Department for Education

2016/17 Teacher Supply Model User Guide

October 2015

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Glossary of key terms

- **NCTL:** National College for Teaching and Leadership.
- **ITT:** Initial Teacher Training.
- **PTR:** Pupil-Teacher Ratio.
- **DTR:** Database of Teacher Records.
- **PGCE:** Postgraduate Certificate in Education.
- **SWFC:** School Workforce Census.
- **FTE or Full-time Equivalent rate**: A teacher that is employed as a full-time teacher is assumed to have a 1.0 FTE rate. A teacher that is employed as a part-time teacher and works 50% of their school's full-time contracted hours is assumed to have a 0.5 FTE rate.
- **MFL:** Modern Foreign Languages (Ancient Languages such as Latin or Ancient Hebrew are included within 'Classics').
- **Wastage:** Teachers in publicly-funded schools leaving the profession for reasons other than retirement or death in service. This includes teachers leaving to teach outside of England, in independent schools, special schools, Pupil Referral Units or other school settings not included within the state-funded sector as defined by the model. It also includes those teachers leaving to other (non-teaching) professions or to become economically inactive. It does not include teachers taking maternity leave. Teachers that are barred from service are now counted towards the wastage rate (previously they were included within a 'deaths in service and barred from service' group within the 2015/16 model that was published online in 2014).
- **NQT:** Newly Qualified Teacher.
- **Newly Qualified Teacher entrants:** Teachers entering the active stock in the year following ITT.
- **Re-entrants:** Teachers entering the active stock having taught previously in the state-funded schools sector as defined by the TSM[1].
- **Entrants that are new to the state-funded sector:** Teachers entering the active stock that are new to the state-funded schools sector. In other words, they are not recorded on datasets held by the department as having taught in a regular teaching role in the state-funded schools sector. They may have taught previously outside of the state-funded schools sector (see below) or in supply roles.
- **Deferred entrants:** Teachers entering the active stock in the year after the year following ITT, i.e. entrance to the active stock is deferred or delayed by a year. Deferred entrants are included within the 'entrants that are new to the state-funded sector' group. They were previously classed as an independent group in the previous (2015/16) version of the TSM.
- **State-funded schools sector:** For the purposes of the TSM, the state-funded schools sector covers state-funded nursery, Primary, and Secondary schools in England (including school sixth forms). Academies and free schools are also

[1] As recorded on datasets held by the department.

included. For the purposes of the TSM, independent schools, further education institutions, state-funded special schools, or Pupil Referral Units are *not* counted as being in the state-funded schools sector. Only teachers employed in regular roles (i.e. non-supply) within the state-funded schools sector are considered (by the TSM) as being in service in the state-funded schools sector[2].

- **Active stock (or active teacher stock):** The number of qualified teachers employed in regular roles (non-supply) in the state-funded schools sector as defined by the TSM (see above).

[2] Whilst the TSM does not consider state-funded special schools and PRUs as being within the state-funded schools sector, the model does account for qualified teachers entering active service within such institutions (either through wastage or NQTs entering those sectors post-ITT). Therefore, the model is (indirectly) estimating and accounting for the number of qualified teachers needed by schools in England that are outside of the state-funded schools sector (as defined by the TSM). The same approach is used for independent schools and FE colleges in England too.

Section 1: The 2016/17 Teacher Supply Model user guide.

This user guide provides information to help the public understand the 2016/17 Teacher Supply Model (TSM) and use scenario testing that is made available to model users.

This user guide explains:

- The **data** that is used in the 2016/17 Teacher Supply Model.
- Which **data sources** are used.
- What **assumptions are used to produce the data** that feeds into the model.
- How the model is **structured.**
- How the model calculates:
    - The **teacher need** (the number of teachers needed in the active stock[3] each year),
    - The **entrant teacher need** (the number of teachers required to enter into the active stock each year by all entrance routes into the profession),
    - The **Newly Qualified entrant teacher need** or **NQT entrant teacher need** (the number of Newly Qualified Teachers required to enter into the active stock in the 2017/18 academic year to meet the needs of the system), and,
    - The **postgraduate Initial Teacher Training trainee need** or **postgraduate ITT trainee need** (the number of ITT places required in the 2016/17 academic year to generate this number of NQTs entering into the active stock in 2017/18).
        - This **postgraduate ITT trainee need** is the **final output** of the 2016/17 Teacher Supply Model and feeds into the NCTL 2016/17 ITT recruitment process. The outputs of the TSM directly inform the phase/subject level ITT recruitment controls and the amount of funding made available to support trainees.
- The **assumptions** used within the model to make key calculations.

[3] The number of qualified regular teachers in active service within state-funded nursery, Primary, and Secondary schools (including academies and free schools).

- The model makes assumptions to estimate the number of new teachers required in the future and how many training places are required to meet this need.

  For example, the model projects how the size of the active stock of teachers will change over time with changing pupil numbers.

  These assumptions are not *policies* and many of the relevant variables depend on school decisions. They are simply *predictions* of what we might expect to happen in the future given what has happened in the past based on the most reliable and up-to-date information we have available.

  In other words, if the model assumes that the Primary Pupil-Teacher Ratio will increase to 24 over the next ten years, this is not a government policy that there should be 24 Primary teachers per pupil in future. This is actually a modelling *assumption* that we most likely expect a PTR of 24 in future given known projected pupil numbers and evidence on previous trends in teacher recruitment and pupil numbers.

- **Scenario testing** that can be undertaken within the model and how model users can use it.

  - For example, the model allows users to test different teacher wastage rate scenarios and to examine the impact that these different wastage scenarios might have on the number of teachers required in future.

    - In other words, what impact would higher wastage rates have on the outputs of the model?

This user guide supports the 2016/17 Teacher Supply Model.

The 2015/16 Teacher Supply Model and model user guide were published in October 2014[4].

[4] Online at https://www.gov.uk/government/publications/teacher-supply-model.

Section 2: The overall structure of the 2016/17 Teacher Supply Model.

2.1 The two parts of the 2016/17 Teacher Supply Model.

The Teacher Supply Model is a statistical model that seeks to predict the future national need for teachers. It is used to inform Government decisions about the allocation of funding and places for Initial Teacher Training at a national level. Actual decisions about the employment and deployment of teachers at a school level fall under the responsibility of schools themselves.

The 2016/17 Teacher Supply Model (TSM) is structured in two distinct parts:

- **Part One** of the model estimates the **teacher need,** the number of teachers required in the active stock[5] each year.

  Part One then uses this teacher need to estimate the **entrant teacher need**, the number of teachers required to enter into the active stock each academic year by all entrance routes[6] into the profession.

  This estimation is made using assumptions as to the number of leavers[7] expected each academic year and how the population of teachers (the size of the active stock) will change over time.

  For more details on Part One of the 2016/17 TSM, see **Section 3**.

- **Part Two** of the model takes the number of teachers needed to enter the active stock each academic year from Part One and estimates the **NQT entrant teacher need** for the 2016/17 academic year[8].

  This NQT entrant teacher need is the number of Newly Qualified Teachers (NQTs) required to join the active stock in 2017/18 to meet the teacher need estimated in Part One[9].

  Part Two then estimates the **postgraduate ITT trainee need**, the number of postgraduate ITT (Initial Teacher Training) places required (in the 2016/17

[5] The number of qualified regular teachers in active service within state-funded nursery, Primary, and Secondary schools (including academies and free schools).
[6] This includes entrants that are new to the state-funded schools sector and re-entrants as well as those that are newly qualified teachers.
[7] Teachers leaving the active stock as either: wastage, retirements, or deaths in service.
[8] ITT trainees completing training in 2016/17 will only be able to enter the active stock as qualified teachers in 2017/18 at the earliest.
[9] Given the number of teachers expected to enter by non-NQT routes (e.g. as re-entrants).

academic year) to generate this number of NQTs entering into the active stock in 2017/18[10]. This conversion is made by making assumptions as to how many trainees are expected to not complete their courses or not go into employment post ITT[11].

For more details on Part Two of the 2016/17 TSM, see **Section 4**.

Figure 1(see below) provides an illustration of how the two parts of the Teacher Supply Model feed into one another and the key calculation steps made along the way. All calculation steps are made for each phase and subject independently.

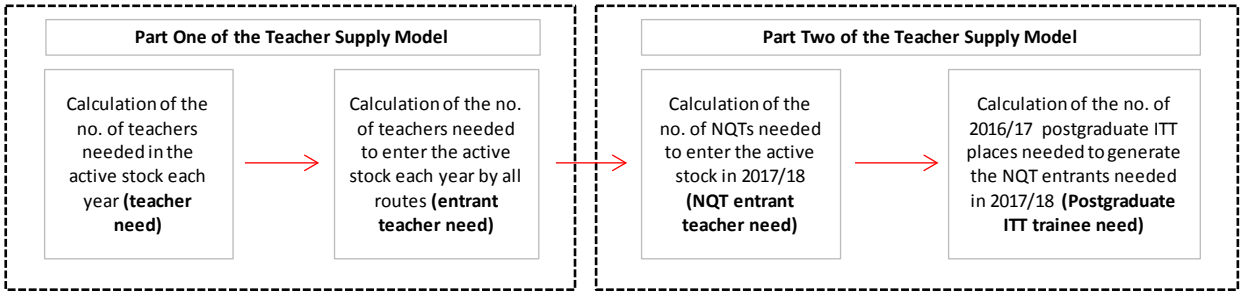

Figure 1: Overall structure of the 2016/17 Teacher Supply Model.

Both parts of the model have **scenario testing capability** allowing users to test the impact (on the outputs calculated) of altering some of the assumptions that feed into the model. The scenario testing available within the model is outlined below.

- In **Part One of the model**, scenario testing covers:
    - Future teacher wastage rates by gender.
    - Projections of pupil population.
    - Projections of how the active teacher stock (via the Pupil-Teacher Ratio) will change as pupil populations change.
    - The scenario testing in Part One enables users to examine the impact on both the teacher need and entrant teacher need of changing these scenarios.

[10] The TSM only calculates the number of ITT trainees required to both start and complete ITT in 2016/17.
[11] These trainees may not go into teaching at all, defer their entrance into the active stock, or enter into teaching in another sector (e.g. in Wales/Scotland, in a supply role, in an independent school, in a special school etc).

        - Comparisons are made to the Part One outputs[12] derived using *central or default* scenarios (these are the most likely scenarios expected and are the values used to derive the *actual* model outputs used by Part Two).

    - For more detail on scenario testing made available within Part One of the 2016/17 TSM, see **Section 5**.

- In **Part Two of the model**, scenario testing covers:

    - The proportions of newly qualified entrants expected among the entrants to the active stock.

    - The scenario testing in Part Two enables users to examine the impact of different newly qualified entrant rates on the postgraduate ITT trainee need (e.g. if the proportion of entrants that will be newly qualified is 5 or 10% higher/lower than forecasted).

    - For more detail on the scenario testing made available within Part Two of the 2016/17 TSM, see **Section 6.**

2.2 The scope of the 2016/17 Teacher Supply Model.

Table 1 (below) illustrates what is and is not included within the 2016/17 Teacher Supply Model.

Included	Excluded
England.	Scotland, Wales, and Northern Ireland.
Q*ualified* teachers (i.e. teachers with QTS)	*Unqualified* teachers are excluded from all teacher flows calculations & rates[13]. Unqualified teachers are also excluded from all entrant teacher need, NQT entrant teacher need, and postgraduate ITT trainee need calculations. Qualified Teachers who are working as *supply* teachers are considered as teaching *outside* of the active stock.

[12] Both teacher need and entrant teacher need.
[13] The model assumes that the proportion of the active stock going forward that will be unqualified will be constant, reflecting the most recent proportion in workforce data.

State-funded Primary (including maintained nurseries attached to schools) and Secondary schools, academies and free schools.	Special schools, Pupil Referral Units, Early Years, Independent schools, and Further Education/Sixth Form Colleges. Qualified Teachers who are teaching in such schools are considered as teaching *outside* of the active stock for the purposes of the TSM[14].
Teaching at Key Stage 5 in Secondary schools.	Teaching at Key Stage 5 in standalone Sixth Forms Colleges.

Table 1: What is and is not included within the 2016/17 Teacher Supply Model.

Table 2 (below) illustrates the subject groupings as used in the 2016/17 Teacher Supply Model:

Subject high level	Notes
Art & Design	*Includes Applied Art & Design, Art & Design, and Art.*
Biology	*Includes Biology, Botany, Zoology, Ecology, Combined/General Science (Biology), and Environmental Science.*
Business Studies	*Includes Applied Business Studies, Accountancy, Commercial & Business Studies, Industrial Studies, other Business and Commercial subjects.*
Chemistry	*Includes Chemistry and Combined/General Science (Chemistry).*
Classics	*Includes Classics and Ancient Languages such as Ancient Greek, Ancient Hebrew, and Latin.*
Computing	*Includes Applied ICT, Computer Science, and Information & Communication Technology.*
Design & Technology	*Includes D & T, Construction and Building, Craft and D & T, Electronics, Engineering, Graphics, Resistant materials, Manufacturing, Systems & Control, and Textiles.*
Drama	*Includes Drama and Performing Arts.*
English	*Includes English Language and Literature.*
Food	*Includes Food Technology plus Catering & Hospitality.*
Geography	*Includes Geography and Geology.*
History	*Includes History.*
Mathematics	*Includes Mathematics and Statistics.*
Modern Foreign Languages	*Includes French, German, Spanish, Arabic, Bengali, Chinese, Welsh, Modern Greek, Italian, and any other Modern Languages.*
Music	*Includes Music.*
Others	*Includes Child Development, Citizenship, Dance, Economics, Law, Media Studies, Other Social Studies, Other technology, Politics, Psychology, Sociology, and Social Sciences among others.*
Physical Education	*Includes Physical Education and Sports.*

[14] The TSM assumes that some qualified teachers will do something other than teach in the state-funded schools sector. All such teachers are handled in the same way within the TSM irrespective of whether they are economically inactive, teach in Wales or Scotland, or teach in sectors other than state-funded Primary and Secondary schools.

Physics	*Includes Physics and Combined/General Science (Physics).*
Religious Education	*Includes Religious Education and Philosophy.*

Table 2: The subject groupings as used in the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model.

The following subjects are classed as EBacc subjects within the 2016/17 Teacher Supply Model: Biology, Chemistry, Classics, Computing, English, Geography, History, Mathematics, Modern Foreign Languages, and Physics.

Section 3: Part One of the 2016/17 Teacher Supply Model.

Section 3 of this user guide describes:

- What Part One of the 2016/17 Teacher Supply Model (TSM) does,
- The structure of Part One of the 2016/17 TSM,
- The data which feeds into Part One of the 2016/17 TSM,
- The assumptions used to produce this data, and
- The calculations used by Part One of the TSM to calculate the teacher need and entrant teacher need by both phase and subject, and the assumptions behind them.

3.1 What does Part One of the 2016/17 Teacher Supply Model do?

As outlined in Section 2, Part One of the Teacher Supply Model estimates the **teacher need,** the number of teachers (as a headcount) required in the active stock each year. This is estimated for both the Primary & Secondary phases using projected pupil populations by phase and assumptions regarding how the PTR (Pupil-Teacher Ratio) will change over time.

This *assumed* PTR is used to estimate how many teachers are required in the active stock each academic year going forward[15]. The assumption is *not* a departmental policy on future PTRs; it is only an *estimation* as to how the PTR will change given historical data and trends.

The Secondary active stock is then broken down by subject by using assumptions as to how much time (proportionately) is spent teaching the different subjects by the total Secondary active stock[16].

These teacher need values are then utilised to estimate the **entrant teacher need**. This is the number of teachers required to enter into the active stock each academic year by

[15] As the projected number of pupils going forward has already been calculated using the Pupil Projections Model.

[16] E.g. if the Secondary teaching stock spends 10% of its' total teaching time teaching English, 10% of the Secondary teaching stock would need to be English teachers.

all entrance routes[17] into the active stock. To do this, the model uses the following formula for year, *x*:

'Need' for entrant teachers in year *x* (Entrant need) = Teacher need in year *x* –

Stock of teachers at the end of previous year +

No. of teachers expected to leave in year *x*

Therefore the model assumes that the entrant teacher need for a particular academic year is equal to:

1. The number of additional/fewer teachers that might be required compared to the stock from the previous academic year (e.g. because pupil numbers have increased/decreased or there have been curriculum changes) *and* ,

2. The number of teachers that are expected to leave the active stock in that academic year (and require replacement).

As part of this calculation process, the model must make an estimation of the number of leavers from the active stock expected each academic year. This estimation is made using assumed projected wastage, retirements, and deaths in service leaver rates.

Additionally, to reflect the effect of the ever-changing characteristics and size of the active stock, the model makes assumptions on:

1. How the size of the active stock changes over time, and

2. The number & characteristic breakdowns of those entering and leaving the active stock each academic year.

The entrant teacher need output of Part One of the TSM plays directly into Part Two of the model.

3.2 Structure of Part One of the 2016/17 Teacher Supply Model.

Each tab in the model workbook includes information at the top as to where data is sourced from and which tabs it feeds into.

[17] This includes entrants that are new to the state-funded schools sector and re-entrants as well as those that are newly qualified.

Additionally, a model map is provided on the '**map of sheets**' tab showing which tabs feed into which and how the overall model is structured. This map is presented below as Figure 2.

Table 3 (see A.1 in the Annex) provides a description of each tab within Part One of the 2016/17 TSM and what that tab does.

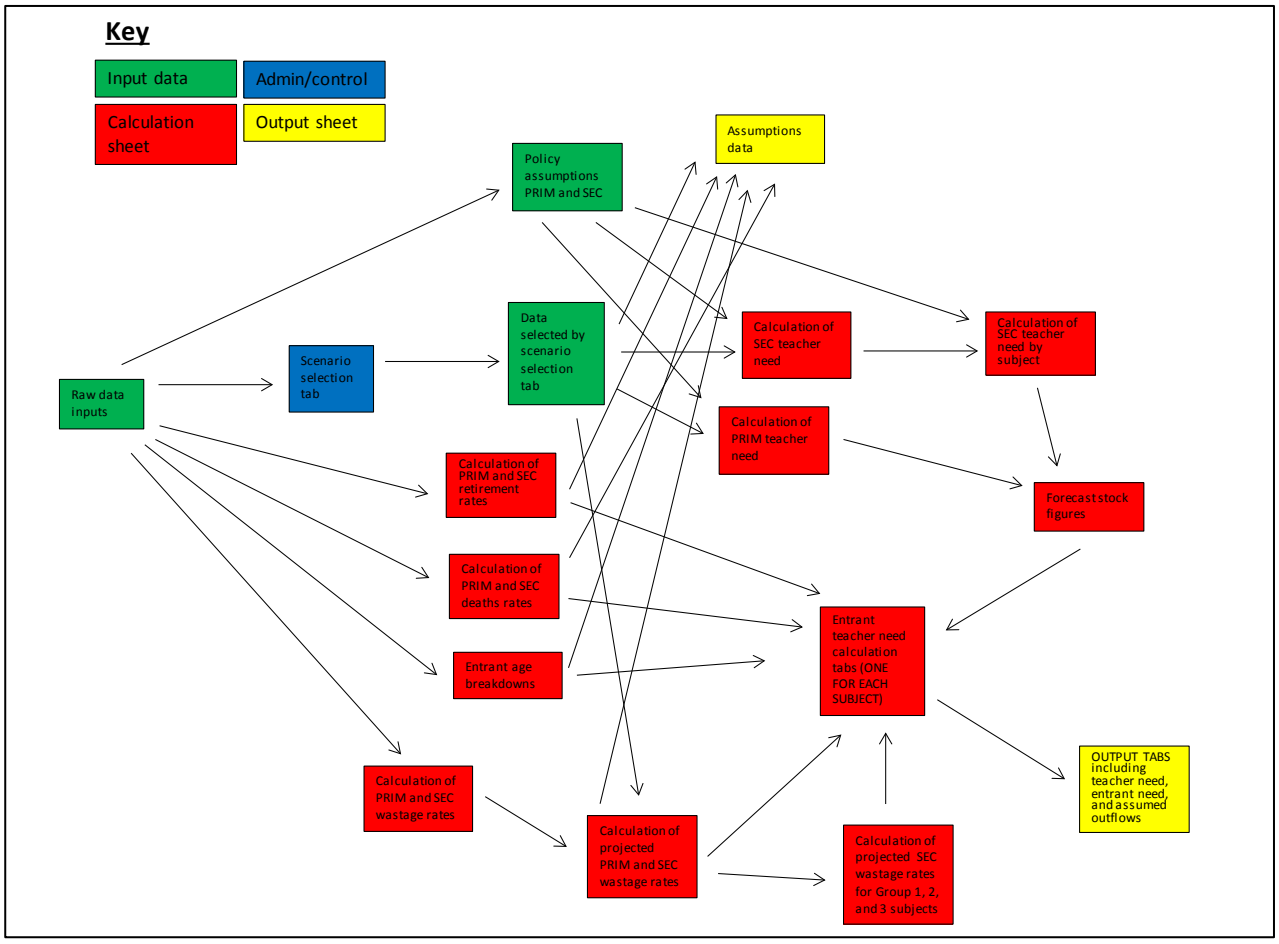

Figure 2: Map of Part One of the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

3.3 The data that feeds into Part One of the 2016/17 Teacher Supply Model?

The following data sources feed into Part One of the Teacher Supply Model:

- **Pupil Population Projections** from the **Pupil Projections Model** by Key Stage.
    - Pupils studying at Key Stage 5 in state-funded Secondary schools are also included.

- **Teacher leavers and entrants data** from the **2014 matched School Workforce Census** (this data was previously provided by the **Database of Teacher Records** for the 2015/16 Teacher Supply Model).
    - Teachers leaving the active stock as wastage[18], retirements, or deaths in service.
    - Data on the characteristics (age group and gender) of entrants to the active stock by all entrance routes[19].
- **Teacher stocks data** from the **2014 matched School Workforce Census**, including data on:
    - Teachers' characteristics (age group and gender).
    - Secondary subject timetable information (what subjects Secondary teachers are teaching at each Key Stage and for how many hours).
    - Teachers' Full-Time Equivalent (FTE) rates[20].
    - Teachers' qualification status[21].
- **Projected teacher wastage** rates from the Department's **Econometric Wastage Model**
    - Data projecting how teacher wastage rates[22] are likely to change going forward.

All data inputs into Part One of the model are provided in the '**raw data inputs**' tab in the model workbook.

The department's standards for data suppression require that fields relating to fewer than five individuals should not be published. In the department's statistical publication this is achieved by replacing figures based on fewer than 5 individuals with an "x". That approach does not work in the TSM as it would suppress the entire function within the model. To overcome this - and still apply the department's suppression rules - fields with fewer than 5 individuals have been aggregated either across gender or age bands. The

[18] Wastage covers teachers leaving the active stock to teach in supply roles, teach in sectors outside of the state-funded schools sector in England, work in other non-teaching sectors, and those that become economically inactive. Teachers on maternity breaks are not classed as wastage. Teachers that are barred from service are now counted towards wastage in the 2016/17 model (they were previously included in a separate group along with those teachers that died in service).
[19] Including those entering as NQTs, new to the state-funded sector entrants, and re-entrants.
[20] A teacher who is employed full-time is classed as 1.0 FTE, a teacher who is employed part-time and works 50% hours is 0.5 FTE.
[21] Whether teachers are qualified or unqualified.
[22] Proportion of the active stock leaving in a given academic year as wastage.

effect of this is to increase the total entrant teacher need for 2017/18 by **two teachers** compared to the actual outputs produced and used within the department.

More information on the data sources used in the Teacher Supply Model can be found within **Section 7**.

3.4 Data and assumptions on the current stocks of teachers.

Calculations relating to the current stock of teachers are made on the **'stock calculations'** and **'stock ages breakdowns'** tabs.

Matched School Workforce Census (SWFC) 2014 data is used to provide information on the *current* stock of teachers[23] by headcount. The census provides a snapshot of the active teacher stock in state-funded schools in England on census day in November 2014. The Teacher Supply Model assumes that the active stock as of November 2014 will be the active stock that will end the 2014/15 academic year.

The census provides information on teachers' gender and age group, whether teachers are qualified or unqualified, and teachers' Full-time Equivalent rates.

Secondary teachers are also broken down by their **subject** specialism. Within the census, teachers are *not* identified as 'belonging' to a particular subject e.g. teacher x 'is' a Biology teacher. The census simply provides information on teachers' qualifications[24] and timetable[25] information. Additionally, the census does not provide any information on any additional training that teachers may have received to teach additional subjects, e.g. a training course to enable a Geography teacher to teach Mathematics effectively[26].

As teachers may teach subjects other than those that they are most highly qualified in or hold a PGCE in, teachers are assigned to subjects according to how much time they spend teaching particular subjects. This assumption is designed to reflect what is happening within schools and how teachers are actually being utilised.

> For example, if a teacher teaches Mathematics 100% of the time, they are assumed to be 1.0 of a Mathematics teacher. If they teach Mathematics 50% of the time and physics 50% of the time they are assumed to be 0.5 of a Mathematics teacher and 0.5 of a Physics teacher. These values are not adjusted to account for teachers' Full-time Equivalent rates (the differences in FTE rates

[23] In the state-funded schools sector only.
[24] The highest post A-level qualification that a teacher holds in that particular subject.
[25] The number of hours that an individual Secondary teacher teaches in each subject at Key Stage 3, 4, and 5 respectively.
[26] A teacher could also have extensive *experience* of teaching a subject outside of their subject specialism that would not be picked up within the census. For example, a Geography teacher may have taught Geography for 30 years but have no post A-level 'Geography' qualifications.

between subjects are accounted for elsewhere within the TSM stock derivation calculations).

Data from the School Workforce Census is published as part of the School Workforce Statistical First Release[27]. Some headcount figures may appear to differ slightly to those used within the Teacher Supply Model. These differences are the result of the active stocks used in the Teacher Supply Model having different selection criteria to those presented within the SFR due to modelling reasons (for example, different subject groupings and coverage).

3.5 Data and assumptions on the number of teaching hours by subject.

The School Workforce Census is used to provide data on how many hours are being taught in which subjects at Key Stage 3, 4, and 5 in Secondary schools by both the *total* Secondary active stock and *individual* Secondary teachers. The subjects are defined as illustrated in Table 1 in Section 2.2.

Data that is similar to this on the *total* number of hours taught for particular subjects in Secondary schools is included within the School Workforce Statistical First Release and may show some slight differences to those figures used within the TSM (see Section 3.4).

Additionally, it is worth noting that the TSM completely *excludes* hours spent teaching PSHE (Personal Social and Health Education). This assumption is made to prevent the model overestimating the number of PSHE teachers required (and therefore the number of trainees requiring PSHE ITT). This assumption was made to reflect that the overwhelming majority of PSHE teaching is carried out by non-PSHE specialists, e.g. teachers of other subjects teaching PSHE to their tutor groups for 1-2 hours a week. The same approach is used for the teachers and teaching of General Studies.

3.6 Data and assumptions on pupil projections.

Calculations relating to pupil projections inputs are performed on the '**pupils data scenarios**' tab.

The change in the size of the pupil population going forward at each Key Stage is estimated using the outputs derived by the Pupil Projections Model which are used in the Department's published national pupil projections[28]. High, central, and low scenarios of

[27] School Workforce Statistical First Release available at: https://www.gov.uk/government/statistics/school-workforce-in-england-november-2014.

[28] These were last published in July 2015. For more detailed figures and background information, please see the release available at: https://www.gov.uk/government/statistics/national-pupil-projections-trends-in-pupil-numbers-july-2015.

projected pupil population are derived for use in the TSM using variations of birth rate and migration projections.

The Pupil Projections Model does not currently forecast how the number of Key Stage 5 pupils in state-funded schools will change over time. Because these projections *are* required by the Teacher Supply Model, for simplicity the TSM assumes over the longer term that the number of Key Stage 5 pupils in Secondary schools will change at the *same* year-on-year rate as the national 16-19 population (projections on changes to the national 16-19 population *are* provided within the Pupil Projections Model). In the shorter term (for the years 2014/15, 2015/16, and 2016/17), the model assumes that the post-16 participation rate will increase based on the participation rate increase of the 3 previous years.

Pupil population projections data for the total Primary and Secondary phases as used by the TSM is illustrated in Figure 3 (see below).

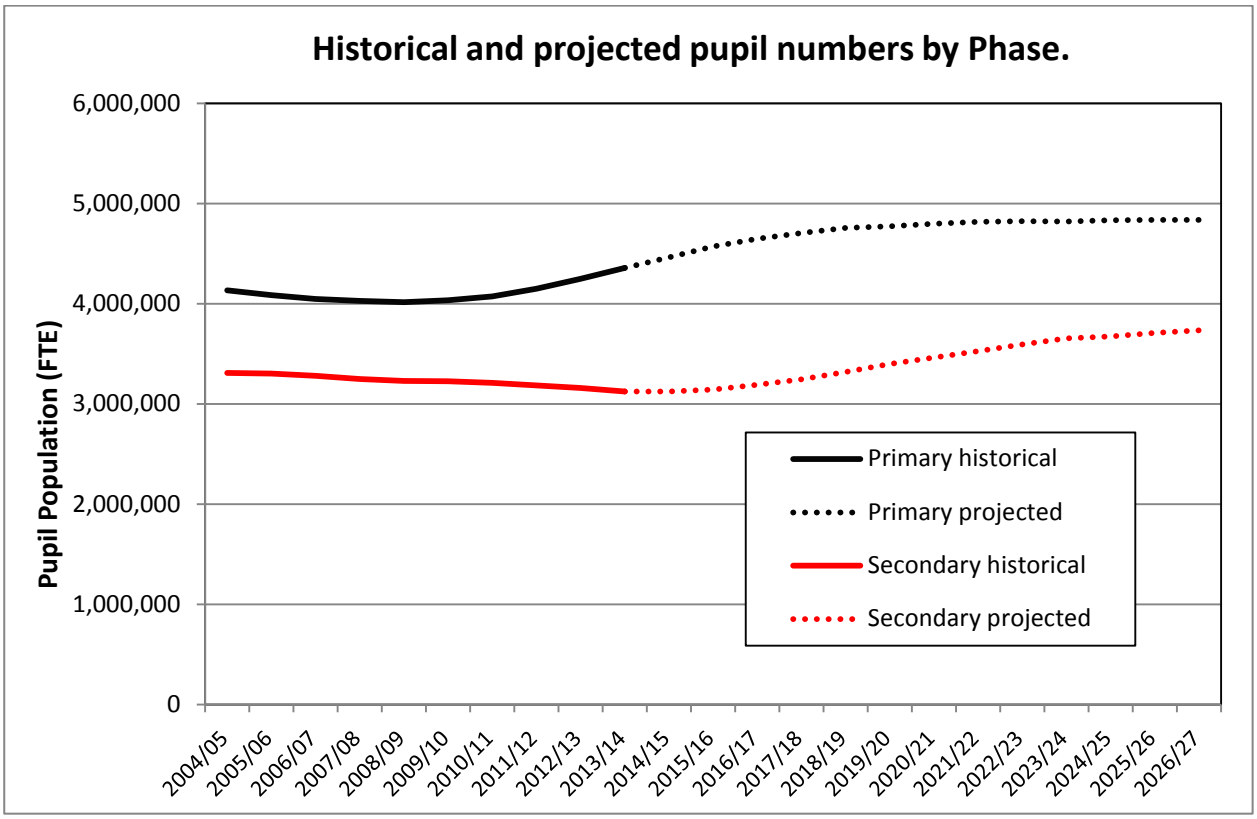

Figure 3: Pupil population projections data as used in the 2016/17 Teacher Supply Model broken down by phase.

Source: 2016/17 Teacher Supply Model Part One and Pupil Projections Model.

3.7 Teacher flows data from the matched School Workforce Census.

Data from the matched School Workforce Census (SWFC) is used in both Part One and Part Two of the Teacher Supply Model to provide information on *historical* teacher flows,

i.e. teachers leaving and entering the stock in previous years. Previously, in the 2015/16 Teacher Supply Model, this data was supplied from the Database of Teacher Records (DTR).

Matched School Workforce Census flows data provides information about:

- The *characteristics* of leavers and entrants (gender and age group).
    - The SWFC also provides information on the phase of school that teachers teach in and the subjects Secondary teachers teach or have qualifications in. The DTR, by contrast, does not provide this subject level information.
- The *origin* of entrants.
    - E.g. whether entrants are NQTs, new to the state-funded sector entrants, or re-entrants.
- The *destination* of leavers.
    - E.g. whether leavers have left through retirement, wastage[29], or death in service.
- All SWFC flows data used in the 2016/17 TSM is in headcount form (rather than FTE).
- As well as information on what subjects teachers are qualified in (and teach for Secondary phase teachers), the SWFC provides a greater coverage of the teaching workforce than the DTR which underreports teachers that are unqualified or employed part-time.
    - The DTR is derived from teacher pensions data. As a result, the coverage of the DTR across the state-funded sector workforce is strongly linked to the take-up and eligibility of the Teacher Pension Scheme (TPS)[30].

Data on historical teacher flows is available up to 2013/14 (however, data for 2012/13 and 2013/14 remains provisional). In light of SWFC flows data post 2011/12 being provisional, the model uses weighted[31] averages of the four most recent years of data for *all teacher flows rates related calculations*.

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[29] Wastage covers teachers leaving the active stock to teach in supply roles, teach in sectors outside of the state-funded schools sector in England, work in other non-teaching sectors, and those that become economically inactive. Teachers on maternity breaks are not classed as wastage.

[30] Prior to January 2007, part-time teachers had to opt-in to (rather than opt-out of) the Teachers' Pension Scheme which affected the number of part-time teaches who were covered by the DTR.

[31] A weighted average is used to account for the fact that the two most recent years of SWFC data is provisional and subject to change. The model uses data from 2010/11, 2011/12, 2012/13, and 2013/14 with an average value being calculated which is weighted towards 2013/14.

SWFC data is a 'snapshot' of the teacher workforce taken on census day in November of each year. As a result, historical flow rates (e.g. the wastage rate) are calculated as being the proportion of the active stock of qualified teachers that leave between November of a particular year and November of the subsequent year.

> For example, the wastage rate for the 2013/14 academic year is the proportion of the active stock in November 2013 that leave as wastage between November 2013 and November 2014.

Rates are calculated for all age groups and for both genders.

For consistency, the stock figures used to calculate such historical flow rates also come from the SWFC. These stock figures may differ to those stocks figures provided from the School Workforce Census elsewhere for the reasons outlined previously in Section 3.4.

The wastage numbers in the TSM may differ from those published in the School Workforce Census Statistical First Release (SFR) and are not directly comparable[32]. These differences are the result of different criteria, for example, the SFR and TSM have slightly different criteria of what is classed as the state-funded schools sector.

All wastage, retirements, and deaths in service figures used in the TSM have been estimated separately[33] from fields in the matched SWFC for modelling purposes in order to apply economic wastage estimates going forward (from the Econometric Wastage Model, see Section 3.9). The figures used by the TSM on future retirements or deaths in service are not designed to be definite estimates of retirements or deaths from service.

3.8 Data and assumptions on historical and current wastage rates.

Data on 'current' wastage rates (data from 2013/14 and the three prior years) is calculated on the '**Calc PRIM wastage rates**' and '**Calc SEC wastage rates**' tabs for the Primary and Secondary phase respectively.

Data on historical wastage rates comes from the matched School Workforce Census (SWFC).

The Teacher Supply Model estimates the proportion of the stock of teachers that will have left as wastage[34] (for each age group and gender) using a weighted[35] average of

[32] For more information, please see the SWF Statistical First Release available at: https://www.gov.uk/government/statistics/school-workforce-in-england-november-2014.
[33] The TSM uses projected wastage rates from the Econometric Wastage Model which does not include deaths in service or retirements as wastage.
[34] In the most recent year for which we have data (2013/14).

wastage rates from the previous four years' of historical data. Values are calculated for the Primary and Secondary phases *combined* together[36].

Whilst the model calculates separate rates for the two genders[37], the model does *not* calculate different wastage rates for individual phases/subjects. This is a result of:

- The Econometric Wastage Model[38] historically using wastage data[39] broken down by gender but not by phase of employment.
    - As a consequence, the Econometric Wastage Model assumes that wastage rates for each gender are consistent across the phases.
- Subject specific wastage data being unavailable from the matched SWFC broken down by both age group and gender.
    - Whilst these rates *could* be derived, the numbers of teachers of each subject within each age group and gender would be too small to make the rates meaningful for modelling purposes.
    - They would also be unsuitable for use in a published model due to data suppression reasons as most figures (number of leavers within a particular gender, age group, and subject specialism) would relate to less than 5 teachers.
- However, the 2016/17 model *does* account for variation in wastage rates for *groups of* subjects and ages in its projections (see Section 3.9).

As a consequence, if the wastage rate for the overall teaching stock of female teachers aged 30-34 is 2% for a particular year, the model assumes that 2% of female Mathematics/Physics/Chemistry teachers aged 30-34 will leave as wastage in that year.

However, the stocks data in the model *does* take into account that subjects have different proportions of teachers who are male/female and within different age groups. Therefore, as the estimated wastage rates are different for each demographic group, the model estimates that different proportions of the stock will leave as wastage for the individual subjects, and the overall wastage rate will change as the age and gender profile of the stock changes[40].

---

[35] A weighted average is used to account for the fact that the two most recent years of SWFC data is provisional and subject to change.

[36] The econometric wastage model used to project changes in the wastage rate (see Section 3.9) does not provide scalar forecast values for male and female teachers for the individual Secondary and Primary phases.

[37] There are noticeable differences in the likelihood of leaving the active stock as wastage between the two genders.

[38] Used to estimate projected wastage rates.

[39] The data used goes back to 1975.

[40] E.g. if the stock of Mathematics teachers had fewer female teachers than the stock of Drama teachers, a greater proportion of the Mathematics stock might be expected to leave as wastage than from within the Drama stock.

3.9 Data and assumptions on projected wastage.

Having calculated wastage rates for 2013/14, the model then calculates *projected* wastage rates on the '**Projected PRIM wastage rates**' and '**Projected SEC wastage rates**' tabs.

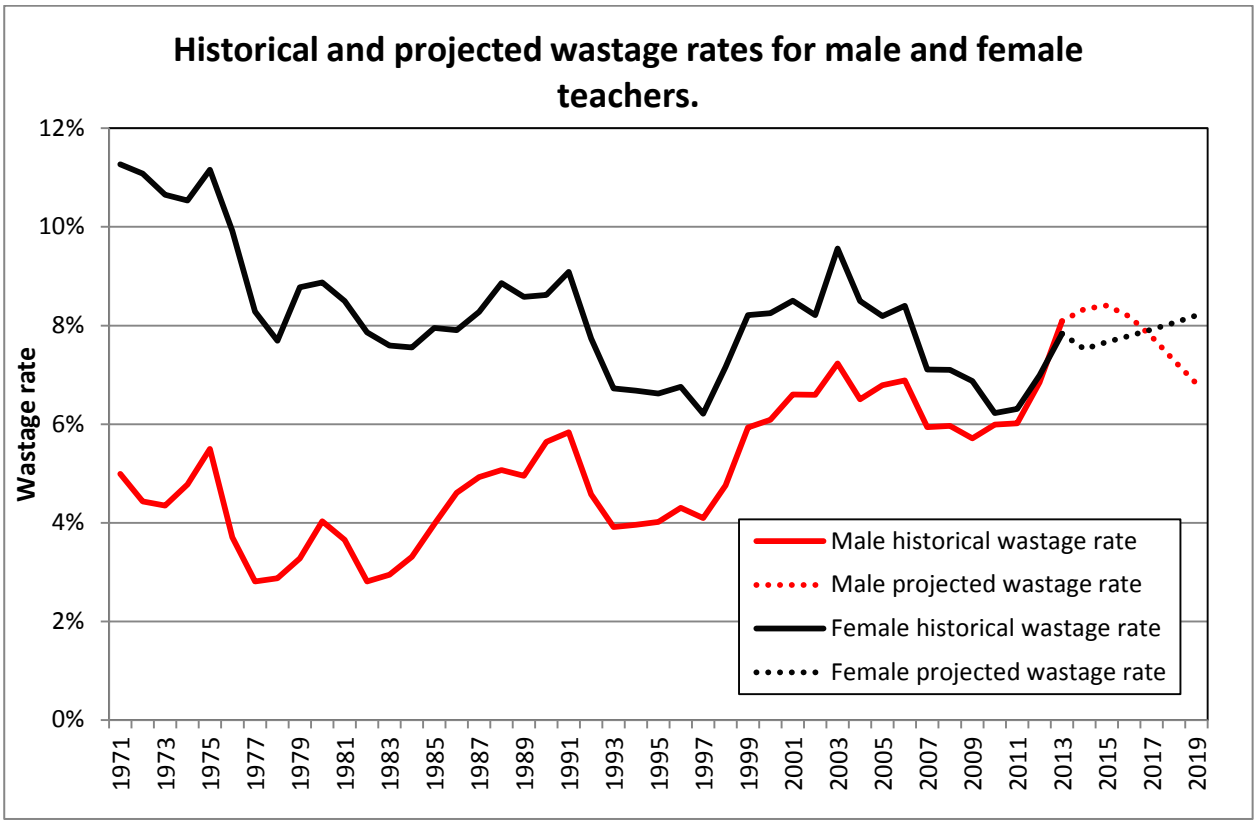

Figure 4: The percentage of male and female teachers leaving as wastage each year (the wastage rate), comparing historical values from the DTR/matched SWFC and projected values from the Econometric Wastage Model.

Source: DTR, matched SWFC, and Econometric Wastage Model.

As wastage rates are quite variable over time[41] (see Figure 4 above) forecasted changes in wastage rate due to economic factors are obtained using the internal **Econometric Wastage Model**.

The Econometric Wastage Model uses forecasts of economic growth and unemployment data to predict how the teacher wastage rate will change up to 2019/20 based upon historical relationships between wastage and these and other variables[42].

[41] Teacher wastage is closely linked to ever changing economic and employment factors.
[42] The Econometric Wastage Model uses data including:

- Teacher pay data from the DTR (pre-2011) and the SWFC (post-2011 up to 2013). Professional pay data comes from ASHE. The two factors above combine to show historic relative pay. The model then assumes relative pay is constant for forecasts (accounting for a 1 year lag).

The Econometric Wastage Model is based on time series analysis of teacher wastage and economic factors from 1975 to 2011. This analysis provides coefficients that estimate the average impact of marginal changes in recent wastage, unemployment, GDP and relative wages on wastage for each gender. By using forecasts of changes in those variables we can use the coefficients that reflect the historic impact of such changes on wastage, to estimate the level of wastage we expect in future years.

The proportional change in the future wastage rates compared to that of 2013/14 is expressed by the Econometric Wastage Model in the form of a scalar value for both genders for each future year. These scalar values are applied within the TSM to the wastage rate in 2013/14 to calculate how the wastage rate will change over time for both male and female teachers due to economic factors. In practice, as explained above, the overall wastage rates calculated by the model will also be affected by changes in the demography of the stock of teachers. The model assumes that the projected wastage rates beyond 2019/20 will remain constant.

For Primary, these projected wastage rates are then fed into the 'Primary' tab to estimate the Primary entrant teacher need (and future wastage numbers for the Primary phase as part of these calculations).

By contrast, the projected Secondary wastage rates are amended to account for differences in wastage rates between subjects.

Using the matched SWFC data, the department now holds wastage data which provide information on the subjects that were taught by leavers before their departure. This data can be used to assess the difference in wastage rates between subjects. As the individual subject 'cohorts' are of small size and the TSM uses averaged rates calculated for each demographic group, subjects are aggregated into three 'subject groups' (to get meaningful sample sizes for analysis[43]). The subject groups used are as follows:

- **Group 1** – EBacc 'Science and Mathematics subjects' - including Biology, Chemistry, Computing, Mathematics, and Physics.
- **Group 2** – EBacc 'non-Science and Mathematics subjects' - including Classics, English, Geography, History, and Modern Foreign Languages.

- Historic GDP data from the ONS YBEZ series: http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=YBEZ&dataset=pgdp&table-id=PREL
- Forecast central GDP comes from OBR fiscal and economic outlook December 2014: http://budgetresponsibility.org.uk/economic-fiscal-outlook-december-2014/
- High and low forecasts of GDP comes from Table M1: Medium-term forecasts for GDP IN HMT forecasts for the UK economy February 2015. For more information, see: https://www.gov.uk/government/statistics/forecasts-for-the-uk-economy-february-2015
- Unemployment Forecasts come from the following source, with the unemployment rate used being the claimant count divided by the number of economically active people in the economy: :http://budgetresponsibility.org.uk/economic-fiscal-outlook-december-2014/

[43] Especially when broken down by age group and gender.

- **Group 3** – All other subjects - including drama, music, PE, and RE among others.

Group 1 subjects have higher wastage rates than group 2 subjects for the younger demographic groups. Group 2 subjects in turn generally have higher wastage rates than group 3. This analysis makes like-for-like comparisons between age groups and gender. This may be an indication that teachers of group 1 subjects are more likely to leave the active stock than their group 2 and 3 subject colleagues.

The 2016/17 TSM applies conversion rates to the overall[44] wastage rates used in the model for each demographic group to take these differences in wastage rates between subjects[45] into account on the Group 1, 2, and 3 rates tabs in Part One of the model (see Table 3 below).

	Assumed wastage conversion rates					
	Male			Female		
Age group	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
20-24	1.20	0.99	0.76	1.08	1.00	0.93
25-29	1.11	1.11	0.85	1.11	1.03	0.92
30-34	1.17	1.05	0.84	1.11	1.01	0.93
35-39	1.19	0.87	0.90	1.04	1.02	0.96
40-44	1.08	0.91	0.97	1.06	1.00	0.96
45-49	1.12	0.87	0.94	1.10	1.00	0.92
50-54	1.04	0.98	0.97	1.05	0.97	0.99
55-59	1.01	1.09	0.94	0.99	1.02	0.99
60-64	0.98	1.08	0.98	0.96	0.98	1.04
65 plus	1.01	1.07	0.94	0.95	1.03	1.00
Total	1.09	1.02	0.91	1.04	1.02	0.95

Table 3: Assumed wastage rate conversion rates used in the 2016/17 Teacher Supply Model for group 1, 2, and 3 subjects.

Source: 2016/17 Teacher Supply Model Part One.

3.10 Data and assumptions on retirements.

Calculations of retirement rates by phase are carried out on the '**Calc PRIM retirement rates**' and '**Calc SEC retirement rates**' tabs.

[44] See Section 7.9 onwards.
[45] We will also seek to calculate these rates by region too.

The model calculates retirement rates as being the proportion of the active stock of qualified teachers that leave the active stock (as retirements only) between census day in November of a particular year and November of the subsequent year[46].

> For example, the retirement rate for the 2013/14 academic year is the proportion of the active stock in November 2013 that leave as retirements between November 2013 and November 2014.

Rates are calculated for all age groups for both genders using four years' of data, weighted towards the most recent years. This retirement rate by age group and gender is then applied to the stock to estimate the number of teachers leaving by retirement for each phase and subject.

> For example, if the projected retirement rate for the overall Secondary stock for female teachers aged 50-54 is 2%, the model assumes that 2% of female Mathematics teachers aged 50-54 will leave as retirements each year.

The model assumes that the Secondary retirement rates are consistent across the subjects e.g. if the retirement rate for female Mathematics teachers aged 50-54 is 2%, it is also 2% for female Physics teachers aged 50-54. However, the current stocks data takes into account that some subjects have higher or lower proportions of teachers over the age of 50 which results in higher or lower proportions leaving by retirement.

The model also assumes that the Primary and Secondary retirement rates remain constant over time. However, as the model assumes that the proportion of teachers within different age groups will change over time, it also assumes that the proportion of the stock that will retire will also change over time.

The retirement rates are fed into the tabs for each individual phase and subject to estimate future retirement numbers for each phase and subject.

3.11 Data and assumptions on deaths in service.

Calculations of death in service rates by phase are carried out on the '**Calc PRIM death rates**' and '**Calc SEC death rates**' tabs.

The model calculates death in service rates as being the proportion of the active stock of qualified teachers that die in service between November of a particular year and November of the subsequent year.

> For example, the death in service rate for the 2013/14 academic year is the proportion of the active stock in November 2013 that die in service between November 2013 and November 2014.

[46] The SWFC is a snapshot from census day in November of a given year.

Rates are calculated for all age groups for both genders using four years' of data and are weighted towards the most recent years. This death in service rate by age group and gender is then applied to the stock to estimate the number of teachers leaving by deaths in service for each phase and subject.

> For example, if the projected deaths in service rate for the overall Secondary stock for female teachers aged 50-54 is 0.1%, the model assumes that 0.1% of female Mathematics teachers aged 50-54 will leave as deaths in service each year.

The model assumes that the Secondary death in service rates are consistent across the subjects e.g. if the deaths in service rate for female Mathematics teachers aged 50-54 is 0.1%, it is also 0.1% for female Physics teachers aged 50-54.

The model also assumes that the Primary and Secondary deaths in service rates remain constant over time.

These deaths in service rates are fed into the tabs for each individual phase and subject to estimate future death in service numbers for each phase and subject.

3.12 How does the model estimate the required future stocks (the teacher need) of teachers by phase?

Part One of the Teacher Supply Model calculates the teacher need by phase on the '**Calculation Primary teacher need**' and '**Calculation overall Secondary teacher need**' tabs respectively.

The model does this by estimating how the Pupil-Teacher Ratio (PTR) will change going forward (from the current PTR) as pupil numbers change (these are projected by the Pupil Projections Model). From this estimated PTR, given that the future number of pupils is known, the overall number of teachers required to provide this PTR can be calculated (this overall number of teachers includes teachers that are unqualified, centrally employed, or occasional).

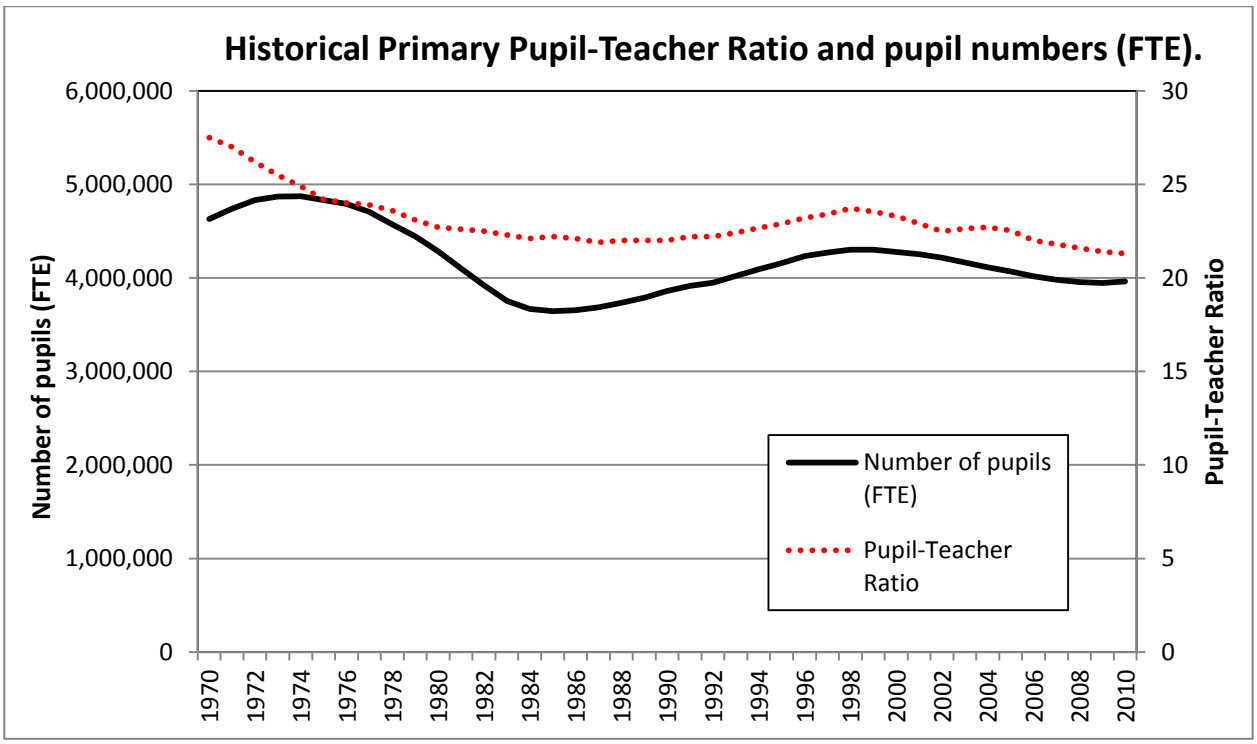

Figure 5: Changes in pupil numbers (FTE) and Pupil-Teacher Ratio (PTR) in Primary schools 1970-2010.

Source: School Census and 618g survey.

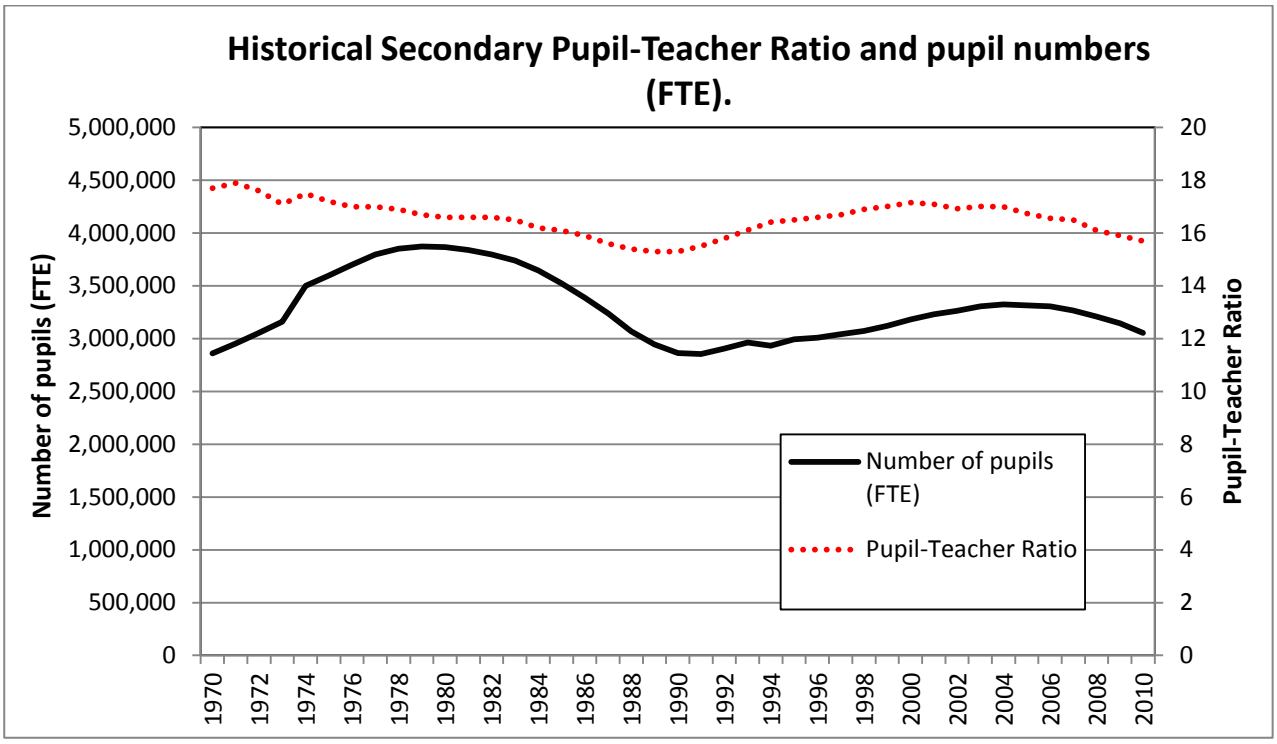

Figure 6: Changes in pupil (FTE) numbers and Pupil-Teacher Ratio (PTR) in Secondary schools 1970-2010.

Source: School Census and 618g survey.

Historical trends of Pupil-Teacher Ratio with changes in pupil FTE numbers from 1970-2010[47] can be seen in Figures 5 and 6 above for the Primary and Secondary phases respectively. These trends illustrate that as the pupil population has increased in the past, part of the additional need for teachers has been met by increasing class sizes (and therefore, PTRs).

These historical figures are used for making these assumptions (as opposed to more recent data that may be available) as they provide evidence on how state-funded schools sector have adapted most recently to, and managed, an increase in pupil numbers over a prolonged period of time[48].

Using rates of PTR change from the historical data above, the model assumes that, for an increase in pupil population of **1%**, the PTR will increase by **0.5 percentage points**[49] for the Primary phase and **0.6 percentage points** for the Secondary phase up to a maximum cap[50]. Should pupil numbers increase such that the PTR would exceed this cap, teacher need increases such that the PTR will remain constant (at this cap).

This desired PTR for the system is used to calculate the number of Full-time Equivalent (FTE) teachers required (the '**teacher need**').

The PTR caps to be used in the model are **22** for the Primary phase and **16** for the Secondary phase (relating to the maximum PTR levels observed around the year 2000[51]).

The current (November 2014) **ratio of unqualified to qualified teachers** is estimated by the TSM using the latest SWFC data (by both phase and subject). This ratio is then applied to the FTE teacher need (by both phase and subject[52]) to subtract the proportion of the teacher need that is assumed will be met by *unqualified* teachers in the future[53]. It is assumed that this rate will remain constant going forward to reflect stability of the unqualified teacher rate in the SWFC and the approach used in the TSM historically.

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[47] Source of information: https://www.gov.uk/government/publications/class-size-and-education-in-england-evidence-report.

[48] More recent data (up to 2014) on Pupil-Teacher Ratios is available within the School Workforce Statistical First Release. For more information, see: https://www.gov.uk/government/statistics/school-workforce-in-england-november-2014. PTRs calculated for years pre-2010 use teacher numbers values from a now discontinued data source. Therefore, as the 1970-2014 PTR time series is not consistent in the data sources used, PTR values post-2010 have not been presented in Figure 5 and 6.

[49] Based on the rates of PTR increase observed in the late 1990s when pupil numbers were increasing noticeably.

[50] This is the approach that has been used in previous versions of the TSM and is based on historical increases of PTR with increasing pupil numbers.

[51] The figures differ slightly to those presented in Figures 5 and 6 as they have been *adjusted* to account for unqualified teachers.

[52] This calculation is performed on the 'teacher need by subject' tab for the Secondary phase and takes into account that different subjects have proportionately more or less unqualified teachers than others.

[53] A similar approach is used to estimate the proportion of teacher need that will be met by centrally employed teachers.

The FTE teacher need is then converted into *headcount* teacher need by multiplying the FTE teacher need by the *FTE rate* for teachers. Values for the Primary and Secondary phase are calculated separately from the SWFC. It is assumed that these FTE rates will remain constant going forward.

The teacher need values by phase as calculated by the TSM are illustrated in Figure 7 below. All figures are calculated using the central scenarios.

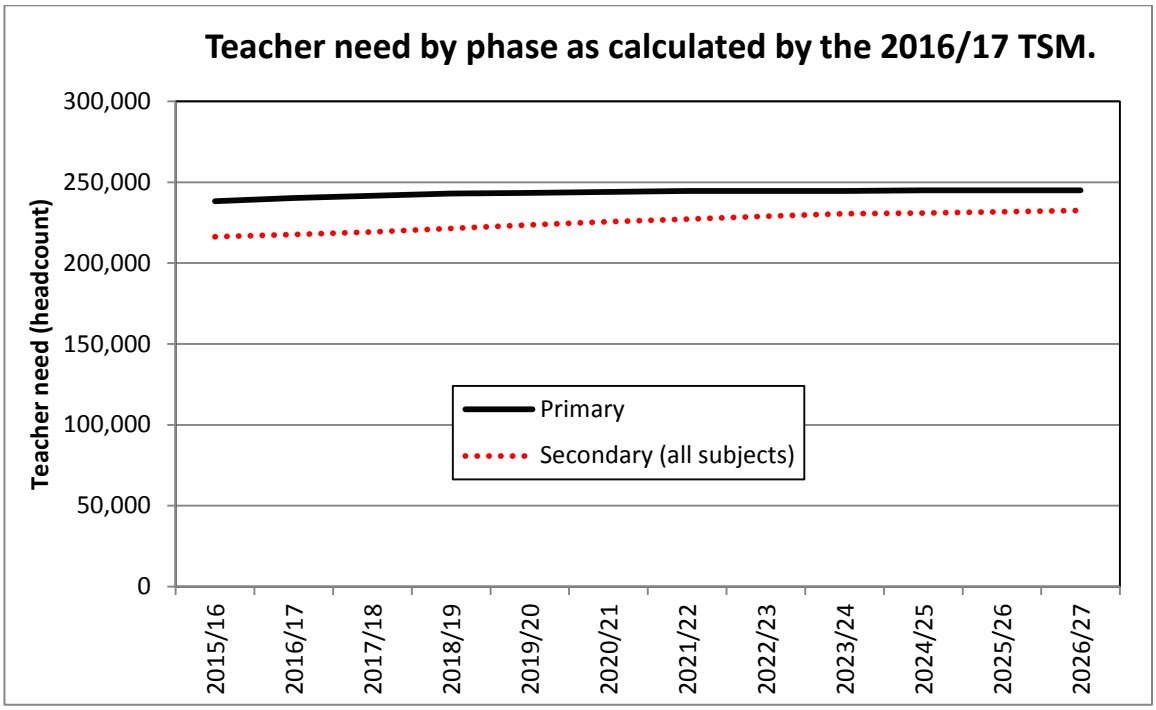

Figure 7: Teacher need values by phase as calculated by the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

3.13 How does the 2016/17 TSM estimate the future stocks of Secondary teachers by subject (i.e. the Secondary teacher need by subject)?

Once the FTE teacher need for the *overall* Secondary phase has been calculated, this figure can then be divided into the teacher need for individual subjects on the **'Teacher need by subject'** tab.

At a high level, this works on the assumption that if 10% of the total teaching time of the Secondary workforce is spent teaching English (for example), then 10% of the FTE Secondary workforce needs to be English teachers. In other words, 10% of the Secondary lessons are currently English lessons.

To reflect that different subjects are more/less popular at the different Key Stages, and that the proportion of the Secondary pupil population at the different Key Stages is in flux, the model estimates the average quantity of teaching time required per pupil for each subject at KS3, 4 and 5 which is then multiplied upwards using projected pupil numbers

to take into account the changing teacher need for subjects as the pupil demographics change[54]. If secondary pupil numbers increase through increased numbers of pupils leaving primary school and moving up to secondary, any increase in secondary pupil numbers will be experienced at Key Stage 3 *before* Key Stage 4 and then 5.

All Secondary teacher need values are adjusted to account for the FTE rates of the Secondary workforce and the proportion of teachers that are expected to be unqualified.

The teacher need values for a selection of subjects as calculated by the TSM are illustrated in Figure 8 (below). All figures are calculated using the central scenarios. Graphical representations of teacher need for all subjects as calculated by the model are available on the **'Teacher need charts over time'** tab.

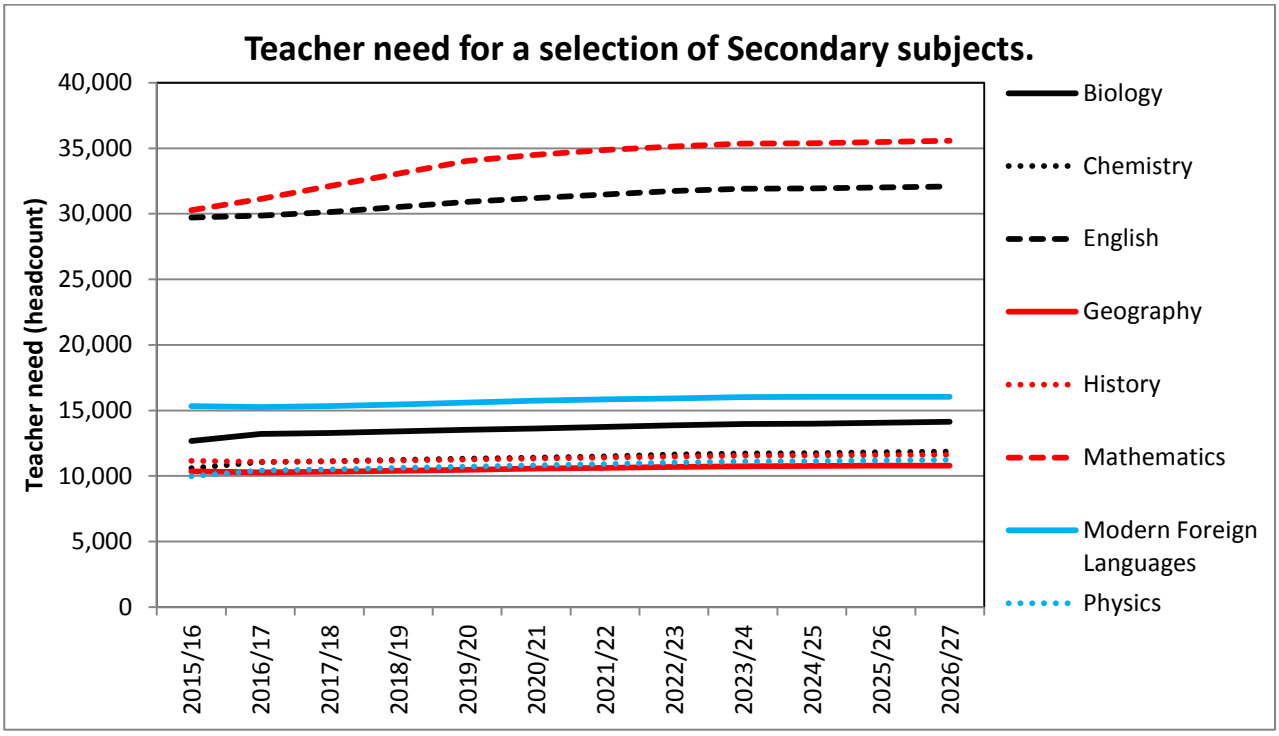

Figure 8: Teacher need values for a selection of subjects as calculated by the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

[54] Different subjects require different amounts of average teaching time per pupil at KS3, 4 and 5.This is a result of different subjects being more/less popular at the different Key Stages and differences in curriculum time. For example, Business Studies is far more popular at KS4 than KS3. Additionally, subjects such as Social Studies and Psychology (within the 'Others' subject group) are considerably more popular at KS4 and KS5 than at KS3.

3.14 How does the 2016/17 TSM account for any additional need for teachers resulting from new teacher related policies?

If a teacher-related policy is expected to *increase* the future need for teachers (teacher need) by **more than 100 FTE teachers in 2017/18 or beyond**, a *policy assumption* (based on evidence) to increase teacher need could be added to the model[55].

If a policy relates to the *training* of teachers, e.g. 100 teachers are to be trained by a new training route, an assumption in the TSM is *not* required as this policy does not affect the number of teachers required in the active stock.

There are no policies relating to the *overall need* for Primary teachers or an additional requirement for more Primary teachers within the active stock.

There are **seven** Secondary teacher related policies that would result in an increase in the number of teachers of particular subjects needed by more than 100[56].

These assumptions are summarised on the '**Policy assumptions Secondary**' tab within both Part One and Two of the TSM. Six of the seven policies (all of those used in Part One) are expected to affect the popularity of particular subjects at particular points within the Secondary education process (e.g. the continuing increases in uptake of EBacc will have made some subjects more popular at Key Stage 4 than they were in the previous SWFC data). Using this information, assumptions are made by the model as to how the proportion of the overall Secondary teacher requirement at Key Stage 3, 4, or 5 might increase (and in what academic year those increases would occur) and are added into the '**Secondary need by subject**' tab.

The policy assumptions that have been added into the 2016/17 TSM are listed below:

- **Hold 2016/17 ITT places for all EBacc subjects at 2015/16 TSM levels (if higher)**
    - The future impact of 'EBacc for all' to create a significant increase in the number of KS4 pupils taking the EBacc, in particular, the number of pupils studying a Modern Foreign Language and either Geography or History has not been accounted for within the teacher need calculations of Part One of the 2016/17 TSM. However, as a first step to support the implementation of the policy in advance of the information needed to model teacher requirements in detail, an end of model assumption is used within the 2016/17 TSM to ensure that 2016/17 ITT places for all EBacc subjects will not fall below 2015/16 levels. In future, the impact of these curriculum changes on future teacher need will be accounted for within the teacher

[55] This assumption could be made at either phase or individual subject level.
[56] Following analysis carried out by the department.

need calculations of the 2017/18 TSM once the outcome of the forthcoming consultation on EBacc is known.

- The number of Secondary 2016/17 ITT places for all EBacc subjects are held at 2015/16 TSM levels, if the 2015/16 figure was greater than those generated by the model in the first instance. EBacc subjects include Biology, Chemistry, Classics, Computing, English, Geography, History, Mathematics, Modern Foreign Languages, and Physics. Mathematics is exempted from this adjustment as the number of Mathematics ITT places calculated by the 2016/17 TSM (under central scenario conditions) is in excess of the number calculated by the 2015/16 model.

- **Introduction of EBacc and adjustments to EBacc subjects**

  - As for the 2015/16 model, the model assumes continuing increases in EBacc subject take-up, caused by the 2010 introduction of the EBacc policy. This adjustment affects modelling results before the adjustment to ITT places described above is made.

  - As in the 2015/16 model, it is assumed that if there was a policy-led increase in teaching hours for one subject (e.g. Mathematics), there would be a corresponding decrease across the other subjects to accommodate this change. This decrease would be proportional across other subjects, i.e. we wouldn’t assume that an increase in Mathematics teaching would specifically be met wholly by decreasing the amount of Art, Drama, and Music teaching. In reality, schools may prioritise the teaching of some subjects i.e. 'ring-fencing' the amount of teaching required for them. Increases in teaching hours are assumed to be experienced by all subjects except English, Mathematics, and the Sciences. This applies to this assumption on increasing EBacc take-up and to the following 5 adjustments.

- **Removal of the option to take just Core Science GCSE**

  - The introduction of the new Combined Science GCSE, which will be equivalent to the current Core and Additional Science GCSEs, will remove the option to take the Core Science GCSE only. We are expecting that for 10% of KS4 students, their Science teaching time will double from September 2016 onwards (as they change to the Combined Science GCSE).

- **Core Mathematics**

- Up to 40% of post-16 pupils could be studying a qualification which takes up similar teaching time of an AS level. Internal modelling has estimated the number of additional KS5 Mathematics teachers needed in state-funded schools by year[57].

- **Enhanced Further Mathematics Support Programme**

  - The Enhanced Further Mathematics Support Programme will be active from March 2014 for 3 years. It is expected that this policy will result in continuing increases in the uptake of further Mathematics and Mathematics A-level at roughly the same rate as currently, which will require more advanced level Mathematics teachers[58].

- **New Mathematics GCSE**

  - The new Mathematics GCSE will require a greater amount of Mathematics teaching per pupil at both KS3 and 4.

  - The model assumes that for 27% of Key Stage 3 and 28% of Key Stage 4 pupils, Mathematics teaching will increase by one hour and that this increase will be gradual across five academic years.

- **New English GCSE**

  - The new English GCSE will require a greater amount of English teaching per pupil at KS4.

  - A one-off assumption is used by the model that any increase seen on 2013/14 at Key Stage 4 in English teaching hours will be seen again between 2014/15 and 2015/16. This increase will be equal to a 2.07% increase in teaching hours.

  - Different assumptions have been used for the new Mathematics and English GCSEs to reflect that the changes which will be made to the GCSEs are expected to have very different impacts on the amount of teaching time required for those subjects.

[57] This number is added on to the Mathematics teacher need in the 'teacher need by subject' tab.

[58] The number of KS5 Mathematics teaching hours is adjusted accordingly within the 'teacher need by subject' tab.

3.15 How does the 2016/17 TSM estimate the number of teachers needed to enter the stock each year (the entrant teacher need)?

Part One of the TSM models the 'need' for entrant teachers by assuming that:

'Need' for entrant teachers in year *x* (Entrant need) = Teacher need in year *x* –

Stock of teachers at the end of previous year +

No. of teachers expected to leave in year *x*

Therefore the model assumes that the need for entrant teachers in a particular year is equal to:

1. The number of additional/fewer teachers that might be required compared to the stock from the previous year (e.g. because pupil numbers have increased/decreased or there have been curriculum changes) *and* ,

2. The number of teachers that are expected to leave (and require replacement).

The entrant teacher need (by headcount) is calculated individually for each phase/subject on the relevant phase/subject tab. For example, the calculations for Mathematics are on the **'Mathematics'** tab. The individual steps required in this calculation are summarised in Section 3.16.

3.16 The individual steps of calculating the entrant teacher need for each phase and subject.

Collated on the yellow output tabs at the end of the model (for all the different subjects and phases together) are both the entrant teacher need values plus any other values that are calculated by the model (e.g. the number of retirements as estimated and assumed by the model are collated on the **'No.s of retirements over time'** tab for example).

The entrant teacher need as provided on the **'OUTPUTS FOR PART 2'** tab is the output of Part One of the TSM and feeds directly into Part Two of the model.

Figure 10 below illustrates the process of calculating the entrant teacher need for each phase and subject. This process is carried out on an individual tab for each subject and phase (for example, all the Mathematics calculations are performed on the **'Mathematics'** tab, the Primary on the **'Primary'** tab etc). All figures calculated are in headcount form.

The calculation process is carried out for one academic year at a time. This is a result of the calculation of values for the 2016/17 academic year being dependent on all the values being calculated for the 2015/16 academic year first (and so on).

The process is described in more detail below in Figure 9 using the 2015/16 academic year as an example. This process is carried out separately for all subjects and phases on the tab relating to that subject or phase.

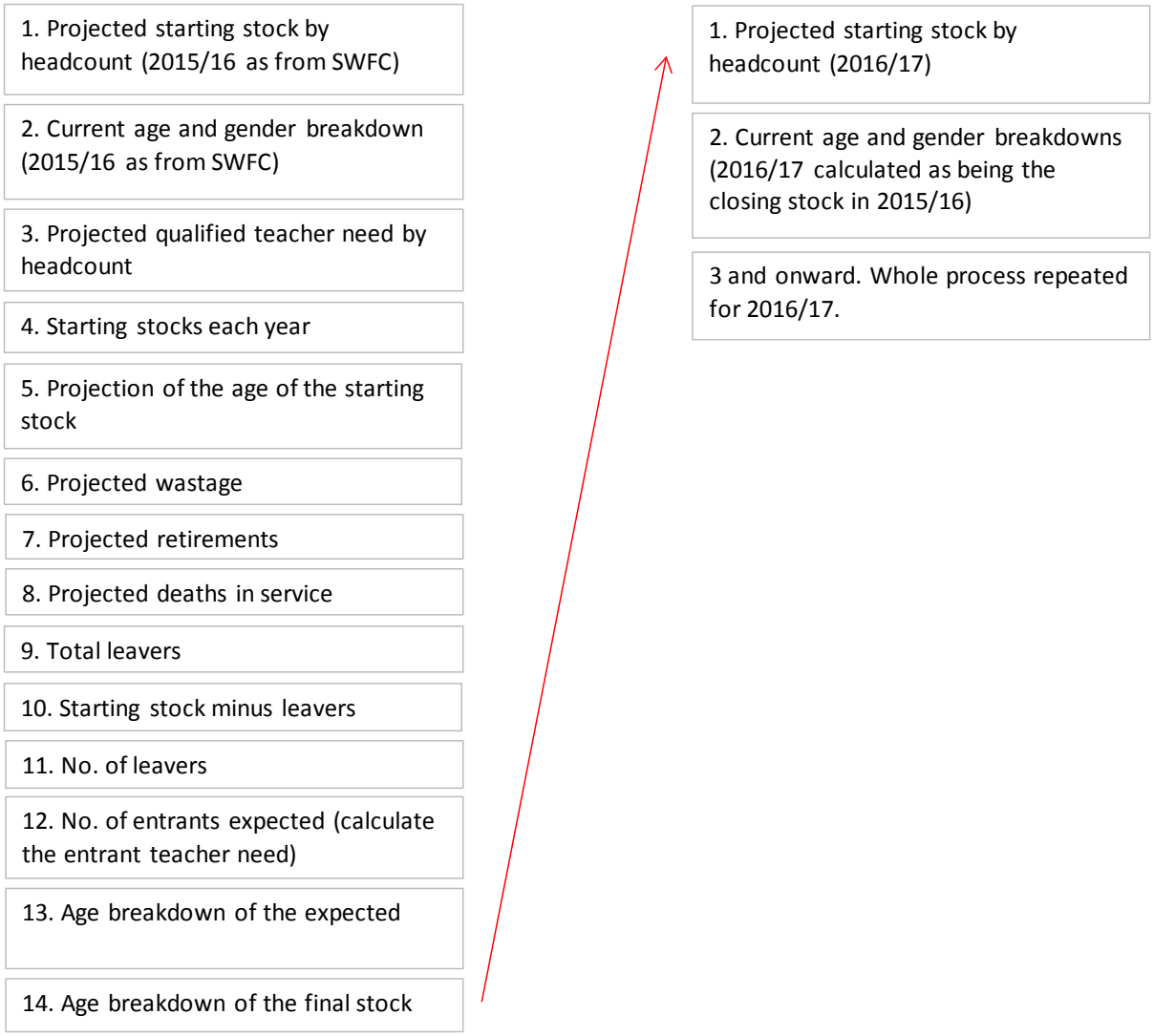

Figure 9: The process of calculating the entrant teacher need values for each phase and subject within the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

1. Projected starting stock by headcount

The **starting stock for 2015/16** is the assumed closing stock from 2014/15, i.e. the *current* stock figures as provided by the 2014 SWFC (see Section 3.4 for more details).

Going forward, the model needs to make an assumption as to how the size of the starting stock will change. It does this by making a high level assumption that the state-funded schools system adapts to changing numbers of pupils over time by meeting the required *need* for teachers in each year (and thus achieving the desired/expected PTR of the state-funded schools system). The projected stock figures are calculated on the **'Forecast stock figures'** tab.

E.g. if the system requires 10,000 Mathematics teachers in 2015/16, the system *will* recruit enough teachers to meet that teacher need. Therefore, the stock of Mathematics teachers at the end of 2015/16 will be 10,000. *This* will be the starting stock for 2016/17.

In other words, the model assumes that **starting stock of a given year will be equal to the need of the year before**.

However, in order to calculate the future entrant teacher need, the model needs to make assumptions as to how the number of leavers will change over time (i.e. how many replacements will be required each year[59]) and therefore how the characteristics of the active stock will change in future.

2. Current age and gender breakdowns

The model assumes that the 'current' age and gender breakdowns (for 2015/16) will be the same as those in the closing stock for 2014/15. The model assumes that these stock figures are those given from the SWFC for the relevant subject/phase.

3. Projected qualified teacher need by headcount

These values are calculated by the model already by subject/phase projected into the long term future (see Section 3.12 and 3.13).

4. Starting stocks each year

The model assumes that the starting stock for 2014/15 is as the current age group and gender breakdowns.

5. Projection of the age of the starting stock

Demographic breakdowns of the *current* active stock are produced from the SWFC.

The active stock is broken down into 5 year age groups for each gender.

The model then makes an assumption as to how the stock naturally ages year-on-year[60].

6. Projected wastage

The model takes the stock from part 5 and assumes that a certain number of teachers will leave as wastage in 2015/16 using the assumed projected wastage rates for each academic year (see Section 3.9).

[59] As the demographics of the stock changes, so does the proportion that will leave as there are differences in the leaver rates of different age groups.
[60] Each year one fifth of each five year age group 'moves up' to the age group above.

Different wastage rates are applied to the different genders and age groups.

7. Projected retirements

The model takes the stock from part 5 and assumes that a certain number of teachers will leave as retirements in 2015/16 using the assumed projected retirement rates for each academic year (see Section 3.10).

Different retirement rates are applied to the different genders and age groups.

8. Projected deaths in service

The model takes the stock from part 5 and assumes that a certain number of teachers will leave as deaths in service in 2015/16 using the assumed projected deaths in service rates for each academic year (see Section 3.10).

Different deaths in service rates are applied to the different genders and age groups.

9. Total leavers

The total number of leavers in 2015/16 (as assumed by the model) are added together and broken down by their gender and age group. The model has now calculated the numbers of teachers for that phase or subject that is expected leave in 2015/16.

10. Starting stock minus leavers

The stock that *started* the academic year 2015/16 now has the teachers expected to leave in 2015/16 subtracted away.

11. No of leavers expected

The total number of leavers in 2015/16 by all leaver routes are added together.

12. The number of entrants expected

The model now calculates the number of entrants required in 2015/16 (the entrant teacher need for 2015/16).

This value is equal to the number of additional or future teachers needed in 2015/16 due to greater/fewer numbers of pupils *plus* the number of teachers expected to leave the stock in 2015/16.

13. Age breakdown of expected entrants

The model then assumes that this number of teachers will enter into the stock in 2015/16. In other words, the number of entrants in 2015/16 will be equal to the entrant teacher need 2015/16.

High-level assumptions are then made on the 2015/16 entrants' characteristics:

- The model assumes that the age group breakdown of entrants coming in is equal to the historical age group breakdowns of entrants (from all entrance routes combined) from the four previous years[61] of SWFC data (for each phase). These are calculated on the **'entrant age breakdowns'** tab.

- The gender balance of entrants is assumed to be the same as the current stock. For example, if 40% of Physics teachers in the current stock are female, the model assumes that 40% of Physics entrants will also be female.

14. Age breakdown of the final stocks

These entrants broken down by gender and age group for 2015/16 are then added to the stock calculated in part 10 to give the *closing* stock for the 2015/16 academic year.

The model assumes that this stock breakdown will be the *starting* stock breakdown for the subsequent year, 2016/17. The whole process now repeats itself.

The Teacher Supply Model in future years

Each year, *new* SWFC current stock data will become available and will be added to the model. This data will update the:

- PTR led teacher need calculations and how the ratios of pupils and teachers are actually changing over time given funding and accommodation capacity issues.
- FTE rates of the stock.
- The unqualified rates of the stock.
- Demographic breakdowns of the stock to reflect how they will change slightly over time.

[61] The data from the previous four years is weighted towards the most recent year. Data is available up to 2013/14, although data for 2012/13 and 2013/14 remains provisional. Data on the age of entrants is not used for individual subjects.

Section 4: Part Two of the 2016/17 Teacher Supply Model.

Section 4 of this user guide describes:

- What Part Two of the 2016/17 Teacher Supply Model (TSM) does,
- The structure of Part Two of the 2016/17 TSM,
- The data which feeds into Part Two of the 2016/17 TSM,
- The assumptions used to produce this data, and
- The calculations used by Part Two of the TSM (at a high level) to calculate the 2017/18 NQT[62] entrant teacher need and the 2016/17 postgraduate ITT[63] trainee need by both phase and subject, and the assumptions behind them.

4.1 What does Part Two of the 2016/17 Teacher Supply Model do?

Part Two of the Teacher Supply Model takes the numbers of teachers (as a headcount) needed to enter the stock each year from Part One of the model and estimates the **NQT entrant teacher need** for 2017/18.

The model calculates the number of NQT entrants required in a particular academic year using the following formula:

No. NQT entrants required in yr *x(NQT entrant need)* = 'Need' for entrant teachers in yr *x (entrant need)* -

No. deferred entrants expected in yr *x(deferred entrant need)* -

No. re-entrants expected in yr *x (re-entrant need)*

To do this, Part Two of the model needs to estimate the number of teachers expected to enter the active stock as **entrants that are new to the state-funded schools sector** or **re-entrants** in 2017/18.

- Entrants that are new to the state-funded schools sector are qualified entrant teachers who did not qualify in the year before they entered into the active stock. They are not recorded on the departments' datasets as having previously held a regular teaching role within a state-funded Primary/Secondary/academy school in

[62] Newly Qualified Teacher.
[63] Initial Teacher Training.

England. However, they may have taught previously within a PRU, special school, independent school, or school in Wales/Scotland etc.

- Re-entrants are entrant teachers who did not qualify in the year before they entered into the stock and are recorded on the departments' datasets as having previously held a regular teaching role within a state-funded Primary/Secondary/academy school in England at an earlier point in their career.

The NQT entrant teacher need is the number of NQTs required to enter into the active stock in the 2017/18 academic year to meet the teacher need estimated in Part One.

The model estimates the proportions of entrants entering the active stock via the different entrant routes (NQT, new to state-funded sector, and re-entrant) using historical entrants' data from the School Workforce Census (SWFC).

Entrant teachers are *not* all employed as full-time teachers with a Full-time Equivalent (FTE) value that is equal to 1.0 FTE. Additionally, the FTE values of entrant teachers may be lower/higher than that of the overall active stock.

To account for this, Part Two of the model calculates the total FTE number of teachers entering by each entrance route (e.g. as NQTs, re-entrants etc) and adjusts these numbers to ensure that the total FTE value for entrants by all routes[64] is *equal* to the total FTE number of entrant teachers required as calculated by Part One.

Using the NQT entrant teacher need values, Part Two of the model then estimates the **postgraduate ITT trainee need**. This is the number of postgraduate ITT places in 2016/17 required to generate this number of NQTs entering into the active stock in 2017/18. This conversion is made by making assumptions as to how many trainees are likely to complete their courses and go into employment in the state funded schools sector post ITT.

The postgraduate ITT trainee need calculated only covers those trainees both starting and completing ITT in 2016/17.

*The **postgraduate ITT trainee need** is the **final output** of the 2016/17 Teacher Supply Model and feeds into the NCTL 2016/17 ITT recruitment process[65]. The outputs of the TSM directly inform the phase/subject level recruitment controls and the amount of funding made available to support trainees.*

[64] Whilst *maintaining* the expected ratio of entrants by different entrant routes by headcount.

[65] The postgraduate ITT trainee need as calculated by the TSM includes any places that are to be assigned to Teach First.

4.2 Structure of Part Two of the 2016/17 Teacher Supply Model.

Each tab in the model workbook includes information at the top as to where data is sourced from and which tabs it may feed into.

Additionally, a model map is provided on the '**map of sheets**' tab showing which tabs feed into which and how the overall model is structured. This map is presented below as Figure 10.

Table 4 (see A.2 in the Annex) provides a description of each tab within Part Two of the 2016/17 TSM and what that tab does.

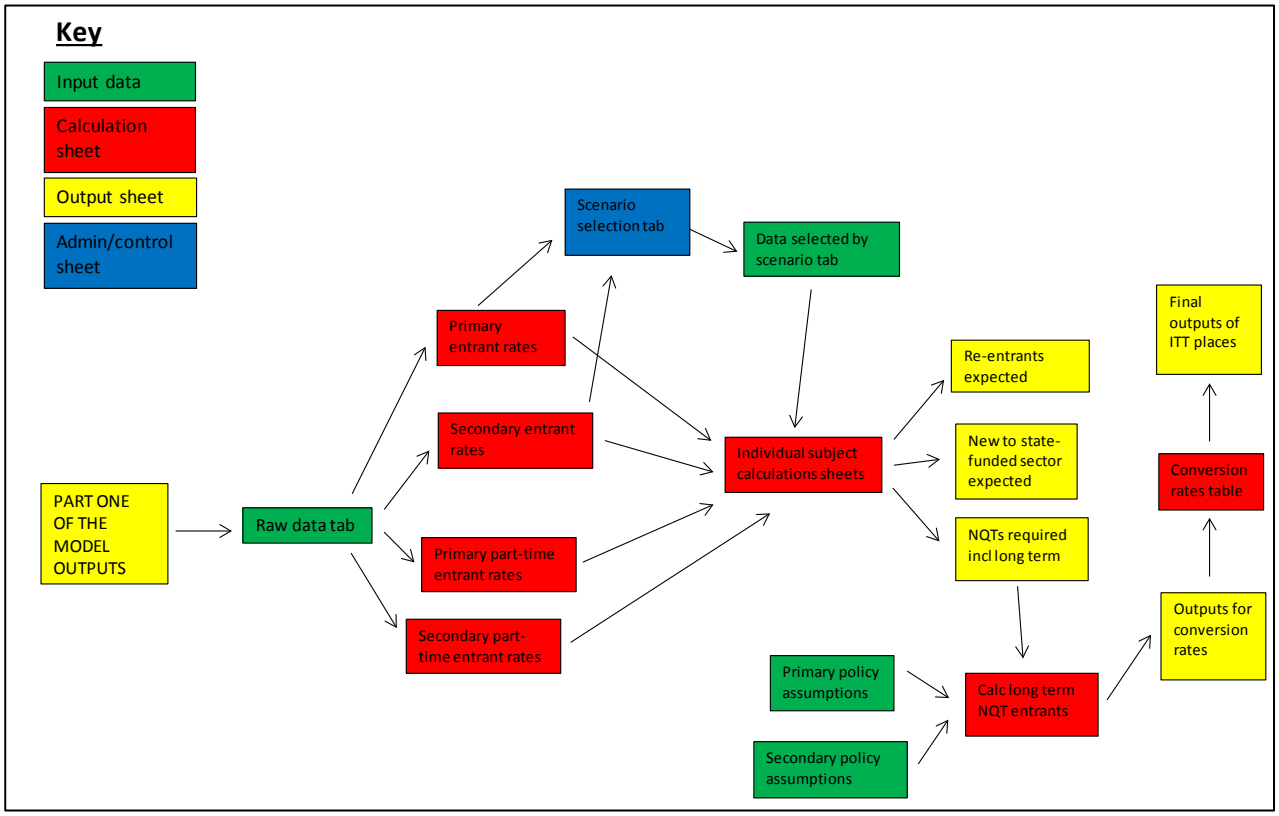

Figure 10: Map of Part Two of the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part Two.

4.3 The data that feeds into Part Two of the 2016/17 Teacher Supply Model.

The following data sources feed into Part Two of the Teacher Supply Model:

- **Entrant teacher need** values (as a headcount) for all subjects and phases from Part One of the model.

    - The values for 2017/18 are the only ones used within Part Two of the 2016/17 TSM.

    - Values for high, central, and low scenarios are used (as estimated using scenario testing in Part One).

    - Only the central scenario values are used in the NCTL 2016/17 ITT recruitment process. The higher and lower values are only used as an indication of how much lower/higher the need for NQTs/trainees might be given extremes of what might happen (e.g. all the different scenarios conspire in the same direction to make the teacher need higher/lower).

- **Teacher entrants data** from the **School Workforce Census (SWFC)**. See Section 3.7 for more details on the SWFC.

- **Teacher stocks data** from the **matched School Workforce Census 2014**.

    - Data on the Full-time Equivalent (FTE) rates of part-time teachers and proportion of entrants that are part-time for each of the different entrant routes.

- Data from the **National College for Teaching and Leadership** on:

    - The **number of trainees completing ITT** from the **NCTL Performance Profiles**. This data is a weighted average from the four most recent years of data.

    - The **number of trainees gaining employment** in the state-funded sector on completion of ITT from the **Destination of Leavers from Higher Education (DHLE) survey**. This data is a weighted average from the four most recent years of data.

    - Data on the number of trainees on longer term courses (e.g. undergraduate teacher training courses) from the **2014/15 NCTL ITT census.** An assumption is made that the published figure on such trainees includes the netted number deferring and re-entering ITT in 3 years' time.

All data inputs into Part Two of the model are provided in the '**raw data inputs**' tab in the model workbook.

The department's standards for data suppression require that fields relating to fewer than five individuals should not be published. In the department's statistical publication this is achieved by replacing figures based on fewer than 5 individuals with an "x". That approach does not work in the TSM as it would suppress the entire function within the model. To overcome this - and still apply the department's suppression rules - fields with fewer than 5 individuals have been aggregated either across gender or age bands. These amendments increase the overall postgraduate ITT trainee need total by **one trainee**.

More information on the data sources used in the Teacher Supply Model can be found within **Section 7**.

4.4 How does the 2016/17 TSM estimate the numbers of entrants needed via NQT and non-NQT (e.g. re-entrants) routes?

Part Two of the TSM calculates the number of NQT entrants required in a particular year (2017/18) using the following formula:

No. NQT entrants required in yr *x (NQT entrant need)* = 'Need' for entrant teachers in yr *x (entrant need)* -

No. new to state-funded sector entrants expected in yr *x(new to SF sector entrant need)* -

No. re-entrants expected in yr *x (re-entrant need)*

Therefore the model is assuming that the number of NQT entrant teachers required in 2017/18 is equal to the overall entrant need for 2017/18 minus the number that will enter via the other entrant routes in that year.

Values are estimated using the high, central, and low scenarios as determined by scenario testing in Part One of the model.

The proportion of the 'entrant need' that will be met by re-entrants or those who are new to the state-funded sector is assumed using a weighted[66] average of re-entrant & new to the state-funded sector rates from the previous four years of data[67].

Values are calculated separately for the Primary and Secondary phases. Values are calculated for the Primary phase on the '**calc PRIM entrant rates**' tab and on the '**calc SEC entrant rates**' for the Secondary.

> For example, if the weighted historical re-entrant rate is 40%, the model assumes that 40% of entrants will be re-entrants. If the entrant need for Mathematics teachers in 2017/18 is 1,000, the model will assume that 400 (40%) of the Mathematics entrants in 2017/18 will be re-entrants.

[66] A weighted average is used to account for the fact that the two most recent years of data is provisional and subject to change.
[67] Data is from the matched SWFC.

4.5 How does the 2016/17 TSM account for different working patterns among the entrants?

Not all entrants will be employed as teachers full-time, with a Full-time Equivalent (FTE) value of 1.0. In particular, NQTs are more likely to be employed full-time than entrants via other entrant routes such as re-entrants. As a consequence, one entrant teacher does not necessarily equal 1.0 FTE teacher.

To ensure that the number of entrants *will* provide the number of FTE teachers required (as identified by Part One[68]), Part Two of the model has to ensure that the FTE 'quantity of teachers' entering the stock via each route is equal to the FTE quantity needed from Part One.

The TSM assumes that full-time entrants are 1.0 FTE and part-time entrants have an FTE value equal to the average FTE of part-time teachers[69] as calculated within the current stock (from the SWFC).

The expected FTE rates of the entrants via the different routes are estimated by the model using historical weighted averages of SWFC entrants data, e.g. 10% of returners are part-time, 2% of NQTs are part-time etc. Values are estimated on the '**calc PRIM part-time entrants**' and '**calc SEC part-time entrants**' tabs for the two phases respectively.

Using these assumptions, the model then calculates the *actual* FTE value of teachers supplied by each route for each phase and subject on the relevant phase/subject tab. For example, all Mathematics calculations are performed on the **'Mathematics'** tab, the Primary on the **'Primary'** tab etc.

The model scales the numbers of entrants via each route accordingly to provide enough FTE teachers to meet the entrant teacher need whilst still retaining the rates of entrant teachers via the different routes as expected[70].

The model assumes that the rates of new to the state-funded sector entrants and re-entrants expected are consistent across Secondary subjects. The number of new to the state-funded sector entrants and re-entrants expected by phase and subject are collated on the **'New to SF sector expected'** and **'Re-entrants expected'** tabs respectively.

The model assumes that any remaining entrants will be NQTs.

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[68] The entrant teacher need.

[69] For the relevant phase.

[70] As calculated and assumed from the historical SWFC data on the proportion of entrants via different routes.

4.6 How does the 2016/17 TSM estimate the numbers of entrants via NQT routes who studied on courses lasting longer than a year?

The model has now calculated the number of entrants expected who are NQTs by both subject and phase (the NQT entrant teacher need for 2017/18). These values are collated on the **'NQT entrants required inc UGs'** tab.

However, some of these NQTs will be those who have studied on courses lasting more than one year[71]. These trainees would *not* require recruitment to ITT beginning in 2016/17 as they are already 'in the ITT system'.

To reduce the 2017/18 NQT entrant teacher need accordingly to remove these trainees on longer courses, the model uses NCTL ITT census data to identify the number of trainees on longer training courses by phase and subject who are expected to graduate in 2016/17.

Using subject/phase ITT specific drop-out rates and rates of employment on the completion of ITT, the model estimates (on the '**Calc long term NQT entrants**' tab) the number of these trainees who are expected to complete their ITT courses *and* enter into the active stock in 2017/18 (using historical performance profiles data from NCTL). These numbers are calculated for all phases and subjects.

This number of NQT entrants who studied on longer courses that will meet part of the 2017/18 NQT entrant teacher need are subtracted from the overall NQT entrant teacher need accordingly.

This provides the 2017/18 NQT entrant teacher need value by phase and subject for those NQTs who will both start and complete ITT in 2016/17 to enter the active stock in 2017/18.

4.7 How does the 2016/17 TSM convert the number of trainees into the number needed to start ITT?

The model uses subject/phase specific ITT drop-out rates and rates of employment on the completion of ITT to convert the 2017/18 NQT entrant teacher need into the number of trainees required to both begin and complete ITT in 2016/17 (the 2016/17 postgraduate ITT trainee need). This postgraduate ITT trainee need *includes* School Direct and Teach First trainees. These calculations take place on the '**conversion rates table**' tab.

[71] Their courses would begin before 2016/17.

When using the ITT drop-out rates and rates of employment, the model assumes that the distribution of places to different routes (e.g. HEI, School/employment based etc) will be the same as for the most recent years.

The final outputs of the TSM to feed into the allocations model are summarised on the '**Final outputs of ITT places**' tab.

4.8 How does the 2016/17 TSM calculate the number of trainees starting ITT in 2016/17 on longer courses?

The TSM does *not* calculate the number of trainees required who will start ITT courses of more than one year length in 2016/17.

Such trainees would not be able to meet part of the teacher need or join the active qualified teacher stock until *after* 2017/18.

If NCTL wished to allocate additional ITT places to longer ITT courses (e.g. places on Primary undergraduate courses), these would simply be accounted for in future versions of the model as described in Section 4.6.

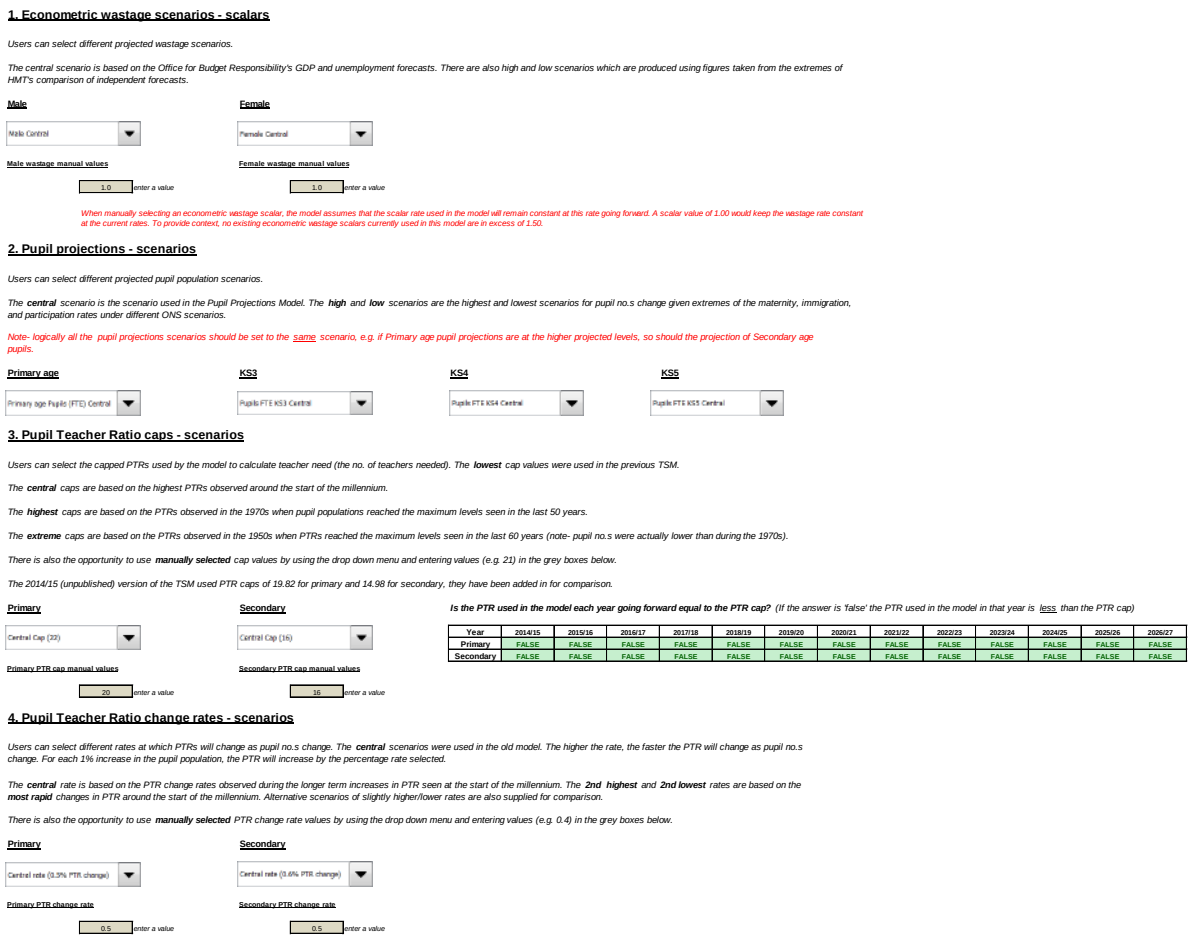
Section 5: Scenario testing in Part One of the 2016/17 Teacher Supply Model.

Section 5 of this user guide describes:

- How to use scenario testing in Part One of the 2016/17 Teacher Supply Model, and
- How to examine the outputs derived from such scenario testing.

5.1 How to use scenario testing in Part One of the 2016/17 TSM.

Part One of the TSM offers a range of scenario testing options on the '**SCENARIO SELECTION TAB**' tab.



1. Econometric wastage scenarios - scalars

Users can select different projected wastage scenarios.

The central scenario is based on the Office for Budget Responsibility's GDP and unemployment forecasts. There are also high and low scenarios which are produced using figures taken from the extremes of HMT's comparison of independent forecasts.

Male — Male Central

Female — Female Central

Male wastage manual values — 1.0 — enter a value

Female wastage manual values — 1.0 — enter a value

When manually selecting an econometric wastage scalar, the model assumes that the scalar rate used in the model will remain constant at this rate going forward. A scalar value of 1.00 would keep the wastage rate constant at the current rates. To provide context, no existing econometric wastage scalars currently used in this model are in excess of 1.50.

2. Pupil projections - scenarios

Users can select different projected pupil population scenarios.

*The **central** scenario is the scenario used in the Pupil Projections Model. The **high** and **low** scenarios are the highest and lowest scenarios for pupil no.s change given extremes of the maternity, immigration, and participation rates under different ONS scenarios.*

Note- logically all the pupil projections scenarios should be set to the same scenario, e.g. if Primary age pupil projections are at the higher projected levels, so should the projection of Secondary age pupils.

Primary age — Primary age Pupils (FTE) Central

KS3 — Pupils FTE KS3 Central

KS4 — Pupils FTE KS4 Central

KS5 — Pupils FTE KS5 Central

3. Pupil Teacher Ratio caps - scenarios

*Users can select the capped PTRs used by the model to calculate teacher need (the no. of teachers needed). The **lowest** cap values were used in the previous TSM.*

*The **central** caps are based on the highest PTRs observed around the start of the millennium.*

*The **highest** caps are based on the PTRs observed in the 1970s when pupil populations reached the maximum levels seen in the last 50 years.*

*The **extreme** caps are based on the PTRs observed in the 1950s when PTRs reached the maximum levels seen in the last 60 years (note- pupil no.s were actually lower than during the 1970s).*

*There is also the opportunity to use **manually selected** cap values by using the drop down menu and entering values (e.g. 21) in the grey boxes below.*

The 2014/15 (unpublished) version of the TSM used PTR caps of 19.82 for primary and 14.98 for secondary, they have been added in for comparison.

Primary — Central Cap (22)

Secondary — Central Cap (16)

Is the PTR used in the model each year going forward equal to the PTR cap? *(If the answer is 'false' the PTR used in the model in that year is less than the PTR cap)*

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Primary	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Secondary	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Primary PTR cap manual values — 20 — enter a value

Secondary PTR cap manual values — 16 — enter a value

4. Pupil Teacher Ratio change rates - scenarios

*Users can select different rates at which PTRs will change as pupil no.s change. The **central** scenarios were used in the old model. The higher the rate, the faster the PTR will change as pupil no.s change. For each 1% increase in the pupil population, the PTR will increase by the percentage rate selected.*

*The **central** rate is based on the PTR change rates observed during the longer term increases in PTR seen at the start of the millennium. The **2nd highest** and **2nd lowest** rates are based on the **most rapid** changes in PTR around the start of the millennium. Alternative scenarios of slightly higher/lower rates are also supplied for comparison.*

*There is also the opportunity to use **manually selected** PTR change rate values by using the drop down menu and entering values (e.g. 0.4) in the grey boxes below.*

Primary — Central rate (0.3% PTR change)

Secondary — Central rate (0.6% PTR change)

Primary PTR change rate — 0.5 — enter a value

Secondary PTR change rate — 0.5 — enter a value

Figure 11: Screenshot of the scenario testing in Part One of the 2016/17 Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

Users of the model can select *different* scenarios of data to be used in Part One of the model using the drop down menus provided. See Figure 11 for an illustration of the scenario testing tab.

Entrant teacher need output values generated by the model using the scenarios as selected.

These are the model outputs generated using the scenarios selected using the drop down menus above.

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Primary	27,159	26,622	26,117	26,080	25,342	25,464	25,349	25,025	24,784	25,161	24,927	24,838
Art & Design	854	805	865	885	897	915	914	918	933	904	909	899
Biology	1,358	1,897	1,485	1,537	1,534	1,526	1,553	1,589	1,568	1,515	1,555	1,558
Business Studies	401	343	363	371	352	380	416	451	452	452	471	466
Chemistry	1,166	1,649	1,275	1,316	1,297	1,288	1,315	1,348	1,316	1,266	1,304	1,307
Classics	40	36	34	32	31	31	31	32	32	32	32	32
Computing	877	810	895	907	893	914	923	937	937	907	923	919
Design & Technology	1,224	1,154	1,225	1,223	1,220	1,215	1,178	1,152	1,161	1,104	1,098	1,082
Drama	480	455	487	497	508	517	514	515	528	512	516	512
English	3,356	3,232	3,354	3,482	3,508	3,434	3,426	3,446	3,392	3,240	3,303	3,308
Food	243	210	260	271	264	264	264	266	252	237	243	244
Geography	1,051	988	1,067	1,078	1,084	1,097	1,083	1,078	1,095	1,054	1,061	1,055
History	1,129	1,058	1,138	1,150	1,154	1,173	1,165	1,166	1,184	1,144	1,153	1,145
Mathematics	4,189	4,347	4,502	4,504	4,567	4,117	4,045	3,973	3,926	3,763	3,814	3,803
Modern Foreign Languages	1,599	1,531	1,692	1,737	1,774	1,787	1,754	1,735	1,750	1,678	1,679	1,665
Music	519	506	521	522	534	539	525	515	536	518	514	507
Others	1,588	1,442	1,379	1,361	1,325	1,396	1,469	1,544	1,600	1,599	1,631	1,597
Physical Education	1,445	1,304	1,566	1,623	1,617	1,652	1,656	1,675	1,666	1,594	1,636	1,646
Physics	1,139	1,602	1,234	1,261	1,224	1,210	1,231	1,259	1,219	1,167	1,202	1,206
Religious Education	725	663	752	770	768	776	770	770	766	732	743	740
Total Secondary entrant teacher need	23,385	24,033	24,094	24,526	24,550	24,234	24,230	24,368	24,313	23,418	23,785	23,689

Differences between the values calculated above and those calculated using central scenario values only.

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Primary	0	0	0	0	0	0	0	0	0	0	0	0
Art & Design	0	0	0	0	0	0	0	0	0	0	0	0
Biology	0	0	0	0	0	0	0	0	0	0	0	0
Business Studies	0	0	0	0	0	0	0	0	0	0	0	0
Chemistry	0	0	0	0	0	0	0	0	0	0	0	0
Classics	0	0	0	0	0	0	0	0	0	0	0	0
Computing	0	0	0	0	0	0	0	0	0	0	0	0
Design & Technology	0	0	0	0	0	0	0	0	0	0	0	0
Drama	0	0	0	0	0	0	0	0	0	0	0	0
English	0	0	0	0	0	0	0	0	0	0	0	0
Food	0	0	0	0	0	0	0	0	0	0	0	0
Geography	0	0	0	0	0	0	0	0	0	0	0	0
History	0	0	0	0	0	0	0	0	0	0	0	0
Mathematics	0	0	0	0	0	0	0	0	0	0	0	0
Modern Foreign Languages	0	0	0	0	0	0	0	0	0	0	0	0
Music	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0
Physical Education	0	0	0	0	0	0	0	0	0	0	0	0
Physics	0	0	0	0	0	0	0	0	0	0	0	0
Religious Education	0	0	0	0	0	0	0	0	0	0	0	0
Total Secondary entrant teacher need	0	0	0	0	0	0	0	0	0	0	0	0

Figure 12: Screenshot of the scenario testing outputs in Part One of the Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part One.

There are a number of scenarios available for testing with further information provided under the relevant headings as to where the scenarios are derived from. The scenario tests available include testing:

- Projected future teacher wastage (high, central, and low scenarios) for both genders.
- Projected pupil populations (high, central, and low scenarios) as derived within the Pupil Projections Model.
- Different scenarios on how rapidly the PTR will change with changing pupil numbers and how high the PTR cap is as used by the model.

Further details are provided on the scenario testing tab.

Users can then examine how the model outputs of teacher entrant need change within the highlighted tables provided below the drop down menus on the scenario testing tab. Figure 12 above shows a screenshot of the relevant tables.

Additionally, users can examine both the impact of changes to the teacher need *and* the entrant teacher need values using the charts provided on the **'entrant need charts over time'** and **'teacher need charts over time'** tabs. Comparisons are made to the default (central scenario) settings for easy examination of the impact of the scenario changes used.

Figure 13 below provides an example of the impact of scenario testing on the Primary and Secondary entrant teacher need using high wastage scenarios for both male and female teachers.

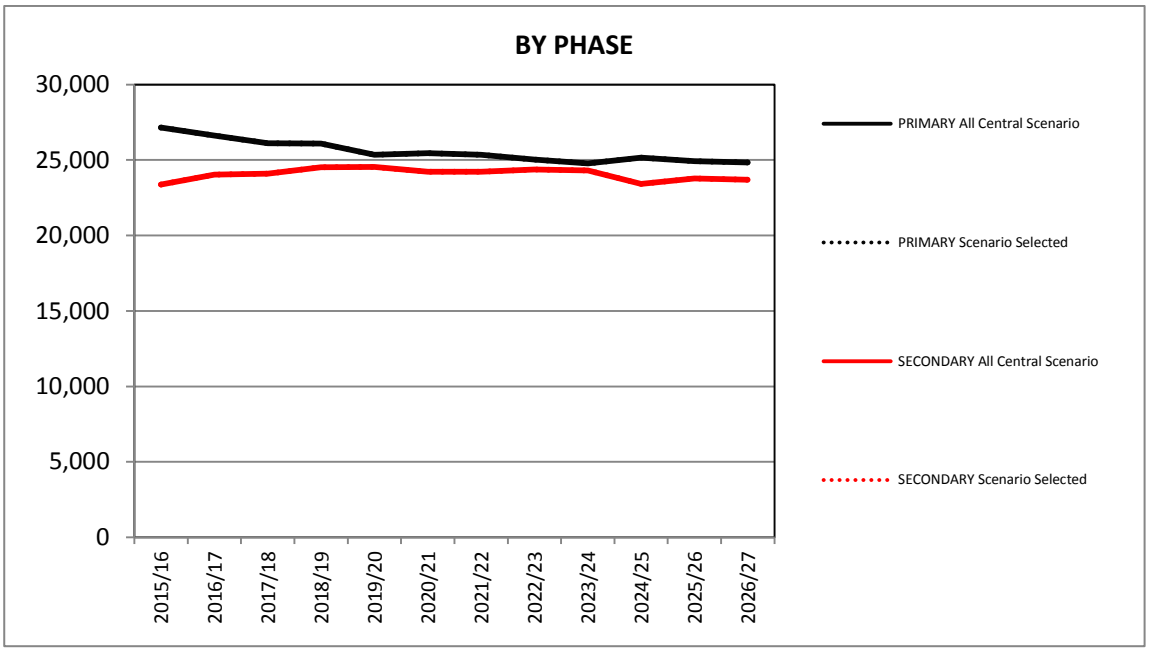


Figure 13: Entrant teacher need values by phase as calculated by the 2016/17 Teacher Supply Model using high wastage scenarios for both genders (Scenario Selected) and the default/central scenario (All Central Scenario values).

Source: 2016/17 Teacher Supply Model Part One.

By experimenting with the scenario testing in Part One, high, low, and central values of entrant teacher need can be calculated by phase and subject and are used to feed into Part Two.

Section 6: Scenario testing in Part Two of the 2016/17 Teacher Supply Model.

Section 6 of this user guide describes:

- How to use Scenario testing in Part Two of the 2016/17 Teacher Supply Model, and
- How to examine the outputs derived from such scenario testing.

6.1 How to use scenario testing in Part Two of the 2016/17 TSM.

Part Two of the model offers scenario testing on the proportion of entrants who will be re-entrants on the '**SCENARIO SELECTION TAB**' tab.

Users of the model can select *different* scenarios of data to be used in Part Two of the model using the drop down menus provided.

Users of the model can select different re-entrant rates scenarios to be used in the model using the drop down menus. Users can then examine how the model outputs of postgraduate ITT trainee need change when using the new values by examining the yellow tables beneath the drop down menus.

Additionally, users can examine how the values compare to the postgraduate ITT trainee need values derived using the central or default selections.

See Figure 14 for an illustration of the scenario testing available in Part Two.

1. NQT (Newly Qualified Teacher) entrant rates - scenarios

Users can select different rates for the proportion of entrants who will be Newly Qualified Teachers. Obviously, this in turn affects the proportion that won't be NQTs too (e.g. re-entrants or new to the SF sector entrants).

*The **central scenario rate** is based on weighted averages of historical rates from the most recent four years for which we have data. (As data is provisional for the two most recent years, the data is weighted).*

*There are four additional scenarios of alternative NQT entrant rates for both phases. These rates are **5 and 10% higher/lower** than the central rate.*

Primary Central rate (historical rate)

Secondary Central rate (historical rate)

The 'Postgraduate ITT trainee need' output values generated by the model using the scenarios as selected.

These are the model outputs generated using the scenarios selected using the drop down menus above.

	Lowest	Central	Highest
Art & Design	575	633	747
Biology	1,178	1,178	1,267
Business Studies	228	252	309
Chemistry	1,053	1,053	1,053
Classics	69	69	69
Computing	723	723	787
Design & Technology	786	848	995
Drama	313	347	413
English	2,253	2,253	2,458
Food	171	186	212
Geography	778	778	864
History	816	816	843
Mathematics	2,914	3,102	3,575
Modern Foreign Languages	1,514	1,514	1,514
Music	365	399	477
Other	848	938	1,131
Physical Education	905	999	1,238
Physics	1,055	1,055	1,121
Primary	9,961	11,489	14,691
Religious Education	497	544	642
Total	27,002	29,176	34,408

Differences between the values calculated above and those calculated using central rate scenario values only.

	Lowest	Central	Highest
Art & Design	0	0	0
Biology	0	0	0
Business Studies	0	0	0
Chemistry	0	0	0
Classics	0	0	0
Computing	0	0	0
Design & Technology	0	0	0
Drama	0	0	0
English	0	0	0
Food	0	0	0
Geography	0	0	0
History	0	0	0
Mathematics	0	0	0
Modern Foreign Languages	0	0	0
Music	0	0	0
Other	0	0	0
Physical Education	0	0	0
Physics	0	0	0
Primary	0	0	0
Religious Education	0	0	0
Total	0	0	0

Figure 14: Screenshot of the scenario testing in Part Two of the Teacher Supply Model.

Source: 2016/17 Teacher Supply Model Part Two.

Section 7: Additional information on the data sources used within the 2016/17 TSM.

1. The **NCTL Employment Dataset** provides the number of ITT trainees who are expected to enter teaching after a one or two year break. Additional information at: http://dataprovision.education.gov.uk/public/page.htm?to-page=publicProfilesHome
2. The **DLHE survey** provides the outcomes of Higher Education trainees and can be found on: https://www.hesa.ac.uk
3. The **ITT Census** provides the course lengths and numbers of new ITT trainees by route. More information is available at: https://www.gov.uk/government/statistics/initial-teacher-training-trainee-number-census-2014-to-2015
4. The **School Workforce Census** provides information (including demographics) on the teacher stock, the number of hours Secondary teachers spend teaching each subject, and teacher flows. Additional information available at: https://www.gov.uk/government/collections/statistics-school-workforce
5. **National Pupil Projections** are used in the demand modelling. Additional information and published statistics are available at: https://www.gov.uk/government/collections/statistics-pupil-projections
6. **PENSTATS** is an unpublished teacher pension data source held by the Department for Education which is used to model retirements. Penstats data is merged into the matched School Workforce Census to identify teachers specifically leaving as retirements.
7. **ONS National unemployment statistics** are used in the teacher Econometric Wastage Model: http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/november-2013/statistical-bulletin.html
8. **Office for Budgetary Responsibility estimates of Gross Domestic Product** are also used in the teacher wastage model: http://cdn.budgetresponsibility.independent.gov.uk/March-2013-EFO-44734674673453.pdf

Annex:

A.1 Further information on the structure of Part One of the 2016/17 Teacher Supply Model.

Table 4 below illustrates the purpose of each tab within Part One of the 2016/17 TSM.

Table 4: The tabs within Part One of the 2016/17 Teacher Supply Model.

Name of tab	Description
Title & Contents	Contents of Part One of the Teacher Supply Model and the purpose of each tab.
Details	Brief summary of model and how it feeds into Part Two (along with details of current version and colour key).
Maps of Sheets	Colour-coded map of the sheets in the spreadsheet.
Subject groupings defined	Defines the phases and subjects as used and modelled in the TSM.
Scenario selection	Tab enabling users to select scenarios to be used in the model calculations and examine the outputs of the scenario testing.
Raw data inputs	Takes the raw data inputs into the model from all input sources.
Policy assumptions Primary	Lists the policy assumptions at Primary level to play into the teacher need calculations.
Policy assumptions Secondary	Lists the policy assumptions at Secondary level to play into the teacher need calculations.
DATA SELECTED BY SELECTION TAB	Lists the data as selected by the scenarios tab to play into the wider model.
Calc PRIM retirement rates	Calculates retirement rates at Primary level.
Calc SEC retirement rates	Calculates retirement rates at Secondary level. Rates used are consistent across subjects.
Calc PRIM death rates	Calculates death in service rates at Primary level.
Calc SEC death rates	Calculates death in service teacher rates at Secondary level. Rates used are consistent across subjects.
Calc PRIM wastage rates	Calculates wastage rates at Primary level.
Calc SEC wastage rates	Calculates wastage rates at Secondary level.
Projected PRIM wastage rates	Calculates projected wastage rates at Primary level.
Projected SEC wastage rates	Calculates projected wastage rates at Secondary level.
Group 1 rates	Calculates projected wastage rates for the Secondary phase for Group 1 subjects only.
Group 2 rates	Calculates projected wastage rates for the Secondary phase for Group 2 subjects only.
Group 3 rates	Calculates projected wastage rates for the Secondary phase for Group 3 subjects only.
Stock calculations	Calculates the Full-time Equivalent (FTE) and unqualified teacher rates for the stock.
Stock ages breakdowns	Calculates the age group breakdowns of the stocks.
Calculation Primary teacher need	Calculates the Primary teacher need.
Calculation overall Secondary teacher need	Calculates the overall Secondary teacher need.
Teacher need by subject	Calculates the Secondary teacher need for specific subjects.
Forecast stock figures	Forecasts how the size of the stock will change over time.
Entrant age breakdowns	Calculates the age group breakdown of entrants.
Pupil data scenarios	Summarises the pupil projection figures using different population scenarios. Also, calculates KS5 pupil projections.
Primary	Calculates the entrant teacher need for Primary teachers and assumptions made on the number of leavers for the phase and how the stock changes over time (including size and characteristics).

Name of tab	Description
Art & Design	Calculates the entrant teacher need for Art & Design teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Biology	Calculates the entrant teacher need for Biology teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Business Studies	Calculates the entrant teacher need for Business Studies teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Chemistry	Calculates the entrant teacher need for Chemistry teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Classics	Calculates the entrant teacher need for Classics teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Computing	Calculates the entrant teacher need for Computing teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Design & Technology	Calculates the entrant teacher need for Design & Technology teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Drama	Calculates the entrant teacher need for Drama teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
English	Calculates the entrant teacher need for English teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Food	Calculates the entrant teacher need for Food teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Geography	Calculates the entrant teacher need for Geography teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
History	Calculates the entrant teacher need for History teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Mathematics	Calculates the entrant teacher need for Mathematics teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Modern Foreign Languages	Calculates the entrant teacher need for Modern Foreign Languages teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Music	Calculates the entrant teacher need for Music teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).

Name of tab	Description
Others	Calculates the entrant teacher need for Others subject teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Physical Education	Calculates the entrant teacher need for Physical Education teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Physics	Calculates the entrant teacher need for Physics teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Religious Education	Calculates the entrant teacher need for Religious Education teachers and assumptions made on the number of leavers for the subject and how the stock changes over time (including size and characteristics).
Deaths over time	Summarises the no. of teachers assumed will leave as deaths in service over time for all subjects.
Wastage over time	Summarises the no. of teachers assumed will leave as wastage over time for all subjects.
Retirement over time	Summarises the no. of teachers assumed will leave as retirements over time for all subjects.
Leavers over time	Summarises the no. of teachers assumed will leave from active service by all routes over time for all subjects.
Entrant need charts over time	Charts summarising entrant teacher need over time for all subjects.
Teacher need charts over time	Charts summarising teacher need over time for all subjects.
Pupil Projections scenarios	Charts summarising the pupil projections data used by the model.
Assumptions data	Summarises the assumptions data used by the model for calculations.
OUTPUTS FOR PART TWO	Summarises the entrant teacher need values calculated by the model to feed into Part Two of the model.

A.2 Further information on the structure of Part Two of the 2016/17 Teacher Supply Model.

Table 5 below illustrates the purpose of each tab within Part Two of the 2016/17 TSM.

Table 5: The tabs within Part Two of the 2016/17 Teacher Supply Model.

Name of tab	Description
Title & Contents	Contents of Part Two of the Teacher Supply Model and the purpose of each tab.
Details	Brief summary of model and how it feeds into further models (along with details of current version and colour key).
Map of Sheets	Colour-coded map of the sheets in the spreadsheet.
Subject groupings defined	Defines the phases and subjects as modelled in the TSM.
Scenario selection	Tab enabling users to select scenarios to be used in the model calculations.
Raw data inputs	Takes the raw data inputs into the model from all input sources.
Assumptions data	Summarises the assumptions data used in the model.
DATA SELECTED BY SELECTION TAB	Lists the data as selected by the scenarios tab to play into the wider model.
Policy assumptions Primary	Lists the Primary policy assumptions as used by the model.
Policy assumptions Secondary	Lists the Secondary policy assumptions as used by the model.
Calc PRIM entrant rates	Calculates the proportion of Primary teachers historically entering the stock via different entrant routes.
Calc SEC entrant rates	Calculates the proportion of Secondary teachers historically

Name of tab	Description
	entering the stock via different entrant routes.
Calc PRIM part-time entrants	Calculates the proportion of historical Primary teacher entrants that are part-time via the different routes.
Calc SEC part-time entrants	Calculates the proportion of historical Secondary teacher entrants that are part-time via the different routes.
Primary	Calculates the proportion of Primary teachers expected to enter by different entrant routes.
Art & Design	Calculates the proportion of Art & Design teachers expected to enter by different entrant routes.
Biology	Calculates the proportion of Biology teachers expected to enter by different entrant routes.
Business Studies	Calculates the proportion of Business Studies teachers expected to enter by different entrant routes.
Chemistry	Calculates the proportion of Chemistry teachers expected to enter by different entrant routes.
Classics	Calculates the proportion of Classics teachers expected to enter by different entrant routes.
Computing	Calculates the proportion of Computing teachers expected to enter by different entrant routes.
Design & Technology	Calculates the proportion of Design & Technology teachers expected to enter by different entrant routes.
Drama	Calculates the proportion of Drama teachers expected to enter by different entrant routes.
English	Calculates the proportion of English teachers expected to enter by different entrant routes.
Food	Calculates the proportion of Food teachers expected to enter by different entrant routes.
Geography	Calculates the proportion of Geography teachers expected to enter by different entrant routes.
History	Calculates the proportion of History teachers expected to enter by different entrant routes.
Mathematics	Calculates the proportion of Mathematics teachers expected to enter by different entrant routes.
Modern Foreign Languages	Calculates the proportion of Modern Foreign Language teachers expected to enter by different entrant routes.
Music	Calculates the proportion of Music teachers expected to enter by different entrant routes.
Others	Calculates the proportion of Others teachers expected to enter by different entrant routes.
Physical Education	Calculates the proportion of Physical Education teachers expected to enter by different entrant routes.
Physics	Calculates the proportion of Physics teachers expected to enter by different entrant routes.
Religious Education	Calculates the proportion of Religious Education teachers expected to enter by different entrant routes.
Calc long term NQT entrants	Calculates the proportion of the NQT entrants needed that will be NQTs in 2016/17 who studied on longer term ITT courses that began before 2015/16.
Re-entrants expected	Summarises the no. of teachers expected to enter as ‘re-entrants to the state-funded sector’ by subject.
New to SF sector expected	Summarises the no. of teachers expected to enter as ‘new to the state-funded sector’ entrants by subject.
NQT entrants required inc UGs	Summarises the no. of teachers expected to enter as Newly Qualified Teachers (NQTs), including those who will complete training via undergraduate training courses.
Check of all entrant numbers	Checks that the numbers of entrants expected via all entrant routes is equal to the amount required.
Outputs for conversion rates	Summarises the outputs to feed into the conversion rates table tab.
Conversion rates table	Converts the NQT entrant teacher need into the postgraduate ITT trainee need using estimations of how many trainees are expected

Name of tab	Description
	to complete ITT and how many are expected to go into employment within 6 months of ITT completion.
Final outputs of ITT places	Summarises the final outputs of the 2016/17 TSM to feed into the NCTL 2016/17 ITT recruitment process.

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