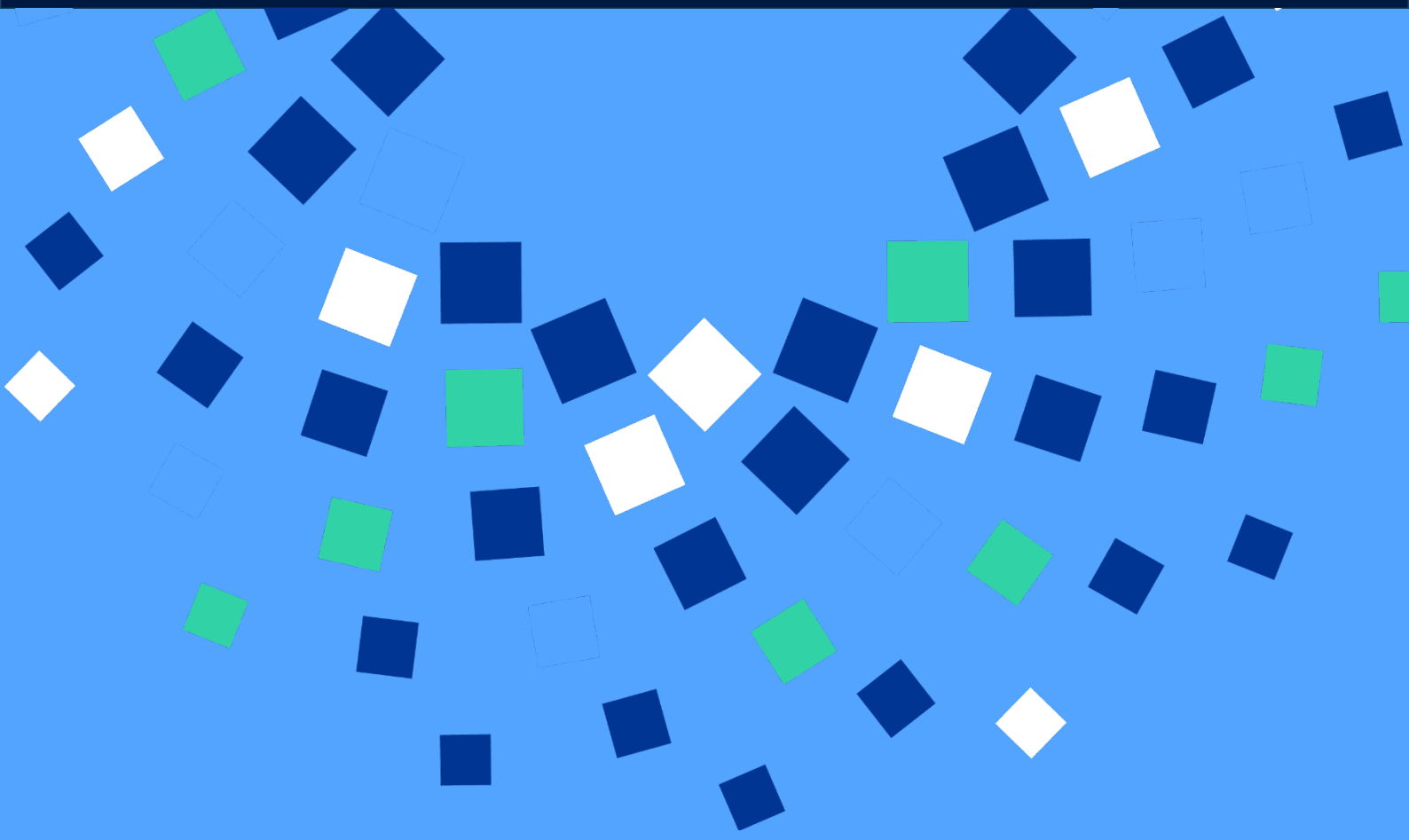
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Data Insight

Degree subjects of science teachers in Wales

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Introduction

Summary

Using linked administrative data from the School Workforce Annual Census (SWAC) and the Higher Education Statistics Agency (HESA), this Data Insight explores the degree backgrounds of recently qualified science teachers in Wales. In doing so, it assesses alignment between undergraduate degree subject specialism and teaching allocation. These patterns are also explored according to the sex of teachers, the education level they teach at, the language-medium they teach in, and the geography of their school.

Such analyses offer new evidence to inform discussions on subject expertise, workforce planning and equitable access to science education in Wales.

Background

Across the UK, concerns have been raised about persistent challenges in recruiting science teachers, particularly those with subject-specific expertise (1), and recent statistics have highlighted the scale of this challenge in Wales. As of 2024, fewer than 50% of secondary school teachers delivering science (37%), chemistry (49%) and physics (44%) in Wales were recorded as having completed a subject-specific teacher training route. While biology had comparatively higher levels of teachers with subject-specific training (57%), it was still below the levels observed in subjects such as English (75%) and maths (78%) (2). For physics, as of 2024, there were fewer physics-trained teachers in Wales (n=174) than secondary schools (n=205) (2,3). These figures raise important questions about subject expertise, curriculum delivery, and equitable access to specialist teaching.

However, defining a 'specialist' teacher is complex and contested. Existing statistics, including the above, typically rely on teachers' initial teacher training route (for example a biology Postgraduate Certificate in Education (PGCE)). However, this approach does not capture prior academic background, whether that be A-level, undergraduate or higher qualifications. A teacher may have trained via a general science teaching route but hold a bachelor's degree in biology. Conversely, they may have completed a biology PGCE but not hold a degree in biology.

This Data Insight takes a complementary perspective by examining teachers' undergraduate degree specialisms. School workforce records within administrative data allow us to identify teachers' subject responsibilities, the pupil age groups they teach, the language-medium they deliver through, and characteristics of the schools in which they work. When linked to higher education records, these data allow exploration of teachers' own qualifications and the alignment between degree subject and teaching allocation.

This Data Insight therefore provides an alternative lens on subject expertise within the science teaching workforce in Wales compared to existing official publications, such as Education Workforce Council statistics.

What we did

This research used the School Workforce Annual Census (SWAC) and the Higher Education Statistics Agency (HESA) data within the SAIL Databank.

SWAC was used to identify all qualified teachers delivering science, biology, chemistry, and physics in state-maintained secondary schools in Wales in 2021 (referred to herein as the 'science teaching workforce').

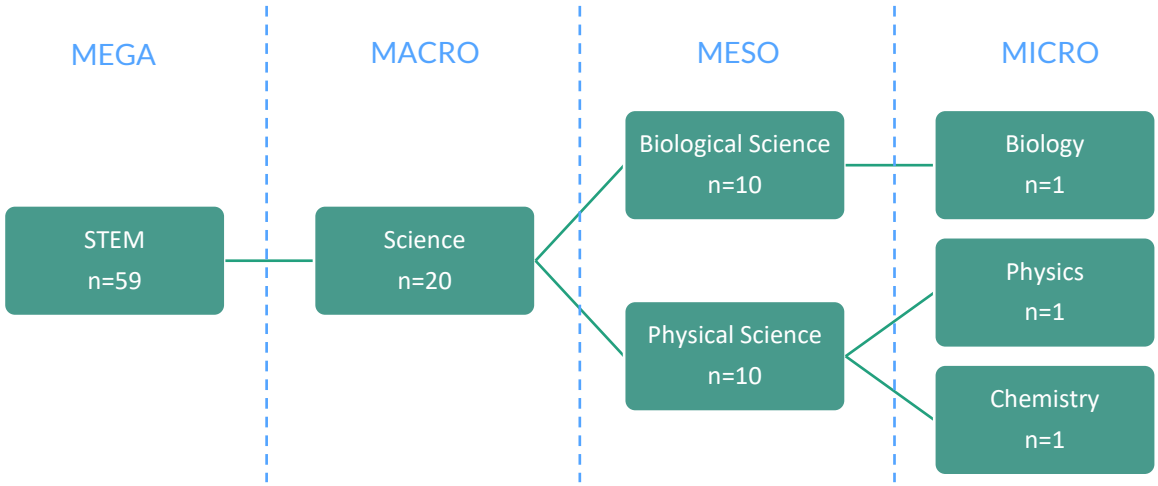
SWAC data were used to examine the distribution of the science teaching workforce by:

- Science subject taught (science, biology, chemistry, physics)
- Sex (male or female)
- Age group of pupils taught
- Language medium of teaching (English or bilingual/Welsh)
- School geography by local authority, classified using the Office for National Statistics' Rural Urban Classification system (4)

To explore degree backgrounds, SWAC records were linked to HESA data to identify teachers' undergraduate qualifications in addition to their PGCE or equivalent teaching qualification.

Degree subjects were classified using HESA subject codes and grouped into seven nested categories (see Figure 1), from broad STEM classifications to specific disciplines (e.g. a chemistry degree was counted within chemistry, physical science, science, and STEM). This hierarchy is structured across four levels; mega, macro, meso, and micro, and enabled analysis of both broad STEM alignment and subject-specific congruence. In Figure 1, 'n' corresponds to the number of individual HESA subject codes within each category, with full subject listings provided in Appendix 1.

Figure 1 – Degree disciplines of science teachers



Data linkage considerations

There are important implications to consider around HESA-SWAC data linkage. Specifically:

- HESA data were only available from the 2012/13 academic year onwards, therefore;
- Linkage was only feasible for teachers born in 1990 or later (who could have entered higher education from 2012/13).
- HESA coverage only includes individuals domiciled in Wales, or domiciled in England but who received some of their education in Wales.

As a result, linked teachers represent a young subset of the 2021 workforce and excludes those born and educated outside of Wales.

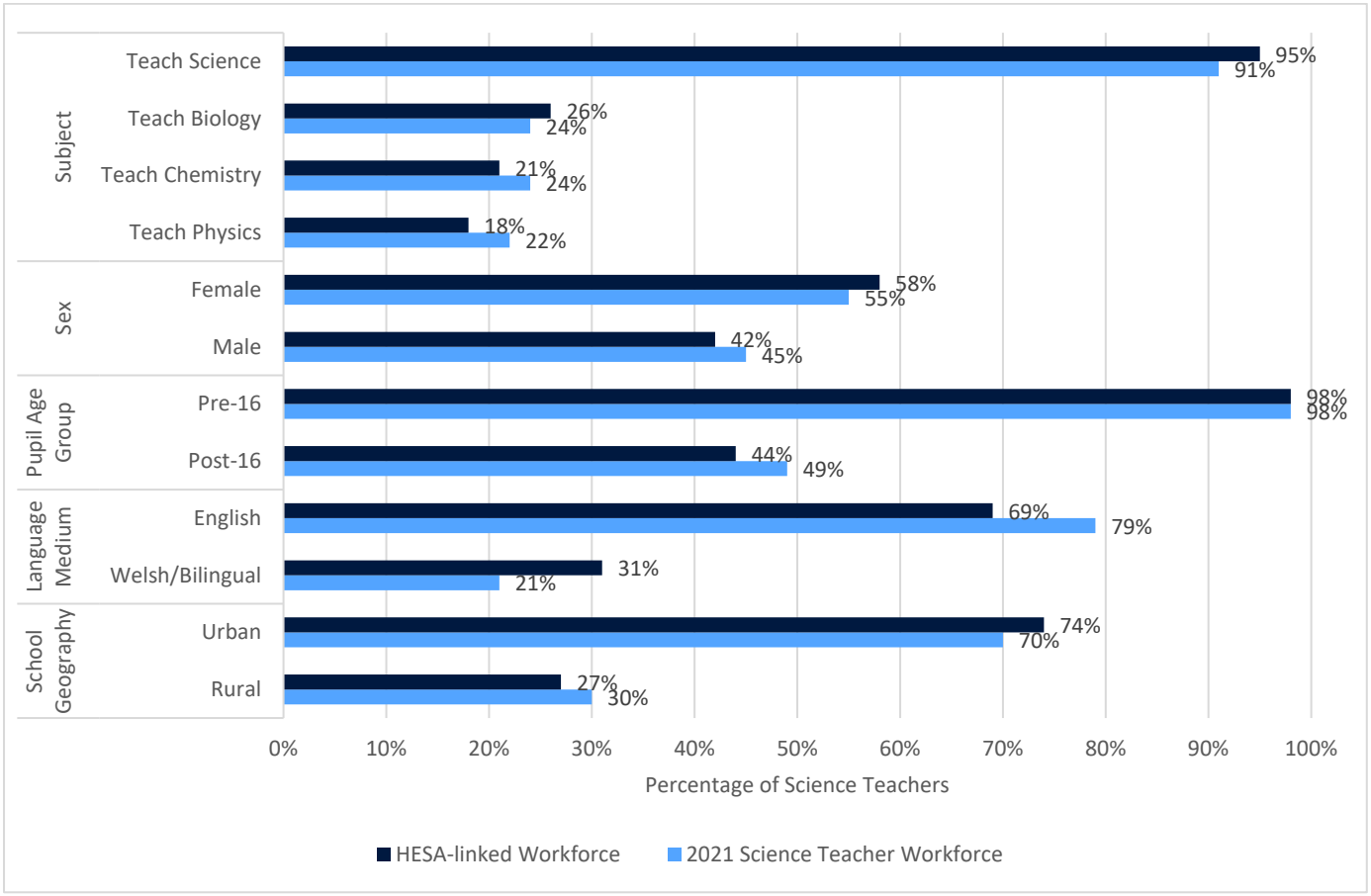
Nonetheless, in 2021, there were 1,820 qualified teachers in Wales delivering science subjects in state-maintained secondary schools. Of these, 355 were born in 1990 or later and 310 were successfully linked with HESA data. This corresponds to approximately 17% of the overall science teaching workforce and 87% of those born in or after 1990.

Of the linked sample of 310 science teachers:

- 58% were female, and 42% were male.
- 98% taught pupils aged 11-16 (pre-16) and 44% taught pupils aged 16-18 (post-16).
- 69% taught through the medium of English, and 31% taught through the medium of Welsh or bilingually.
- 74% taught in schools in urban locations, and 27% taught in rural locations.

To give a sense of how the representation of this subgroup of science teachers compares with the full science teacher workforce in 2021, the ratio of each demographic is illustrated in Figure 2. This comparison illustrates that while younger, this subgroup does not differ markedly from the full science teaching workforce in terms of broader characteristics. The exception being language medium whereby English-medium teachers are underrepresented in the HESA-linked subgroup compared to the full science teaching workforce and Welsh/bilingual teachers are overrepresented.

Figure 2 – Demographics of the HESA-SWAC linked science teacher workforce and the 2021 full science teacher workforce



What we found

Among the 310 linked science teachers:

- 95% taught science
- 26% taught biology
- 21% taught chemistry
- 18% taught physics

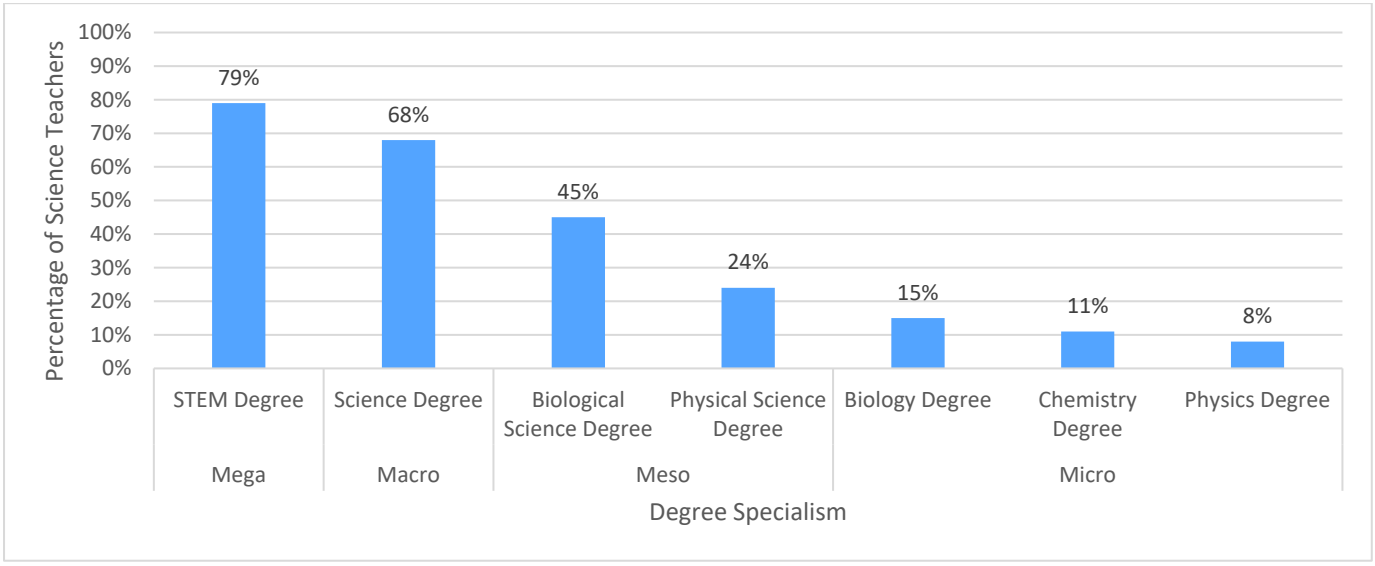
Many teachers taught multiple science subjects. While 48% taught a single science subject, 47% taught two science subjects, and 5% taught three or four science subjects. In addition, some teachers held more than one degree; 39% had one degree, 45% had two degrees, and 16% had three or more degrees. However, for simplicity, percentages are calculated as a proportion of teachers (n=310) rather than total qualifications.

Subject specialisms of science teachers

At the mega- and macro-levels, 79% of the 310 science teachers had a degree in a STEM discipline, and 68% held a degree in a science discipline. While both of these represent a majority, they also illustrate that approximately a fifth of teachers in this cohort do not possess a STEM degree, and nearly a third do not hold a science degree. While some of these teachers may have followed subject-specific teacher-training routes or hold relevant pre-university qualifications, undergraduate alignment with science teaching is not universal.

At the meso-level, it is apparent that biological science degrees were more prevalent among the 310 teachers (held by 45%) than physical science degrees (held by 24%). Similarly, at the micro-level, physics degrees were the least prevalent, held by just 8% of the 310 science teachers, equivalent to less than one in ten of the science teachers, compared to chemistry and biology degrees which were held by 11% and 15% of the 310 teachers respectively. These proportions are summarised in Figure 3.

Figure 3 – Degree qualifications for all science teachers who were linked to HESA data



When looking at the prevalence of STEM and science degrees among teachers delivering each biology, chemistry, or physics, different patterns emerged (see Figure 4). At the mega-level, STEM degrees were most

prevalent among physics teachers (held by 82%), followed by chemistry teachers (77%), and then biology teachers (75%). However, this pattern reversed at the macro-level where the greatest proportion of science degrees were held by biology teachers (75%), followed by chemistry teachers (69%), and then physics teachers (64%).

Looking at subject congruence at the meso- and micro-levels, we see that:

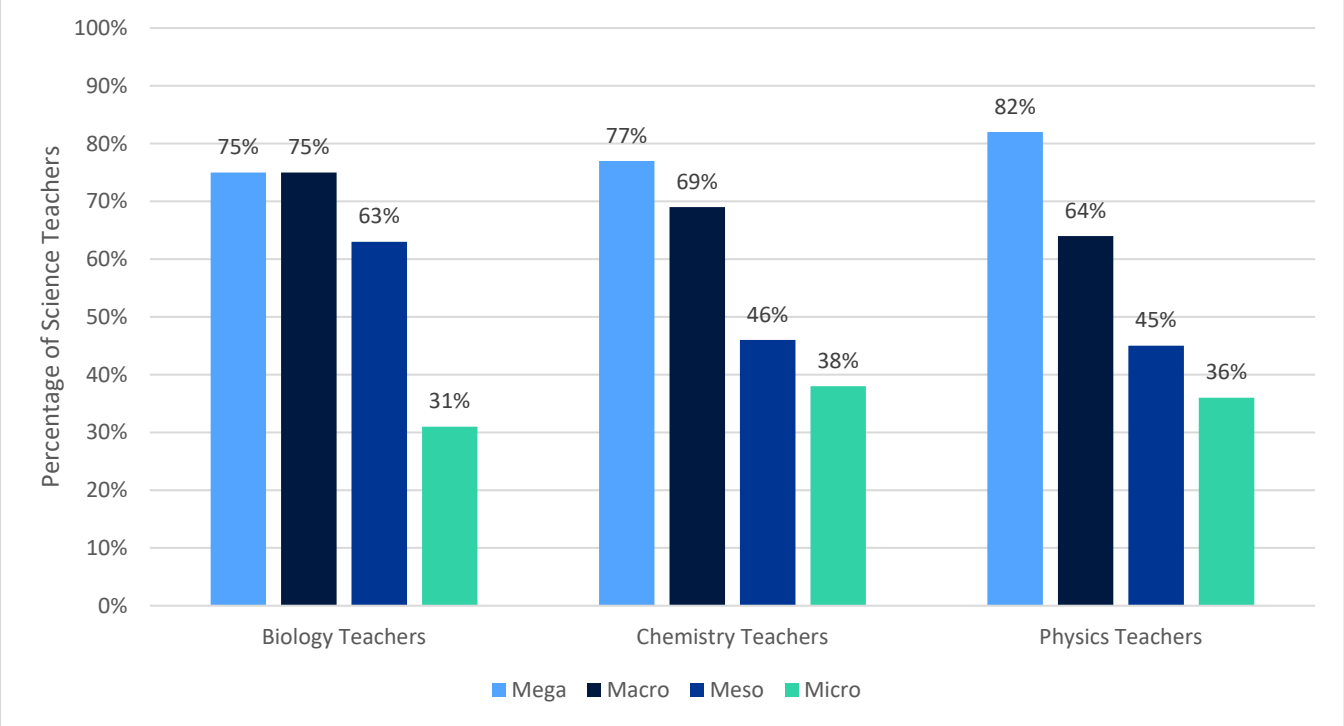
- 63% of biology teachers held a biological science degree
    - 31% of biology teachers held a biology degree
- 46% of chemistry teachers held a physical science degree
    - 38% of chemistry teachers held a chemistry degree
- 45% of physics teachers held a physical science degree
    - 36% of physics teachers held a physics degree

Thus, while physics had the greatest proportion of teachers with degrees at the mega-level (STEM degree), it had the lowest proportion of teachers with degrees at the macro- (science degree) and meso-levels (physical science degree).

Conversely, while biology teachers had the smallest proportion of degrees at the mega-level (STEM degree) and micro-level (biology degree), they held the highest proportion of degrees at the macro- (science) and meso-level (biological science).

While chemistry middled across mega-, macro- and meso-levels, it had the highest proportion of subject congruence at the micro-level (chemistry degree). These proportions are summarised in Figure 4.

Figure 4 – Degree qualifications for biology, chemistry and physics teachers who were linked to HESA data



Subject specialisms of science teachers by sex

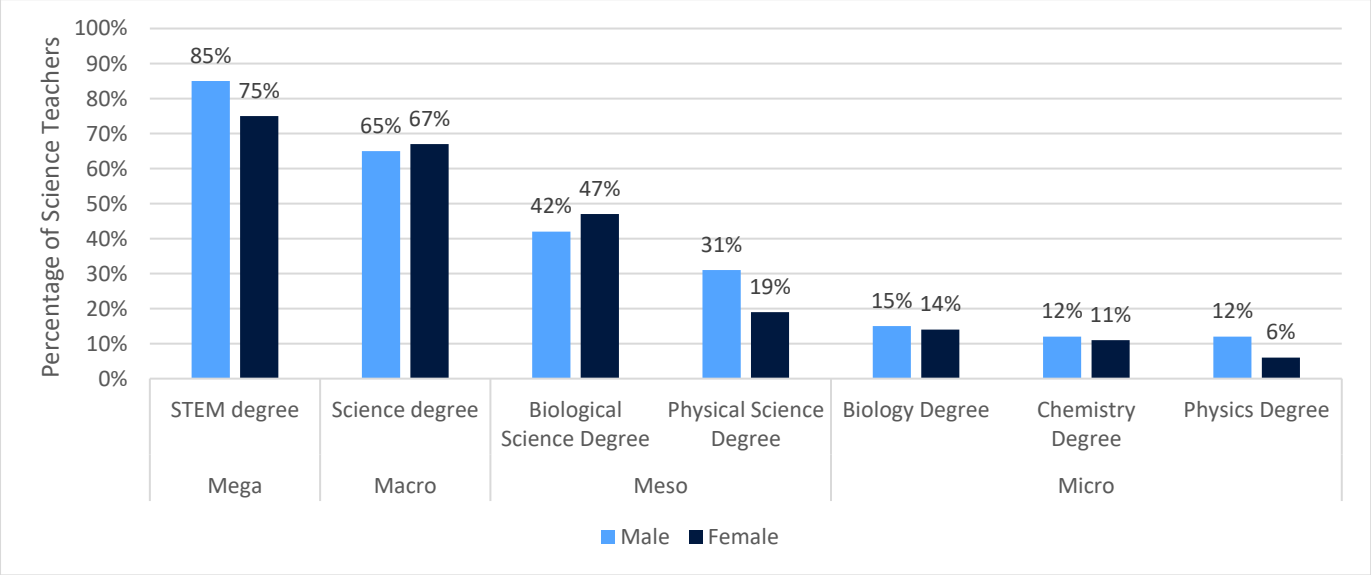
When exploring degree specialisms among science teachers according to sex, some key differences emerged. While at the macro-level, proportions of science teachers with science degrees were comparable by sex (held by 67% of females, versus 65% of males), discrete differences were seen at the mega-, meso-, and micro-levels.

At the mega-level, proportionately more male teachers than female teachers held STEM degrees (85% versus 75%). This could explain why STEM degrees were most prevalent across physics teachers (shown above), as the majority of the physics teacher workforce in Wales is male.

At the meso-level, while proportionately more male than female science teachers held physical science degrees (31% versus 19%), they had proportionately less biological science degrees (42% versus 47%).

At the micro-level, prevalence of biology and chemistry degrees were roughly comparable, however physics degrees were held by just 6% of female science teachers compared to 12% of male science teachers. These patterns are illustrated in Figure 5.

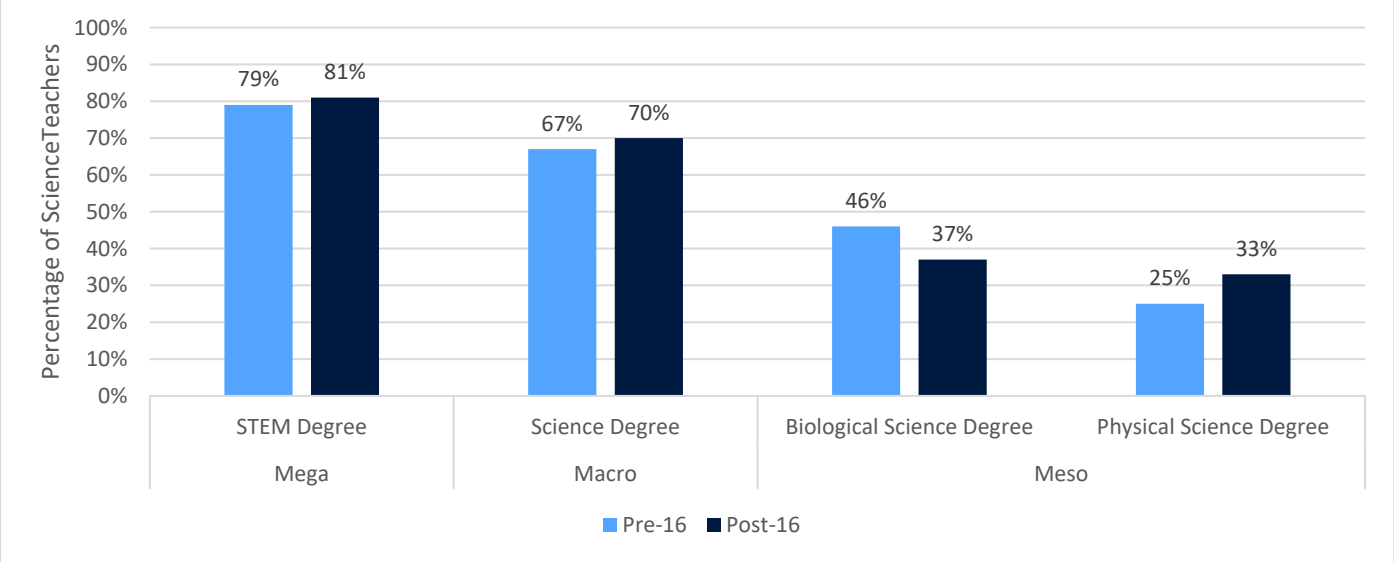
Figure 5 – Degree qualifications of science teachers by sex



Subject specialisms of science teachers by pupil age group

In terms of the degree specialisms across the age groups who science teachers deliver to, divergent patterns were evident, as illustrated in Figure 6. While STEM (mega-level), science (macro-level), and physical science (meso-level) degrees were consistently more prevalent in science teachers who taught at post-16 level than those at pre-16 level, the reverse was true for biological science degrees (meso-level), which were more prevalent among pre-16 science teachers.

Figure 6 – Degree qualifications of science teachers by pupil age group



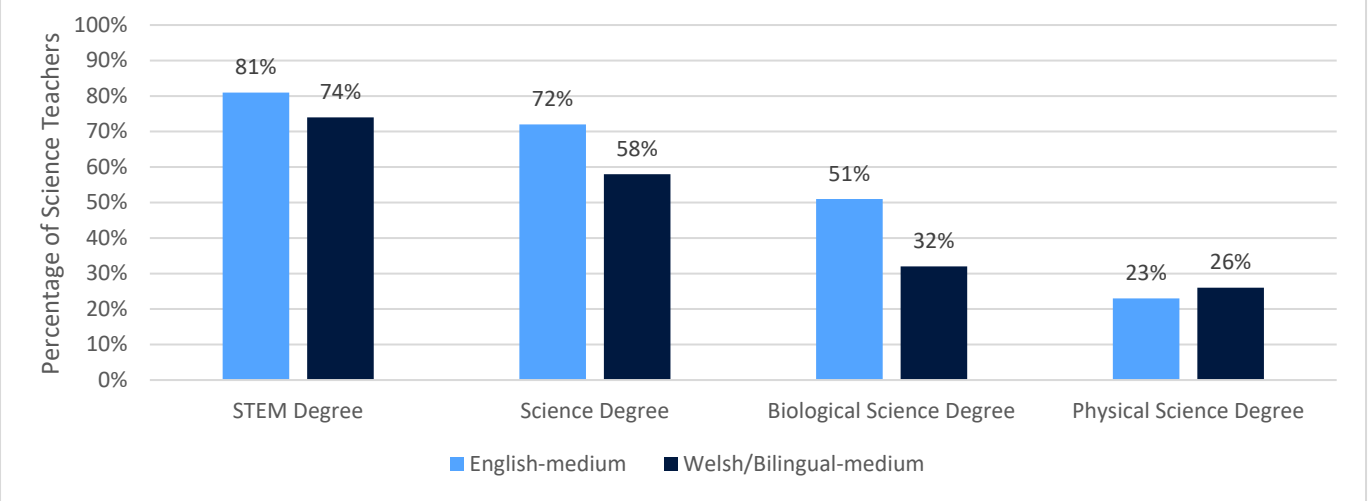
Subject specialisms of science teachers by language medium

The proportion of science teachers with specialist degrees also varied between teachers who delivered their subject through the medium of English versus those who delivered in Welsh/bilingually.

These differences were particularly pronounced in terms of science and biological science degrees. Science degrees were held by 72% of English-medium science teachers, compared to just 58% of Welsh/bilingual teachers. For biological science degrees, these were held by 51% of English-medium science teachers, compared to just 32% of bilingual/Welsh-medium science teachers. For physical science degrees, the pattern reversed, although much less severe. These degrees were held by 23% of English-medium science teachers, compared to 26% of bilingual/Welsh-medium science teachers.

These comparisons are summarised in Figure 7. Specialism by degrees at the micro level (biology, chemistry, physics) could not be explored due to insufficient sample size.

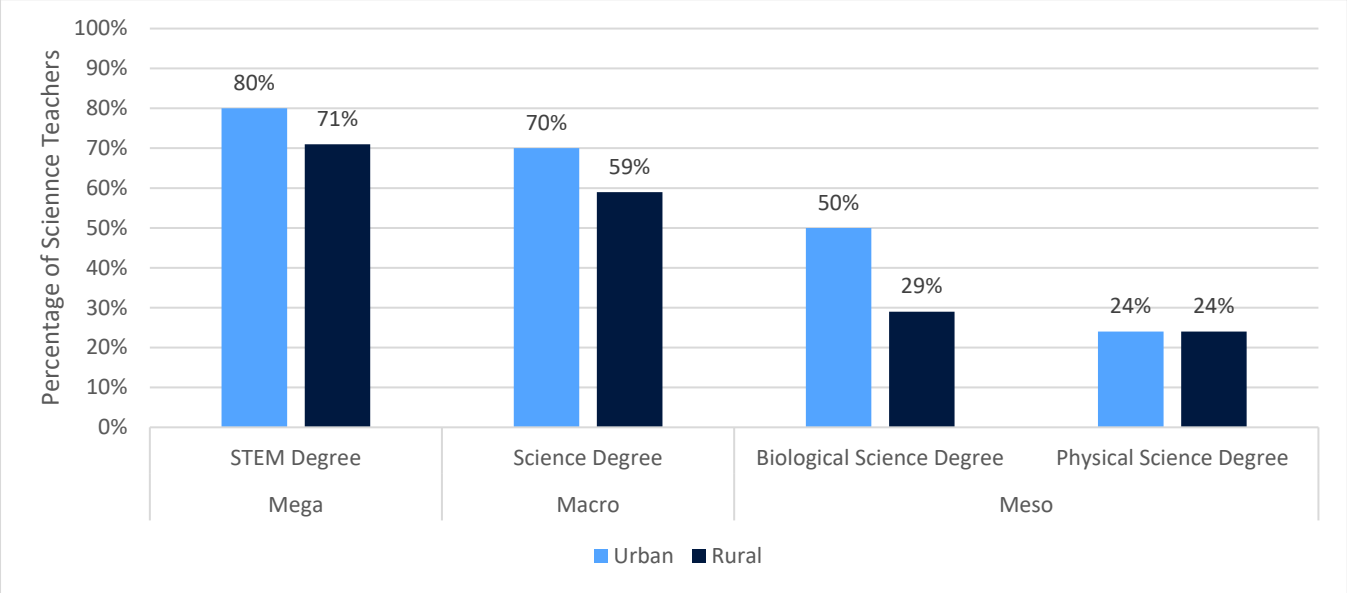
Figure 7 – Degree qualifications of science teachers by language medium



Subject specialisms of science teachers by school geography

Degree specialism according to the geography of a school, whether a rural or urban local authority, indicates that proportionately more science teachers in urban areas held specialist degrees at the mega, macro, and meso-levels. The exception was physical science degrees, which were held by 24% of both urban and rural science teachers. The starkest difference was seen for biological science degrees. While these were held by 50% of the urban science teacher workforce, they were held by just 29% of the rural science teacher workforce. These comparisons are illustrated in Figure 8.

Figure 8 – Degree qualifications of science teachers by school geography



The prevalence of degree specialisms among rural versus urban science teachers reflects a similar pattern to that of English- and bilingual/Welsh-medium science teachers (Figure 7). Given that a greater proportion of bilingual/Welsh schools are in rural areas (5), these patterns are not surprising and are likely interrelated.

Why it matters

This analysis provides new insight into the academic backgrounds of the more recently qualified science teaching workforce in Wales.

The prevalence of biological and physical science degrees among the science teacher workforce mirrors the broader population of university graduates both in terms of overall subject popularity and difference by gender (6). While most science teachers hold a STEM degree, specialist degree congruence ranged from 31-38% at the micro-level, and 45-63% at the meso-level for biology, chemistry, and physics teachers. If newer science teacher entrants continue to show relatively low alignment with their subject, this may reinforce existing recruitment pressures and constrain subject expertise within schools. In turn this could have implications for confidence and quality of curriculum delivery, particularly in post-compulsory education.

The lesser prevalence of physical science degrees and greater prevalence of biological science degree among female science teachers could also be exacerbating the perception that physics is a 'masculine' subject (7). Indeed, pupils are unlikely to continue in subjects that they don't perceive to be 'for them'. As such, not being taught by someone of the same sex could contribute to a misalignment of identity with physics among females, and subsequently discourage them from continued participation.

The finding that a smaller proportion of Welsh/bilingual-medium science teachers hold science or biological science degrees than their English-medium peers may reflect narrower recruitment pools that is known to be a particular challenge in Welsh and bilingual schools (8). In the context of Welsh Government ambitions for expanding Welsh-medium education (9), ensuring access to subject-specialist teachers is particularly important (10).

While the findings reported here should be interpreted cautiously given that the linked sample reflects a younger cohort of teachers, and misses those in the workforce who grew up and were educated outside of Wales, this may also be viewed as indicative of the direction of travel for the workforce.

What next?

Maintaining a sufficiently sized, well-qualified and equitably distributed science teaching workforce is critical in an increasingly science- and technology-driven society. This Data Insight provides a snapshot of degree specialism among more recently qualified science teachers. Future research will focus on broader prior academic background of teachers, including A-level subject qualifications, and extend into the specialism in other subjects beyond the sciences. Research will also involve tracking the science teaching workforce over time, and examine potential links between teacher degree alignment and pupil subject choice and attainment.

By continuing to use linked administrative data, ADR Wales can strengthen the evidence base for science workforce planning and support equitable access to high-quality science education across Wales.

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Appendix 1 – Full list of degree classifications

Degree classifications	Number of degrees within classification	Degrees within classification
Physics Degree	1	Physics
Chemistry Degree	1	Chemistry
Biology Degree	1	Biology
Physical Science Degree	10	Chemistry Materials science Physics Archaeology as a physical science Astronomy Geology Oceanography Geography studies as a science Environmental science & other physical sciences Balanced combination of physical science subjects
Biological Science Degree	10	Biology Botany Zoology Genetics Microbiology Molecular biology & biophysics Biochemistry Psychology (not solely as social science) Other biological sciences Balanced combination of biological science subjects
Science Degree	20	All Physical Science subjects All Biological Science subjects
STEM Degrees	59	All Physical Science subjects All Biological Science subjects Pre-clinical medicine Pre-clinical dentistry Clinical medicine Clinical dentistry Balanced combination of medicine & dentistry Anatomy & physiology Pharmacology Pharmacy Nutrition Ophthalmics Audiology Nursing Medical Technology

		Other medical subjects Balanced combination of subjects allied to medicine Veterinary sciences Mathematics Statistics Other mathematical science Balanced combination of mathematical sciences Computing science General engineering Civil engineering Mechanical engineering Aeronautical engineering Electrical engineering Electronic engineering Production engineering Chemical engineering Other engineering Balanced combination of engineering subjects Minerals technology Metallurgy Ceramics & glasses Polymers & textiles Other materials technology Maritime technology Biotechnology Other technologies

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This Data Insight has been produced by the ADR Wales Education research team. It provides a snapshot of informative research currently underway at ADR Wales but is not intended to provide a complete picture of work undertaken within this field or the ADR Wales programme of work. The information presented in this Data Insight has been reviewed by ADR Wales colleagues with expertise within this thematic area and accepted to be accurate at the point of publication. Views expressed in this Data Insight are those of the researchers and not necessarily those of ADR Wales partner organisations.

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