Position Statement

Addressing the digital skills gap in UK chemistry education

Last reviewed: September 2025

Summary

Digital skills are essential in the chemistry-using workforce, yet current education pathways are not keeping pace with industry demands. The rapid evolution of digital tools, combined with outdated curriculums, has contributed to a growing digital skills deficit, estimated to cost the UK economy £63 billion annually. Modern scientists rely on digital technologies to improve accuracy, collaboration, and sustainability. Yet, school chemistry curriculums remain largely manual and disconnected from these professional practices.

To help close this gap, digital competencies must be introduced early and developed progressively from primary education through to university. Students should build both core digital literacy and subject-specific competencies, introduced in a purposeful way that complements foundational analogue techniques. This approach will better prepare learners for the evolving demands of the future workforce.

Recommendations

- *Infrastructure* – Educational institutions need to access the necessary digital infrastructure. This includes ensuring the provision of sufficient computer desktop/laptop devices (rather than app-based devices, e.g. tablets) and reliable internet access.
- *Interwoven* - The 11-19 chemistry curriculum should be reviewed and streamlined to better reflect real digital practices of working scientists. Where appropriate students should engage with digital tools that support data handling and manipulation, graph drawing, predicting trends and molecular modelling. These experiences should be embedded meaningfully within the curriculum.
- *Beyond school* - Post-18 education should ensure a solid foundation in digital literacy for all, preparing young people for the workplace. Students should develop a clear understanding of how digital tools and technologies are used in chemistry jobs. HEIs should work closely with industry partners to align their digital skills provision with current and emerging workplace digital skills needs.
- *Disciplinary knowledge* – Students should have opportunities to explore how scientists use digital skills and tools in their roles – such as spectroscopy, programming and data analysis. Students should understand not just how to use these tools, but why they are used. This will help them form realistic expectations of what they will encounter in higher study and/or the workplace.
- *Teacher expertise* – Educators should be supported to upskill where needed, e.g. improving confidence in using spreadsheets and modelling tools. This may require investment in ongoing targeted subject-specific professional development.[1]
- *Wider support* – the wider curriculum should be reviewed to ensure that foundational digital skills, such as using office programmes, files, typing, building confidence in using a computer, are more secure and can be built on in science lessons through each education stage.

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[1] The Royal Society of Chemistry supports teachers to upskill through our professional development courses and tailored resources to help deliver the curriculum.

Background

Digital skills are increasingly critical to both the UK workforce and economy. In the chemistry-using sector, roles often demand not only basic computer literacy but also advanced digital competencies in areas such as data analysis and automation.[2] However, the rapid pace of technological change[3], combined with gaps in current education pathways, has led to a growing digital skills deficit[4] - estimated to cost the UK economy £63 billion annually.[5]

There has generally been a lack of digital skills development outside of computer science lessons at school across the UK, despite calls for digital skills to feature more prominently and to be regarded as important as maths and literacy.[5] Digital skills development in England is largely confined to computing lessons and has a deep focus on programming. Teachers report that students often lack foundational skills such as using office software, typing, emailing and file management.[6,7] Primary schools in Northern Ireland often prioritise developing pupils' coding and animation skills, resulting in pupils entering secondary education with uneven digital skill levels.[8] Wales is embedding digital competence alongside literacy and numeracy as mandatory elements of its new curriculum.[9] However, across the UK digital skills are rarely taught in interdisciplinary contexts, limiting the real-life applications in subjects like chemistry.[10]

The experience of students in higher education is inconsistent, with a majority of students not receiving enough support for digital skills development.[11] While HEIs benefit from flexible curriculums, the inclusion of digital skills in chemistry degrees often depends on staff expertise and departmental priorities.[12] Although the Royal Society of Chemistry's accreditation criteria call for the development of transferrable skills, including digital skills, current implementation tends to be generic and lacks chemistry-specific relevance.[13]

With the anticipated growth of the chemical industry in the UK[2] the need for subject-specific digital skills will only intensify. Without consistent development from school through to university, future chemists risk falling behind peers in other STEM disciplines where digital training is more embedded.[14]

Barriers to better development of digital skills

Young people's familiarity with technology is often mistaken for proficiency.[15] Informal use of devices does not translate into the digital skills required by employers or being able to apply digital skills scientifically.

The computing curriculum is less focused on basic skills like using office applications. The resulting lack of foundational digital skills[16] coupled with limited curriculum time for chemistry makes it difficult to introduce contextualised digital skills into chemistry education.[17]

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[2] Royal Society of Chemistry (2024), 'Future workforce and educational pathways', available at: https://www.rsc.org/policy-evidence-campaigns/discovery-research-and-innovation/discovery-research-innovation-reports-surveys-campaigns/future-workforce-and-educational-pathways/
[3] Royal Society of Chemistry (2020), 'Digital futures', available at: https://www.rsc.org/policy-evidence-campaigns/discovery-research-and-innovation/discovery-research-innovation-reports-surveys-campaigns/digital-futures/
[4] Unpublished qualitative data from Royal Society of Chemistry's 'Future Workforce and educational pathways' research (2024)
[5] House of Lords Communications and Digital Committee (2023), 'Digital exclusion', available at: https://publications.parliament.uk/pa/ld5803/ldselect/ldcomm/219/219.pdf
[6] Teacher interviews
[7] UK Parliament POSTnote 643 (2021), 'Developing essential digital skills', available at: https://doi.org/10.58248/PN643
[8] Education and training inspectorate (2024), 'Digital Skills in the Curriculum – A Baseline Evaluation of the Digital Skills provision in Primary and Post-primary Schools', available at: https://www.etini.gov.uk/sites/etini.gov.uk/files/publications/digital-skills-in-the-curriculum-a-baseline-evaluation-of-the-digital-skills-provision-in-primary-and-post-primary-schools_0.pdf
[9] Welsh Government (2024), 'Curriculum for Wales digital competence framework', available at: https://hwb.gov.wales/curriculum-for-wales/cross-curricular-skills-frameworks/digital-competence-framework/
[10] Department for Education (2013), 'National Curriculum in England: computing programmes of study', available at: https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study/national-curriculum-in-england-computing-programmes-of-study
[11] Jisc (2024), '2023/24 UK higher education students digital experience insights survey', available at: https://digitalinsights.jisc.ac.uk/reports-and-briefings/our-reports/2023-24-uk-higher-education-students-digital-experience-insights-survey-findings/
[12] HE interviews
[13] Royal Society of Chemistry accreditation of degree programmes, available at: https://www.rsc.org/globalassets/03-membership-community/degree-accreditation/accreditation-of-degree-programmes.pdf
[14] HE interviews
[15] Ofsted (2022), 'Research review series: computing', available at: https://www.gov.uk/government/publications/research-review-series-computing/research-review-series-computing
[16] Teacher interviews
[17] Royal Society of Chemistry (2024), 'Future workforce and educational pathways focus groups (unpublished)'

The lack of basic key skills also has a knock-on effect at HE, where providers are having to run remedial classes around core digital skills (such as the use of spreadsheets) before they can move on to more advanced skills and concepts.[18] Many undergraduates are also entering university without a complete picture of the growing role of digital skills, tools and techniques within modern chemistry due to the lack of exposure during their school education.

Access to devices, workspace, software and reliable internet access varies widely in schools.[19] In England, the median device access is one laptop for every 8 students, with disadvantaged schools facing even greater challenges. Only 2% of teachers in those schools report adequate digital access for their students.[20,21,22]

Universities are facing resource constraints and increasingly expect students to use their own devices during their course, with limited provision of hardware by the institution beyond specialist equipment.[11] While most students have basic access, many still report difficulties with device suitability, workspace availability and Wi-Fi connectivity, hindering effective digital learning.[22]

In many cases, teaching staff in schools have not been trained in these digital skills themselves and so can lack the confidence to teach them.[23,24]

Key messages

Modern scientists often rely on digital tools, such as computational modelling, imaging and visualisation, machine learning and AI, advanced sensing and automation, to enhance accuracy, foster collaboration and support sustainability.[3] However, the current school chemistry curriculum does not reflect these realities. Students are still expected to draw graphs by hand and perform basic, time-consuming data analysis (e.g. calculating means, predicting trends) even though such tasks are routinely performed using digital tools in professional settings.

To better prepare students for future study and careers, digital skills must be introduced early and developed progressively, just like literacy and numeracy.[8] Our curriculum framework emphasises the importance of developing both core digital literacy and subject-specific competencies, such as collecting data and generating computer models, across all key stages.[25] These skills should be taught in a purposeful, progressive way that compliments, rather than replaces, analogue activities. [26] For example, while graphing by hand remains valuable, it should be followed by opportunities to use digital tools to analyse and visualise data.

Core digital skills should be embedded throughout the science and chemistry curriculum from primary through early secondary education, with more advanced digital skills and tools explored at key stage 5 (or equivalent).[27] To make space for this, existing content may need to be streamlined, rather than simply adding more to an already crowded curriculum.[28]

Assessment also plays a critical role. At A level, practical assessments (PAGs and CPACs[29]) offer a valuable opportunity to embed digital skills into practical experiences, better reflecting the work of scientists. Similar updates could be made to Scottish Highers and Advanced Highers through revised coursework criteria, and to Welsh qualifications by updating the practical technique requirements for unit 5 to include digital techniques. Including digital skills in level 2 and level 3

[18] HE interviews
[19] BESA (2025), 'The state of the estate', available at: https://www.besa.org.uk/wp-content/uploads/2024/01/StateoftheEstate_V1.pdf
[20] Department for Education (2023), '2022-23 Technology in schools survey', available at: https://assets.publishing.service.gov.uk/media/655f8b823d7741000d420114/Technology_in_schools_survey__2022_to_2023.pdf
[21] Teacher Tapp/Teach First (2021), 'Digital access survey', available at: https://www.teachfirst.org.uk/press-release/digital-access
[22] HE interviews
[23] Teacher interviews
[24] Royal Society of Chemistry (2025), 'Science teaching survey', unpublished
[25] Royal Society of Chemistry (2020), 'The elements of a successful chemistry curriculum', available at: https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/chemistry-curriculum-framework/#undefined
[26] Ofsted (2023), 'Finding the optimum: the science subject report', available at: https://www.gov.uk/government/publications/subject-report-series-science/finding-the-optimum-the-science-subject-report--2
[27] THE (2021), 'Digital literacy in the UK', available at: https://www.timeshighereducation.com/sites/default/files/digital_literacy_in_the_uk_the_consultancy_report_6.pdf
[28] Royal Society of Chemistry (2024), 'Science Teaching Survey: the top issues impacting student learning outcomes', available at: https://www.rsc.org/policy-evidence-campaigns/chemistry-education/education-reports-surveys-campaigns/the-science-teaching-survey/2024/top-issues-impacting-student-learning-outcomes/
[29] Specified practical skills and activities at A-levels in England are often collectively known as PAG (Practical activities group) or CPAC (Common practical assessment criteria), depending on exam board.

specifications would help to ensure meaningful skills development in a science context. Without assessment, these skills risk being overlooked due to time constraints.[30] However, if these skills are to be assessed, schools (and their students) must be supported with the necessary infrastructure to avoid disadvantaging students who lack access to devices or the internet.[31]

Post-18 education should continue to develop core digital skills and techniques relevant to both the workplace and future research environments. While it's unrealistic for undergraduate courses to cover every professional tool, there needs to be a balance between developing strong chemistry skills (and knowledge) and a buildable core set of digital skills.[30] Students should be equipped to react to changes in the digital environment and the continued development and ethical use of technologies such as AI.[2]

Delivering this level of improved digital skills requires investment in infrastructure and people. Institutions need access to the appropriate number and type of devices/hardware, and the physical spaces to accommodate them. Educators also need to have the required skill set and knowledge to teach any included skills.[15] Making the investment now in digital skills will have long-term economic benefits to both the individual and the wider economy. Across the whole school estate in England for example, it is estimated that an investment of £130m a year for 10 years (£1.3bn) could have a net value to the economy of up to £8.7bn over 10 years.[32] This suggested investment would pay for devices, broadband access improvements and teacher training, and would have impact far beyond just chemistry.

For any queries relating to this position statement, please contact: EducationPolicy@rsc.org

[30] Teacher interviews

[31] Digital skills could be assessed on a competency basis or via exam-based questions, but further work is needed to determine the best method(s) of assessment.

[32] Pearson/Cebr (2025), 'The case for investment in digital transformation in schools', available at: https://www.pearson.com/content/dam/global-store/en-gb/news-policy/cebr-report/cebr-digital-transformation.pdf

Appendix

Example approaches to implementation

5-11

Develop understanding in pupils that digital tools are regularly used by scientists, and the reasons why. This could be added to the 'working scientifically'/scientific inquiry elements of the curriculum.

Use of simple animations and modelling to represent scientific concepts. Development of science communication skills via presentations, videos, typed documents, etc. Introduce pupils to searching for sources on the web, and why scientists do this. Expand the use of data loggers to collect data digitally and explore basic data analysis techniques in spreadsheet (or other appropriate) software.

11-16

Application of block-based languages, e.g. Scratch, into a science context. Students at 11-14 will be familiar with Scratch due to its inclusion in the primary curriculum, and it can be used to simulate experiments, experimental design and data analysis. If infrastructure allows, virtual simulations of techniques could support the understanding of investigative processes and give learners a greater awareness of the current technology used in research.

Wider skills such as basic spreadsheet workbooks (using them for calculations, basic data manipulation, basic graph drawing), using the web to search for data and using it for sources (including misinformation and trusting sources), and introducing the effective use (and potential misuse) of AI in a scientific context.

16-19

Building on the use of block-based languages, introducing programming languages such as Python to manipulate and present data, predict properties and conduct simple modelling. More advanced use of spreadsheet software for data handling and manipulation. Further use of simulation to support understanding and explore techniques.

Develop an awareness of how digital tools are used by scientists (e.g. spectroscopy, automation, AI/machine learning, simulation and modelling).

Suggested approaches include having a potential list of competencies to provide some consistency and ensure all chemistry learners at level 3 are achieving the same base level of digital skills (in a chemistry context).

Digital skills could be folded into the existing A-level/Higher/Advanced Higher practical assessment scheme and into vocational course tasks.

Higher Education

Continue to build high basic computer literacy and knowledge of the Microsoft Office Suite (or equivalents), alongside more advanced digital skills, knowledge and abilities that help develop problem solving and critical thinking, particularly in relation to data analysis, but also automation and computer science.[2] Introduction of specific digital tools where appropriate, e.g. ChemDraw, TopSpin (or equivalents).

Introduction of chemical drawing and modelling software to represent and visualise chemicals. General skills such as use of databases, digital file management, and how to be professional on digital platforms could also be incorporated to increase employability. Exposure to the potential ethical/safe uses and risks of AI/Machine Learning.

Some chemistry specialisms would benefit from more advanced coding and analytics including programming e.g. plotting collected data with Python.[33]

Digital skills could fit well into practical-based activities/sessions as they are about putting understanding into practice. Digital skills should be introduced early and embedded in a degree programme and used in applied settings throughout to encourage mastery; this could be achieved through modernisation of existing content, rather than removal or addition.[34]

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[33] HE interviews
[34] McCluskey, A.R., Rivera, M. & Mey, A.S.J.S. Digital skills in chemical education. *Nat. Chem.* 16, 1383–1384 (2024)