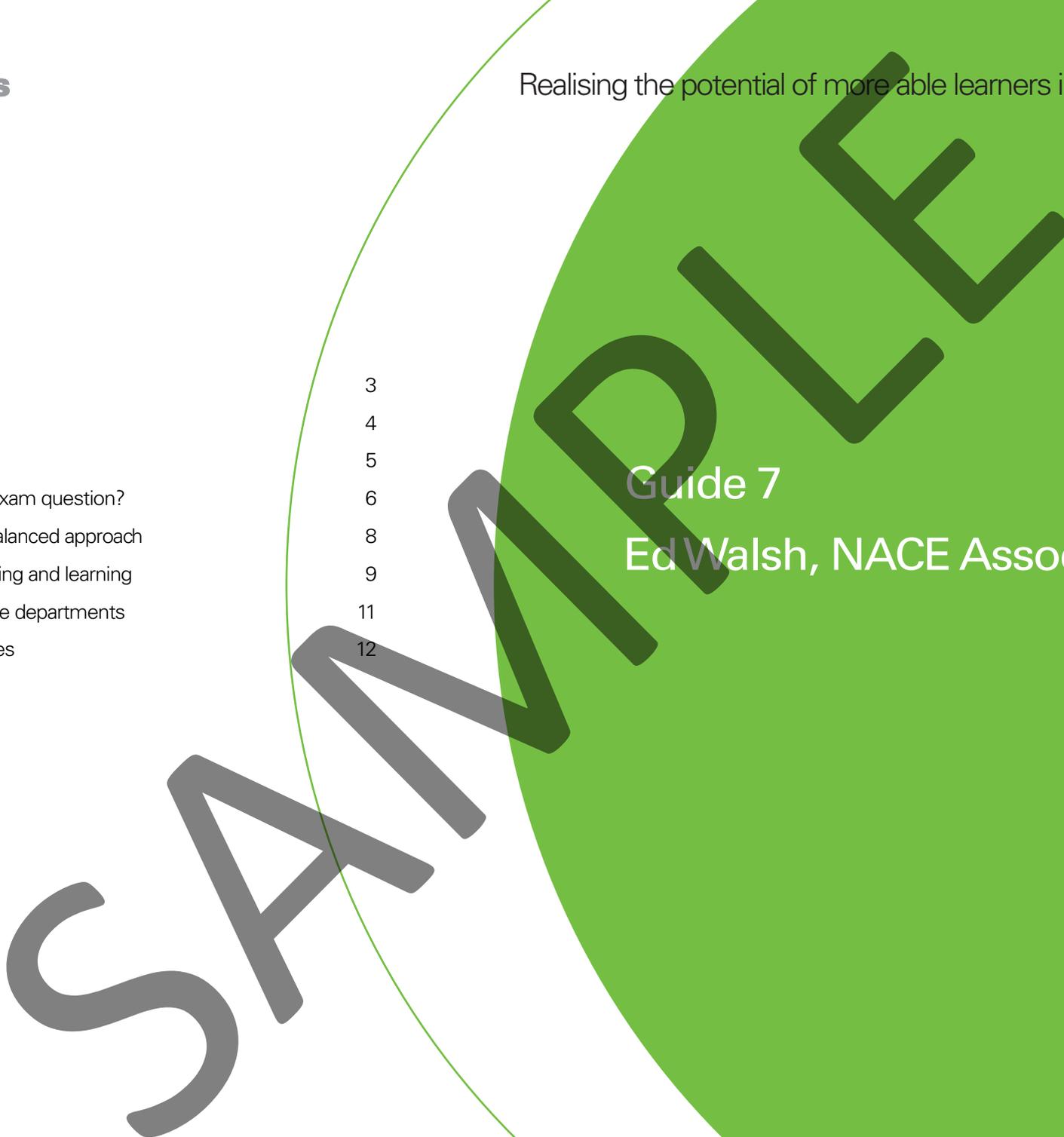
Ed Walsh, NACE Associate

Contents

Foreword	3
Introduction	4
What's changed and why?	5
What makes a challenging exam question?	6
Assessment objectives: a balanced approach	8
Practical strategies for teaching and learning	9
10 killer questions for science departments	11
Further reading and resources	12

Guide 7

Ed Walsh, NACE Associate



Foreword

Hilary Lowe, Series Editor

Recent years have seen, quite rightly, much discussion and campaigning to highlight the plight of science subjects in schools and the representation of young people in science-related careers. A growing number of organisations are working with teachers and schools to stem the early exit of students from science subjects and ultimately open the gates to their taking up science-based careers, as well as realising the importance of science for everyone.

We are very fortunate in counting Ed Walsh, author of this NACE Essentials guide, among our network of NACE associates. Ed has a wealth of experience and successful track record in supporting schools to improve, develop and innovate in science teaching and provision. He has published widely on science education; produced teaching materials, student textbooks and multimedia resources; and developed and delivered training programmes for teachers and heads of science. As a NACE associate Ed designs and delivers training and materials to support effective teaching for more able learners in science.

This NACE Essentials guide explores the reasons behind and the nature of the changes to GCSE science specifications, identifying implications for teaching and learning and exploring some practical strategies that science teachers and leaders can adopt.

As Ed emphasises: "It's not simply that [learners] should be attaining high grades, but that they should be doing so by responding to a more challenging course. [...] There are a number of ways in which questions can be made more challenging and in order to support students with high targets this needs to be understood. There is sometimes an assumption that it is the complexity of the content that is the key determinant – this isn't necessarily the case."

In this publication Ed steers science teachers through a series of key questions and critical areas to address if students are to achieve the highest GCSE grades, suggesting a range of strategies and approaches which can be incorporated into everyday planning and teaching. Not least, he emphasises the link between high-level mathematical and language skills and achievement in science, making a strong case for ensuring that these cross-cutting areas are dealt with explicitly and through collaborative approaches between departments.

For secondary heads of science, science teachers, and those responsible for teaching and learning or leading on more able learners, this guide is an invaluable, timely and indeed unique resource addressing the distinctive needs of high achievers under the new GCSE science specifications.



Introduction

Ed Walsh, NACE Associate

Science is not only a core subject, but a key curriculum area for many more able learners. As well as being essential for those wishing to follow a career in the STEM disciplines, sciences have a wider currency. Being good at science indicates the ability to think logically, interpret evidence and construct explanations relating to a variety of phenomena.

The science GCSE specifications changed in 2016 in response to concerns about previous versions. While these changes obviously affected all students in KS4, there are clear implications for more able learners:

- **A stated aim of the development work was to make the new qualifications challenging and rigorous. In line with other GCSE qualifications, grades 8 and 9 were introduced. More grades above the old C/D (now 4/3) borderline allow for finer discrimination at higher levels of performance.**
- **The demise of controlled assessments and the assessment of working scientifically in the final exams means that candidates face questions that assess enquiry as well as mastery of concept.**
- **The strengthened role of maths skills means learners need to have these at their fingertips; some numerical skills required in higher tier papers have not previously been part of the specifications.**
- **Extended response questions can now ask for prose responses or for multi-stage calculations.**
- **The higher tier papers include stretch and challenge questions. These are driven by a number of factors, only one of which is complexity of concept.**

Understanding the nature of the changes and exploring responses is important in the development of high-quality provision for more able learners.

This guide explores the nature of the science GCSE specification changes in more detail, identifies implications for more able learners and for teaching and learning more widely, and explores some practical strategies that science teachers and leaders can adopt.

Note on national differences

There are differences in the GCSEs and equivalent qualifications offered in each region of the UK, including slight differences between Wales and England, the two countries to which this guide primarily relates. The science GCSEs developed by WJEC for use in Wales reflect many, though not all, of the changes referred to in this guide. The assessment objectives are very similar and the weightings are the same. However, the Welsh courses retain the direct assessment of practical skills, though there are also questions relating to working scientifically in the final exams, and the list of mathematical skills is slightly shorter.



Further reading and resources

General guidance:

- Ofqual, GCSE (9 to 1) subject-level guidance for combined science, 2015: <https://www.gov.uk/government/publications/gcse-9-to-1-subject-level-guidance-for-combined-science>

Practice grade 8-9 questions:

- Sample high-demand questions collated by AQA: <https://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-SAMPLE-HDQ.PDF>
- Targeted exam practice workbooks for grades 8-9 for AQA and Edexcel (published by CPG): https://www.cgpbooks.co.uk/School/books_gcse_science

Command words:

- AQA: <https://filestore.aqa.org.uk/resources/science/AQA-SCIENCE-GCSE-COMMAND-WORDS.PDF>
- Edexcel: <https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/GCSE-9-1-Sciences-Command-words.pdf>
- OCR: <https://ocr.org.uk/Images/108139-teachers-handbook.pdf>

Teaching maths skills for science:

- AQA: www.aqa.org.uk/resources/science/gcse/teach/maths-skills-in-GCSE-sciences
- ASE: <https://www.ase.org.uk/mathsinscience>
- Edexcel: <https://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/Guide-to-Maths-for-Scientists.pdf>
- OCR: www.ocr.org.uk/Images/310651-mathematical-skills-handbook.pdf

Guide author

Ed Walsh

Drawing on his experience as a secondary head of science, county science adviser and a regional and senior adviser for the Secondary National Strategy, Ed Walsh is now an independent consultant in science education. With a proven track record in helping schools improve their science provision, he has published widely in the field, produced teaching materials, student textbooks and multimedia resources, and developed and delivered training for teachers and heads of science, including on behalf of organisations such as ASE and AQA. As a NACE associate, Ed designs and delivers programmes and resources to support effective teaching and learning for more able learners in science.

Series editor

Hilary Lowe

Hilary Lowe has written, advised and presented widely on the education of more able learners. She led a major national professional development programme for gifted and talented coordinators and has designed national training and guidance materials. She is currently NACE's Education Adviser.



National Association for Able Children in Education

© Published by NACE September 2018.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of NACE.

For information or further copies of this publication or the series:
NACE

Horticulture House, Manor Court, Chilton, Didcot OX11 0RN
01235 425000 info@nace.co.uk www.nace.co.uk
Registered charity no. 327230 Company no. 06604325