SOCIETY

In a world where global challenges and advances in technology bring both uncertainty and new possibilities, the chemical sciences have a critical role to play. But what will that role be? How can we maximise the impact we make across academia, industry, government and

A major policy objective of the Royal Society of Chemistry is that everyone should, during their schooling, have access to an excellent chemistry education that is engaging, inspiring and relevant. It should equip them with the skills and understanding they need to be scientifically literate citizens and to pursue the study of chemical sciences at higher levels should they so wish.

We work to achieve this objective in a number of ways. This includes supporting teachers in the classroom with our network of Education Coordinators, providing high quality resources through our online education platform, and with our policy work on the curriculum and teacher recruitment and retention.

The curriculum is fundamental to ensuring that learners experience an excellent chemistry education. So, in 2014, the Royal Society of Chemistry set up a Curriculum and ,d

The chemical sciences are entering an era of unprecedented discovery and impact. They will be essential for finding paths to sustainable prosperity. So it is vital that chemistry education is fit for the future.

The Royal Society of Chemistry aims to influence the development of chemistry curricula and qualifications by governments and other authorities throughout the UK and Ireland. This document presents a proposed framework to inform curriculum design at ages 11–19. While this proposal is intended to be a valuable resource to policymakers and curriculum designers, we hope it will also be of interest and use to teachers.

The ideas in this document rest on a much greater body of work, which is still being refined, as well as extended to other stages of education. The framework presented here represents what we see as the core of an ideal chemistry curriculum, but by no means its totality. While our ideas about good curricula should always be reviewed in the light of evidence and experience, we aim here to present something that is enduring and can be used flexibly in di erent education systems and types of qualification.

We want to engage with the chemical sciences and education communities to inform the next steps in this work, so that we are aligned with their needs and have broad support for our proposals. This is the beginning of a longer conversation; future publications will expand on the ideas in this report.

A communit and evidence informed frame ork

The curriculum framework presented here has been developed by a succession of curriculum and assessment working groups.

The working groups referred to evidence on good curriculum design in general and on e ective learning in chemistry in particular, as well as looking at current practice. They thought about the most important knowledge and skills to teach to learners aged 11–16 years and 16–19 years, as well as the guiding principles that should underpin good curriculum design. From these discussions, our curriculum framework emerged.

We have tested our ideas with teachers and other educators through reviews of dra documents, focus groups and other discussions. Practice was also shd.1 (ame)-11.9 (w.ƀDCing in.ƀ0 (tic4i ƀD1v en-Gx03ƵMC /Sof0 0 12 9.1ƀ71bodhe , 119.Inscussioituons. Pr)12 Physic0.187 19.RC /Soycussitice was also s

Our approach to developing the frame ork

A curriculum for all

In designing this framework, we have carefully considered the skills and knowledge learners will need at each stage of education to pursue further study and work. This includes helping them understand the variety of contexts and careers in which chemistry is used so they can make

Practical skills

Development of competency in practical skills should remain a core aim of a chemistry curriculum. Practical work supports understanding of chemistry as an empirical science, and provides the opportunity to learn skills that are useful not only for progression into further study and careers in the sciences, but also more widely. Examples of wider relevance include the ability to take accurate measurements, an understanding of hazard and risk, and an appreciation of application and innovation in the sciences.

While not explicitly expressed in the framework diagram, practical work should be understood as a core part of answering the question ' Learners should encounter a range of techniques appropriate to their stage of education and linked to other areas of the curriculum, and understand the place of experimentation and observation in the wider processes of investigation.

Coherent progression across education

To ensure coherent progression in understanding it is important that the narratives remain linked, while specific aims at different education stages are accounted for. This will support age-appropriate conceptual development of the subject. While each stage has its own set of aims, they stay connected through the Big Questions.

We set out the key aims for each educational stage below. We have included ages 5–11 years as we believe the Big Questions can be adapted for this age group. We are still in the process of developing a more detailed framework for this educational stage.

Aims for each educational stage

5–11 years

Lay the foundations of chemistry education within a science framework, in terms of scientific knowledge, skills and enquiry. Learners start to become informed about the part that science plays in the world around them.

11–16 years

Provide a broad and balanced chemistry education for all learners, including about the role of chemistry in the world around them. Prepare learners who wish to pursue either an academic or a technical pathway.

16–19 years

Prepare learners for further study on academic or technical pathways and careers related to chemical sciences, through developing essential skills and embedding a secure knowledge base.

Appendi A note on assessment

Assessment is an indispensable tool in ensuring that learners are making progress against expectations, and in planning next steps for teaching and learning. Any programme of assessment should include all three components outlined in this curriculum framework, including practical work and contextual awareness.

We are developing our recommendations in this area. At present we suggest the following key principles for designing assessments:

- Assessments should be **tailored to the setting** in which the curriculum is delivered and likely progression routes, whether academic or technical.
- A **broad range of types** of assessment should be used to cover a variety of competences, cater for diverse learners, and minimise any negative impacts associated with particular tasks.
- Assessment of **theoretical concepts** should focus on learners' **understanding of and ability to apply** concepts, including to unfamiliar contexts. It should also evaluate learners' ability to analyse and evaluate new information and data, and to bring together ideas and skills from across the breadth of the curriculum, rather than focusing on rote memorisation.
- We acknowledge that **recall of core knowledge** is also important in developing fluency of understanding and may therefore feature in assessment.
- Some aspects of the curriculum may be better assessed through **'can-do' tasks** that most learners can achieve. For example, competence in certain practical skills.
- Every effort should be made to **avoid bias**, including on the basis of gender, socio-economic background, ethnicity or disability.