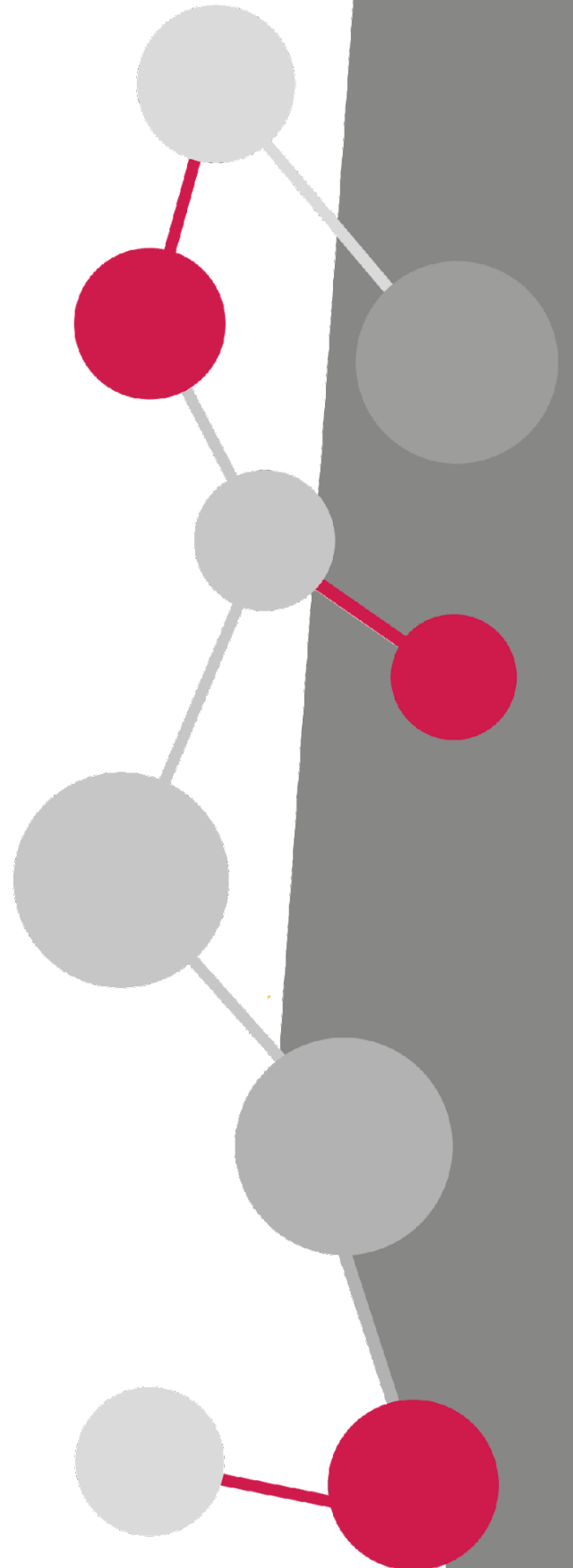


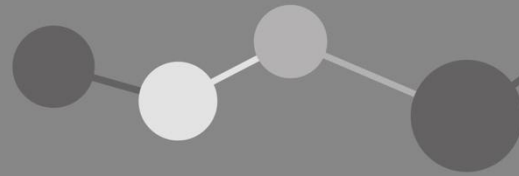


The Impact of STEM Learning Science CPD:

An analysis of teacher
retention

June 2023





Executive Summary

The recruitment and retention of high-quality teachers of science is an ongoing challenge in England, with around half of science teachers leaving the profession within five years of qualifying. When coupled with difficulties in recruiting specialist teachers in physics and an increasing number of school aged children, the problem is likely to continue into the future. One way to support retention is by ensuring teachers are able to engage with high quality, subject-specific continuing professional development (CPD).

As the largest provider of science, technology, engineering and maths (STEM) education support to schools in the UK, STEM Learning is helping to address this challenge through its CPD provision, which has previously been shown to improve the likelihood of a teacher being retained within the profession¹.

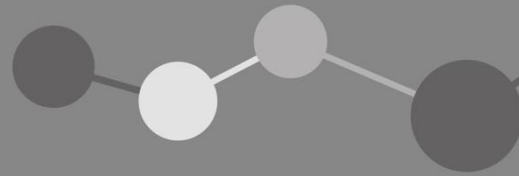
The current work explores whether engagement with STEM Learning's science CPD is associated with an increased likelihood of remaining in the profession.

The results show that:

- The odds of a science teacher remaining within the profession the year after engaging with CPD are around **155% higher when compared to a non-engaged counterpart**.
- Early Career Teachers are around **151% more likely to remain in the profession** when compared to a non-engaged counterpart.

Teachers engaged
with STEM Learning
science CPD are
155% more likely
to remain in the
profession

¹ [Improving Science Teacher Retention](#), Wellcome Trust and Education Datalab, 2017.



Introduction

The teacher workforce in England

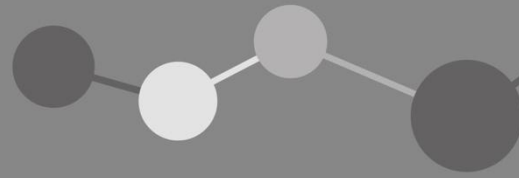
England faces a number of significant challenges in order to maintain a high quality teacher workforce of sufficient size. The current UK workforce is one of the youngest within the OECD (1); almost one in three primary teachers and one in five secondary teachers are under thirty years old. This shows the high rate of teacher turnover and challenges in retaining qualified teachers within the profession.

There is a high likelihood that early career teachers in England will leave the profession. Previous research showed that 13% of early career teachers leave teaching within a year and 31% in their first five years (2). The reasons for teachers leaving the profession are variable but include factors such as their working environment in addition to pay (3). Retaining teachers within the profession is important for a number of reasons, with teaching experience being linked with positive student performance and behaviour, and research showing that teachers reach 'peak performance' within their first three to five years (4).

When it comes to STEM subjects, the issue of teachers leaving the profession in the first few years following qualification is greater. The retention rate for science and mathematics teachers is lower than for the profession as a whole: 16% of teachers leave within their first year, and 53% within their first five years (2). While the economic uncertainty caused by the COVID-19 pandemic saw a decrease in the number of teachers leaving the profession in 2020, this number rose again in 2021 (5).

Meeting the demand: Teacher recruitment

The Department for Education (DfE) sets annual recruitment targets for the number of initial teacher training entrants. Figures for 2022/23 show the recruitment target for primary teachers was almost met (93% of target recruited), but the target for secondary teachers was missed by a significant margin (52% of target recruited). Recruitment is a particularly acute problem in STEM subjects, with just 54% of the target number of teachers being successfully recruited. While the target numbers were close to being achieved in biology (85%) and chemistry (86%), this was not the case in physics (17%). In mathematics the target was almost met (95%) but computer science (30%) and design and technology (25%) also fell far short of the intended recruitment numbers (6). This has been



an ongoing issue, as failure to meet recruitment targets has been a pattern evident for years; for example, in 2017/18 only 66% of physics teachers were recruited. While there was an increase in applications for initial teacher training during the COVID-19 pandemic, the number of applications as of summer 2022 is lower than in any of the preceding five academic years (5).

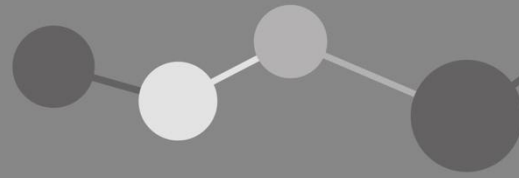
Various policies have been implemented over the years in an attempt to improve recruitment and increase retention. Most recently, the Teacher Student Loan Reimbursement scheme attempted to address shortfalls seen in specific local authorities by allowing eligible teachers to reclaim student loan repayments, however the success of these schemes has been mixed. In the case of this scheme, there was evidence of a difference in leaving rates seen between teachers in receipt of repayments compared to similar teachers not in receipt, however this was found not to be significant (7).

In addition to the challenges seen in both teacher recruitment and retention, there is an increase in the population of secondary school aged children. By 2025, there will be 15% more students in secondary schools than in 2018 (8). This further highlights why it is important to retain teachers within the profession, as well as recruiting more.

The importance of high quality professional development

One proven way to improve outcomes, both for teachers and their students, is through participation in high quality, subject-specific continuing professional development (CPD). There is strong evidence that subject-specific CPD is more effective than non subject-specific CPD when it comes to raising student attainment (9). Additional evidence to show the importance of ensuring access to CPD was gathered as part of the The House of Lords Science and Technology Committee inquiry into people and skills in UK STEM (10), and as part of the Royal Society's report on science education (11). Evidence from a study by the Education Policy Institute also highlights that in addition to improving student outcomes, engagement with high quality CPD leads to impacts on teacher wellbeing, motivation and ultimately, their likelihood of remaining within the profession (12).

The CPD offered by STEM Learning has been found to improve teachers' enthusiasm and confidence in teaching STEM subjects, along with their quality of teaching (13). It has also been shown to have an impact on retention: an independent analysis undertaken by FFT Education Datalab showed that secondary school teachers who attend CPD delivered by



STEM Learning were around 160% more likely to still be teaching in the following academic year when compared to non-engaged teachers who share similar traits ([14](#)).

Rates of Teacher Retention

STEM Learning has undertaken an analysis of the trends in teacher retention nationally between 2016 and 2021, and replicated the retention analysis carried out by FFT Education Datalab. The analysis was replicated using updated engagement data and teacher records to explore whether the CPD offered by STEM Learning continues to support teacher retention. The results of this analysis are summarised in this report.

Trends in teacher retention

In order to gain a better understanding of the current landscape concerning teacher retention, this analysis first looked at how teacher retention has changed over time. Data from the School Workforce Census (SWC)² was used to examine what proportion of teachers present in the dataset were still in the profession one year later. For example, 88.3% of primary teachers in the 2016/17 SWC were still in the profession 1-year later.

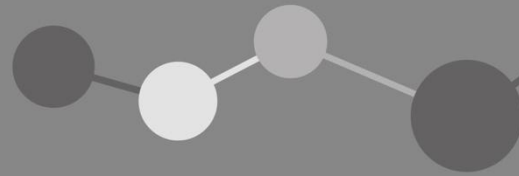
Table 1 shows the 1-year retention rate across the profession as a whole has slightly increased year-on-year between 2016/17 and 2019/20, with a particularly pronounced increase in 2019/20, possibly due to the economic uncertainty of the COVID-19 pandemic.

Primary school teachers (averaging 89.6% across the four years) are slightly more likely to remain within the profession than secondary teachers (88.5%). The results of this analysis are presented in table 1 below.

	2016/17	2017/18	2018/19	2019/20
Primary	88%	89%	90%	92%
Secondary	87%	88%	89%	91%

Table 1. Proportion of all teachers working in English state schools recorded in the School Workforce Census who also appear in the following academic year, split by Primary and Secondary.

² The [School Workforce Census](#) collects information from schools and local authorities on the school workforce in state-funded schools in England. Independent schools, non-maintained special schools, sixth-form colleges and further education establishments are not included. The data includes information on teaching and support staff, their characteristics, teacher retention and pay, qualifications and details of the subjects taught in secondary schools.



In addition, the retention of Early Career Teachers was also explored. This showed that teachers in their first year of teaching after gaining Qualified Teacher Status are more likely to leave the profession compared to the rest of the teaching population as a whole, both for primary and secondary teachers. Similarly to the analysis of all teachers, 1-year retention rates have improved slightly over time. The results of this analysis are shown in Table 2.

	2016/17	2017/18	2018/19	2019/20
Primary	85%	85%	86%	89%
Secondary	82%	82%	83%	87%

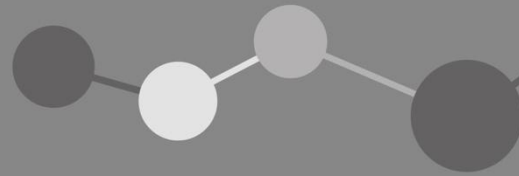
Table 2. Proportion of all teachers recently awarded QTS working in English state schools recorded in the School Workforce Census who also appear the following academic year, split by Primary and Secondary.

Trends in science teacher retention

A similar methodology was used to explore the 1-year retention rates of secondary science teachers and early career secondary science teachers. This analysis showed that the 1-year retention rate of secondary science teachers is around 12 percentage points (ppt) lower than the retention rate of the profession as a whole. Additionally, the rate of early career science teachers is around 11 ppt lower than for science teachers as a whole. These results are shown in Table 3 below.

	2016/17	2017/18	2018/19	2019/20
All secondary science teachers	74%	76%	77%	78%
Early career secondary science teachers	72%	73%	71%	72%

Table 3. Proportion of all secondary science teachers working in English state schools as recorded in the School Workforce Census who also appear in the following academic year. The second row shows the proportion of secondary science teachers who were awarded QTS within 1 year who are still in the profession



Rates of Teacher Retention for CPD participants

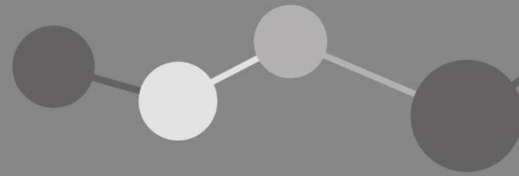
Science is clearly a challenging area when it comes to teacher retention as highlighted by the data shown above. STEM Learning science CPD aims to support teachers to develop their teaching and learning, reduce their workload and improve student outcomes. Previous work has shown a relationship between engagement with STEM Learning CPD and remaining in the profession (14). The following analyses utilises a similar methodology with updated CPD engagement and SWC data to explore this relationship again.

Over 8,100 secondary science teachers who engaged with science CPD offered by STEM Learning between the 2016/17 and 2019/20 academic years were matched to similar non-engaged teachers in the SWC on a number of characteristics (see [Appendix](#) for full details). This allows a comparison of two distinct groups of teachers (engaged vs. non-engaged) and minimises the chances that an effect is due to a difference in the characteristic makeup of the two groups. For example, if the engaged group of teachers was significantly younger, received higher salaries and worked less hours per week compared to the non-engaged group, these characteristics may influence their choice to remain in or leave the profession. The statistical matching process ensures that the two groups are as close as possible on their characteristics and the key difference between the groups is whether the teacher has engaged with STEM Learning science CPD or not.

Engaged with STEM Learning science CPD	Proportion of teachers who remain in the profession 1 year later	Proportion of teachers who have left the profession 1 year later	Odds of a teacher remaining in the profession 1 year later	Odds Ratio
Yes	89%	11%	8.09	2.55
No	76%	24%	3.17	

Table 4: The proportion, odds and odd ratio of engaged and non-engaged teachers still being in the teaching profession in the following academic year.

As with the analyses above, the 1-year retention rates for engaged and non-engaged teachers were explored and presented in Table 4. The odds of an engaged and non-engaged teacher remaining within the profession is also shown. For engaged teachers, odds of ~8 show that for every one engaged teacher who left the profession, eight did not.



For non-engaged teachers, odds of ~3 show that for every one teacher who left the profession, three did not.

The odds ratio³ allows for a comparison of the odds that the intervention (in this case, engagement with CPD) affects the outcome (in this case, whether a teacher remains in the profession). Table 4 shows an odds ratio of 2.55, meaning that **teachers engaged with STEM Learning science CPD are 155% more likely to remain in the profession 1 year later compared to similar, non-engaged counterparts.**

Retention of early career teachers who engaged with STEM Learning’s CPD support

Following the analysis of all secondary science teachers who engaged with STEM Learning’s CPD, a further analysis was completed which looked specifically at teachers who had been awarded Qualified Teacher Status (QTS) in the preceding academic year.

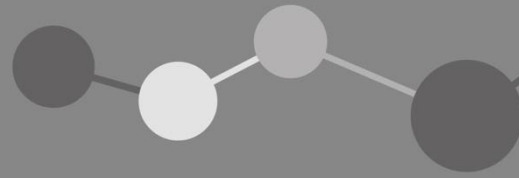
Over 1,900 teachers who were recently awarded QTS in the preceding academic year and had engaged with STEM Learning CPD were matched with similar non-engaged counterparts. The odds of an engaged and non-engaged teacher remaining within the profession is shown in Table 5. For engaged teachers, odds of ~6 show that for every one engaged teacher who left the profession, six did not. For non-engaged teachers, odds of ~2 show that for every one teacher who left the profession, two did not.

The odds ratio comparing engaged and non-engaged early career teachers is 2.51, showing that **early career teachers engaged with STEM Learning science CPD are 151% more likely to remain in the profession than a matched, non-engaged counterpart.**

Engaged with STEM Learning science CPD	Proportion of teachers who remain in the profession	Proportion of teachers who have left the profession	Odds of a teacher remaining	Odds Ratio
Yes	86%	14%	6.14	2.51
No	71%	29%	2.45	

Table 5: The proportion and odds of engaged and non-engaged early career teachers still being in the teaching profession in the following academic year.

³ More detailed explanations of probabilities, odds and odds ratios can be found in the [Appendix](#).



Discussion

The analysis above shows that 1-year retention rates for teachers have remained relatively stable from 2016/17 through to 2018/19, followed by a 3-4 ppt increase in 2019/20, potentially caused by the economic uncertainty of the COVID-19 pandemic and the relative stability and security of teaching as a career. The data also show how retention rates for secondary teachers are 2-3 ppt lower than primary teachers.

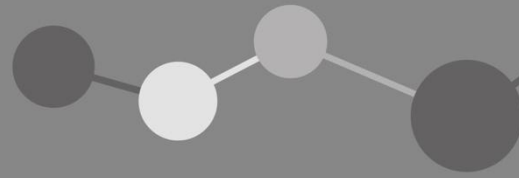
Further analysis shows that science teachers (~12 ppt lower) and early career science teachers (~11 ppt lower) have lower retention rates than all teachers, showing that science is a particularly challenging area for retaining teachers.

High quality teacher CPD has been shown to positively affect teacher wellbeing, motivation and ultimately, their likelihood of remaining within the profession ([12](#)), and engagement with STEM Learning science CPD has previously been shown to have a positive relationship with engaged teachers more likely to remain in the profession ([14](#)).

The current work also explores the 1-year retention rate of secondary science teachers engaged with STEM Learning's science CPD and similar non-engaged teachers. The results show that **teachers engaged with STEM Learning science CPD are 155% more likely to remain in the profession than a matched, non-engaged counterpart.**

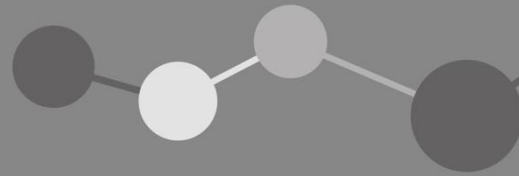
Further analysis shows that **early career teachers engaged with STEM Learning science CPD are 151% more likely to remain in the profession than a matched, non-engaged counterpart.**

The matched comparison methodology aims to minimise the effects of confounding variables (such as age, geographic location, salary) on retention, however there will also be factors that are not controlled for during this process - for example, a recent survey from the Royal Society of Chemistry shows that the main reasons science teachers leave the profession are stress, workload and work/life balance ([15](#)). Whilst the current work shows a relationship between engagement with high-quality professional development and the odds of remaining in the profession, it does not show causality. Nevertheless, with the above evidence showing the impacts high-quality CPD can have on teachers, it would not be unreasonable to suggest that engagement with CPD may have an indirect causal effect



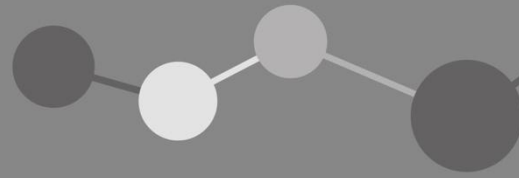
on teacher retention by supporting improved wellbeing and motivation, and reduced workload - factors identified as significant in teachers' decisions to leave or remain.

STEM Learning is committed to evaluating the quality and impact of CPD, and better understanding and evidencing how CPD influences teacher retention. By increasing the number of motivated and experienced science teachers, STEM Learning aims to improve outcomes and ensure a world-leading STEM education for all young people.



References

1. OECD (2019). Education at a Glance 2019: OECD Indicators, OECD Publishing, Paris. [Link](#)
2. Worth, J. and De Lazzari, G. (2017). Teacher Retention and Turnover Research. Research Update 1: Teacher Retention by Subject. Slough: NFER. [Link](#)
3. Burge, P., Lu, H. and Phillips, W. (2021). Understanding Teacher Retention. RAND Europe. [Link](#)
4. Watson, P. (2013). Most teachers reach a performance plateau within a few years. Montrose Public Affairs Consultants Ltd. [Link](#)
5. Zuccollo, J. (2022). The Teaching workforce after the pandemic. Education Policy Institute. [Link](#)
6. Department for Education. (2022). Initial Teacher Training Census, Academic year 2022/23. [Link](#)
7. Higton, J., Spong, S. and Hansel, M. (2023). Teacher student loan reimbursement scheme: final evaluation report. [Link](#)
8. Department for Education. (2019). Teacher Recruitment and Retention Strategy. [Link](#)
9. Coe, R. (2020). The Case for Subject-Specific CPD. Institute of Physics. [Link](#)
10. The House of Lords Science and Technology Committee inquiry into people and skills in UK STEM-December 2022. [Link](#)
11. The Royal Society report on Science education for a research and innovation economy. [Link](#)
12. Van Den Brande, J. and Zuccollo, J. (2021). The effects of high-quality professional development on teachers and students: a cost-benefit analysis. [Link](#)
13. STEM Learning. (2022). Impact 2022. [Link](#)
14. Allen, R. and Sims, S. (2017). Improving Science Teacher Retention: do National STEM Learning Network professional development courses keep science teachers in the classroom? [Link](#)
15. Royal Society of Chemistry (2023). The Science Teaching Survey 2022. [Link](#)



Appendix 1: Methodology

The School Workforce Census

This analysis utilised data from the Department for Education's School Workforce Census (SWC). This is a comprehensive dataset on almost all teachers working in English state schools which has been collected on an annual basis during the autumn term since 2010. It contains demographic, employment, curriculum and qualification data on these teachers.

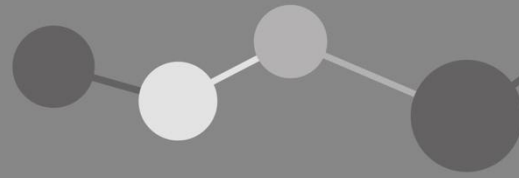
STEM Learning provided the Department for Education with an extract of data covering individual teacher engagement with STEM Learning's CPD between the 2016/17 and 2020/21 academic years. The extract showed whether a teacher had engaged with CPD support provided through either the National STEM Learning Centre, the network of Science Learning Partnerships or STEM Learning's online CPD in a particular academic year. The records STEM Learning provided were matched to the SWC and made available to STEM Learning's accredited researchers through the ONS Secure Research Service.

Analysis of retention across the profession

The School Workforce Census contract dataset was used to examine retention across the profession, regardless of whether the teacher has engaged with support offered by STEM Learning. The dataset was analysed by comparing whether a teacher present in the 2016/17 SWC was still present in the SWC records for the 2017/18 academic year. This analysis was repeated for subsequent years, and also independently for all teachers who work in a primary school, then for all who teach in a secondary school. In both cases, teachers who worked in other phases such as all-through schools or a middle deemed primary school were discounted.

Analysis of retention of Early Career Teachers

The methodology above was expanded in order to examine the retention of teachers who are new to the profession. The contract dataset also contains a column which shows the date that a teacher was awarded Qualified Teacher Status (QTS). Only teachers who were awarded QTS in the preceding academic year were retained, and the steps above repeated.



Analysis of science teacher retention at a secondary level

In addition to the contract dataset, the SWC Curriculum dataset was used to examine retention of science teachers. This dataset contains information on how much time secondary school teachers spend teaching individual subjects to specific year groups in given census years. This dataset was filtered to retain only teachers who taught science for at least one hour per week. The subjects considered science were:

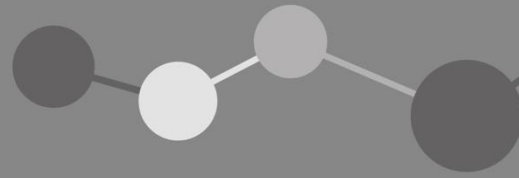
- Biology / Botany / Zoology / Ecology
- Chemistry
- Physics
- Science
- Combined/General Science – Biology
- Combined/General Science – Chemistry
- Combined/General Science – Physics
- Other sciences

Once this filtered list was created and deduplicated, it was matched to the contract dataset and analysed in the same way as outlined above to produce figures for the proportion of all science teachers and early career science teachers who remain in the profession.

Retention of teachers who engaged with STEM Learning CPD compared to non-engaged teachers and retention of early career teachers who engaged with STEM Learning CPD

Science teachers who engaged with STEM Learning's CPD were matched to non-engaged teachers who shared similar traits. Following removal of non-science teachers using the same filtering outlined above, a dataset was produced containing approximately 8,100 unique secondary science teachers who engaged with STEM Learning's CPD between the 2016/17 and the 2019/20 academic years. Where teachers engaged multiple times, only their first engagement was included within this dataset.

There are a wide range of additional factors which may lead to teachers leaving the profession. Where possible, these factors were controlled for by matching engaged teachers with a non-engaged counterpart with whom they share similar traits.



Matching variables

The SWC has information about teachers who work in schools in England. Some of these relate to the individual, while others relate to the school they work in. The table below shows the SWC reference used, alongside an explanation in parentheses where needed.

Age (years)	Date of arrival in school
Gender (Male, Female, Unknown, Not specified)	Geographic Region (GOR)
Ethnicity (Please see below)	Contract Type (Permanent, Fixed)
Base Pay (Annual base pay before allowances)	Hours Worked Per Week
Qualification Date (date QTS was awarded)	Subject Code (Please see below)

A note on subject code and ethnicity

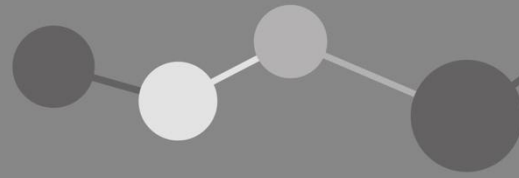
Where possible, holding a post-16 STEM qualification was controlled for. To do this, the SubjectCode variable within the SWC was used. Using the list of Codes available on the [HESA website](#), any qualification which began with the letters A, B, C, D, F, G, H, I or J were considered to fall under this banner.

On Ethnicity, the SWC codes ethnic groups according to the codes found within the [Common Basic Dataset](#). These codes were used for matching teachers based on ethnicity. The twenty main group codes are used as opposed to the extended codes

Calculating the odds of a teacher remaining within the profession

Odds are not the same as probabilities. The probability that an engaged teacher will remain in the profession after one year is 89%, and the probability that they will leave is 11%. Odds are the ratio of an event happening to an event not happening (i.e. staying in the profession versus leaving the profession). Therefore the odds from our example above are calculated as such: $0.89/0.11 = 8.09$. Or for every one teacher who leaves, eight do not.

Odds Ratio is the ratio of two odds. So, if the odds of retention for engaged teachers are 8.09, and the odds of retention for non-engaged teachers are 3.17 ($0.76/0.24$), the odds



ratio is $8.09/3.17 = 2.55$. This shows us that the odds of a teacher remaining in the profession are 155% greater for those engaged with CPD compared to those non-engaged.

Comparison to previous analyses

Previous analysis of STEM Learning science CPD showed that engaged teachers were around 160% more likely to remain in the profession compared to similar non-engaged teachers (14). This analysis used data from 2010 through to 2015. During that period, the proportion of teachers remaining in the profession in the year after qualifying averaged 87%. During the period that the current report covers, the equivalent rate of retention was 86% suggesting a very minimal decrease (which is likely to be statistically non-significant).

Assuming the provision of CPD has remained high quality and consistent, it could be expected that the retention rates would be similar or slightly lower in the current period compared to the previous analysis. Indeed, the headline retention rates from the current report (155%) are comparable to those previously published (161%).

Limitations and caveats

While the School Workforce Census is comprehensive in terms of the reach, there are gaps within the data. For example, a teacher may have empty records in specific rows, such as the date they were awarded QTS. This means that all proportions are based on a sample of teachers who have complete records within the fields of interest and will therefore be lower than the teaching population they represent.

A similar limitation should be highlighted from the analysis of retention of engaged and non-engaged teachers. As STEM Learning does not collect teacher identifiers such as Teacher Reference Number, the matching of engagement data to SWC was done using teacher name and school unique reference number. This resulted in an overall match rate below 100%, meaning that a non-engaged teacher may have engaged at some stage but not be marked as having engaged with CPD due to this.